SOUTH WALES CAVING CLUB
CLWB OGOFEYDD DEHEUDIR CYMRU

50th Anniversary Publication
(Newsletter No. 118) 1996

9th March 1946.

4, St. Albans Road,
Brynmill,
Swansea.

POST WAR CAVING IN WALES.

Following a number of requests from people interested in Caving, it would seem that the time is now opportune for a complete resumption of activities. Although Caving has continued during the war period on a limited scale it is felt that every endeavour should now be made to launch our efforts on a more stable basis.

A circular was recently sent out to the members of the Mendip Exploration Society which has brought forward a proposal for amalgamation of all clubs interested in the South Wales area.

Arrangements are going ahead for a meet at the GWYN ARMS, Penycae, Swansea Valley, over the coming Easter week-end, from Good Friday, April 19th to Easter Monday, April 22nd, both dates inclusive.

On the evening of Saturday, April 20th, a meeting will be held at the GWYN ARMS to discuss the alternative proposals

(1) The amalgamation of all clubs interested in the South Wales area, or
(2) The formation of a new club to operate in South Wales in place of the Welsh Branch of the M.E.S.

TRIPS Owing to difficulties of petrol rationing specific arrangements regarding trips will be held over until the meet takes place, but it is hoped to obtain the owners' consent to visit Dan-yr-Ogof.

ACCOMMODATION All available accommodation in the district has been booked up for the Meet, and, in addition, shelter bunks will be provided for a limited number. There will be every facility for camping, and it will be of great assistance, in view of food rationing difficulties, if those who can camp will do so. For the others, it will be necessary to bring food rations, and at least one blanket per head.

It is hoped you will give this Meet your support, and please make a point of replying early, stating whether you will require accommodation.

(signed) E.J.MASON

A.H.HILL.

Recommended route for foot passengers:- Swansea by train, thence by 'bus from Trinity Place (2 mins. from G.W.R. station). Book to Gwyn Arms.

South Wales Caving Club
Clwb Ogofeydd Deheudir Cymru

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Front cover photograph:
Pete Glanvill in Ogof Ffynnon Ddu II, by Chris Howes FRPS

Back cover photograph:
Traverse, Ogof Ffynnon Ddu I, 25/10/52, by David Hunt

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Foreword

by Peter Harvey, SWCC President

It was the Thursday before Easter 1946, and as I pulled up outside the Gwyn Arms and leaned my motorcycle against the wall I never imagined that I would be writing this half a century later. I had hardly dismounted before a scruffy, hairy man came out of the pub and after asking who I was, announced that he was the leader. This was Gerard Platten who was going to show us the dry series beyond the lakes in Dan-yr-Ogof during that Easter weekend.

I had been looking forward to seeing Dan-yr-Ogof for quite a while, after hearing Bill Weaver's graphic descriptions of crossing the lakes and exploring the huge chambers beyond. He also told me about his examination, with Don Lumbard, of a long crawl with a draught at the far end of the cave. It seems strange now that the Long Crawl was not followed up sooner but entry to Dan-yr-Ogof in the early days was rarely available.

It was during this weekend that the club was formed. Up until now the main club caving in Wales was the Welsh Branch of the Mendip Exploration Society, but there were also several other clubs and groups operating in the area. These included the UBSS and the Wessex Cave Club. There was also the Dragon Group whose members were drawn from various clubs and was centred on Platten and included Bill Weaver and Paul Dolphin. I believe Paul acted as the Hon. Secretary. Paul also had his own group of friends who later became known as "The Dolphin Gang", whose main activity was digging at Waen Fignen Felen, but quite by accident they later found Pwll Dwfn. They were sitting in a depression, having a snack, when they heard a stream beneath them and in a short time they were at the head of the first pitch of 20ft.

All these clubs and groups tended to cave in their own particular areas of South Wales, the areas which they were interested in and operated in. The Wessex were usually to be found in the three river valleys, Neath, Hepste and Mellte, whilst the MES were based in the Swansea Valley. The signs were already showing that there was some resentment when it was thought that someone was poaching on someone else's territory. When I was in Wales in 1945 with Bill Weaver and John Parkes we spent several hours walking up and down the mountain trying to find Pwll Swnd in the pouring rain and failed, so instead we went into a cave in the side of Herbert's Quarry, now known as Ogof Pasg. While we were in there we met a local collier called Eddie Morgan and he informed us that we were caving on his patch! We did not take a lot of notice because we did not suppose that he owned the quarry. He didn't seem upset that we were on his patch but I got the impression he might have been if we had been digging for a cave entrance.

It was against this background that E.J.Mason and Arthur Hill, Vice President and Hon.Sec. of the MES Welsh Group, wrote a letter in *The British Caver* (Vol.14 p.71) suggesting that "...the Welsh field of operations is of such importance as to demand a society independent of any organisation operating in another area. As nothing can, at present, be learned of the parent society, it has been suggested that the group be reformed into a new club, The South Wales Cave Club". In the same volume (page 86) Don Lumbard proposes the same idea. Following these initial moves a meet was organised for Easter 1946 at the Gwyn Arms in the Swansea Valley where the future of caving in South Wales would be decided. The reference to the "parent society" was because towards the end of the war the MES seemed to have disappeared, probably because there had been some casualties amongst its members during the hostilities.

So... the Thursday evening of Easter 1946 saw me arrive at the Gwyn Arms. There were a large number of people attending the meet. The fact that there were to be trips into Dan-yr-Ogof and that the cave divers, Graham Balcombe and Jack Shepphard, were going to try and enter a new cave at the large spring, called Ffynnon Ddu, ensured that most of the active caving fraternity were present. Accommodation consisted mainly of camping behind the Gwyn although some stayed in the restaurant building at Dan-yr-Ogof. The Elite, the Hills and the Masons stayed in the Gwyn itself whilst others could get "Bed & Breakfast" with Mrs Griffiths at the Ancient Briton, down the valley in Pen y Cae. During these early days we, the campers, cooked our evening meal in the ladies' toilet in front of the Gwyn. This was on the assumption that as serious drinking did not start until about 8pm the ladies would not need their toilet until about 9pm.

On the evening of Saturday 21st April the meeting took place, chaired by Brigadier E.A.Glennie, at which the Welsh Branch of the MES was dissolved and reformed into a new club, the South Wales Caving Club (Clwb Ogofeydd Deheudir Cymru). The coach house at the Gwyn was packed tight, there must have been nearly forty people at the meeting. I noticed that Frank Frost and Graham Balcombe did quite a lot of talking but did not actually join the club. The first officers of the club were elected: Ted Mason was Chairman, Arthur Hill was Secretary and Charles Freeman was the Treasurer. The annual subscription was ten shillings with an entrance fee of five shillings (50p & 25p). During this first year there were between twenty and thirty members.

Over the years the club has grown. Later in the year a cottage on the Llynfell, the river resurging from Dan-yr-Ogof, was made available to the club by the generosity of T. Ashwell Morgan. This was an ideal site as it was within walking distance of Ogof Ffynnon Ddu, Dan-yr-Ogof and the Gwyn Arms. We were able to move into it during the summer of 1947. It was not very big but it was the headquarters for the next twelve years or so. The accommodation was for men only, the girls staying in the Gwyn, as the then secretary, Arthur Hill, thought that the local people would disapprove if they slept with the men in the small cottage. About 1960 a row of ten quarrymens' cottages was purchased at Penwyllt on the mountain directly over Ogof Ffynnon Ddu. Instead of two small rooms upstairs and downstairs there was plenty of room for changing rooms, showers, sleeping and cooking accommodation. The club architect, Brian de Graaf, drew up plans and most of the work was carried out by members of the club and except for the addition of central heating and the shower block the building was substantially as it is now. Its position over Ogof Ffynnon Ddu has encouraged several discussions about digging a shaft in the long common room floor down to Cwm Dwr Jama, about 70ft below, but for some reason this was never started!

Now, fifty years on, the South Wales Caving Club has increased its membership to over three hundred and it has become one of the leading clubs in Britain. We own our own headquarters and our members have travelled to all parts of the world where there is limestone and explored the caves there. I don't expect to survive the next half century but I hope that it will be as exciting and satisfying as the last fifty years. There are several promising digs on the go and I expect there will some exciting discoveries to come. So, good luck! However remember, things never remain the same and it could be that in 2046 very few people will actually go caving but will experience it electronically sitting at home in some form of virtual reality, while there will be "Karst Wardens" to make sure only those speleologists licensed by the "British Cave Heritage Council" would occasionally be allowed to go underground. Digging of course will be carried out under the supervision of a council member but subsequent exploration will only be for the scientists. So enjoy your caving while you can.

The Discovery of Ogof Ffynnon Ddu

(Reprinted from *The British Caver*, Vol.15.)

Report on Ogof-Yr-Ffynnon Ddu

The history of the Ffynnon Ddu system is one of prolonged attempts to solve its mysteries.

In 1927 Mr Powell of Rhongyr Isaf discovered the upper roadside cave (Penwyllt Cave). This was a beautiful remnant of some long-vanished system showing unmistakable signs of phreatic action and pointing to the existence of a large system at some lower level.

During blasting operations a second cave was brought to light, in the Penwyllt Quarry (Cwm Dwr Quarry Cave) which leads downwards and back in the general direction of Penwyllt Station. Progress was halted by mud and sand chokes in narrow passages.

In the Easter Meet of 1942 operations by the South Wales group of the Mendip Exploration Society led to the discovery of Pwll Pant Canol. This was a high level "feeder" cave and again pointed to the existence of a much larger system at some lower point in the valley.

During the 1946 Easter Meet of the newly formed South Wales Caving Club, F.G.Balcombe and J.S.Sheppard of the Cave Diving Group attacked the main rising of Ffynnon Ddu. At Whitsun the authors, while surveying the possibilities of the location, discovered a small cave on the northern side of Pant Canol. This 200ft tight crawl is also probably part of some ancient vanished system.

Location of the present dig.
When surveying the possibilities of effecting an entrance to the Ffynnon Ddu system a number of facts should have been borne in mind.

There have been cloud bursts within living memory in the Tawe Valley. These were in 1907 and again in 1933. On each occasion flood water burst out in Pant Canol at two separate and well-defined places. The first flood rising lies in a bed of stones at the foot of the Pant and the second at a point just underneath the hedge on the right 50 yards up the valley. From this later point a well-defined dry stream bed leads in the direction of the Tawe, and Mr. Downey has stated that many years ago he was responsible for filling in a hole in the rock at its head.

Mr Downey also informed us that some years ago while moving a large stone which lay beneath a little cliff some 25 yards further up the valley he has revealed a small hole among boulders through which blew a draught.

Examination of the geological survey and memoirs of the district revealed the fact that this cliff was the edge of a minor fault and lay at the head of a major fault beneath the surface running due north and south. On the strength of the above evidence the authors decided that a dig at this point held strong possibilities of forcing an entrance.

Work was commenced on 5th July 1946 and a 15ft shaft was driven through a mass of loose glacial debris. At this point it was evident from the strength and temperature of the draught which blew between the boulders at the base of the shaft that prospects of an entrance were extremely good. However the sides of the shaft were in a dangerous condition indeed and it was decided to postpone further work until timber could be bought in to shore them up.

The attack was resumed on 3rd of August 1946. The sides were made safe and the shaft, which had fallen in to some extent, re-opened and driven to a depth of approximately 18ft. The timely arrival of Bill Weaver with a rope aided the removal of a large boulder and a small hole in the cliff was revealed.

FFYNNON DDU WAS OPEN

The Cave.
With truly commendable presence of mind (although we say it ourselves) the authors returned to the Gwyn Arms, and partook of food and wine, and returned post haste to the scene of operations.

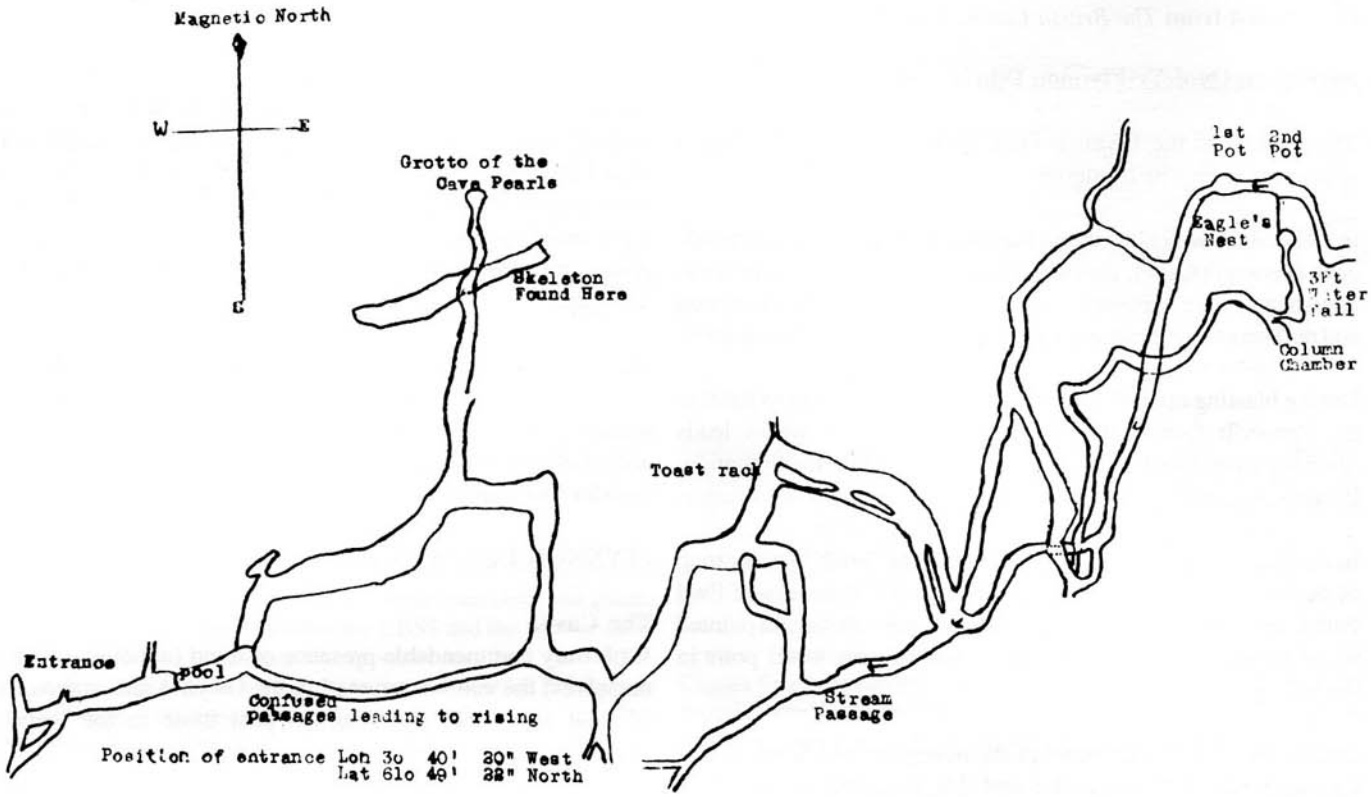
The base of the shaft gave access to a tunnel of fair dimensions and a turn to the left, through a low arch and a deep pool, led into an ascending passage with a beautiful pure white calcite floor. This went upwards to a parting of the ways with a small stream dripping from the roof covering the boulders beneath with a white drip deposit. Straight ahead was a low muddy passage ascending to a small pot-hole with a small pool and a stream dripping in. This pool proved to contain what is certainly one of the largest single finds of cave pearls in this country.

Near the end of the passage a small window looked into another passage running below at right angles. This was later to become known as "bone hole".

Returning to the parting of the ways, the cave turned to the right and led downwards through a series of chambers and a large circular passage until a distant roaring of water indicated the proximity of the main river. A second stream entered from the roof at this point and the floor ahead was covered broken boulders with a high stalagmite bank on the left and a large passage above. Across the boulders a deep pool gave access to a descending tunnel leading to the main stream passage.

This main passage was, for the most part, a finely modelled rift with an average width of about 5ft and from 15ft to 60ft high, which carried on through a series of deep pools and rapids until progress was arrested by a very deep pot. However there was an easy traverse over this but almost immediately a second similar pot barred the way, and exploration ended here for the day.

After a night of appropriate celebration the attack was opened again the following day. The second pot in the stream was passed with ease and the river followed up for a long distance, across two



more quite formidable pots (15ft wide) to a point where it emerged from a sump on the right. On the left a "dry" passage with a small stream lead for a distance until progress was again halted by a huge boulder choke. The stream emerged from a hole high up in the left side not far from the choke. Meanwhile others had been busy. Charles Freeman had climbed out of the stream on the right bank and discovered a series of dry passages. The lower of these passed from a wide and roomy passage to a narrow and uncomfortable crawl through a coral pool to a chamber of vivid colouring.

At two places side passages returned to points overlooking the main river. The upper passage, entered by a steep climb up a 15ft stalagmite bank, was floored with solid stalagmite and at the end broke into a large chamber profusely decorated with large stalactites and erratic formations. At the far end of this in a deep pool of clear water stood the most impressive formation yet seen, a 35ft column of pure stalagmite some 1Oft round at the base.

A further discovery bought archaeologists post haste from Ogof-yr-Esgyrn. Mr. John Barrows while exploring the passage leading to the cave pearls had descended through the "window" into the lower passage and had discovered a skeleton in an advanced stage of decay crouched among the rocks at the upper end which was choked by a heavy rock fall.

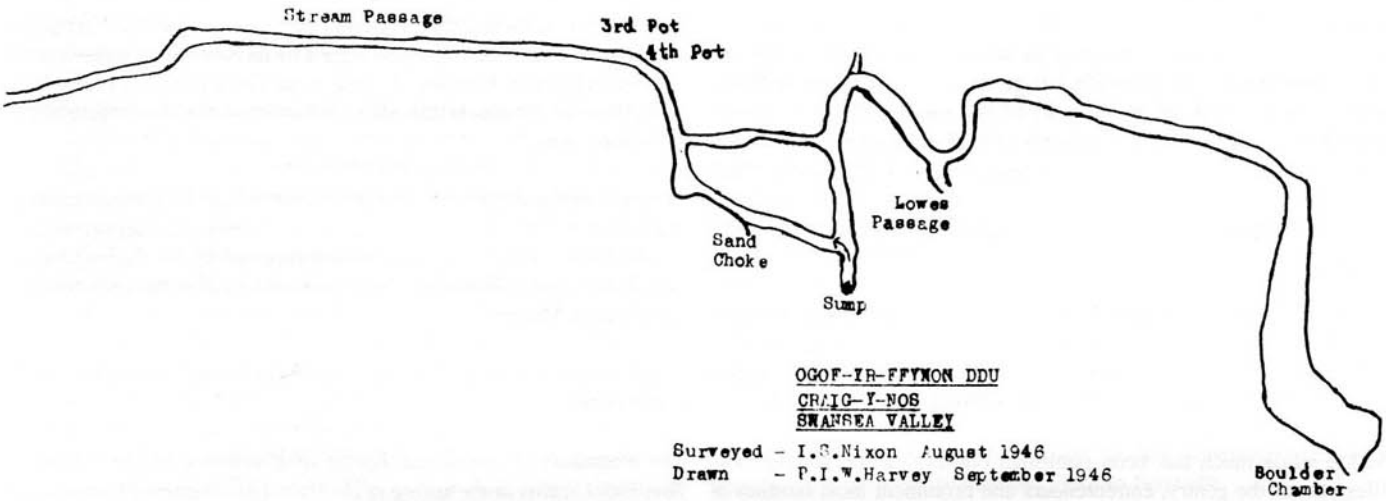
Later Messrs. Dolphin and Lowe arrived and made a fast and wet trip upstream returning with the news that they had found a large passage high up on the right of the "dry" section past the sump which apparently "went".

On the same day it was found that the stalagmite chamber was not the end of the series. Turning left at the foot of the stalagmite column a 6ft duck led into a passage lavishly decorated with stalactites of all varieties and on into a second large chamber. A narrow passage off this gave access to a small perch some 80ft up in the roof of the main stream passage. It was later found that this was almost directly above the second pot.

Meanwhile the high stalagmite bank near the entrance to the stream passage had been climbed and the passage above proved to be a bypass to the stream. Off this on the left Gwyn Bannister discovered a maze of passages of singular complexity and great discomfort, redeemed only by their patches of great beauty.

The stream may also be followed downwards to some extent until it disappears into a mass of very unstable boulders. A number of passages lead off from the main system towards this point but are all a maze of interconnecting rifts and bedding planes subject to flooding in times of high water.

The few side passages off the stream past the dry series were fully explored early in the second week after discovery. The only one of any interest was that reported by Dolphin and Lowe, which ran for a considerable distance before it petered out in a boulder choke similar to that in the main passage. Almost the whole of the known



cave has been surveyed on centre line basis, and the survey is probably accurate to within 50%, the main errors being in the bearings at the far end where continuous shivers of cold rendered their taking a tricky business.

As a result of the survey it has been shown that contrary to expectations the cave runs due east/west for 1500ft as the crow flies. (The actual length from the entrance to the boulder choke is 2600ft). As the stream was supposed to be fed from Pwll Byfre it was an even greater surprise to find that the main stream is fed from nearby swallets in the quartz conglomerate such as Pwll-yr-Gosseg. Such conditions would however account for the sudden flooding of the system as has been observed. The theory however awaits confirmation at a later date.

The only promising section of the cave available to the normal caver for further exploration is the tunnel which carries the stream leading into the dry section at the far end. This would best be reached by some form of ladder as the climb would be difficult enough without the complications of the constant shower bath. We also look forward to the time when the CDG will find it within their power to penetrate the sump and see what is beyond.

The authors wish to thank all those people in the district who gave them endless help during the dig and subsequent explorations. Above all to Mr. Powell for his constant help and tuition in the use of sledgehammer and to Mr. Downey for his advice and those hot baths which were so badly needed on emergence from the depths! Our thanks go also to those people who gave valuable aid in compiling the survey of the cave.

Notes.

(a) The Cave Pearls. These were found to be disappearing at no uncertain rate and have been removed to the Welsh National Museum for safe keeping.

(b) The Bones. These have been removed to the care and examination of Mr. E.J.Mason, Prof. Savory and Dr. Aslett. It is hoped that a report as to their age and nature will be available shortly.

(c) Safety. Ogof-yr-Ffynnon Ddu is liable to extremely sudden flooding and it only requires a rise of 1ft to make the stream passage quite impassable. It is capable of rising by this amount **IN LESS THAN FIFTEEN MINUTES!** It is hoped that any explorers will take account of the weather possibilities before entrance, and if the stream is already high will not proceed beyond the entrance to the dry series.

P.W.Harvey and I.S.Nixon

Penwyllt Village: Growth, Development and Decline

Extracts from a Thesis by ***Helen Matthews***

Preface

This work is primarily intended to describe the development and subsequent decline of Penwyllt village from the enclosure of Forest Fawr (Great Forest of Brecknock) to the present (1815 to 1991). However some measure of awareness of the fascinating history of this part of Breconshire, and indeed some appreciation of the changes which took place in society in general over preceding years, will enable the reader to more fully appreciate the finer implications of the events which created Penwyllt.

I therefore make no apology for telescoping eight centuries of history into the opening chapters as a means of setting the scene for what followed. These years, which are only lightly explored, can be studied in much greater detail in a number of publications.

Sadly, while much has been published concerning the fortunes and lifestyles of the gentry, entrepreneurs and prominent local families of the area, little material is available to give an insight into the lives of more ordinary families but such sources as there are have been used to piece together a picture of the community which was Penwyllt.

Introduction

The earliest evidence of human activity in the area which is now known as Penwyllt was unearthed by the discovery, in 1886, of bronze age implements found just below the surface of the ground on the mountain which overshadows the later 19th century settlement. The find consisted of six celts of various sizes, all ornamented to some degree and each having loops for thongs; two gouge-like instruments, a chisel-like tool, bronze moulds, a bronze annulus, which was thought to be the end of a spear, and a bronze blade. These are described by Theophilus Jones in the Glanusk Edition of *The History of Breconshire* (1930), and he tells how at first there was some doubt about the authenticity of the find but that it was later verified by Colonel W. Ll. Morgan, R.E., of Swansea in *Archaeologica Cambrensis* in 1901. It appears that our forebears found the Penwyllt mountain to be a suitable place to form encampments, perhaps using the limestone caves for shelter and protection.

There is little documented evidence of later inhabitants, although the area was well marked by small maenhirs on early ordnance and the Roman road, Sarn Helen, ran between the garrison towns of Neath and Carmarthen, passing within a few miles of the later settlement, making it likely that well worn tracks already existed across the mountain tops, high above the densely wooded valleys in which travelling was difficult and attack from wild animals and opposing factions easy.

However with the increase in permanent settlement and a consequent decrease in nomadic lifestyle the area became used only for grazing livestock and preparing lime for soil improvement, a practice as old as cultivation itself.

Chapter 1: The Fforest Fawr, Dedication to Enclosure

When Bernard de Newmarch marched from the borders of Wales, through the fertile Usk Valley and went on to conquer Brycheiniog (Breconshire) for his king the future of the area was sealed. The Norman bond resolved that some 40,000 acres (10 sq. miles) would be dedicated as hunting forest and governed by forestal laws, i.e. that it should be reserved for "feris and cervis" (wild beast and deer) and that its use be restricted to those holding a pass signed by de Newmarch himself or his appointed forester. It became known as the Great Forest or Forest Fawr and to this day the area is thus identified although the ancient restrictions have long gone.

No early written definition of the boundaries of the Great Forest has been traced but in 1795 they were colourfully described in a report made to Crown Officers, based on information supplied by Mr Philip Morgan, who at that time collected the forest dues on behalf of the Crown lessee, Sir Charles Morgan.

The description published in John Lloyd's *The Great Forest of Brecknock* commences:

The Boundary of the Great Forest of Brecknock in the County of Brecknock iegins at the spring of the river Usk (Blanewsc), situated on the North side of the Long Vann (Vann hyr), and following the course of the Usk is the boundary between the Counties of Carmarthen and Brecknock until it enters the Parish of Llywell in the County of Brecknock and thence to Abercray, where the River Cray falls into the Usk. Up the River Cray to Tygwynyn Cray, and thence in an Eastward direction to Clwyd-y-Cae Newydd, and thence to Nantddu and up Nantddu to its source, and along an old Watercourse southward to Cinewr, and up Cinewr to the Road leading from Ystradgynlais to Brecknock, thence Northwardly along an ancient Watercourse leading to Bailygwern Mill at Blaentrewerren, and down Trewerrin Brook to Senny River, and thence to the river Usk ...

Later, when George III's government sought the enclosure act, a formal survey was made which similarly, though less poetically, describes the boundaries.

John Lloyd points out that whilst the Great Forest was nominally within the Lordship of Brecon Castle, it had for many centuries been treated as a distinct property, being held by the crown long after the Brecon Lordship was dispersed.

The manor tenants had, from earliest times, been granted the rights of grazing livestock on the land and of obtaining lime from the forest quarries. (The importance of the latter is a recurring theme in the more modern history of Penwyllt and referred to more fully in later chapters). It is likely that the intrusive grazing was instrumental in wiping out the "ferae and cervi" which first attracted the attention of the hunting lords.

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Much of the Crown's control of the land was disposed of by the Stewart kings. In 1631 Charles I granted the agistment of the Breconshire holdings to Sir William Russel, who in his turn sold it to Sir Thomas Morgan in 1639. The Morgan family, later the Earls of Tredegar, remained in control of the Great Forest from that time until enclosure. Lloyd makes the point that this hereditary tenancy resulted in a sense of ownership, not only by the incumbents, but also by neighbours and tenants. Whilst appreciating that Lloyd's sources are impeccable, it should be noted that his opinions and source selection may have been

influenced by subjectivity; nevertheless there is no doubt that some of the claims made by successive Morgans displeased those tenants who chose to remember that ultimate authority over the Great Forest belonged to the Crown. Several law suits were initiated, one in 1781, centred around the tenants rights to dig and burn lime. Reference is made to this right in later chapters as the principles are an intrinsic part of the Penwyllt story. It is true to say that the arguments surrounding such issues are so much a part of the culture of the people of the Great Forest that they even now are only shallowly buried beneath the surface, part legend and part resentment.

George II and his government finally completed Crown land disposal in Breconshire by the sale of the Great Forest retaining an interest only as trustees of 17,000 acres of commoners' allotment. As a result of this sale, settlement at Penwyllt was inevitable.

Chapter 2: Events Instrumental in the Development of Penwyllt

Penwyllt lies adjacent to beds of limestone and silica rock which may have lain undisturbed for ever, with the exception of an occasional commoner digging lime to burn in his turf kiln for use as a soil improver. The knowledge that lime assisted in generous cropping had been passed down through generations. Primitive kilns have been excavated at Khafaje, Mesopotamia dating from circa 2450 BC. However, during the 19th century, demand for the mineral increased as war and population growth placed increased demand on food production.

Allied with this demand was an investment class of speculators which had been steadily growing since the 17th century when world exploration resulted in the foundation of new colonies and trading stations in hitherto undiscovered lands. This opening up of a new world presented opportunities for merchants to amass unprecedented wealth and, in pursuit of respectability and sound investment, they sought to buy land.

Meanwhile, the heavy fines imposed by Cromwell on royalist landowners left many of the gentry so impoverished that they were required to sell their estates to pay the debt. Land acquisition and ownership became a business for the first time with self-made men able to purchase vast holdings with their new fortunes. Businessmen before all else, the new landowners sought means of improving land to increase productivity and profit.

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The inflated prices of domestically produced food offered the opportunity for landowners to make high profits to the extent that hitherto unproductive land would be a valuable asset, if only the soil could be improved enough to raise healthy crops. Those who were able to produce reaped rich rewards and wished to experiment with ways of increasing production. It was a viable proposition to invest time and money in any new technique which might show good returns. The most important soil improver of the era was burnt limestone.

British government resources were already drained by a century of expensive wars, but finance was urgently needed to continue the struggle against Napoleon. Enclosure, which had been going on for centuries, was accelerated to an unprecedented level. Land which had previously been dismissed as unproductive was suddenly desirable. Much of this was common land where since time immemorial, peasants and small farmers had been able to turn out their animals to graze to supplement the family's food supply. Much of the Crown Land holdings throughout Britain had long since fallen into disuse, neglect rendering them useless for production without intensive investment in soil improvement. However, sale and enclosure of these holdings was seen as a means of raising much needed revenue to continue the struggle against Napoleon and replenish Government coffers exhausted by a century of wars. The Forest Fawr was one of the parcels of land.

While international and domestic affairs conspired to release the land on which the community of Penwyllt developed, the *raison d'être* for the development of this workers' village lies in the industrial developments taking place concurrently. During the early 18th century scattered iron forges and localised coal and copper industries had developed throughout South Wales; however poor communications, lack of investment and low demand for produce had restricted their growth.

The incessant wars ensured a climate for unprecedented development in the heavy metal industries, demand for cannon, ammunition and iron clad warships was insatiable and capital investment in these industries was attractive to the newly rich. One result of such investment was the opening of the Swansea Canal in 1798 which was designed to enable well documented but hitherto inaccessible ironstone, coal and limestone to be utilised. During the subsequent 50 years industry in the valley expanded at a great rate; iron works were developed or expanded at Abercrave, Ystalyfera and Ynyscedwin while later tinplate industries developed at Pontardawe, Gurnos, Trebanos, Clydach and Morriston. The limestone which had previously been used only as a soil improver was now needed for a flux in the smelting process, giving quarry owners a new marketplace for their product.

In 1817, during this period of industrial expansion, William Harry of the Swansea Valley patented a method of coating the vaulted brick roofs of smelting kilns with silica sand which fused to make a solid arch. Three years later, William Weston Young invented the Dinas Silica Brick by binding silica with 1% of lime. In 1822 he founded the Dinas Silica Brick Company with the new manufacturing process. Demand for silica bricks grew in the late 19th century in response to the needs of the open hearth furnace and following the First World War they became the standard refractory for coke ovens with demand steadily increasing. Silica rock and the sand were easily quarried close to Penwyllt.

As these threads of social, agricultural and industrial change drew together, so the development of the community of Penwyllt progressed. The story of the village is a brief one in terms of history, but its growth and decline are an illustration of that time between 1812 and 1970 from which our post industrial society developed. The men who were central to the development of the industrial settlement are typical of an era when fortunes were made and lost almost overnight.

Chapter 3: The Sale of the Great Forest of Brecknock

The original Act for Inclosure of the Great Forest of Brecknock was passed in 1808 but after much argument and discussion concerning commoners' and tenants' rights it was July 11 1815 before modified legislation received royal assent. Dispute did not end there; further legal battles followed and it was not until 1820 that the Crown Allotment was bought by John Stewart on behalf of John Christie. Christie's final holding amounted to 13760 acres. Archibald Christie, a cousin to John, had already acquired some 799 acres and mineral rights over "five allotments" which adjoined his kinsman's land.

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A receipt was issued by the Bank of England for the £1330 received from John Stewart on the 19 February 1822. (A full description of the complicated sale of the land is contained in Lloyd's *The Great Forest of Brecknock.*)

Chapter 4: John Christie's Developments at Penwyllt

The connection between John Stewart and John Christie is unclear but it would seem that the former was acting on the latter's behalf. Nevertheless it was John Christie who shortly afterwards took possession of the Crown Allotment, amounting to one third of the original Forest. A vast landholding which was to change the history of the area and lead to the development of Penwyllt was acquired for the sum of £1330. The only land surrounding Penwyllt which was not in his possession was the commoners' limestone quarry, designated as No. 4 on the enclosure map. This was one of only eight limestone workings designated as public limestone quarries under the modified Inclosure Act and placed under trusteeship of the surveyors of roads. The allocation of these was a result

of long legal battles fought by the commoners.

Although based in London, John Christie came from a successful Scottish family of Presbyterians and had made his own fortune from the indigo trade. As far as can be ascertained he had no previous connection with Wales whatsoever and quite what motivation such a man had for obtaining a vast tract of land in an area renowned for its poor communications remains a mystery and matter for speculation. As a businessman in an age of entrepreneurship it is likely he was aware of the industrial development taking place in the Swansea Valley; however it is generally supposed that his original purpose in acquiring his new estate was purely for agricultural development and social status. Whatever his original motivations, within a few years his interests lay southward of Penwyllt, for by the time of his bankruptcy in 1828 he owned 21 transport barges on the Swansea Canal and all the necessary equipment to operate a wharf. It seems likely he was first tempted by possible mineral wealth derived from his new lands although it is equally feasible that he hoped to make financial gains from the coal boom which was happening in Wales. Many fortunes were made (and some lost) in a similar manner during this period and there is evidence that he hoped to find rich coal seams under his new land and prospected for it. However, initially he only considered the possibility of lime production for agricultural purposes.

Christie developed two model farms on the Fforest Fawr, one at Glanusk and the other, which remains substantially unaltered today, at Cnewr. The latter was completed by 1821, illustrating something of the drive and energy which had made his earlier fortune. Cnewr was more than five kilometres from the limestone outcrop at Penwyllt, but burnt lime was required to improve the land for cultivation. Only tracks connected the quarries to the farms and they would have been rutted in summer and near-impassable quagmires in the winter rain. The routes had served the farmer collecting lime by the cart for small manorial farms of the Forest but for economic conditions and Christie's intended scale of agricultural improvement such transport was cumbersome, expensive and time consuming.

Christie was above all a man of his times. He invested his accumulated capital in a scheme which even now would overwhelm the most enterprising contemporary engineer. He planned a tramroad which would link the quarries and kilns of Penwyllt to his landholdings and then continue on to serve the farms of the Usk Valley and Black Mountains thereby securing, he hoped, a profitable lime trade.

This early investment in Penwyllt was, no doubt, to sow the seeds of the further developments which took place there over the succeeding 150 years. A detailed description of Christie's tramroad is recorded in *The Brecon Forest Tramroad* (Stephen Hughes - Aberystwyth, 1990).

The drams were wooden and horse-drawn, so it was inevitable that there would be a smithy and a carpenter's shop at Penwyllt although no evidence remains of these.

Christie also invested heavily in the building of new kilns, the style of which had only been in use for half a century or so. Previously lime had been traditionally burnt in turf built clamp kilns using peat, timber or coal, if available, as a fuel; a method which was cumbersome, slow and uneconomical as the extraction of the burnt lime meant the kiln's virtual destruction. The new "draw kilns" were built of stone and designed to for continuous production. Lime application however has always tended to be seasonal, so it was also necessary to construct limesheds nearby for storage of the finished product.

Related settlement at Penwyllt began with the building of Ty Mawr and the house which was later destined to become the Penwyllt Inn, both built during Christie's period to house key workers.

The sheer quantity of lime to be burnt at Penwyllt required an abundant coal supply. After his initial disappointment with investigations in the locality, Christie acquired ownership of collieries on the Drum Mountain and proceeded to link these to the Penwyllt kilns by extending the tramway southwards. It was a further logical step to link the coal mine to the Swansea canal and thus achieve the ultimate link with the port at Swansea.

It also seems fairly certain that unburnt limestone from the Penwyllt quarries was carried along Christie's tramroad for burning closer to the farms which used it, both out towards Sennybridge and down the Swansea Valley. Limesheds and kilns abounded along its length and some ruins still remain to be seen today as testimony to the lucrative trade which emanated from the quarries of Penwyllt. This practice lessened the possibility of accidents, for burnt lime is a volatile substance, but increased the cost as raw limestone is considerably bulkier and heavier than burnt lime.

The relevance of the early tramroad to the story of Penwyllt lies in the importance of creating an improved transport system which, when completed, linked Penwyllt to the coal field, the agricultural hinterland and, through the Swansea Canal, to the industrial valley and the docks beyond. Penwyllt may never have existed as a thriving village had it not been for Christie's valiant efforts to provide the earliest of these links.

The building of the tramway was undertaken, according to John Lloyd, without the consent of the commoners through whose allotted quarry the tramway ran. However, as Lloyd points out, it is doubtful if any opposition was raised at that time because, in an area of non-existent communications such a work was of advantage to all. The system was crude by today's standards but nevertheless advanced the area and was a triumph of engineering over terrain.

In 1827 the heavy investment required by Christie's dream rendered him bankrupt. His previous fortune had been dissipated and he lost his entire holding of the Crown Allotment. The Christie estate was claimed by his largest creditor, Joseph Claypon, a Lincolnshire banker, and all the requirements for lime production and distribution were included.

Chapter 5: The New Owners

Claypon and Garfit, bankers, foreclosed on Christie's £98000 loan on 1 April 1827. Christie subsequently held a London sale of his assets, including the Crown estate, but the properties failed to meet the reserve. A Commission of Bankruptcy was issued on the 21 Dec 1827 and an inventory of Christie Estate was finally completed by 3 June 1828. Joseph Claypon reluctantly became the new owner of the Great Forest and most of the tramroad on 10 Dec 1829. He did not have Christie's unbounded enthusiasm for the property and industry which he had acquired more by default than design. He leased most of his holding, thus devolving responsibility while retaining an income from the estate.

Initially, while administrating Christie's holdings in receivership, the bankers leased the Brecon Forest Tramroad and other properties, including the limekilns, limeshed, cottages, stables and 70 acres of land at Penwyllt, to London timber merchants Thomas Arnott and Robert Mercer, who had other interests in the local area. They in turn issued a sub-lease on 12 August 1828 to a group of local businessmen, William Watkins, William Powell and David Jefferys together with the Marquis of Campden who formed the Brecon Forest Tramroad Company. By 1830 Arnott and Mercer were themselves bankrupt.

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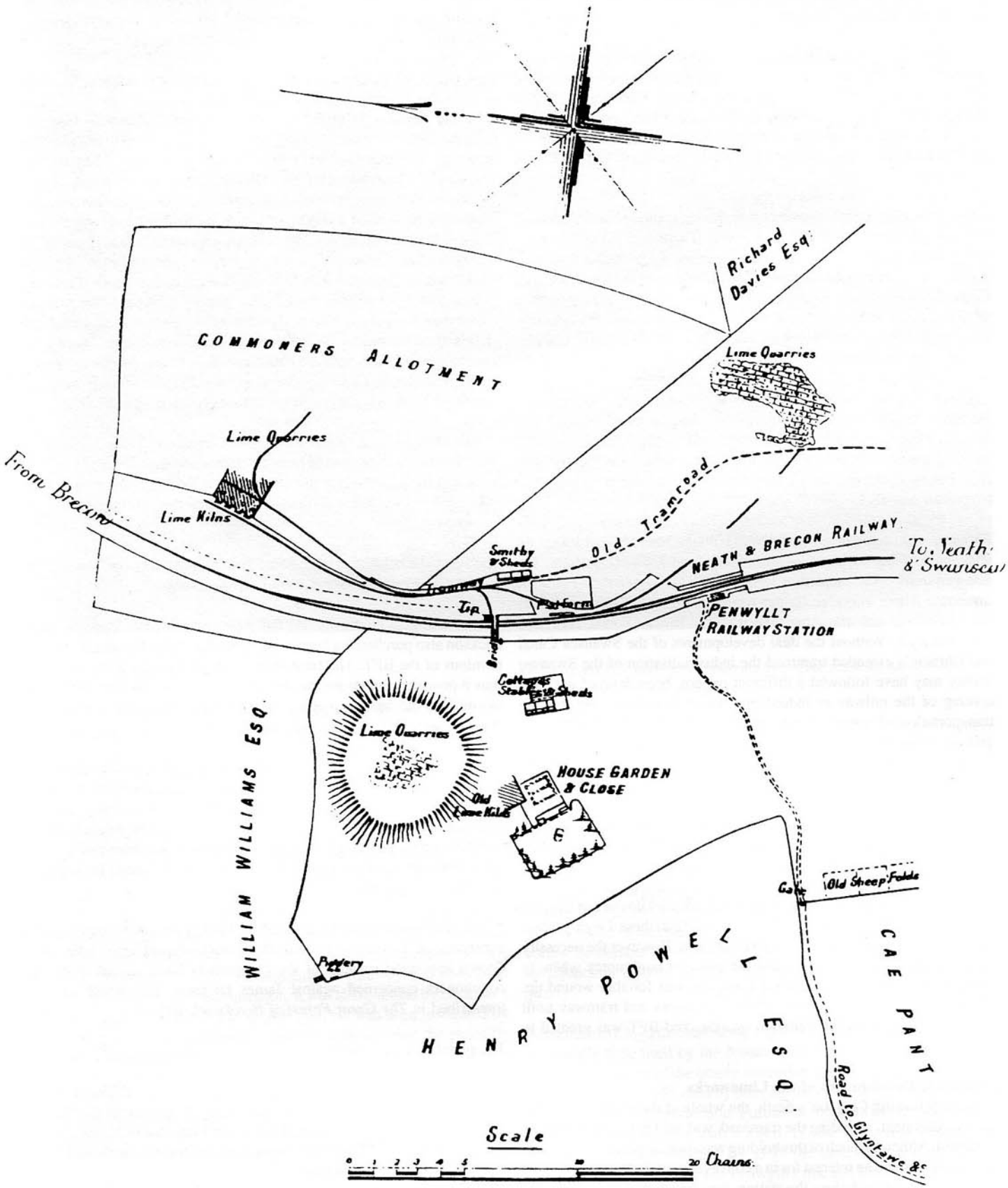
Thus the lease reverted direct to Claypon who appointed an agent, Charles Gabell, to manage the affairs at Penwyllt.

In all this time, there is no record of Claypon himself ever having visited his new acquisition, although his name appears on the 1837 Electors List (Glyntawe) as entry number 1043.



PENWYLLT.

Plan of Lot 4 offered for Sale by Auction in 1875.

Claypon, through his agent, was keen to assist in the development of iron works in the Swansea Valley as a means of exploiting the limestone resource at Penwyllt and using the capital Christie had invested in creating the Tramroad system.

A period of comparative national stability had reduced the pressure on food production causing a slackening of interest in soil improvement and a lessening of demand for agricultural lime. The Brecon Forest Tramroad was at this time being used to carry other goods as well as lime, using the Swansea Canal link with Swansea docks as a means of moving materials between Castell Du Wharf, Devynock, and the Bristol Channel ports.

It was necessary to seek markets other than agriculture for limestone if the Penwyllt holdings were to be viable. There is no doubt that the burgeoning iron producing industries supplied that demand. The new hot blast iron smelting technique had been developed in 1836 by George Crane, director of Ynyscedwin ironworks, and required large quantities of limestone. Christie's original tramway had connected his coal rich land on the Drum mountain with Penwyllt in order to carry coal for burning lime to the Penwyllt kilns.

Between 1832 and 1834 the tramroad had been extended southwards to Gurnos Wharf via Ynyscedwin ironworks enabling coal to be conveyed from the Drum to the works. When lime became important for the new hot blast method it was an easy matter to carry it down to Ynyscedwin from Penwyllt; the alternative would have been to ship it up the canal from Swansea docks.

Furnaces were constructed at Onllwyn colliery, built on land leased by Claypon to John Williams, of Monmouth, and John Jones. Later the Banwen ironworks, founded in 1845, was also dependant on Penwyllt limestone. These works, and others which sprang up in Swansea Valley, used local coal and limestone carried on the Brecon Forest Tramroad from Penwyllt. Without the dual developments of the Swansea Canal and Christie's extended tramroad the industrialisation of the Swansea Valley may have followed a different pattern, been delayed until the coming of the railway or indeed may never have happened, for the transportation of goods in the early years of the 19th century was difficult, time consuming and expensive. As it was, between 1840 and 1850, furnaces in the Swansea Valley which were served by the Brecon Forest Tramroad increased from three to 22 in number.

The tramroad was publicly hailed as a means of communication with the Welsh hinterland and *The Cambrian* (September 7 1833 and August 23 1834) expressed hopes for its potential.

So great was demand for lime that the new Penwyllt kilns which Christie had built circa 1825 became obsolete. Around 1840 these Twyn-y-Ffald kilns were replaced by kilns at Twyn Disgwylfa. However the necessity for continual investment was again the cause of bankruptcy when, in 1840, the Brecon Forest Tramroad Company was forcibly wound up. Claypon resumed direct control of the limeworks and tramway until 1857 when a lease on the Penwyllt quarries and BFT was granted to David Jeffries.

Chapter 6: Development of the Limeworks

In 1859, following Claypon's death, the whole of the ownership of the Crown Allotment, including the tramroad, was sold to George Edwards of Bristol. Although much of this holding was soon disposed of, Edwards obviously retained an interest for in a conveyance of 31 December 1872, six acres of land, including the station, was transferred from Edwards to The Neath and Brecon Railway Company. There is virtually no information readily available concerning George Edwards nor was there any substantial development of the settlement between 1859 and 1863, but from this time onwards the village of Penwyllt, as it is remembered, began to take shape. By 1863 the construction of the main Neath and Brecon Railway was well under way, the main contractor being John Dickson. Tracts of land at Penwyllt, including parts of the tramroad, were acquired by the railway company for construction of the permanent way, but John Dickson, on his own account, brought much of the remainder from George Edwards. His new holding included the limestone quarry which continued to be worked by James Dickson. It is assumed the latter was a relative in the light of later events.

John Dickson's involvement in the area did not stop either at Penwyllt or with the construction of the Neath and Brecon Railway. He also agreed to purchase the more famous Oystermouth Railway, in Swansea, from the then owner George Byng Morris. An agreement to this sale was drawn up on 19 October 1864 followed by an indenture on 15 May 1865. The agreed price was £20,000. Dickson's interest in acquiring the Oystermouth Railway is linked to his activities at the head of the Swansea Valley for he wished to build an extension to the Neath and Brecon Railway to reach Mumbles. We can only speculate as to his motivation but the relevance would seem to lie in the possibility of linking the lime production at Penwyllt with that which already existed in the South Gower and Oystermouth area where export facilities were already established. The purchase of the Oystermouth Railway was not completed at this time, although Dickson ensured his continuing interest by transferring bonds in both the Neath and Brecon and Anglesey Central railways to Morris. He still held this option at the time of his bankruptcy sale in 1875, which also included his properties at Penwyllt.

James Dickson and others executed a legally dubious manoeuvre whereby they bought most of John's holdings and later restored it to him, including the right to buy the Oystermouth Railway, and it was John Dickson who, in 1878, formed the Swansea and Mumbles Railway Company Ltd.

The Penwyllt holdings are illustrated on the plan on page 11 which is reproduced from *The Great Forest of Brecknock.*

Whilst acting as contractor for the Neath and Brecon Railway, John Dickson also purchased a farm in Sennybridge which lay adjacent to the terminus of the BFT. The farm land was well forested at the time and thus it provided timber for the sleepers used in construction. He built a sawmill on the land to prepare the wood and today the holding still operates as such.

Demand for limestone was ever increasing and James Dickson, as operator of the quarries, apparently had scant regard for the commoners rights in the adjacent quarry. He proceeded to work and even erected kilns and sidings on the commoners land. John Lloyd expresses surprise that these rights, possessed since time immemorial, had been disregarded for so long, in fact ever since Christie drove his tramroad through the area thus designated.

A writ was issued in the High Court by John Price and Watkin Joseph, surveyors of Ystradgynlais and Devynnock respectively, who were Crown appointed trustees of the commoners land, on behalf of the commoners concerned against James Dickson. The whole case is transcribed in *The Great Forest of Brecknock*, p114.

The plaintiffs claims were:

1. An Injunction restraining the Defendant, James Dickson, from continuing in possession of or encroaching upon any part of the Quarry premises, and Allotment marked No. 5 in the Plan annexed to the Award made in the month of June 1819, in pursuance of the Act for the Inclosure of the Great Forest of Brecon.

2. An injunction restraining the Defendant, James Dickson, his servants, workmen, and agents, from digging or getting any limestone or any other minerals in, under, or out of any part of the said Quarry and premises.

3. That the Defendant, James Dickson, may be ordered to give up possession of such portion of the said Quarry and premises as was now

held by him to the plaintiffs...

4. That an account may be taken of all profits made the last six years by the defendant James Dickson, by his workings in the said Quarry, and that the defendant, James Dickson, may be ordered to pay the plaintiffs... the amount of such profits...

A full report of the ensuing proceedings was carried in *The Brecon County Times* on May 28, 1881. Dickson pleaded that he had a perfect right to erect kilns, quarry stone and burn lime on the allotment as his predecessors had done so, without payment or interruption, for more than 40 years. He also pleaded that John Christie had made his tramway across "Twyndisgwylfa", as it was then called, using the quarries to raise limestone and burnt lime without payment to the Commoners as had subsequent owners and lessees including Claypon, Edwards and John Dickson. Furthermore the Neath and Brecon Railway had been built through the allotment without question. It was also claimed by Dickson's QC that the action was not a *bona fide* one, but had been instigated by The Breconshire Coal Company, rivals in trade, and that the plaintiffs were not accurately representing the opinions of the majority of farmers and inhabitants of the Great Forest. However the case went against him. A ruling was made that the defendant should give up possession of the quarry but the plaintiffs agreed to waive their claim for retrospective payment.

Dickson's apparent greed and the commoners sudden surge of interest are understandable, for the lime trade was thriving. In 1864 Thomas Levi wrote of Penwyllt:

Thousands of tons of rock were carried down from this mountain, as lime, on the backs of horses, around the surrounding country and over the tramroad built by John Christie, from Waunclawdd to Ynysyrwylfa, near Defynog in 1825, and more is carried by engine since the railway between Brecon and Neath was completed.

He also gave credence to the historical importance of the commoners' quarry in his description of Tafarn y Garreg, the inn in the valley below Penwyllt. He wrote:

This is the old resting place for travellers and for the carts of lime and coal on their way from the Cwm to the towns and districts of Brycheiniog.

Although Dickson presumably withdrew his workings on the Commoners Allotment the argument never really died. In 1886 the then quarry owners, Mr Jeffreys Powell and John Williams, commoners themselves, were accused of trespassing by working 30 yards inside the allotment border. Settlement was made by allowing the common rights but issuing an injunction against them for selling limestone from the common quarry.

According to Lloyd this last ruling explains why the common quarry was historically little used by the commoners. The original settlement had made the workings of the quarry uneconomical by forbidding limestone thus worked to be sold, thereby denying the commoners the opportunity to offset the cost of production. Furthermore the 1818 Act also forbade working in partnership with owners of the limestone beds in the adjoining Crown Allotment. By 1895 the limeworks and quarries at Penwyllt were operated as The Penwyllt Lime and Limestone Company, the proprietor and manager being John Atcherly Jebb of 12 Castle Street, Brecon. Jebb was an important enough contemporary figure to be featured in *Contemporary Portraits, Men and Women of South Wales and Monmouthshire*, and in *The History of Breconshire*, (Glanusk Edition). Along with ownership of the works, Jebb acquired extensive property holdings at Penwyllt. The 1910 listing of Duties on Land Values records him as owner of all Powell Street (also known at this time

as Penwyllt Cottages), including the Reading Room. One of the dwellings was let to Charles Jones, the station master, the others being occupied by families who may have worked either at the lime kilns and quarries, in the brick works or for the railway company. Publication of the 1901 census will no doubt reveal the answers. The original gross value of the holding was £1125 with rateable value of each being assessed at £3 8s.

In 1887 Jebb added Crynant Colliery to his industrial holdings, the obvious link being a ready supply of steam coal for his kilns. According to an engineer's report submitted to his executors, the colliery comprised 1750 acres and between 1900 and 1913 produced a gross trading profit of 1/1d a ton with potential output of 100,000 tons per annum. The colliery was affectionately known as "Jebbs Colliery" until its closure in 1956.

In 1874 Madame Adelina Patti fell in love with and subsequently purchased Craig-y-Nos Castle which had been built in the Valley below Penwyllt some 30 years previously. As a result of the Married Women's Property Act the diva was unable to hold property in her right so the transaction was made by Nicolini who was destined to become her second husband. Following his death Patti remarried and the Baron Cederström became the nominated owner of the Castle and other land holdings which Patti and Nicolini had acquired. This package contained much of Penwyllt, including workers' housing and the lime quarries. A 1901 sale document for Craig-y-Nos Castle included amongst the package:

1 limestone quarry at Penwyllt let for 21 years from 1889 at £250

Patti's influence on the community of Penwyllt was widespread. It was she who caused the rutted access lane to become a metalled road enabling her and her guests to be transported to and from the station by car. She used the facilities at the station so often that it was renamed Craig-y-Nos and a decorative waiting room was built for her private use.

Chapter 7: The Remaining Years of the Limeworks

Throughout the 20th century the quarries continued to be worked up until the late 1960s. Requirement for the product varied according to economic and social patterns but post war policy finally reduced the demand for burnt lime and the resource became sought after as an aggregate.

In the early 1930s, well within living memory of the many people who have recounted stories of their life at Penwyllt, Mr Jenkins of Porthcawl purchased the working kilns, which he retained until 1935. He was apparently a poor business man who neglected to pay bills and, more importantly, he finally "forgot" to pay his workers' wages leaving behind a trail of hardship. However in the suddenness of his departure he left equipment on site. It is said, the people of Penwyllt had no qualms about "confiscating" what was due to them. The receiver who wound up the business is said to have paid the men in asbestos.

Brothers John and David Morgan, who were born and worked much of their lives at Penwyllt, remember him coming into Penwyllt station by train soon after his hasty departure but, sensing the mood of the villagers, he refused to leave the comparative safety of his carriage.

From 1936 until their effective closure in 1959 the lime kilns were worked by Jim Morris and his family. Working conditions at a time when wages at the limeworks were 7/6d a day for an 8 hour shift have been vividly described by ex-workers, in particular Jim Morris' nephew, Mr Ron Davies.

Kindling a kiln, he stated, consists of lighting something similar to a domestic fire at the bottom of the kiln, using paper and sticks. Once this was established alternating layers of limestone and coal were added. At first this was shovelled in from the top, but as the kiln filled, the men who were loading it would get inside and stand on top of the layers in order to spread the load evenly. The coal and stone, tipped into the kiln from drams which ran around the top of the kiln on a circular track, were added in a proportion of three drams of stone to one of coal. This gave layers of 4-5" of coal and 18" of stone. Each dram contained 3cwt and each kiln, when fully loaded held about 50 tons of stone and 10 tons of coal and yielded approximately 15 tons of burnt lime each day. It was important to use the appropriate quality of coal which needed to be fast-burning, giving a good heat, and would then die away without leaving debris to retain the heat. Such coal was obtained from Blaenant Colliery, in the Dulais Valley, from whence it was transported to Penwyllt by train.

The burnt lime was taken from the bottom of the kiln where it had been deposited by the firing process. This was done continually as it became ready, enabling the kilns to be kept alight and more raw materials added to the top. From 1936 until 1938 lime was dug from the traditional quarries, as before, to supply the kilns. When quarrying reached the boundary of the Commoners Quarry, operations were transferred to Cwm Dwr. People tell of a pool in that area which disappeared as the quarry was worked, either because it became filled with waste or leaked away.

The outbreak of war in 1939 and the consequent increase in demand for domestically produced food renewed the agricultural importance of limestone. Burnt lime was again being considered an essential and economically produced soil improver. Limestone was also required in increased quantities by the iron and steel industries which were supplying machinery and weaponry to the armed forces.

In 1940, official permission was at last given to break through the boundary which had protected the Commoners Quarry for over 100 years and over which many battles had been fought. Demand at this time was so great that former residents of Penwyllt remember five quarries working simultaneously and employing up to 10 workers in each quarry. One of these was known as Michael's Quarry and was on the approach to Penwyllt, close to the cattle grid. It opened in the 1940s specifically to supply fluxing stone to Gilbertson's Works in Pontardawe and was worked by a company from Ynysmeudy. The stone was taken from there by lorry to the sidings at Penwyllt where a special ramp was constructed so that it could be tipped straight into the waiting railway trucks and transported down the valley by train. The quarry continued to operate until 1959.

When peace came, the government saw fit to continue to encourage self-sufficiency in food supply for many years. At first burnt lime continued to be used but, by the latter half of the 1940s, it was replaced by kibble lime. During this period the limeworks were under contract to Welsh Brecon Farmers and the product was distributed as far afield as the Elan Valley and Pembrokeshire. The Company owned its lorry fleet and several spreaders, enabling them to apply the fertiliser to the land where required. Once in position the spreader was "fed" by the smaller vehicles which at first were wooden bodied resulting in a potentially dangerous situation with lime, taken hot from the kilns, setting the body of the lorry on fire. All this was a far cry from the days, less than half a century before, when farmers left home at midnight by horse and cart to be first in the queue next morning at the kilns, or when they dashed to the kilns overnight in order to avoid the cost of road tolls.

By the early 1960s, limestone was in demand as an aggregate for an unprecedented road building programme and the need for burnt lime decreased as chemical fertilisers were introduced. The quarries remained an important local supply of aggregate. In 1963 they were taken over by Hobbs (Quarries) Ltd. who used the Penwyllt/Coelbren rail link for distribution. The Neath and Brecon Railway, later part of the Great Western, had been closed by British Rail in 1960. As well as serving as a passenger link between the Midlands and Swansea it had been instrumental in the carriage of Penwyllt products for many years; bagged lime to farmers in mid-Wales, silica bricks to the industries of Swansea Valley and, all too often, transportation of men with industrial

injuries to Swansea Hospital. Discussions resulted in Hobbs leasing the line and station solely for stone shipment. Hobbs intended to create a museum in the old station dedicated to Adelina Patti but it never materialised.

Part of the company's quarrying was carried out in the former Commoners Quarry and continues to be so by their successors, Wimpey Hobbs. An article in the Cambrian Caving Council Annual Report of 1976/7 states:

At Penwyllt, Hobbs Quarries operate a large limestone quarry within the Commoners Allotment.

A further article in the 1977/8 Report shows a plan and explains the Council's concern over potential damage to the unique cave system at Penwyllt. However planning permission for extension of the quarry has been negotiated in such a way that there is no immediate threat, i.e. the extension allowed is further surface area, avoiding greater depth. It seems this compromise was not reached without dispute between the two councils involved. On 8 January 1977 *The Western Mail* carried a report on their contradictory opinions.

The common rights to the quarry still exist but it is said they are traded for concrete blocks to make sheep folds on the hillsides around Penwyllt.

Modern machinery, such as is used in the quarries still worked at Penwyllt, is able to literally move mountains; thus the scale of operations is much larger although fewer men are employed. Those whose livelihood depends on the limestone deposits at Penwyllt now travel to work by car and most of the limeworkers' cottages have either fallen into disrepair or been demolished, but the kilns still stand as a testament to the years of Christie, Claypon, the Dicksons, Jebb and Morris.

Chapter 8: The Creation of the Brick Works

Although the lime industry certainly helped to create the village of Penwyllt, the largest development of the settlement occurred when a silica brick manufacturing unit was established there. No records of the exact date of opening have been found or, indeed, any reference to who was the inspiration behind the project.

The works, with three kilns operating, appears for the first time on the 1895 OS map but a more accurate estimate of the opening would place it in the second half of the 1870-80 decade. The Penwyllt population recorded at the 1871 census numbers three whereas by the 1881 enumeration no less than 166 bodies are recorded. The *1877 Valuation of Mines and Quarries in the County of Brecknock, Parish of Glyntawe* lists only Dickson's limestone quarry and the Breconshire Coal and Lime Company's quarries at Penwyllt whereas in the 1879 Rating List a silica quarry in the ownership of the Abercrave Brick Company is identified. This last entry may prove to be the clue to the origins of he works.

Nevertheless, by 1895, the brickworks at Penwyllt were established and owned by Kershaw and Pole Limited, firebrick manufacturers, Penwyllt Dinas Silica Brick and Sand works. On October 26, two years later, they registered at the Royal Metal Exchange, Swansea identifying themselves as trading in silica bricks and cement, sand, gannister and limestone under the company name of Penwyllt Dinas Silica Brick Co. Ltd. Kershaw is nominated as proprietor with Mr T Ellis as representative. It appears that brickmakers were members of the South Wales Association of Iron, Steel, Tinplate and Metal Merchants and thus *bona fide* members of the Swansea Metal Exchange. The Exchange report has further entries for the company under the group headings "Limestone and Silica Sand and Gannister" and "Firebricks" in the classified list of trades. The company established itself well enough by 1901 to have an engraved letterhead which details their operation.

Kershaw remained at the helm for many years and people still remember how his popularity was acknowledged when he left. A huge marquee was hired and erected in the station goods yard to cater for well wishers and workers who turned out to say goodbye.

Chapter 9: The Stephens Years

According to a lease in the possession of Hobbs Holdings Ltd. a conveyance dated October 1 1926 was made between the Baron Cederström and Craig-y-nos Silica Brick Co. Ltd. although the Brick Company was not incorporated until 18 July 1928. This may hold a clue as to why the 1926 Kelly's Directory lists the Amalgamated Dinas Silica Brick Works Ltd. at Penwyllt, in this one edition rather than any of the other names which have been used over the years.

On November 14 1927 the brickworks were officially acquired by Sir Alfred Stephens of Broomhill, Kidwelly; oral evidence suggests that Stephens was installed at Penwyllt by the time he was knighted in 1927, for people well remember the special train hired by the Company to take workers and their families to Weston-Super-Mare in celebration of the event. Stephens was already in possession of Kidwelly Brickworks, or rather his wife was nominal owner.

Competition in the silica brick market was fierce and there is some doubt as to whether Kershaw was co-operating with the cartel pricing on which the industry thrived. He was certainly a member of The Silica Association, of 2 Worcester Place, Swansea, which was instrumental in fixing the price of silica bricks. There is an insight into the methodology of this in a letter from its president, Alfred Stephens, urging Kershaw to co-operate which has been retained by the West Glamorgan Archive. It is fairly certain that the Craig-y-nos Silica Brick Company, referred to above, was set up by Stephens though whether as a serious threat to production or as a means of obtaining ownership of the silica quarries and/or the lease of the land on which the brickworks stood is unclear.

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Quite when Butler acquired the works from Kershaw is uncertain although Kelly's 1920 Directory mentions neither man, only Mr T Ellis, in his position as manager; the same gentleman who was listed as representative in the Swansea Exchange entry of 1897. He is also the only contact identified on the Quarries List of the same year. However Butler was presumably in his position long enough to have a newly built row of houses named for him.

In 1929, by special resolution in company name was changed from Craig-y-nos Silica Brick Co. Ltd to Craig-y-nos and Penwyllt Silica Brick Co. Ltd. and a further resolution in 1933 gave the works another new identity, the Penwyllt Silica Brick Company Ltd.

The Craig-y-nos Silica Brick Co. Ltd. was presented for filing by Jordan and Sons Ltd, 116 Chancery Lane, and Martin Richards of Thomas Street, Llanelli was the solicitor engaged in the formation of the company which was registered No. 232068. Initially there were two shareholders each with one share: Sir Thomas Alfred Stephenson, Broomhill, Kidwelly and Thomas White Thomas, Roselawn, Kidwelly who was works manager at Stephens' existing brick company at Kidwelly. The directors consisted of Sir Alfred Stephens, Director of Refractories Industries (Silicosis) Compensation Fund (for which services he was knighted), who was a permanent director, and others, who were to be determined in writing by a majority of subscribers, initially Lady Margaret Emily Stephens, Kilgetty, Director of Stephens Silica Brick Company Ltd. and Thomas White Thomas. The Company's registered office was at Kidwelly.

The agreement between Sir Alfred Stephens and the Craig-y-nos Brick Company included properties, stock in trade, fixed and loose plant, machinery, engines, locomotives, tramway, railways and sidings, railway wagons, sheds, stables, horses, fixtures and fittings...

As far as can be ascertained the works at this time consisted of eight kilns with three ton grinding rollers.

Only one kiln was fully fired up at a time, the others being at the heating or cooling stage. Each kiln had the capacity to fire 35,000 bricks at a maximum temperature of 1720°C. The inner walls were constructed of Penwyllt bricks and the outer skin was clay with the two being held together by steel bands.

It is unlikely that Stephens intended to achieve any substantial production at the Penwyllt works being content, in the main to safeguard his Kidwelly operation by ensuring lack of competition. At its height the works had employed 130 people with two wagons of bricks a day being shipped out by rail and going to places as diverse as York, The London Gas Company and overseas. Some were sold more locally and it is said that the works supplied Gilbertsons, Pontardawe, and Baldwins steel works, although documentary evidence of this has been elusive.

By the late 1940s technology had advanced and silica bricks were becoming less sought after. The Penwyllt works were closed and such workers as were inclined to do so transferred to Kidwelly along with the moulds which for over 50 years had turned out silica bricks clearly stamped "PENWYLLT". Customers who were still purchasing Penwyllt silica bricks had to find new suppliers.

This was quite a change from the war years when it is recalled 250 men and women were employed at the works as well as a substantial number of prisoners of war, bought in by train on a daily basis. It was they who taught the young lads of the village to make an electric motor of cocoa tins and wire. This skill was passed on through the generations and many a Penwyllt lad has driven his Meccano model using the same primitive technique.

Strange to think that in the harsh winter of 1947 men struggled to haul second-hand machinery brought from Pyle, including a ball mill, drier and elevators, up to Penwyllt to erect the new works which were in fact never opened!

The Company, however, remained extant. The Stephens family retained interest in the land at Penwyllt with the nominated managing directors being Lady Margaret Emily Stephens, (widow of Sir Alfred who died 28 November 1938), Thomas White Thomas, Margaret Esme Priscilla Farr-Davies and Doris Helena Stewart, Alltyradyn, Llanyssul (both nee Stephens). Company capital was reduced in 1945, by a resolution passed 27 March, from £30000 to £13500 and all arrears of dividends on the issued preference shares, prior to 30 September 1944 were cancelled. By 4 November 1947 the directors including Catherine Aubrey Stephens, of The Burlington Hotel, Eastbourne; Violet Mary Semmence of Killeney, Old Green Lane, Camberley and Dorothy Kathleen Burniston (both née Stephens) of The Gables, Station Road, Cockett, Swansea, all were also directors of Stephens S B Co Ltd.

The 1971 notes on the returned accounts show a mortgage loan to Hobbs (Quarries) Holdings Ltd.

The company continued to trade with various changes of directors until its liquidation on 25 March 1980. In 1982 the remaining interests were sold including the lime quarries and mineral rights under 2000 acres of the Great Forest.

Chapter 10: Operations at the Brickworks

The components of silica bricks were all found in close proximity to Penwyllt - silica sand, silica rock and limestone. Coal to fuel the kilns was carried up to the works by the successor to Christie's tramroad, the railway, but the other materials continued to be transported the comparatively short distance from the quarries to the works by tramway. Locomotive power varied according to the topography.

The three main parts of the works were the kilns, the moulding sheds, the drying room and the "mixing pan". Silica sand, silica quartzite and lime were all bought by dram to be tipped into the ball mill crusher, in reality a huge crusher and mixing machine with rotating arms attached to a vertical shaft. Once thoroughly processed, the resulting clay was barrowed to the moulders who formed the bricks which were then taken by the boys to the drying sheds. Wooden wheelbarrows were used to move the "set" bricks to the kilns where the firing lasted up to three weeks.

In the moulding sheds, the moulders reigned supreme. They apparently considered themselves prima donnas. Their task seemed simple enough, being to bring down the overhead mould onto the clay which had been ready positioned in a pre-shaped form cast from iron. However to make a perfect brick, just the right amount of pressure was needed and only experience taught this.

The moulders, who were paid piece rate, each had a "boy" who carried the moulds away to the drying room. Although conditions were unpleasant they were continually harried to work faster because a slow bearer cost the skilled man money. One man who vividly remembered his short time as a bearer tells how, in 1913, he left school at 13 to find work at Penwyllt even though he was not legally allowed to finish until his 14th birthday. He described the agony of climbing the hill from Abercrave Church to Penwyllt still tired from the previous days toil and speaks of the heat in the drying room floor - so hot that the studs fell out of boots and so all the boys changed to clogs on arrival at work. He carried two soft clay brick forms at a time from the moulder across to the drying room where fires burnt continually beneath the floor. In the ruin of the drying room at Penwyllt today it is still possible to make out the channels under the floor where the fires were lit and imagine the heat which rose through the concrete.

During the 8 a.m. to 5 p.m. day he and his three colleagues moved many thousands of bricks before stumbling back down the hill too exhausted to do more than wash and fall into bed. These comings and goings at the works were marked by the hooter, for few people possessed clocks of their own. It was intended that the sound would be heard by all who were due at work and indeed it was a regular interlude for Patti's servants at Craig-y-nos castle in the Valley below in 1915. There is a persistent tale of a wise old horse working the tramroad which ran from the silica beds to the brickworks who, when the hooter sounded for the end of the day's work, refused to go any further and often left the men to pull the drams the remainder of the way!

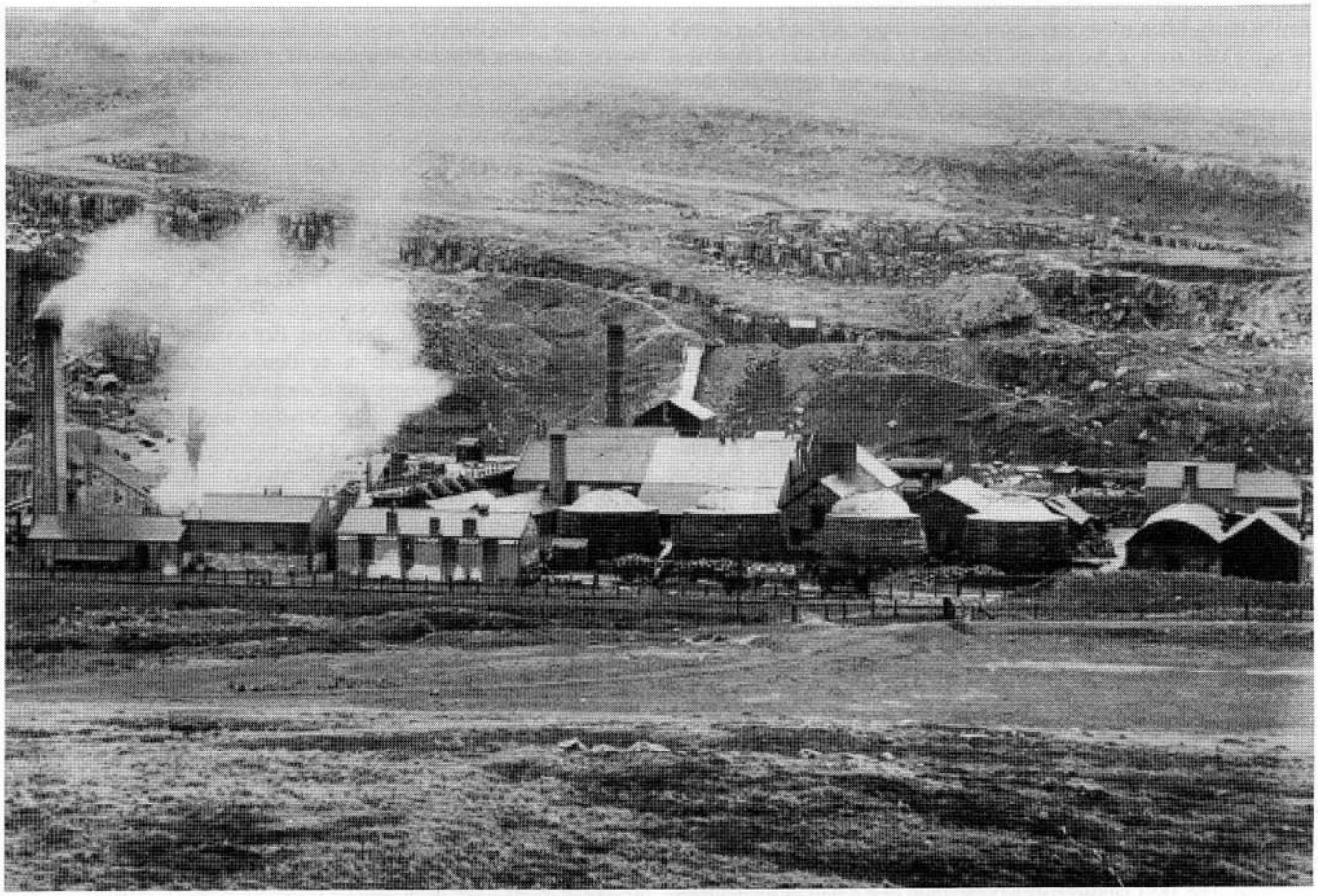
The motivation for work by the boys was the three shiny half-crowns in pay each week. One recalls the pride of taking home his first wage and kneeling on the kitchen floor to roll them one at a time to his mother. However the labourers' wage averaged £2 a week (at a time when colliers earned £3).

At its height the brickworks employed four men in the quarry working with picks and shovels, two in the ball mill crusher, three moulders each with two boys and two firemen to tend the kilns as well as labourers, the carpenter, blacksmith and loaders. In living memory two shifts were worked, 7.30am to 4.30pm and 5pm to 7am.

There is no standard shape for the silica brick, each purpose requiring its own shape, so the carpenter who made the original templates for casting the moulds had his own workshop within the works and was kept very active. Even so the chippy, as he was known, was also responsible for repairs to the Company houses in the village.

After drying out, the bricks were taken to the kiln for hardening. Too much heat too soon on wet clay would have weakened the brick and, for the same reason, the heat in the kiln needed to be built up gradually. When sufficient bricks were in place, the kiln was lit and the temperature built up over a week, retained at heat for a week, then left to reduce for a further week with the bricks still in place.

The finished bricks were loaded onto the goods train which linked Birmingham and Swansea via Penwyllt. Many were used in the South



Wales furnaces but others were taken to the industrial areas of England or carried to Swansea Docks for export world-wide, in particular Egypt and Argentina. The goods train drew into Penwyllt at 7.30 p.m. and came back through on its way to Birmingham at 3.45 a.m., many people tell how they marked time by its passing.

It was not only the workers who were attracted to the kilns. The warmth also attracted the tramps who used the railway line as a route from Rhydder to Pontardawe via Brecon. On many a night there would be three or four tramps huddled into the works. Apparently they caused no trouble and were largely ignored although the village women boasted they were never sent on their way without at least a cup of tea, no matter how stringent a lifestyle the households were living at the time. One itinerant who do not move on was Jack Ball, a legendary figure who slept in the works stores and passed his days as an employed bricklayer for the company.

The silica beds were a way removed from the works, but many types of transport were used to bring down the raw materials dependent on the gradient involved and the state of technological expertise. The mineral rights to the silica quarry were vested in the lessee of the Stump. Certainly the Misses Wagge and Evans who managed the inn around the 1940s are reputed to have benefited from royalties paid by Sir Alfred Stephens, but ultimate ownership remained with Cnewr Estates.

The quarries were governed by government regulations and in 1895 it was T Ellis who signed the Special Rules documentation relating to the quarry known as Penwyllt Silica.

In the process of quarrying silica stone, two grades were obtained. The better stone went direct to the brickworks, while the inferior stone, or spar, was sent away for roadmaking or to the Sheffield steelworks.

W.L. Meredith in his paper delivered to the Royal Institute and Swansea, *The Geology of Penwyllt*, quotes Mr Kershaw as having told him that:

...it is supposed the celebrated old Swansea china wares were manufactured from the finest grained of these same rocks.

Chapter 11: Development of the Settlement

In less than a century, Penwyllt grew from Christie's token attempts at providing workers housing, into the thriving community which is still fondly remembered by former residents. Where before enclosure there had been only wilderness, a self-supporting population was soon established whose work, recreation and interests all were centred on this bleak hillside.

John Christie built his new kilns beside those of the commoners and developed lime quarrying into an industry, but he and his immediate successors drew the majority of their labour from the surrounding farms and the valley villages. Certainly 1941 census returns show quarrymen resident in Glyntawe, Yniswen and the Garth, but only two households are recorded at Penwyllt. These have no specified addresses, indicating that the community was tiny. The wage earners are merely classified as labourers. Likewise, parish records up to 1841 show only two references to Penwyllt; in 1840 the three children of one of these Penwyllt homes were baptised at Callwen Church and Mary Williams, a Penwyllt farm servant, is recorded as marrying Benjamin Price, a farmer of Maes Eglwys, in 1847.

By 1851, Penwyllt had grown to four households, one being that of the same Benjamin and Mary Price, who obviously chose to settle there following their marriage. Ben was working as a coal haulier, perhaps employed at the Drim workings. The two Griffiths families referred to on the 1841 census were still in residence and Daniel Griffiths' wife was

identified as originating from Carmarthen which was quite a distance away in times when roads were poor and transport limited to a horse! The two eldest sons of the second Griffiths household were employed as quarrymen; the first sign that the limeworks and settlement were interrelated. Also living at Penwyllt and working at the quarry was William Llewellyn, son of Gladys, a widow of 59.

Lack of substantive evidence of dwelling houses at Penwyllt continues throughout the 1850 and 1860 periods. Occasional baptisms, burials and marriages involve a Penwyllt address but the pattern shows no growth, neither do such entries as there are in the 1861 census returns. The only interesting development of the period is the appearance of Penwyllt Huts on the burial register in two entries dated 1864 and 1866. The surnames, Kinedy and Bennett respectively, indicate that the families were not local, while the reference to "huts" may refer to a navvy settlement. Certainly navvies were used to construct the Neath and Brecon Railway, but these deaths were two years before the enabling act was passed. However there is no trace of Penwyllt Huts in the 1871 census, thus the settlement was either a temporary one or it was later given a more becoming title. Renaming was an all too common occurrence at Penwyllt to allow for accurate assessment of the early period, however it is more or less certain that the Penwyllt Cottages, registered for the first time on 1871 census records, were later renamed Patti Row. The two households thus identified are those of Alexander McIntyre, a farmer from Ayrshire, and John Cassey, a railway inspector, from Scotland. Another cottage was uninhabited.

The railway had opened in 1866, bringing with it John and James Dickson, an opportunity for prosperity, growth at Penwyllt and many workers from other areas.

During the subsequent decade, Penwyllt underwent a period of rapid expansion. The 1881 census lists a population of 67, half of them under 16 years old, in 12 homes. The Penwyllt Inn appears for the first time as does Penwyllt Row, later to be renamed Powell Street. Listed occupations show the diversity of the community with lime burners, lime hauliers, quarrymen, lime weighers, rottenstone miners, railway employees, general labourers, domestic servants and a licensed victualler. This population included immigrant workers from Llangadog, Gloucester and Sussex.

The founding of the brickworks ensured the continuing development of the village, a young community from which four marriages, 28 baptisms and 11 burials were registered between 1892 and 1901. Expansion continued throughout the following decade with the new Kershaw Terrace and Brickyard Row being constructed. They were built to house brickworks labour and the first was named for the owner, the other for its construction material - surplus bricks left over from the building of the Crai Reservoir.

By 1889 a good deal of Penwyllt was owned by Adele Maria Govanna Guilis Patti, Baroness Cederström, more commonly known as Adelina Patti. Since buying Craig-y-nos Castle in 1874 she had used Penwyllt Station on a regular basis for her comings and goings. She made extensive land and property purchases and, following her death in 1919, her widower, Baron Cederström, sold much of his inherited local holdings, including the following:

All those lands and quarries known as Penwyllt quarries together with nine cottages known as 1-8 and number 10 Powell Street and a Reading Room or Mission Hall (forming part of Number 9 Powell Street) and the disused Lime kilns stables smithy and other buildings erected and all Rights of the Vendor in the rails trams and weighbridge at present on the said Land... together with any common rights over the Commoners Allotment appurtenant thereto... (from H.M. Land Registry Official Search No 232300/1929)

Later sales of the other parcels refer to other agreements of the same period; one made 25 August 1927 between Baron Cederström and Ystradgynlais Rural District Council enabling them to construct and maintain a public footpath across land on payment of 6d per annum and another allowing Morgan Morgan sole grazing rights on the property.

Sale document details also give an insight into the tenancy agreements of Powell Street. Rents for numbers 1-8 were 3/9d, number 10 was 12/6d and ground rent of 5/- p.a. was payable on the Billiard Room. Existing rights on the use of the Reading Room/Mission Hall were protected as a condition of the sale. The buyers were the Craig-y-Nos Silica Brick Company who paid £2750.

Chapter 12: The Community

There is no escaping the fact that Penwyllt can be a bleak and inhospitable place, but there is no doubt that the community was generally happy and thought itself somewhat privileged. In order to comprehend the philosophy, it is necessary to understand the alternatives the period had to offer.

Heavy industrialisation had polluted much of the region and being centred in the valleys, where space was at a premium, smog, dust, fumes and overcrowding were normal living conditions for the working class. On the traditional farms, improving life expectancy with larger surviving families meant land inheritance was by no means certain and the smaller units certainly could not provide a living for every grown child. It was in this climate that the community of Penwyllt developed. The Village's industrial expansion meant work was available to the majority, housing was newly built, if basic, and there was room for gardens large enough to provide for self sufficiency in basic foodstuff. In addition, the air on the hillside was clear; the smoke from the works was carried away by fresh breezes. Taken in this context it is possible to understand the affection with which the village is well remembered but during the time which is within living memory and even that of antecedents. Tales of the preceding years have been handed down by word of mouth. It is from both these sources that the following sketch of the community is made.

However memory plays many games and while one source claims that electricity was installed as early as 1937, another categorically maintains that domestic oil lamps were used until 1948/9. Nevertheless it is a proven fact that there was never any street lighting on the unmade tracks which ran between the houses, railway and works.

High on this hilltop, severe weather in the winter months is a common occurrence. Ex-villagers well remember being isolated by winter snowfalls, some so severe that the men walked all the way down to Pen-y-Cae using the hedgetops as paths because the road was filled to that level with snow.

A major source of supplementary income during the leaner years was the lodger. The practice of accommodating the itinerant workforce was encouraged by both the managers and the authorities who were hard pressed to keep pace with housing an expanding workforce in South Wales. Lodgers also helped to eke out a housewife's budget and so single men were welcomed into homes already overcrowded with expanding families. In many of the two or three-bedroomed terrace houses, up to ten children lived in apparent harmony with their parents and a lodger. Interestingly, procedure ensured that the paying guest always had the privilege of sitting at the table alone for his meals, never expected to endure the chatter of children or be privy to the daily family chit-chat. The weekend must have been a relief to all as most lodgers caught the 12 o'clock train from Penwyllt station on Saturdays to return to their homes for the formality of a family Sunday. However by 1922 authorities were becoming concerned about this practice and greater household prosperity was breeding a reluctance in women to cope with the extra work involved.

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Although these young men no doubt enjoyed the pleasure of their mother's weekend cooking, they also ate well, if basically, during the

week. The menu at the Penwyllt homes generally consisted of traditional Welsh foods with bacon, cheese, milk, eggs, broth and cawl forming the staple diet. Much of this was home produced; most households reared a pig and kept chickens, at least until the war years when even feeding pigs became difficult and the practice was abandoned. Vegetables were also generally home grown; only during June did most villagers resort to buying potatoes as the climate high on the mountain dictated a late growing season. The outlines of the sizeable garden plots can still be seen amongst the ruin of the terraces and one optimistic resident laid out strawberry beds and managed to produce a crop. In many ways the Penwyllt housewife's lot was an easier time than that of her urban counterpart who was unable to supplement the diet with home grown fresh vegetables.

"The Stump" as the Penwyllt Inn was generally known, was the social centre for many of the men. In fact the consumption of ale had as much, if not more, to do with a thirst created in the fierce heat of the brickworks than it had to do with the inn providing a focal point. Women, however, were not welcome at the public house, even though it was owned and run by two of their kind. Instead social outlet for the ladies was in the form of the weekly whist drives organised to provide funds for the Rovers the Penwyllt football team which gained something of a regional reputation by providing potential league players. The team were provided with a field between the Stump and the station by Craig-y-nos home farm and were trained at one period by Mr Smith, one of the missionaries appointed to Penwyllt.

Alternative entertainment was provided by concerts held in the mission. These affairs were famous throughout the Upper Swansea Valley, being staged by villagers anxious to display their musical and dramatic talents. Mrs Lewis, who often accompanied performers on the piano, is remembered with affection. Sometimes a couple of violins were bought in to help the music along while the young people devised sketches as their contribution. The audience arrived from all around the area on foot, horseback or by train.

The first radio owned in Penwyllt was home-made and was such a remarkable event that the villagers crowded into the lucky house to take a turn with the earphones. Later, as radios became more common, the batteries would often be taken carefully by train to Neath to be recharged, although some residents managed to do this at the brickworks using the facilities designed to ensure power supply there.

Another popular meeting place for the men of the village was the billiard hall. In reality this was little more than a tin shack, which stood a little apart from the residential terraces of Powell Street, Brick and Butlers Row but was nevertheless an important recreational facility.

In the early days of settlement at Penwyllt, the doctor, when he was called, came from Abercrave, by gig. Later his was one of the few cars to attempt the narrow, unmade road which wound its way up from the Valley. It was Madame Patti who caused the road to be widened so that her own splendid car could come and go to and from the station without damage. At one time the village supported two resident midwives, Mrs Morgan and Mrs Boucher. The latter had 13 children of her own but was still called on to attend births and to lay out the dead.

On Saturday afternoons many of the women made a shopping trip by train to Neath but even so, the village was quite well served for its everyday supplies. At various periods of its history, meat deliveries were made by The Gwyn Arms, which once doubled as a slaughterhouse/ butcher and tavern, and by Mr Jefferies of Coelbren who made the journey by train. Various traders in Abercrave and Ystradgynlais journeyed up to Penwyllt with other victuals including J Powell, W Edwards, Abercrave Emporium, which also made bread deliveries every other day by horse and cart. Milk was bought up daily from the Rhongur farm in churns.

Certainly by 1936 household coal was in ready supply to the villagers through Mr Jim Morris, who was running the limeworks. His nephew well remembers leading the horse and cart round the village delivering coal to the houses.

The Post Office stores at Penwyllt kept a basic supply of groceries, although the one proprietress is not always remembered with affection. Tales of her "carefulness" abound such as the story of a hard boiled egg, unused from her lodgers tea table, being included amongst five "fresh" ones to make up the half-dozen.

According to Kelly's directories, Mr George Palmer was postmaster in 1895 and at that time there was incoming mail at 9.18 a.m. and outgoing mail at 6.35 p.m. Postal orders were issued but not paid. In 1920 the post office had been taken over by John Lewis.

One of the first houses to be inhabited in the Penwyllt area was Penfoel which was probably part of a farm. One former resident who lived at Penfoel for a while (circa 1920) especially recalls the well which was situated close to the house and which was so deep that ice cold water was drawn from it in summer and winter alike. This well doubled as a natural refrigerator and butter, placed in a metal box inside the cavity, kept fresh from the day it was made until it was used.

There was no road access to this house so all supplies had to be carried across rough terrain for some couple of miles by Ned - a donkey. At this time, people employed by the brickworks were entitled to subsidised coal but it had to be fetched from the railway sidings by the household themselves. Ned really came into his own for, once saddled up and instructed "go and get the coal for mum", he made his own way to the station where the men loaded him and sent him back. However, with the perversity of his species, he would only carry out his task if he was in the mood, otherwise he would sit and refuse to budge. In any case Ned knew his limit which was two loads a day, nothing ever induced him to make a third journey!

Penfoel was a good example of Penwyllt self-sufficiency and designed for the purpose. As well as two small bedrooms and a kitchen, there was an integral dairy so the family were able to keep two cows and a nanny goat of their own who were fed by the grandfather rising at 4 a.m. on summers' mornings, before the heat of the day, to cut hay and bring it home in sacks.

The same resident illustrates the seemingly continual movement which went on around the Penwyllt settlement for with her family she later moved to 3 Powell Street and then to Butlers Terrace where she lived until she married. After the wedding she lived with her husband in number 10 Powell Street, known as the big house as it had two extra bedrooms above the mission which was on the ground floor. Like the rest of the row the house was owned by the Brickworks.

The mission at Penwyllt was founded by the Church of England Navvies Society and its creation coincided with the building of the railway. However, even after the navvies had moved on, the mission remained a cornerstone of the village, providing adult and children's education as well as religious succour. It always remained a Church of England establishment, although the area was generally non-conformist, in order to provide appropriate worship for the workers from Shropshire and Scotland. In later years the missionaries, like Mr Smith who trained the footballers, were part time and they were provided with light work in the brickworks in addition to their religious duties.

As well as the Wednesday evening service the mission housed a regular Sunday School which all the village children attended. Many of these now feel they were sent more to be out of the way for a couple of hours than for the good of their souls! Perhaps this is so given the crowded conditions many families shared.

Chapter 13: Industrial Hazards

Penwyllt, like many other industrial communities of the era, was all too

familiar with industrial accidents, often resulting in premature death.

Several former inhabitants remember one of the Potter family losing his arm when it was crushed by trucks in the brickworks. Rumour says the same arm is buried in Callwen Churchyard but this is treated with scepticism by others! However there is no doubt about the poignancy of the epithet on one headstone which wonders who could have foreseen that when the boy buried within went off to work that morning he would never return. It is said that as the lad squatted close to the kiln to eat his lunch with his colleagues he joked about what would happen if the wall collapsed on them. Within seconds it did just that. As far as the limeworks were concerned it was often felt to be necessary for efficient working that men filling the kilns should stand within them. Frequently the clinkers, which were forming a "shelf" to support the stoker, gave way without warning and dropped a considerable distance towards the seat of the fire. The unfortunate worker had to climb out up the hot kiln side resulting in unpleasant burns to the hands and body.

A further threat to health and safety around the kilns was the noxious fumes given off from the burning lime and coal. These were particularly dangerous to men inside the body of the kiln itself. Once overcome, recovery was a slow process which could take several hours and did not begin until the affected man was carried away to breathe fresh air.

Digging for stone was equally hazardous and at least one quarryman met with untimely death early in this century. He made the error of attempting to move split stone from in front of a full dram but failed to clear the track in time with the result that the dram contents tipped onto him, effectively crushing his body.

The same man's son came close to losing his life some years before, when he was placing explosives in the quarry along with his father. The black powder ignited and exploded before its due time, engulfing both men in flames. The older, more experienced man rolled on the grass to dowse the flames but the younger ran around in fear of his life. All his clothes burnt from him leaving only socks and muffler. It was not thought he would survive and for many days his life was in the balance. However the young man lived to marry and sired seven children.

These were not the only men to suffer. Fatal premature explosions happened all too often but on one occasion it was not industry but celebration which tragically curtailed a life. It was customary for wedding celebrations to be saluted by cannon fire as the couple made their way down the hillside to Callwen Chapel of Ease. In 1880 this horseplay ended the life of John Potter, aged 24, when the cannon backfired as he was firing it.

In so remote a settlement, accidents were always made more tragic by the delay in transporting sufferers to hospital. Calling an ambulance was never a practical alternative to laying the patient on the station platform ready for the next train out. It is easy to imagine the additional suffering incurred by the delay.

Silica itself is an inherently dangerous substance to work with. It is perhaps ironic that Sir Alfred Stephens was presented with his knighthood for his work in Silicosis Committees. The Adelina Patti Hospital, as Craig-y-Nos Castle became after Patti's death, was founded for TB rehabilitation but by the mid 1930s it was silicosis patients who occupied many of the beds for it is an established fact that of all the pneumonoconioses, silicosis was responsible for the largest numbers succumbing to the disease which was frequently allied with tuberculosis. Such was the pattern of life and death at Penwyllt, but many of those who survived the rigours of the industries survived to comparative old age.

Chapter 14: Transport In and Around the Village

Penwyllt was well served by trains from the time of the coming of the railway, but from about 1930 until 1960 there was also a 20 minute bus service from Pen-y-Cae on which three companies competed for custom. However these vehicles also carried miners coming off shift at Abercrave, before the days of pithead baths, and so travel on them was not popular because of coal dust left on seats.

Thus it was to the railway that the inhabitants turned and it is fortunate that so remote a settlement should have been so well served by train. From 1903 there were three daily services between Brecon and Neath stopping at Penwyllt station. Access to Swansea was easily made by changing lines at Coelbren junction.

More fascinating perhaps was the mixture of systems used in and around Penwyllt to transport the stone from the quarries to the works. The remote silica quarries always presented a problem as the gradient rose 535 feet in a distance of two-and-a-quarter miles which made it unsuitable for many methods of transport. Indeed for many years the rottenstone miners had used sled-like carriers which were manually hauled across the uneven ground and a similar method was used for many years as means of moving beer barrels from the station to the "Stump". However, useful as such transport may have been for the movement of small quantities of goods, it was too cumbersome for the scale of operations demanded by the brickworks. At first a 4' 8" mountain railway zig-zagged up the mountainside motivated by a mixture of steam and horse power. This soon proved too slow and expensive and Mr Alfred Lewis, a consulting engineer from Merthyr Tydfil was called in to determine a more suitable method.

The system which Mr Lewis finally devised was the subject of a paper in the Colliery Guardian where it is fully described. Briefly explained the transport consisted of a 2' 3" light tramway with tractive effort supplied by endless cable to Kerr Stuart gripper cars on each train. An interesting complexity of the system was that it was divided into halves by an elaborate clutch and gear box arrangement made by Heywood and Bridge of Manchester to allow independent working of the silica quarry. It is inferred, though not stated, that the whole arrangement was powered by a central steam engine. In 1929/30 the system was replaced by an electric winding drum arrangement from the Central quarry to the brickworks with the motor housed up at the Central quarry, fed from a generator in the works itself by overhead copper cables. There was a later attempt to dispense with electricity and replace the system with a counterbalance which would allow the descending full dram to draw up the empties but the invention failed.

Once over the steep gradient, normal steam locomotive power was used to pull the drams out to the quarries. The engines were housed in their own sheds which were fully fitted with inspection bays and a water column. One such locomotive was named Emily, reputedly after Kershaw's daughter. The locomotive tramroad remained in place for many years alongside the electric winding gear.

Chapter 15: Schooling

Such a young community required certain basic amenities, not least schooling for its children. It was in answer to the pressure of numbers on the existing school at Pencae that Glyntawe school was opened in 1899. The children of Penwyllt made the formidable journey from their homes down over the "Tasg", no more than a track, each morning and returned at the close of afternoon lessons from the age of five years and in all weathers. Although the school was new it was nevertheless beset by problems as the following extracts from the school managers minute book prove:

25 April 1908 - A resolution was put forward to the District Committee as follows: We as managers most earnestly beg to draw your attention to the very bad state of the drinking water supply to the above school which is at present running along the surface about 100 yards passing

close to a farm yard and sewerage from the cow sheds etc. is running direct to the stream which causes the water to be unfit for drinking.

23 December 1916
... a stove to be fitted in the upper Class room where the heat has been under 40 deg. on many occasions lately which is injurious to the children's health while in the other room its very little better.

In addition, there were numerous worries expressed concerning flooding, especially after 1911. On 8 May that year it was noted that:

the road was flooded to the extent that the headmaster was obliged to carry planks and lay them in a position so as to secure safety for the children from the floor to go home.

A commemorative brochure published for the school's centenary in 1949 also recalls the tribulations of flooding including the effects of a cloud burst on 21 July 1907 which considerably damaged Cwm Byfre House which stood in close proximity to the school. The same document records the spasmodic attendance of pupils in the early years, especially during the winter months. Those who did present themselves were often wet and in the early years were either sent back home or to nearby houses to dry out, otherwise they were kept close to the class fire to air their clothes. Subsequently a drying cloakroom was provided and later still pupils from outlying districts, such as Penwyllt were given transport to and, even later, from school. Although the centenary brochure makes no mention of the fact, ex-pupils speak of steaming mugs of hot chocolate provided to cheer wet pupils.

Records relating to attendance at Glyntawe school mirror population trends at Penwyllt. The remainder of the catchment consisted of a reasonably static society form agricultural roots. At its peak, in 1915, the school had 69 pupils followed by a steady decline until the mid 1920s when a slow increase resulted in a 1937 pre-war figure of 58 children. Throughout the war and in the post war years attendance's showed a steady decline with only 22 pupils left in 1959.

Chapter 17: The Decline and Abandonment - Postscript

The growth of Penwyllt's prosperity was mirrored in the Electors Lists for Glyntawe, which included only the surrounding agricultural land owners until 1837 when Joseph Claypon is mentioned, but as owner of freehold land at Glanusk, not for his Penwyllt property. It was not until 1870 that electors such as Daniel Davies, proprietor of the Penwyllt Inn, were registered as freeholders in the village. Others listed in the same year are Gwilym Davies of Bwllfa House, Rees Davies of Penycae, Benjamin Evan, Rees Morgans, William Morgans and Francis Price. However, one hundred years later the village was all but abandoned, the homes of the workers condemned, the Stump closed, and much of the old industrial sites designated as nature reserve. The beginning of the end was in reality 1927.

When Stephens gained control of the brickworks Penwyllt's fate was sealed. Demand for silica bricks was already in decline as new technology was being introduced in kiln manufacturer and such market as was left was oversubscribed. Survival depended on buying out the opposition. Rationalisation always depends on analysis of costs and the location of the Penwyllt operation would have weighed heavily on the debit side. In any event by 1940 the works were closed and no new industry was likely to relocate in so remote an area. The limeworks, aided by the home food supply constraint of the war years struggled on for two more decades but in later years only as a minor employer.

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In 1960 British Rail closed the line from Brecon to Neath which had brought prosperity to the village; custom in both goods and passengers had declined to an uneconomical level. The housing stock was no longer a necessary adjunct to the works and what little investment there had been in upkeep faded away to nothing. In any case the new generation of young people were not satisfied with the lonely life offered in such a remote a location.

By 1974 all but a few freehold property owners were relocated to new authority housing in Glyntawe and surrounding communities and since that time the settlement has begun to revert to its natural state. In many ways the area is again a study centre for geologists and naturalists just as it must have been in 1868 when the Reverend W D Symonds M.A. F.G.S. gave an address to the Woolhope Naturalists Fieldclub based on the geology of Penwyllt.

Powell Terrace remains conserved, used as headquarters for the South Wales Caving Club; members explore the cave system below the lime workings. Mounds of bricks are all that remain of Brick Row and Butlers Terrace but the pattern of the settlement is visible in the outline of the gardens and the tracks between one part of the village and another. Patti Row, back to back housing, stands in ruins. Little remains of the brickworks which were the heart of the community. PENWYLLT bricks lie around in abundance.

The Stump still stands with its adjoining dwelling, Wern House, as do many of the limekilns. Remnants of Christie's tramroad and its later additions are all around. It is also possible to walk the trackbed of the Neath and Brecon Railway. The station is intact although Madame Patti's private waiting room has long gone.

Hobbs Quarries work the limestone deposits for aggregate including the old Commoners Quarry and some commoners still resent this. Above all there are the scars on the landscape which are a testament to mineral exploitation in pursuit of which fortunes were won and lost over the 150 year period between 1820 and 1970.

This work has been published with the gracious permission of Helen Matthews who should be congratulated on such a lucid and interesting survey of the place that for many of us is a second home. Omissions from the body of the text have been indicated by asterisks (***)

In the original thesis a number of appendices followed covering a listing of land transfers, the properties and uses of limestone and silica, together with a bibliography. If any members are interested in this information a full copy of the thesis is held in the library at Penwyllt. - Alan Wood, March 1996

The Discovery of the RAWL Series

(Reprinted from SWCC Circular, June 1950)

It is indeed strange that popular articles on caving always mention Yorkshire, Derbyshire and Mendip caves, but seldom, if ever, the caves of South Wales. With continued exploration since its entry in 1946, Ogof Ffynnon Ddu must now surely rank with the finest caves in the country. When attention is given to the numerous other caves in the area, it is reasonable to expect extensions and new discoveries on a comparable scale.

At Whitsuntide, a party led by Lewis Railton, forced Low's Passage and entered a new series of varying magnitude and estimated at 1,200 feet in length.

This major effort was preceded on the 27th and 28th May by survey work and the forcing of several small passages in the Maypole Series, and included entry of the well-decorated chamber - Flowstone Grotto.

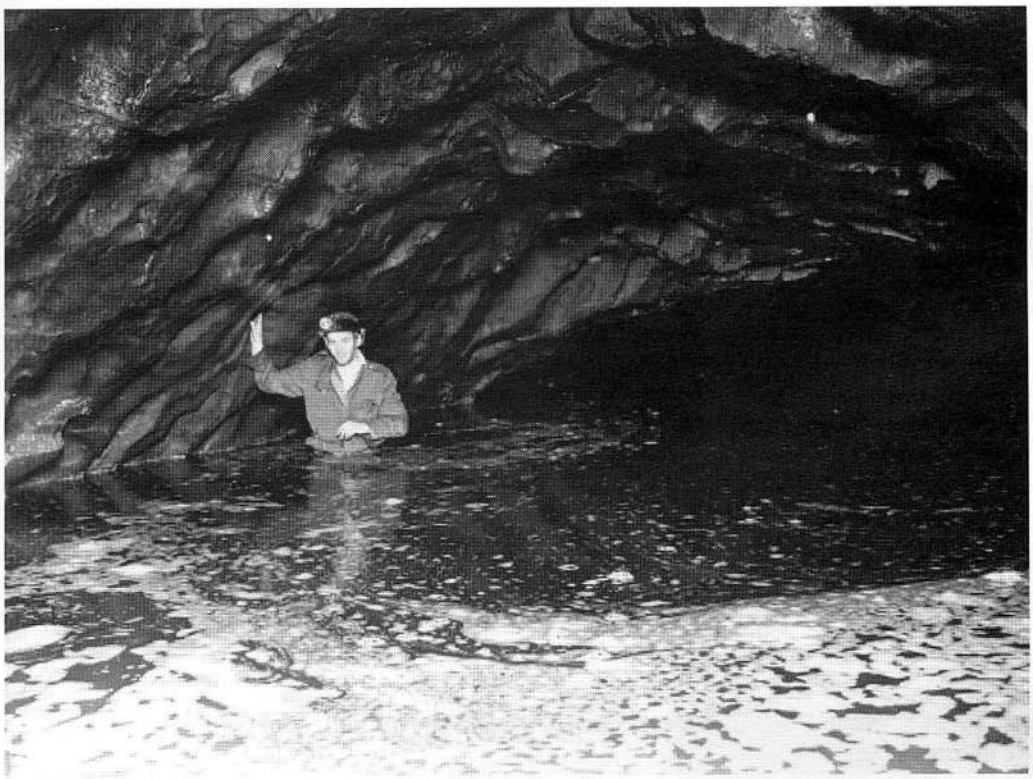
On the 29th, attention was given to the boulder choke in Low's Passage. Little and Railton climbed to the top of the boulders, but failed to squeeze through them, although noting that the stone above their heads was the only object between them and a vast black space. As a last resort, it was decided to blast the two boulders which blocked the way. This was successfully accomplished with 7ft fuse which burned for four minutes giving ample time for retreat down the boulder slope. The boulder slope was found to continue ahead, but to a dead end on the left, although there seems to be a ledge some 25ft up the right hand wall which appears to become a passage over the chock stone of the dead end. At the top of the other slope is a relatively low passage with a right turn giving access to a circular chamber about 40ft in diameter. Here follows a crawl and suspected bat droppings were first noticed.

"... the now spacious passage has a floor of dry mud and boulders, and on the right hand side lie numbers of broken off straws over which, in places, have grown quite large stalagmites. The further we went, the more impressive the scene became, and before long we found that the only way on was on a ledge on the right hand side, to be followed by the crossing of a huge boulder bridge over a drop that appeared to be some 40-50ft deep. The roof at this point just about disappears. In a few yards, we were at the edge of a short stal-covered boulder slope. From here, there appeared to be three ways on - left, half-left and forward. From a promising junction, things started to peter out in boulders left, right and centre. The nether regions were, however, again observed through some boulders in the floor and at the end of the passage in a wall. Some degree of inter-connection of this lower series was established by the party splitting up and hurling down stones. The passage up the cream stal slope terminated in a narrow upward squeeze, followed by a crawl. (Here, an obstructing small boulder had to be rolled out of the way.) Then a few yards over stones leads to a squeeze by the left-hand wall which must be entered feet first to cope with the small drop. This leads to a small space too low to stand in, with a small patch of dry sand in one corner. Here again, we observed one or two suspected bat droppings. Samples were collected for examination. If, instead of dropping down the squeeze, one pushes straight on there is an exceedingly steep slope of apparent soil and small rough stones which come in from the right and shoot down in front for some 10-15ft..."

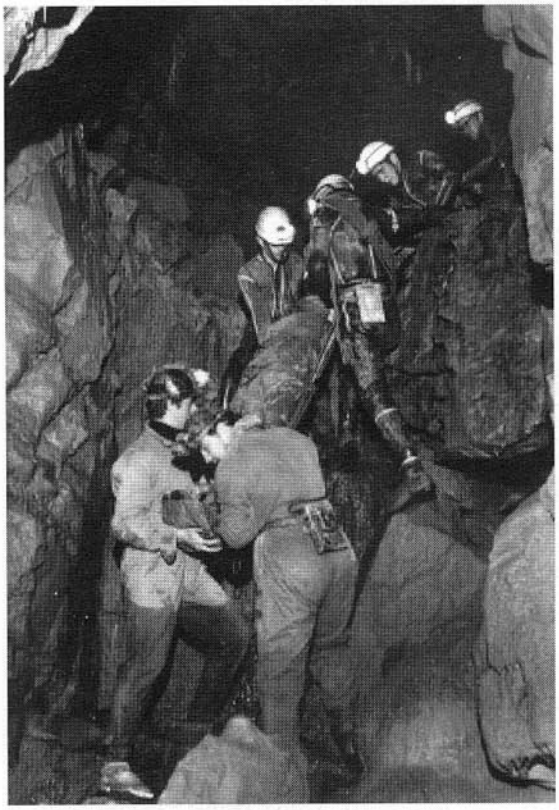
Some 3 hours were spent in this series which is being called "R.A.W.L." after the names of the party of Railton, Afford, Wild and Little, who made this excellent discovery.

(From a report by **C.Lewis Railton**.)

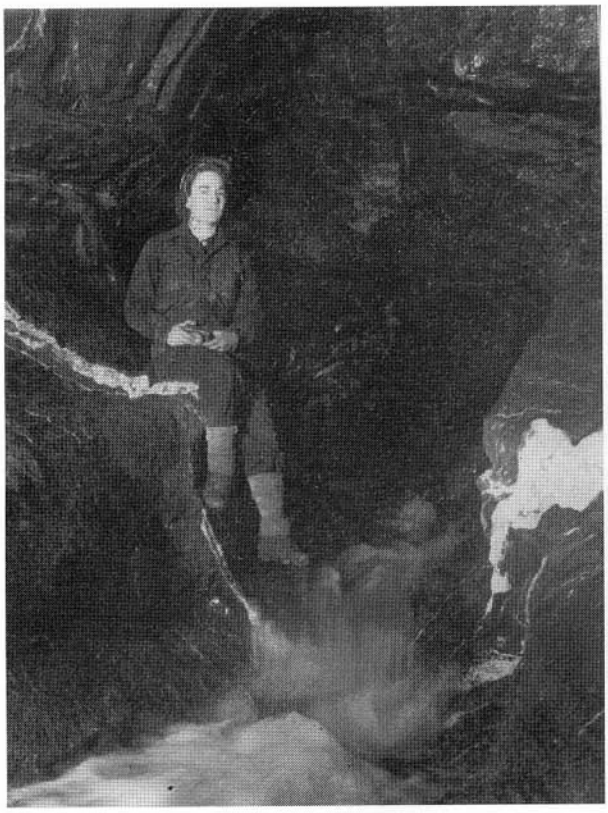
Photographs by Peter Harvey

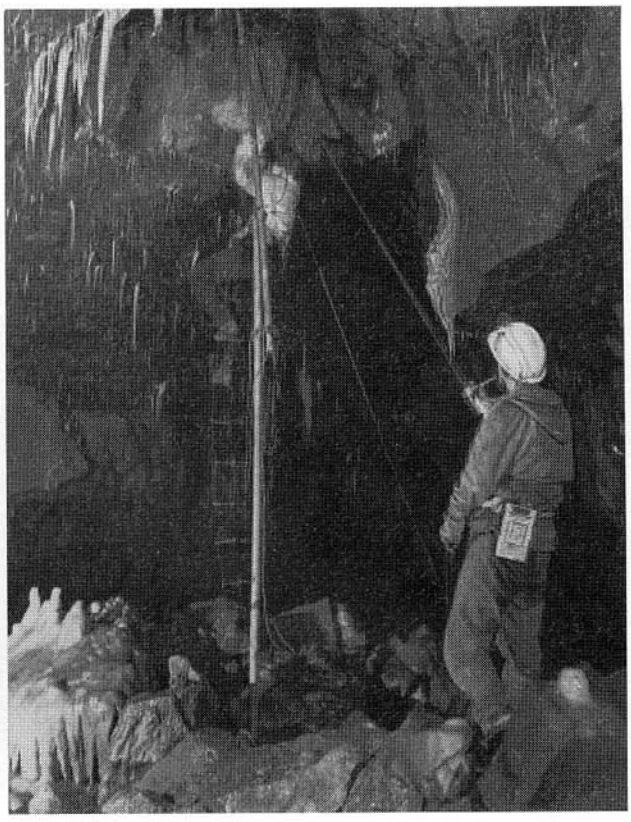


John Davies in the Lakes, Dan-yr-Ogof, circa 1950

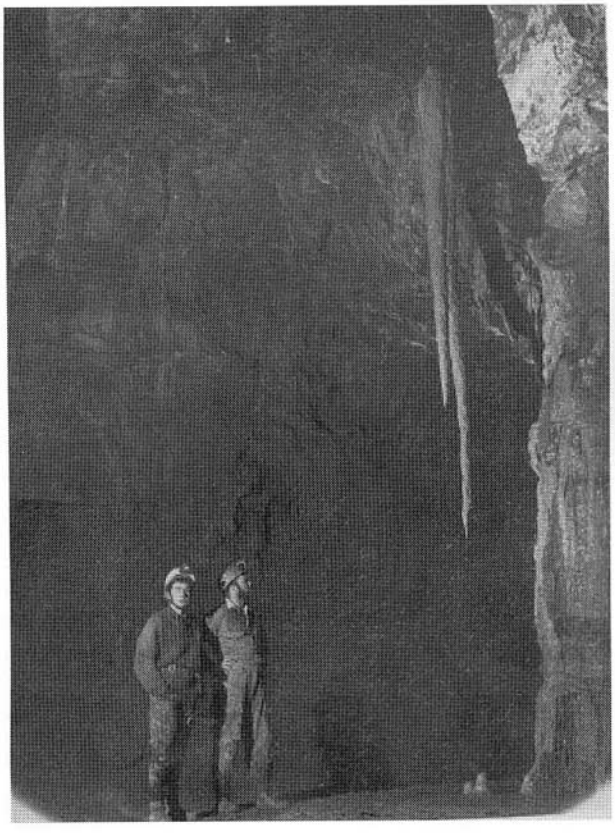


Two pictures from a rescue practice in the RAWL Series, date unknown

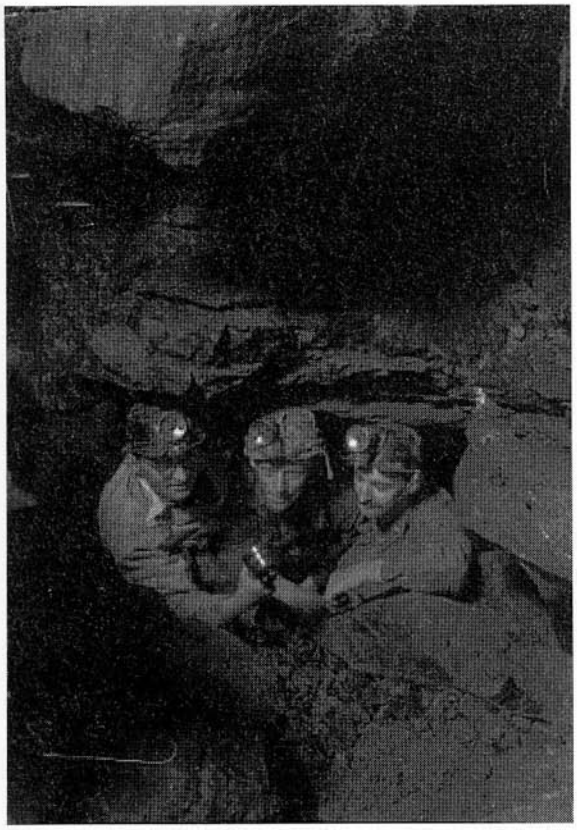




Above left:Peggy Hardwidge in the Ogof Ffynnon Ddu streamway, circa 1947-48. Above right: Maypoling at The Wedding Cake, Ogof Ffynnon Ddu II, date unknown

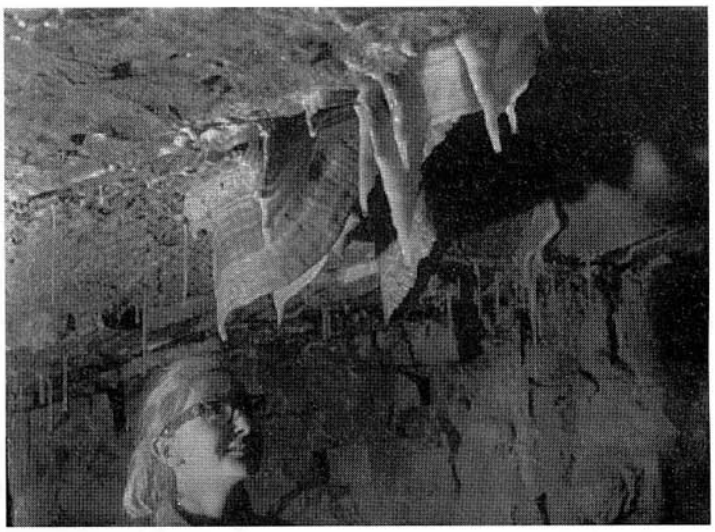


Above left: Hywel Ball and John Bevan at The Trident, Ogof Ffynnon Ddu II, date unknown. Above right: Eileen Davies in Flabbergasm Oxbow, Dan-yr-Ogof, date unknown



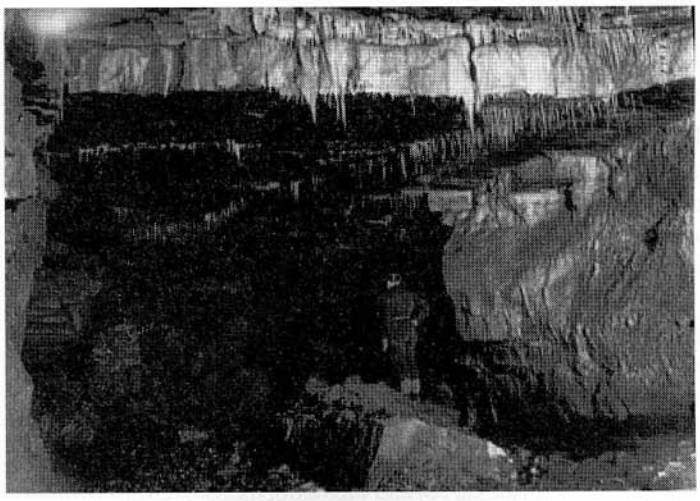
Bill Little (centre) and two BBC Radio employees, when a radio programme was recorded in Ogof Ffynnon Ddu in the 1950s

"The Fingers" in Ogof Ffynnon Ddu



Judy Day in Ogof Ffynnon Ddu II

Left to Right: Peter Harvey, Phyllis Harvey, Arthur Hill, Gwen Tudor (later Mrs Arthur Hill), late 1950s



David Hunt in Pant Mawr, probably early 1950s

A Report by C.L. Railton and W.H Little, on Experiences in Ogof Ffynnon Ddu, August 25th to 27th 1951

(Reprinted from SWCC Circular)

SYNOPSIS

This report details the pertinent preliminary information regarding the cave, the persons involved, the conditions, the food available, together with the experiences of the trapped men. Appendices give recommendations concerning emergency supplies and procedure.

THE CAVE

The entrance passages of the cave are dry after which the main passage is traversed by a stream for some 400 yards. Under normal conditions the stream enters the cave from a flooded passage some 100 yards from the far end of the main passage, thus leaving this 100 yards relatively dry. From this "dry" section two extensive series of passages radiate. One of these is the RAWL series in which we were trapped. This is at the end of Lowe's Passage which is entered by a vertical climb of 1Oft from the main passage. This is followed by a steep scramble up a boulder slope leading to an extensive series of passages (dry) that are about 150ft. above the main passage. In three parts of this high level system trickles of water enter under normal conditions. Due to the size and bends of the passages the sound of these trickles and that of the main stream is not audible except when fairly near to them.

The main stream passage meanders considerably and at stream level varies in width between 3 and 8 feet, while the height varies between 12 and 60 feet. The floor is of rock, sometimes level, sometimes sloping. In places there are many small holes up to 3 feet deep. In four places there are holes some 7 feet in diameter and up to 15 feet deep. These are usually traversed by placing a steel tube across each one and shuffling ones feet along it while balancing with ones hands on the wall. The water flows towards the entrance and its force is such is such that with a depth of 1 foot progress is almost impossible either up or down stream. On occasions of heavy rain the stream in the passage runs some 4 to 6 feet deep. Under such conditions the tubes across the water-filled holes are swept away.

The passages of the RAWL series are well ventilated by a thermal air system. There are no running streams that could give indication of rainfall by their rising. This absence of a danger warning was appreciated and led to the leaving of emergency rations in the system; these are detailed later.

THE PERSONS INVOLVED

W.H.Little is 31 years old. He has had considerable experience of mountaineering and rock climbing. He has been caving regularly for four years in Derbyshire, Mendip and S.Wales. He has been into every part of Ogof Ffynnon Ddu. He has assisted considerably with the survey and was one of the original discoverers of the Rawl Series. He is sound, steady and not excitable.

C.L.Railton is 44 years old and has been caving regularly except for the war years since 1934. He is familiar with many caves in Yorkshire, Derbyshire, Mendips, S.Wales, France and Norway. He has been carrying out a detailed survey of Ogof Ffynnon Ddu and has spent approximately 1000 hours in the cave. He is also steady and not easily excited. Both men are cool and level headed in an emergency.

CLOTHING AND PERSONAL EQUIPMENT

When entering the cave both members went up stream passage with a minimum of clothing around legs and feet. Little had borrowed a girl's rubber-lined mack and Railton had a short waterproof jacket to protect upper garments from drips during the journey. On reaching the dry series all wet garments were removed and dry ones put on.

These comprised woollen underpants reaching to the ankles, thick woollen vest with sleeves to elbows, woollen bathing trunks, thick woollen shirt, woollen polo-neck sweater, two pairs woollen socks, climbing boots, boiler suit, (U.S.A. coverall, French combinations *de toile de lin*) and miners' helmets. For lights, Railton had a 3.5 volt Nife accumulator and was using a 0.3 amp bulb giving light for some 30 hours. Little had a miner's acetylene cap lamp with spare carbide to give 20 hours' light, in addition he had an electric torch with approximately six hours' light. The survey equipment included an electric lamp with six hours' light. In addition we had eight candles and four watertight containers each holding about two dozen matches. Spare bulbs were carried as well as spare for carbide lamp and veganin tablets. Railton was wearing a waterproof watch. Little had 14 cigarettes and a watch in a waterproof container.

FOOD

Long experience of the slow movement entailed when surveying or photographing showed need for hot food when in a cave for more than six hours so on this as on previous occasions the following food etc. was taken into the cave:

1 Saucepan.
1Tin solid fuel containing 8 tablets, each sufficient for boiling 1 pints of water.
2 Cups, 2 spoons, 1 knife, a tin opener.
1Tin Scotch Broth.
1lb Bread.
1lb Butter.
1lb Cheese.
1Tin full cream sweetened condensed milk.
1Small bottle of coffee essence.
4ozs Chocolate biscuits.
4ozs Milk Chocolate.
2ozs Malted milk tablets.

The emergency rations etc. cached in the cave comprised:-

1Tin Scotch Broth.
1Tin solid fuel, 1 Tin opener, 1 Small pick, 11lb carbide.
4ozs Sugar, 8 candles, 1 bottle of water for acetylene lamps.
2 Tins U.S. Life Boat rations each containing:
12 biscuits - 9ozs, 4 x 2oz blocks of chocolate, 8ozs malted milk tablets, 2 x 3 oz tins of fruit "Pemmican" (nuts, fruit, sugar, salt and dextrose.)

EVENTS

We entered the cave at 10.45 Saturday after saying that we expected to be out at 20.00 hours. Survey work commenced about 11.45. At 14.00 hours we had a break for lunch consisting of a tin of hot soup with bread, some bread, butter and cheese, chocolate biscuits and cups of hot coffee. We returned and completed the survey of Phil's Parade and then started to make our way out. There was a deluge of water descending at the end of bridge passage where at lunch time there had been the usual trickle. Lowe's Passage was reached at 19.30 hours. Looking down from the top of the 10ft climb it was estimated that flood water some two feet deep was rushing past in the main passage. (This section of main passage normally only has a mere trickle of water.)

There was a great temptation to sit and watch this water, firstly to see whether it was rising or falling and secondly because of its fascination. Below the 10ft climb the main passage makes a sharp right turn, the water rushing past us down the slope was striking the left-hand wall of the bend, sweeping up and turning over like the bow-wave of a ship doing 25 knots. The noise made conversation difficult and the draught was considerable.

We promptly returned to Sand Passage, filling our saucepan on the way in Lowe's Chamber. The water bottle was drained, washed out and refilled from the saucepan and with the remaining water we made hot coffee and had some bread and butter. We considered continuing survey work but as this would have involved the simultaneous use of at least three lights as well as increasing our need for food the idea was dropped. Sand Passage was the obvious choice of resting place because the sandy floor was remarkably dry by English caving standards and there is ample room to stand up and walk about, while the passage is absolutely dead silent. Its only disadvantage was the very slight draught due to thermocirculation.

For lying down a small bay some three feet high and eight feet wide was considered best. To eliminate the draught, stones from a ledge nearby and sand from the floor were used to build a wall about 1 feet high across the front of the bay; a gap being left for entering and leaving. The small pick from the emergency cache proved valuable for this operation. We had with us a waterproof canvas carrying bag of such a shape and size that Railton could just get his legs and bottom inside providing legs were folded up tightly. While this offered some warmth ones legs soon became cramped and stiff. Sand was banked up for a pillow and pieces of dry rag were used to cover it. Little wrapped himself in the waterproof mack. We covered our faces with our handkerchiefs to conserve warmth and lay down as close together as possible; for economy our lights were extinguished. We talked much and almost entirely about what was happening on the surface, what our friends would be thinking and doing and whether the water would be down by noon on Sunday as we expected and hoped. After about two hours we were shivering so we lit a candle and held our hands over and around it and after 15 minutes felt much warmer. Thus the time was passed by lying in the dark, warming our hands, and going into the Sand Passage to walk around and stretch our legs. Neither of us have any recollection of sleeping.

At 07.00 hours on Sunday we opened a tin of lifeboat rations and had half a tin of fruit pemmican as well as two biscuits and butter each. Two blocks of chocolate were made into enough hot cocoa for two large cups each. A trip was made to Lowe's Passage, the rucksack containing survey equipment was placed where it could be seen from the main passage below and on it was placed a large sheet of paper stating where we could be found. This was also used to record times and water levels. A separate record was kept of our meals. We refilled the saucepan and returned to our resting place. We then had the idea of lying face to face with the cape spread over us with sufficient space between us to place a lighted candle or Little's acetylene lamp. This not only warmed our hands and stomachs but also the air we were breathing and our faces. Due to our breathing the candle soon guttered which was wasteful apart from easily being knocked over. It was found safer and more economical to put pieces of candle in a small shallow tin (half pemmican tin) with a piece of string for a wick. This was now kept going except for the short periods when we lay back to back or in some other position to relieve our limbs. Something less than an hour without the flame reduced the temperature sufficient to cause shivering.

13.00 Hours Sunday.

Lunch, three biscuits and butter and hot coffee each. Visit to Lowe's Passage to replenish water supply and examine flood water. Flood higher than previously seen. Messages indicating that we were dry and O.K. were printed on both sides of pieces of white card. These were tossed into the stream at short intervals in the hope that someone might see them. The fascination of the rushing water was very strong while the roar of the sound booming around the lofty passages (estimated 70ft high) was awe-inspiring but disturbing to the nerves. We did not stay there long and admitted to each other later that we had a strong temptation to jump into the flood and be whisked away towards the entrance. We found that we had each thought that the other must not be left on his own when near the water. We returned to Sand Passage and

admitted that we both had headaches, so we had mugs of hot water with condensed milk in and veganin tablets each before returning to our resting place. Resting and conversation as before. Headaches departed and we felt much better.

22.45 Hours Sunday.
Had tin of hot Scotch Broth and the last of our bread between us. Visited Lowe's Passage. Flood water down to about four inches deep. Estimated that below where main water enters the stream would still be about three feet deep and therefore impassable. Returned to our resting place expecting to be able to get out first thing in the morning.

A suggestion was made that we should dig a trench in the sand to lie in, the mack being spread over the top thereby confining the heat better. Second thoughts suggested that the sand would be damper lower down, so the idea was not carried out. Shortly after this discussion, when lying with the flame between us, we noticed that the flame was gradually going out. We immediately realised that our bodies and the sand pillow were forming a small shallow well which was filling with CO_2. A slight separation of our legs cleared this trouble. This incident bought home to us what could have happened had we dug a trench and lay down in it with our flame. We kept the flame going properly until we felt drowsy when we put it out. We both slept for about 2 hours and awoke feeling very cold. Flame relit to warm up; it was then put out and we slept again, procedure repeated. We estimate that we slept for a total of six hours.

08.00 Hours Monday.
In good spirits. Used two bars of chocolate to make four cups of cocoa and had a tin of pemmican and one biscuit each. Then packed up our things and took them down to Lowe's, fully expecting to be able to go out of the cave. Floodwater back up to Saturday night level. Great temptation to sit and watch whether it was rising or falling. This was resisted and we returned to lie down.

The air current in Sand Passage was noted to be very slight, indicating a cold, dull or wet day on the surface. Decided that in future Little must use his electric lamp when moving to conserve carbide for heating. Food and fuel situation considered, as well as likely rescue measures that would now be brought into operation in view of the obviously bad weather outside and the time we had been trapped. On the assumption that a good team of diggers got started by mid-day, we estimated that they would complete the necessary damming and trench cutting to divert the stream at Pwll Byfre by early Tuesday morning, in which case we should be out by Tuesday noon. It was decided to keep food consumption up to the present level up to Monday night to ensure that we would be strong enough to get out without much assistance on Tuesday. If the water was not well down on Tuesday morning it would indicate that diversion techniques were not being successful and that passage bridging would have to be brought into operation, in which case the food left after Monday night would have to be eked out for Tuesday and Wednesday. Candles and carbide should have to last to some time on Wednesday.

15.00 Hours Monday.
Lunch, Cocoa made with one bar of chocolate and three biscuits and butter each. Visit to Lowe's. Water down to about four inches deep again. We estimated that if it continued to go down it would be at least seven hours before it would be wise to attempt the stream passage on our own. We therefore returned to rest with the intention of having a tin of pemmican, biscuits and cocoa at about 22.00 hours and then examine conditions.

At about 18.00 hours neither of us felt too good, our stomachs were aching and rumbling badly and we both had headaches which were not improved by putting our heads on our hard pillow. We were both longing for our next meal and for the last of our veganin tablets which we would have with it.

At about 19.30 hours the first of our rescuers appeared. As we passed our feeding quarters I opened a tin of pemmican which Little and I shared. In Lowe's passage we were offered hot sweet black coffee and sandwiches. We both drank coffee but had no desire for the food, so did not have any.

We were both fit enough to get out of the cave, get back to the temporary headquarters and change unaided. We felt very weary and had not our normal appetites the next day, but after this we soon returned to normal, and have suffered no ill effects.

C.L.Railton.
W.H.Little.

The Gents' Dig

(Reprinted from SWCC Newsletter no.11)

Historical Note - The dig, previously known as the Ladies' Dig, has been viewed with interest as a possible link-up with Ogof Ffynnon Ddu. As the earlier name suggests, the first attempt was made by lady members of the Club - but who they were has not been recorded.

In 1950 a serious start was made by Arthur and Gwyn Hill, Peter Harvey, Lewis and Marjorie Railton, and others. A promising start led to further efforts by Peter Harvey, Don Coase, Lewis Railton, and others.

These efforts were usually made during "holiday meets" with the result that parts of the dig fell in. Finally it was abandoned and no further work was carried out until Les Hawes and Co. attacked it again last year. - Editor.

> Nothing useless is, or low;
> Each thing in its place is best;
> And what seems but idle show
> Strengthens and supports the rest.
> (Longfellow)

Boulder Chamber - Starlight Chamber - Coronation Aven - these are just a few of the names familiar to those who have battled unsuccessfully to extend Ogof Ffynnon Ddu during the last six or seven years. Early last year, David Jenkins and I decided to have another go at getting in from the surface and we finally chose the Ladies' Dig as the scene of our attack.

The dig is the last - down dip - in a group of shakeholes on the high ground overlooking Penwyllt (roughly on the 1200' contour). The dry valley coming down from the Byfre direction passes the dig to the East.

Our first job was to dig back to solid rock all round and our early days were spent hammering up slabs of fallen rock and clearing clay from the sides of the shaft. At first we employed a crude and rather laborious straight bucket pull up the side of the shaft but as work progressed we developed a ropeway and pulley system which made the hauling-up job much easier and certainly removed much of the anxiety felt by the digger crouching beneath a small overhang at the bottom! Soon we had clean fluted rock all round and good downwards progress was made. One day, with a party of five, work was co-ordinated to such good effect that buckets were filled, hauled up, and tipped once every 1 minutes. Most unfortunate for the last digger, who found the bottom of the rope ladder almost out of reach at the end of the day!

A large slab on the floor proved both unbreakable and unliftable and Glyn Thomas was called in to remove it by a rapid chemical process in which he specialises. Ten feet down and we could see an arched roof appearing under the lone tree. It sloped downwards but was blocked a few feet in. At this stage we decided (more in hope than in fear) that the open shaft looked remarkably like the Pant Mawr entrance and thereafter the digger was belayed to the surface.

The Club Log reads "The Gents' Dig is now an Ogof". A sober reflection of the excitement we felt when part of the floor slid away to reveal an attractive black opening. Clive Jones made the first entry, followed by Brian Jones. They remained down for what seemed an interminably long time to the lone watcher on the surface. Entrance was made by sliding down a steep muddy slope - the side of a boulder and mud cone which levelled out on one side into a small flat-roofed chamber extending roughly southwards. Bones were scattered about in untidy heaps on the floor but seemingly in no sort of arrangement. We collected a few choice ones to bring out for identification (the preliminary verdict is horse - did someone say female?!). We pressed on down the slope and through a small opening to the present base of the cave. The boulders were quite healthily arranged on the slope above our heads but up dip we could see quite a few "untouchables".

Running down dip was a small passage with a squeeze entrance. It opened out quite comfortably but ended disappointingly with the roof meeting floor after about fifty feet. The floor was washed pebbles and silt. Was this the outlet for surface water collected by the many tubes in the roof? Investigation proved that the cave floor of loose boulders would take all the surface water likely to percolate into the cave. Despite its proximity to the surface there is little doubt that the passage strongly resembles a roof meander.

Probing in the boulder floor opened up a hole and we could peer down between the wall and the base of the boulder cone for about four or five feet. At one place we exposed a shelf of bed-rock with a space below and we wondered if this was instrumental in holding up the cone. A hefty charge was packed in but when the smoke had cleared very little damage had been done and things remained pretty solid. Another day, when conditions above prevented surface digging, we probed deeper into the floor until we had to leave rapidly due to what Daniel would call "A great movement in the cave"!

The winter season is not particularly affable towards surface "haulers-up" on this bit of exposed moorland so work has ceased until the spring. We had "acquired" some timber and sheet iron but the shelter we built had to be forsaken to work the ropes and tip the buckets so no great advantage was achieved. We hope to speed up excavation on removal with special tipping buckets and a mechanised pulley system.

In the meantime we have plenty of time to ruminate on what we hope to find this year. It is, of course, dangerous to theorise at this early stage but the writer is quite willing to stick his neck out in the hope of attracting the views of other members. First of all, we think we are digging in the top of a aven - the extreme solutional activity in and around the dig indicates more of the cave than we can see and we think that further development is vertical. Our recent experiences in Steeple Aven (Tunnel Cave) have illustrated only too well that avens or chimneys can be blocked with boulders at or near the surface. In the terms of the surveyed limits of Ogof Ffynnon Ddu the dig is roughly half-a-mile from the nearest section and, estimating the continuation at known levels, somewhere around sixty feet above. The general view that the main cave lies in a more south-easterly direction could well mean that progress beyond the dig will be of a "crawly" nature but quarrying nearby has exposed, and subsequently destroyed quite a moderate little system.

There is no apparent draught although summer conditions have brought about a slight expulsion.

This article would obviously be incomplete without a word of praise for all those who have worked on the dig and in particular the little band of regulars whose efforts have been sustained whatever the weather :-

Brian Jones, Clive Jones, John Hartwell, Glyn Thomas, P.Gelatine

Finally, in a lighter vein, there are a couple of rumours rife amongst S.W.C.C. members which need to be scotched. First - the name of the dig was changed before Dick Underwood spent a day there. Actually it was changed because those digging there felt that they stood a better chance of "acquiring" an appropriate nameplate with the new name! Secondly - there is no substance in the stories circulating about the finding of rare "Hawes" bones at the dig. - **Les Hawes**.

South Wales Caving Club at Penwyllt

by Roger Smith

The history of Penwyllt has been well described by Helen Matthews elsewhere, but it may be of interest to know how it was that SWCC came to Penwyllt. The 3rd March 1959 is a milestone in the Club's history, for that was the date on the Conveyance transferring the ownership of the ten cottages in Powell Street, Penwyllt, from the Penwyllt Silica Brick Company (PSBC) to SWCC. The three Trustees appointed by an AGM to hold the land on behalf of the Club were Edward Aslett, David Jenkins and Les Hawes, the latter having arranged the purchase for £200. Negotiations had been under way since early 1958 or perhaps a little earlier. I hold the copy of the application by the Club for change of use to "Proposed HQ & Hostel for South Wales Caving Club" which was received by the then Breconshire County Council on 1st July 1958. Formal approval came from the Ystradgynlais District Council in a letter dated 15th August 1958.

At the time, the Club had the use of two cottages at Pen-y-bont Llynfell below Dan-yr-Ogof. One of these was at the end of a small terraced row on the banks of the river Llynfell and in a very poor state and the other - the main HQ, at No.1 Pen-y-bont Llynfell - a detached cottage near the road bridge. The former was supposed to be used only for the storage of equipment but some of us would bunk there from time to time as it was very quiet compared with No.1. Even though there was no electricity in this cottage and the state of the southern wall was appalling (would it still be there in the morning?), this was a useful place to escape to if you wanted a quiet and uninterrupted nights sleep. There was no water laid on at the Club in those days, only a tap at the bridge which we would use to fill the water carrier and at which we would wash first thing in the morning and on return from caving trips, objects of curiosity to passing coachloads of tourists. After breakfast on Sundays, the digging of the hole for the contents of the Elsan was standard practice - rain or shine - although tipping into the river did occur sometimes when it was in flood! When the river was in flood it would rise around the cottages flooding the ground floor of the HQ and a clean-up would inevitably follow afterwards. It was against this background that opposition to the move to Penwyllt seems surprising when we look back today. However, there was a strong sense of Club spirit and the number of visitors would only exceed Club members present on very rare occasions.

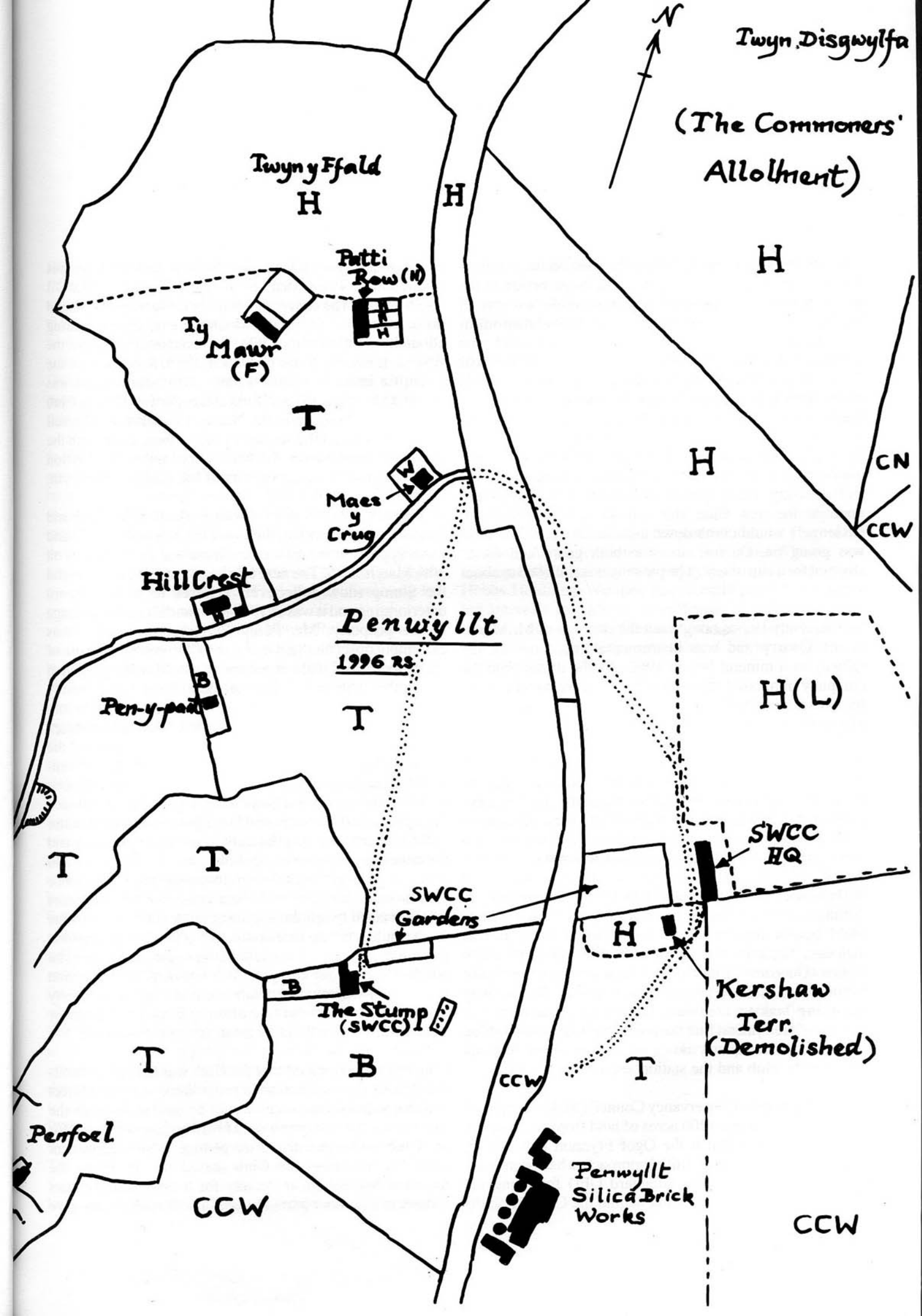
The quest for another HQ came when a committee member asked Sylvia Barrows at Y Grithig if she knew of any cottages for sale in the area. Sylvia mentioned that some of the cottages at Powell Street, Penwyllt were likely to become available as residents were being rehoused in the valley. An approach was then made to the Penwyllt Silica Brick Co. Ltd (PSBC) which was unwilling to part with individual cottages but was prepared to sell them all as a single lot. During the negotiations the Club tried to get the gardens included in the sale but the Directors of the PSBC were adamant that they would not sell any land. There was some brinkmanship during the negotiations, as indicated in club minutes at the time, but eventually a satisfactory deal was brought about, with the Club purchasing the ten cottages, the mineral rights down to a depth of 200 feet below the property and with a tenant in No. 4. Number 9 was a former mission hall. Our tenants were Bill Burton and his wife; Bill worked in the quarry ultimately to become manager when the quarry came under new ownership.

In the year or so leading to acquisition, Club newsletters said little of what was going on, partially because of the sensitivity of negotiations and partially because movement to considerably larger premises did not have the wholehearted support of all club members at the time. However, I can remember Les, who was then Treasurer, recommending to a crowded AGM held at the Gwyn Arms that the Club go ahead with the purchase. There was much discussion. What on earth did the Club want with ten cottages at Penwyllt? Some members felt this was a bit over the top and would destroy the Club as we knew it. Les explained that the existing premises in the valley could only be short term as they were condemned and scheduled for demolition. Some felt that we would never use all the space at Penwyllt and that we should wait for other accommodation to become available in the valley. Les insisted that we had to plan for the future, that this opportunity would never recur and ultimately succeeded in persuading the meeting to accept his recommendation. This was a historic decision which considerably influenced the future growth and development of the Club.

By the 1st April 1959 Brian de Graaf, one of our members who worked in the Planning Office in Brecon, had designed a septic tank of large proportions and approval was ultimately given. The Club moved to Penwyllt sometime in

The accompanying map shows some of the land ownership at Penwyllt today.

Key: B- Mr.H.Bengree; CCW- The Countryside Council for Wales; CN- Cnewr Estates; F- Mr L. Flintham; H- Hobbs Holdings Ltd.; H(L) - Owned by Hobbs but leased to CCW from 31st August 1984 for 20 years until; T- Mr.W.D.G.Toye. W- Mr&Mrs G.Williams.
Unfenced Boundaries are shown --------


N
Twyn Disgwylfa
(The Commoners' Allolment)
Twyn y Ffald
H
H
H
Patti Row (H)
Ty Mawr (F)
T
H
CN
CCW
Maes y Crug
Hill Crest
Penwyllt
1996 RS
H(L)
B
Pen-y-pant
T
T
T
SWCC HQ
SWCC Gardens
H
B
The Stump (SWCC)
Kershaw Terr. (Demolished)
T
B
T
CCW
Penfoel
Penwyllt Silica Brick Works
CCW
CCW

1959 and there was much work to be done on the cottages. Bill Little was heavily involved in the construction of the septic tank which included a considerable amount of brickwork. Inspection of the final job brought astonishment from the inspector who came to inspect and who exclaimed that he'd never seen anything like it! That year there was an embargo on all caving activities in order to get the cottages into a habitable state and many members gave freely of their time to achieve it.

At that time the quarry was being operated by a Mr.Morris with a small workforce and the Neath Brecon Railway was still operating. There were times when the train would stop opposite the new Club HQ and the driver, guard and passengers would climb down and come over to see what was going on. On one occasion both guard and driver stopped for a cup of tea!. The passenger line closed in about 1960.

Subsequently Hobbs bought out the interests of Mr.Morris in the Quarry and was instrumental in reopening the railway as a mineral line in 1962. At about that time the company purchased the station for use a weekend cottage for its executive staff and I remember that it was refurbished extremely well, with the original Victorian toilet brought back on loan to the station from the Victoria & Albert Museum. Hobbs developed the Twyn Disgwylfa Quarry and went on to buy the old Cwm Dwr Quarries from the PSBC. We then discovered that the triangular piece of land, which they had bought, carried a 1947 planning permission for quarrying. Interestingly, the tip of the triangle which crossed the track to the silica quarries was not included in the sale, (there is still has an old section of drill rod down the hole with the hammer end intact from the exploratory drilling in 1970) although the almost worked-out Twyn-y-Ffald quarry together with some land around it was included. The purchase price was ·£25,000 and the sale to Hobbs (Quarries) Holdings Ltd. was completed on 28th October 1969. This purchase was critical in the way quarrying was to continue. Ultimately, following the closure of the mineral line the company bought the section of line from the quarry down to a point about halfway between the club and the station.

In 1975 the Nature Conservancy Council (NCC) completed the purchase of some 1200 acres of land from the Forestry Commission to establish the Ogof Ffynnon Ddu (OFD) National Nature Reserve. Initial approaches had been made to NCC early in 1970 to safeguard OFD following the sighting of drilling rigs on land behind the Club. With the threat of quarrying taking place behind the Club there was considerable worry that the recently discovered OFDII could be lost. The concern encouraged everyone who could do so to provide the inputs which were necessary to bring about the creation of the OFD National Nature Reserve, the first such reserve to be created in the UK because of the scientific interests within a cave. This achievement was brought about due to the efforts and expertise of many Club members. Subsequently the Nature Conservancy Council (NCC) purchased the section of old railway track from the culvert southwards of the brickworks up to that section owned by Hobbs in the vicinity of the station at Penwyllt.

Dr.Edward Aslett, a much-loved member of the Club and long-serving Chairman, died on 11th November 1974 and I was appointed as replacement trustee at an AGM held on 30th March 1975. The next two years saw Wern House and the Stump (now collectively referred to as the Stump) deteriorating and it was in 1976 that vandals caused damage to the property. Mr. Percy Bengree, the owner, was extremely upset and said that if the Club could make use of the property and make it secure he would willingly give it to us rather than see it falling into dereliction. Subsequently the Club bought the properties from him for the token sum of ·£25 (The legal costs came to about £500 due to complex legal problems over the land) The purchase included the fenced-off gardens and was sold with certain rights conditional upon their being taken up within 21 years of the date of the Conveyance (1st September 1977). These included the right to drill for water and lay pipes for supplying water to the property and also the right to install a septic tank and the necessary pipework, manholes, etc for all sewage and drainage purposes over the vendors land. The Conveyance also included a clause that if the vendor or his successors in title wished to sell the adjoining land within 21 years the Club would have the first option to buy it at the open market price and conditions were laid out as to the procedure to be adopted should any disagreement occur. A similar option was agreed whereby the Club could not sell the property within 21 years without first offering it back to the vendor - conditions are laid out in detail in the Conveyance.

Concern was expressed that the Club was heavily committed with its own maintenance programme at Powell Street and that valuable resources would be used to maintain the Stump which at that time would fulfill no immediate role for the Club. Subsequently, after getting written agreement from Mr. Bengree, the Club leased the Stump to the Swindon Speleological Society for a period of 20 years subject to a number of conditions. The National Park gave

approval for the premises to be used as a caving hostel by Swindon on 4th September 1979 subject to strict conditions, one of which was that the premises were not be leased to others without its approval. For a while, after Swindon took over the property, there were some problems with the tenant of the land over which the track to the Stump passed. Despite Mr.Bengree's statement that there was a right of passage for vehicles over adjoining land, the then tenant proved awkward.

In 1982, the Penwyllt Silica Brick Co. went into liquidation and I immediately contacted the liquidator to see whether he would consider selling land to the Club. Useful discussions took place and I was able to help with him in providing certain essential information. He became quite interested in the work of the Club and suggested that we bought the whole of the brickworks land. For some 70 acres of land he quoted what would be regarded today as a ridiculously low price - particularly as it included the mineral rights over some 1200 acres of the National Nature Reserve plus much more outside the reserve. The land included quarries bordering the road to Penwyllt and also those beyond the brickworks. The proposal was put to the Committee of the day which felt that there was an element of risk in spending a large part of what was our roof fund. Also it was felt that the Club should not get into estate management with the associated responsibilities and liabilities. At the time I felt strongly that we should buy, mainly because the opportunity would probably never arise again to obtain mineral rights in an area in which we had so much interest. The Club could have sold the land it didn't want to other interested parties - and there were several. One can only conjecture at what the consequences of such a purchase might have been - it could have been good or bad, who knows! The liquidator was not interested in breaking up the estate and selling piecemeal but because of our particular position, and the help he had been given, was prepared to sell us an easement over land from Penwyllt Station to the Stump for the laying of water pipes together with the gardens in front of the Club premises in Powell Street down to the railway line. Because these were such small items they were sold to us at what was a premium price at the time with the gardens costing us £750 and the easement enabling us to a right of way with vehicles back and forth to the Stump together with the right to lay and maintain water pipes over PSBC land costing us £500. Some money left to the Club by Edward Aslett went towards the cost of the gardens. This purchase was completed on 9th February 1983. Subsequently a buyer was found for the remainder of the land; he proved to be Bill Toye, John Barrows' son-in-law. With Bill as the owner of the brickworks the Club has been fortunate in having uninhibited access to his land at Penwyllt ever since. The sale to him was completed later in the same month.

In the early 1980s an agreement was made between Hobbs Holdings and the Planning Authority to exchange planning permission to quarry Cwm Dwr for planning permission to quarry northwards (and effectively remove the whole of Twyn Disgwylfa) down to the level of the railway line. This was followed on 31st August 1984 by the sealing of an agreement between the Nature Conservancy Council and Hobbs Holdings Ltd. to lease nearly 10 acres of land for a nature reserve, for a period of 20 years. This encompasses an area behind the Club and part of the old Cwm Dwr Quarries. An association between Hobbs and Wimpey was subsequently formed with Wimpey leasing the quarry from Hobbs Holdings. Wimpey has recently passed its quarrying interests to Tarmac in exchange for house building interests. Recent estimates are that the present quarry at Penwyllt will be completely worked out by sometime in either 1998 or 1999.

Times have changed at Penwyllt. My first memories are of the signal box based somewhere near the quarry weighbridge and of the signalman hanging out of the window with his air rifle, shooting at the railway lines in order to frighten the sheep away when a train was due, of the sleepy old Craig-y-Nos station which kept my small wooden trunk for six months until I got around to collecting it and taking it to Pen y bont, and of the Post Office at the top of the hill at Maes y Crug (where Gwyn & Elaine Williams now live) which used to sell sweets and soft drinks as well. Bill Burton moved out of No. 4 Powell Street in about 1964 to "Hill Crest", the bungalow opposite Mr.Bengree's house just above the now-disused quarries towards the top of the hill to Penwyllt. The cottages beyond the Club known as Kershaw Terrace were demolished by Hobbs following the death of old Mrs Burton, Bill Burton's mother, and the Club succeeded in getting a footpath diversion order finalised on 3rd March 1986 which diverted the public path away from the alleyway passing through our line of cottages.
Yes, times have changed!

Obituary: Charles Freeman

by Clive Jones

It is said that a wise man makes more opportunities than he finds. If this is the case then Charles Freeman was a very wise man indeed.

We all count ourselves fortunate if we can live one interesting life: Charles lived so many interesting and exciting lives that no short obituary can do justice to his adventures.

He was born in Bristol and brought up in Cardiff, the son of a draper who taught him all about buying and selling and who made him streetwise. He also taught him the skills of argument and debate.

At that time there were more horses than cars, and as many sailing ships as steam ships in Cardiff. Charles fished for trout in the feeder canal in what is now Churchill Way in the centre of Cardiff. But it was the sea that attracted him and at the age of 14 he signed on to a steamship still carrying sail, and set off to see the world. By the time he came ashore he was a well-respected merchant navy captain.

In his time at sea he did it all. To earn money from passengers he would dive off the top rigging or perform acrobatics on the ropes between masts. His ship was boarded by pirates in the China seas and by the looks of it he talked his way out of that one. He was on the bridge of his ship when a silent storm with no wind or rain struck, and they had to ride out this weird experience for some time before calm returned. It turned out that this was a tidal wave, the consequence of a major earthquake in Japan. His ship was one of the first to reach the devastated port of Tokyo and he become involved in the rescue operation.

Charles seems to have operated on both sides of the law: he helped to stop smuggling and on at least one occasion was involved in smuggling Chinese cooks into the USA.

He was in Russia before the Russian revolution and witnessed some terrible deeds as the Czars troops tried to enforce their version of law and order.

When he left the sea to marry Glad these experiences stayed with him and he and Glad became involved in selling a left wing paper, *The Daily Worker*, on street corners. At that time such a reactionary paper was banned from sale in newsagents. They also helped to organise lecture tours including Paul Robeson's first tour of the U.K.

At this time he was manager of a block of council flats in Manchester. He studied to become a building inspector and learned several building trades including bricklaying, carpentry, plumbing and surveying. It was then that he became interested in the outdoors and joined the Yorkshire Ramblers. He explored all the then-known caves in Yorkshire. At the same time he and Glad were becoming well-known competition ballroom dancers. It always struck me as being a good combination, caving and ballroom dancing.

They moved to South Wales and Charles was able to get a job as a lecturer in seamanship and navigation at the College of Advanced Technology. He became very interested in caving in Wales.

At that time petrol was rationed but Charles was able to talk himself into getting a special ration to travel to the Gwyn Arms in the Swansea valley, the centre of the caving country. How? Well, he was an expert on beekeeping and the then Ministry of Agriculture and Food needed as many hives as possible in the countryside to ensure good crops.

He had many caving adventures including being arrested as a German spy by farmers at Ystradfellte. They had come across him and Gerrard Platten dressed in waterproofs and carrying lamps, ladders and digging equipment in the back of a car. He talked his way out of that one.

He was a founder member of the South Wales Caving Club and its first Treasurer. He was then 48 and the club celebrates its 50th anniversary this year. So to most of us in the club he had always been an elderly club member: what we didn't appreciate was that he had done it all by then.

He built his own bungalow, continued his competition dancing and studied to improve his position at the C.A.T.

After Glad was killed in a car crash he renewed his interest in fellwalking and I'm sure that there was no part of wild Wales that he did not know and understand. He became interested in music but every time he bought a record he had to find out all he could about the composer and the performers. Any book he read was filled with margin notes and points to follow up or to check. He was interested in everything and everybody.

When he retired he became involved in the tape club and corresponded in this way with people in several countries. He was fascinated by popular science and knew what was going on the frontiers of many disciplines. He was particularly interested in maths. His favourite radio programmes were *From Our Own Correspondent* and *Science Now*.. But don't get the wrong impression that this was a boring old man: he was always looking for a laugh and could usually find one.

Most of us will remember him for his quick response in any argument.

When in his late 80s he was shopping in Penarth and met two of his ex-students. That day he had been struggling with some complex navigation problem and he asked them if they could explain some maths to him. They replied: "It was you who gave us that information."
"That's where you are wrong" responded Charles, "I only loaned the information to you. I now want it back."

If any of you need a feel-good factor may I suggest that you subtract your age from his and then realise that if you can pack as much into the time that you have left as he did that you have a lot to look forward to.

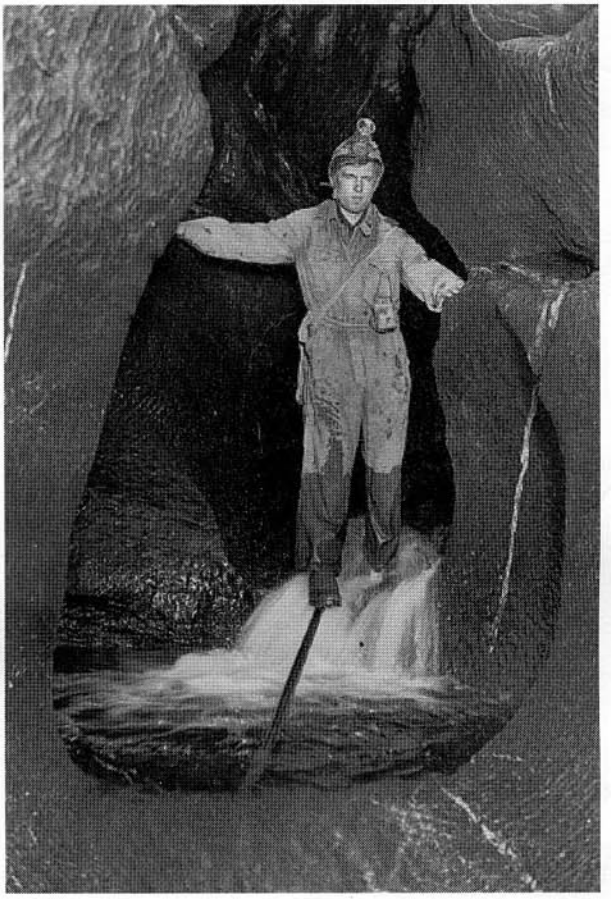
Charles did not believe in life after death -WHAT IF HE WERE WRONG?

Don't worry, those of us who knew him well will know that by now he has talked his way out of that one.

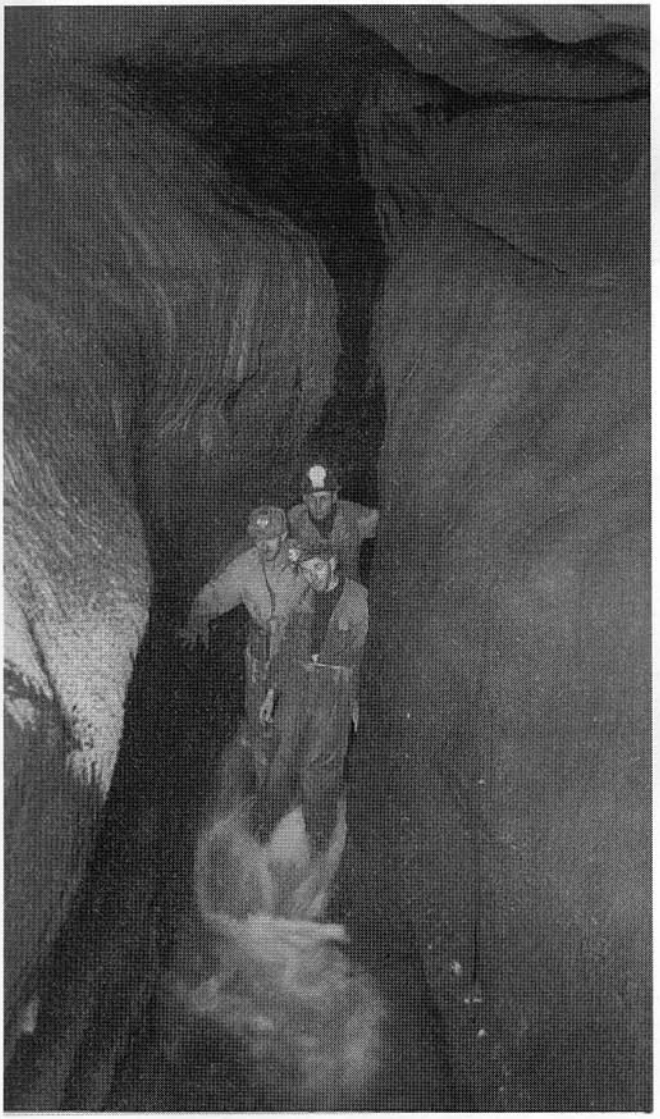
Thank you Charles, and GOODBYE, SKIPPER.

Photographs from the Collection of the Late Charles Freeman.

Editor's Note:*for several years before he died, I would occasionally receive from Charles small packages full of interesting photographs, usually accompanied by notes in his rather shaky handwriting with favourable comments about the latest edition of the SWCC Newsletter. Some of the pictures date from before the war when, as Charles put it, he had done most of his caving. A selection of pictures was used in N/L no. 112 in 1993, and over the next four pages I've chosen some more that are relevant to the club. It has not, in some cases, been possible to credit the photographers concerned, since Charles was unable to remember who took the pictures. Similarly, although most of the photos had captions on the back, they were generally rather vague; thanks to Clive Jones and Peter Harvey for providing additional information.*



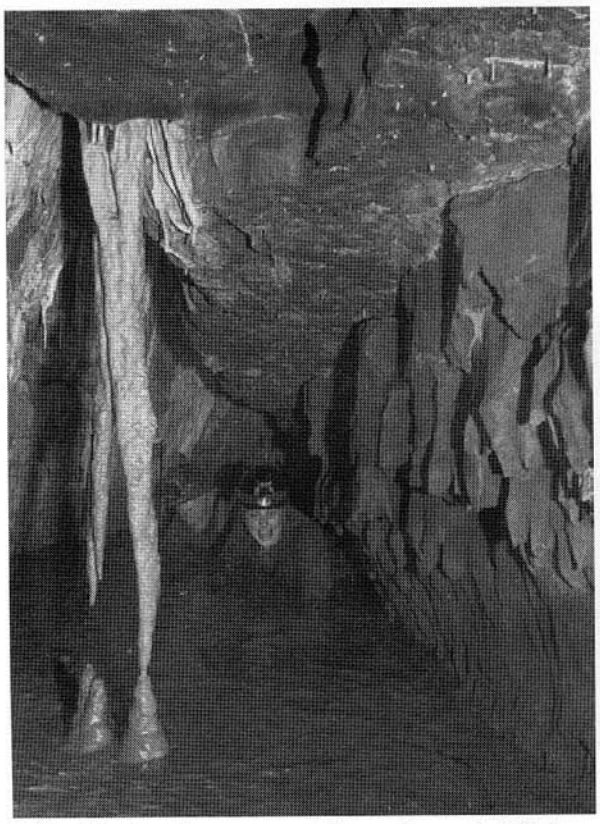
Gwyn Thomas (?) in Ogof Ffynnon Ddu I

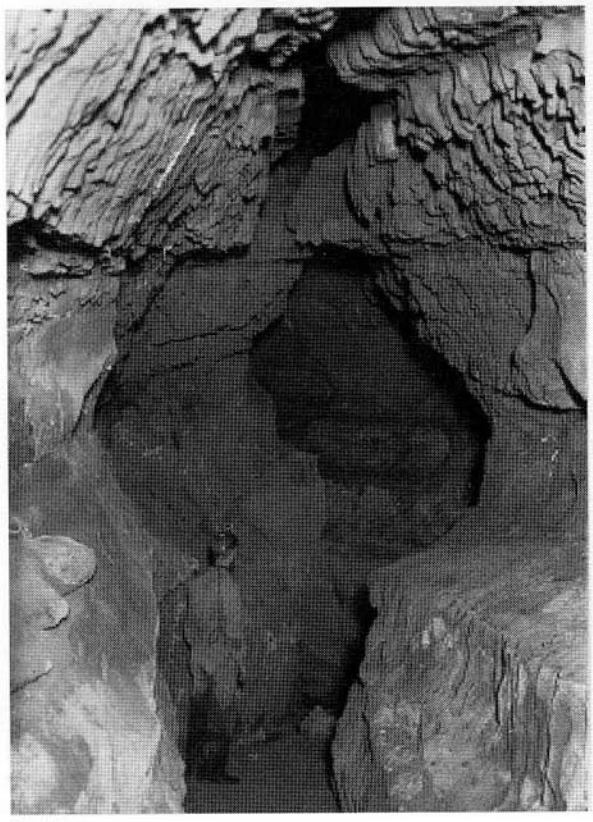


Ogof Ffynnon Ddu I streamway, Lewis Railton in centre

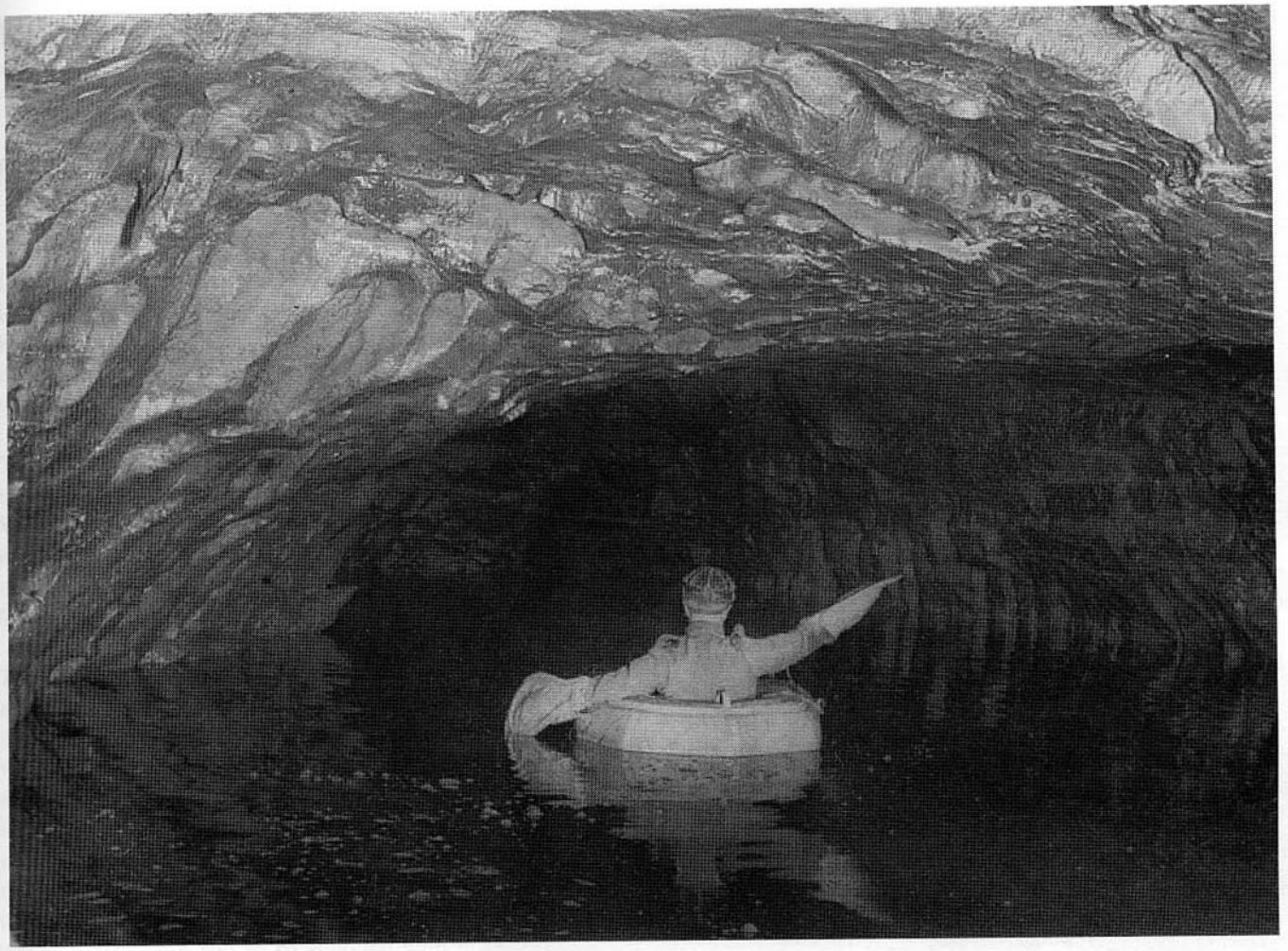
Back row, L to R: Gwen Hill, ?, Dorien Mason
Front row: Brigadier Glennie, Mavis Cook. Early days, possibly before SWCC, on Penwyllt road

SWCC prepare to start the first Brecon - HQ walk, 1968. L to R: Derek Webley, Bernard Wood, Colin Graham, John Hartwell, Clare Harvey, Terry Lloyd, Gwyn Thomas, Arnold Jones, Edward Aslett, Rod Stewart, Gordon Clissold, ?, Mark Skinner, Mary Galpin, Glyn Jenning, Paddy Cleary, ?. Photography by Beacon Studios, Brecon.

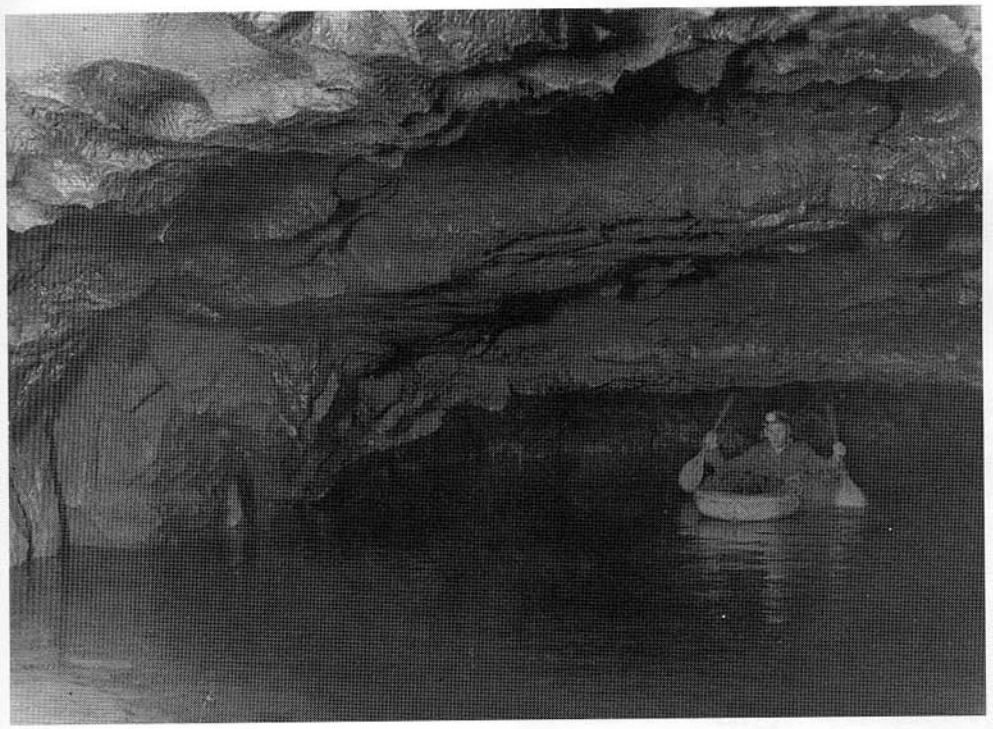




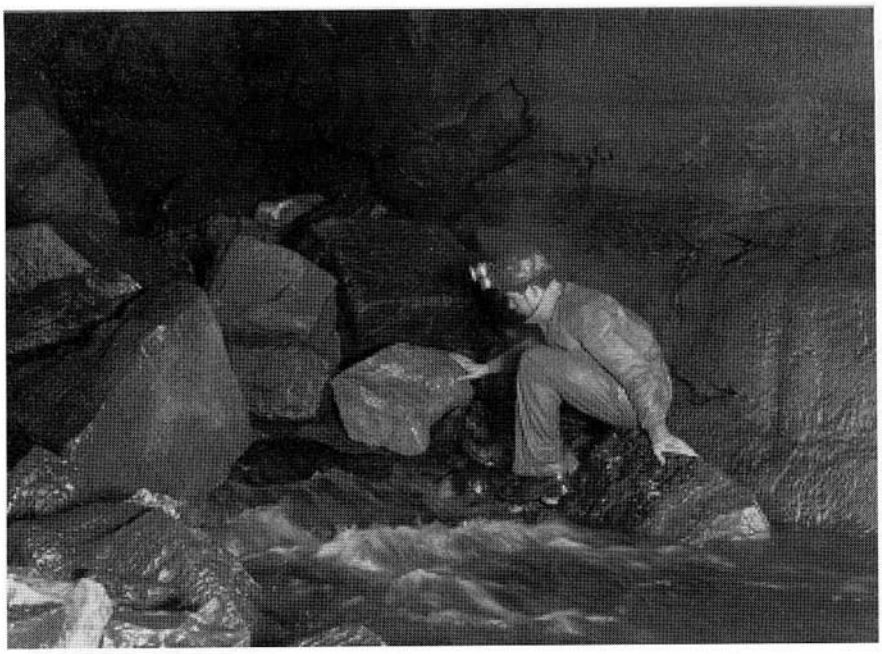
Left: Charles Freeman and ?, coming out of Column Pool in Ogof Ffynnon Ddu I. Photo by Noel Christopher
Right: Lowe's Passage, Ogof Ffynnon Ddu



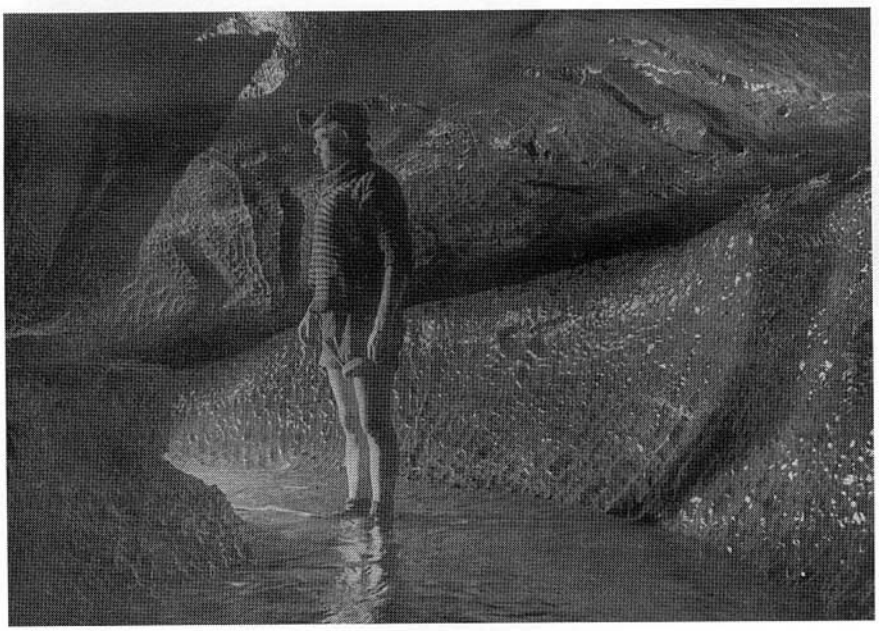
Crossing the 3rd Lake, Dan-yr-Ogof. "Didn't like these hand paddles - no power in straight arms. Much easier to wade, or swim." - Charles' caption on back of photo. Taken by Peter Harvey.



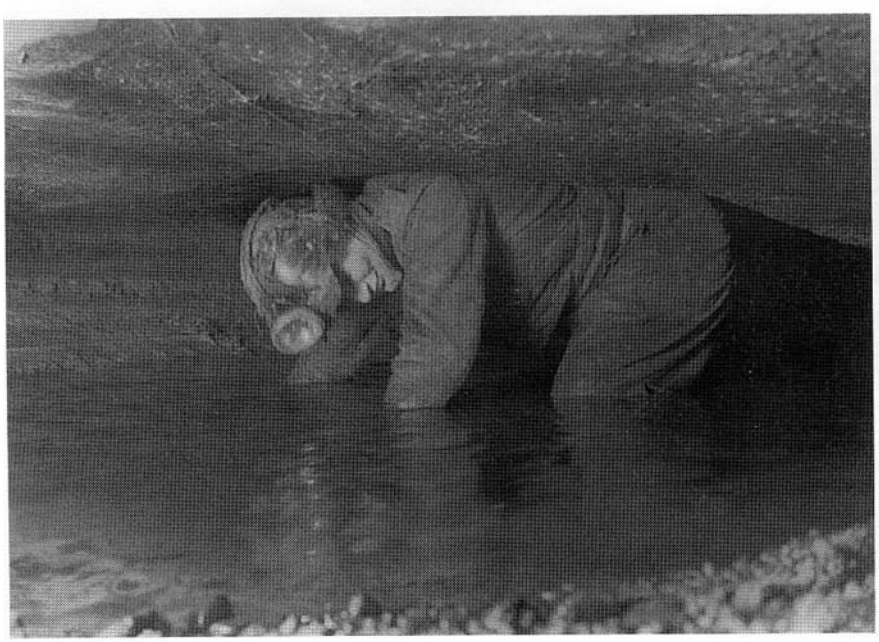
More conventional paddles in use, also in Dan-yr-Ogof. Photo by Peter Harvey



Flood water in Boulder Chamber, Ogof Ffynnon Ddu



Peter Harvey, probably in Ogof-y-Ci. Photo by Peter himself



"Think this was Ann Bolton", Ogof-y-Ci. Photo by Peter Harvey.

101 Great Caving Trips, no.7 :
The Milwr Tunnel

by Eric Inson

I have been prompted to write this article by reading other interesting accounts in this series, and by the untimely passing of Rod Stewart. Although this is primarily about a mine tunnel, part of the system is a natural limestone cavern. The date of our trip would be about 1967.

The Milwr Tunnel is the main drainage channel serving the lead mines in the Halkyn Mountain, near Holywell in north-east Wales. A complete description of the system is contained in an excellent book of the same name by Chris Ebbs, published recently, although some of my recollections differ slightly from the descriptions in the book.

The Halkyn Mountain contains numerous lead mines and, as the mountain is largely composed of limestone, a great deal of water, including the River Alun, finds its way into the workings. This water caused great problems for the various mining companies, and often affected the profitability of their operations. Eventually in 1897 they started to construct the sea-level tunnel which drains into the Dee near Bagillt. The tunnel was constructed in sections, the last part completed in 1957. So successful was the operation that it eventually drained the whole area, including the Holy Well which subsequently had to be supplied with piped water. The volume of water flowing out into the Dee reaches 36 million gallons per day in wet weather. The tunnel length is something over 10 miles, with the workings totalling over 60 miles.

In the early 1960s the mine was being worked for limestone. An area of particularly pure rock was being mined to supply Pilkington's glass works, and the water flowing out of the tunnel was being used for industrial purposes. No lead was being mined at this time. A group of cavers from SWCC and BC&C were lucky enough to arrange an official guided tour of the workings. The trip was fascinating. Entry was via the Olwyn Goch shaft near Rhydymwyn, about 400ft. We were taken around the current workings (limestone) in mine cars pulled by a diesel locomotive, and also around the old workings, including old munitions stores and the huge natural chamber at Powell's Lode. This chamber may well be the largest natural chamber in Britain, with a lake over 200ft deep into which mine waste was poured for years without affecting the depth or water level.

A few years later, when the mine was once more producing lead, Rod Stewart and John Osborne became interested in the possibility of a through trip (unofficial, of course), from the Olwyn Goch shaft to the outflow at Bagillt, a distance of eight miles. They did a lot of groundwork, getting first-hand information from local people to determine the probability of the tunnel being open, and that they would not be swept into a flooded section caused by a roof fall. Although the mine was working, all the operations were upstream of the shaft bottom, and the maintenance of the downstream section was doubtful. It must be emphasised that the tunnel is a major waterway. Some sections have a raised rail track at one side where one can walk, (or wade), but the main length is in waist-deep water moving rapidly, with no chance of returning on foot against the current. They also had to solve the logistical problems of not encountering workmen underground, not being seen by the watchman, and getting back to the car afterwards. They solved the problems and completed the trip, although they did become worried somewhere in the middle when the draught stopped, but it was just due to the weather and the arrangement of the intermediate shafts.

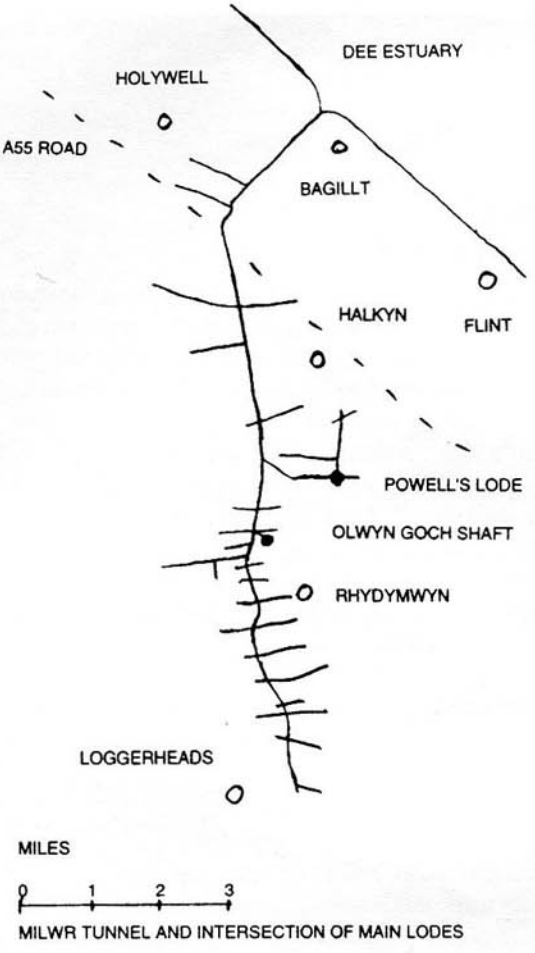
About three weeks later Rod asked me if I would like to do the trip. It was easy for me to say "yes" as all the preparation had been done and it was unlikely the place would have fallen in during a few weeks. There was some resistance to my going from my wife: "Who knows where you are going? How can you be rescued if you have a problem?" and so on, but on the appointed weekend we went.

Rod said that as we would be spending some time in the cold water, not using much energy but going with the flow, we should obtain some extra buoyancy to keep at least parts of our bodies out of the water. Previously they had used motor inner-tubes but these were not really satisfactory. Whatever we took could not be too big because we had to get it down the ladders and also the last 100ft or so of the tunnel near the exit had been reinforced with a low steel lattice structure which we would have to go under. Clive Jones volunteered his ex-RAF one-man inflatable dinghy, which would allow one of us to sit partly in it and one to hang on over the back.

The trip was to be on a Saturday night to avoid the watchman and the workforce and to be able to use public transport for one journey. We drove up on the Saturday morning and stopped at Rhydymwyn near to the shaft. Here we left our caving gear, wet-suits and dinghy in a disused railway hut and drove to the other end at Bagillt, a journey of about half an hour. We parked the car in a disused yard close to the outflow. This was surrounded by a high fence - "no problem" said Rod. The actual exit was protected by a stout grill - "don't worry, it's hinged". Then we caught the bus (two in fact) back to Rhydymwyn. This took two hours. We changed into our caving gear, and waited until it got dark at about 10pm.

The method of entry was down 400ft of wooden ladders at the side of the shaft. For some reason the actual shaft was some distance up the hill from the mine buildings, and to save the miners the effort of going up the hill a tunnel had been dug to allow them to walk on the level and under cover. The watchman's cabin was near the entrance to the tunnel, but with lights on in the cabin and it being dark outside we were able to walk quietly past.

It had recently been raining, and I was rather worried at finding the base of the shaft already knee-deep in water. At the bottom there were several locomotives, the electrical ones plugged into



MILWR TUNNEL AND INTERSECTION OF MAIN LODES

their chargers. The problem was that their wheels were under water and they looked like boats. "Come and see this" said Rod. We went into the mess-room where the miners had their food. The table was there but only the tops of the benches were visible. Diners would have to sit in the water. In one corner was a "Heath-Robinson" heating device. This was a large earthenware container with a pair of electrical leads going into it and the whole device glowed gently. I got out quickly!

Rod said that we had plenty of time to look around, as there was not much point in getting to the other end before daybreak. At this time in his life Rod was involved in mining operations and knew about locomotives. So, carefully noting the exact position of a "free" diesel (so that it could be returned exactly to the same position), and pushing an empty wagon in front (as we could not see the rails or any obstruction), we set off for a tour of the present lead workings. It was just like being in a boat, complete with bow-wave. After some time the water became shallower, and eventually we were on dry track. About two hours later we returned the locomotive. There was apparently no work in the mine on the Sunday so the engine would have time to cool by the next shift and not cause suspicion.

Now was the time to start on the main journey. The first part of the tunnel carried the railway track and could be walked, but there was enough water about to make walking tedious and probably enough to float the dinghy. So after some huffing and puffing (no pump or gas cylinder) we set off. We got all of 100 yards when we found an unseen sharp object and *psssss...*, down went half the dinghy. We now needed more buoyancy, so we went back to see what we could find. An empty five-gallon oil drum with a seal was the best we could find in the workshop.

So off we went with a very strange arrangement of flotation devices. We investigated various side passages, which were of various ages, but mostly getting older in age as we got closer to the exit. We did not venture to Powell's Lode on this trip, as I remembered that it was some distance along a side turning. The tunnel passed under four other shafts to the surface, all long-disused but left open for ventilation. One of these is 800ft deep. Under these shafts there was a pile of debris, enough to cause us to climb over but fortunately not enough to cause a blockage.

At one side turning we overshot by only a few yards, but it was as much as we could do to get back against the current. We'd have had no chance of backtracking several miles. The nature of the tunnel changed from time to time, depending on the nature of the surrounding rock. In the limestone the shape is rectangular and unlined, but near the exit where it passes through coal measures (and a smell of hydrogen sulphide) it is brick-lined or steel-lined.

As we neared the exit, we came to the section with the extra steel supports. Longitudinal steel bars were supported by door-frame structures every yard or so. A problem was caused by the fact that the frames had diagonal struts across both top corners. There was a lot of water about, and we were having to duck under to pass each arch. The problem was that Clive's dinghy had enough air left in it to make it impossible for us to force it under the arches. The emptying valve was found, but our hands were too cold and wet to turn the brass screw. Nothing for it but to make another hole in the dinghy...

Arriving at the exit, we pushed the gate open and scrambled over the fence just as it was getting light. Half an hour later we were back at the railway hut and our dry clothes. A very memorable and exciting trip.

As we drove back through Rhydymwyn, Rod said: "See that place on the right?".
"Yes."
"High barbed wire fence, high security gates with guards, no sign or notice saying what goes on - must be a military establishment. See those two towers in the field?".
"Yes."
"Those are ventilation shafts. You can climb up the fixed ladders on the outside and provided the fans are not turning you could drop a caving ladder down through the fan blades. I'd love to find out what's in there". I don't think he ever did.

A couple of weeks ago I saw a note in the newspaper that a germ and/or chemical warfare establishment near Mold had finally been closed.

Footnote: The mine finally closed in 1987. The head-frame and winding gear from the Olwyn Goch shaft have been moved to the Dolaucothi mining museum near Pumpsaint, and the shafts have been sealed off.

Details of the Book: *The Milwr Tunnel - Bagillt to Loggerheads - 1897-1987,* by Chris Ebbs. ISBN : 0 9522242 0 8
On sale in Abercrave.

The Search For Ogof Ffynnon Ddu II

(Reprinted from SWCC Newsletter no.34, December 1960)

The search for O.F.D. II, which has been going on ever since the South Wales Caving Club came into being, has now entered a new phase. On the one hand there is the school of thought which favours getting there by way of the stream passage or its extension, from the known part of the cave: on the other hand there is the party that is intent on breaking in from outside at a point higher up the system. Curiously enough both parties seem to be made up of largely the same people, battling away first on one site and then on the other. Still, they seem to be getting results!

The following notes are concerned with the "stream passage or bust" attempt. I hope someone else will write up "through fire and flood".

1. STREAM PASSAGE O.F.D.

The key to this was the discovery of Boulder Series back in 1957. (see SWCC Newsletter No.23) This was thought at the time to be an offshoot of the main Stream Passage but it is becoming more and more evident that we are still in the main artery of he cave, and that the main stream rising is emerging from a byway.

The clear and spacious sumps - "Pot" and "Dip", and later "Hush", found in the Boulder Series, were just begging to be dived, and in the Summer of 1958 Oliver Wells and John Buxton made the first attempt by entering at Pot Sump and making a reconnaissance in the direction of Dip Sump. Conditions were reported to be clear, and at a point somewhere beneath Dip Sump Oliver entered what was apparently a large submerged chamber with big passages leading off. He also reported a branch passage coming into the side of Pot Sump, and remarked that the system appeared to be "a diving site rivalling Wookey Hole", which is the Cave Diving Group's favourite training ground in Somerset. His prophecy was remarkably accurate.

A year later, following a course of training sparked off by this visit, Brian de Graaf established the useful link between Hush Sump and Pot Sump, which saved much of the long drag through the boulders. (See SWCC Newsletter No.29) An attempt to follow this up with Brian Walton in Easter 1960 was cut short by a collapse of boulders in Hush Passage, but after this had been sorted out Charles Owen George and Brian de Graaf began a series of dives which is still continuing with excellent prospects of breaking through into a large dry system, above the artificial water table found in this part of the cave.

After each dip, notes were made while the details were still fresh in mind, and apart from the omission of one or two embarrassingly wrong conclusions these are reproduced in the form of a "Diver's Diary".

September 5th 1960.

A strong party pushed up Stream Passage under above-average water conditions on Sunday 4th and at 1.27 p.m. the two divers left base, following previously discovered submerged passages through Pot Sump until they reached unexplored territory directly below Dip Sump, at the "Parting of the Ways". Bearing in mind the prevailing dip of the strata, the left hand passage was taken in the hope of finding air spaces similar to those already known in Boulder Series, and after traversing a meandering passage which fell at one point to 25ft depth, the roar of water overhead proclaimed a cascade which on surfacing proved to be falling from the roof of a high aven apparently similar in character to, but higher than, Pot Sump. Climbing out was difficult by the fact that its vertical sides fell directly into 8ft of water. The first diver was half out when the lid of his Aflo fell open and all the works dropped on the diver beneath, but he had seen enough to be convinced that dry passages opened from the top of the aven. After having sat on the bottom and re-assembled the scattered fragments, diver No.2 found he had developed a slight high pressure leak from his reduced bypass spindle and as time was getting on a return to base was made, 55 minutes after setting out.

The Waterways throughout are large rounded passages of massive limestone with a light sandy shingle bottom which does not rise to obscure visibility. Visibility on this occasion was restricted to about 10 ft. by the peatiness of the flood water.

September 18th 1960.

1.35 p.m. The exploration continued with the divers setting off to see what lay in the passages they had not been into on the previous occasion. Following the wire they were soon back in Shower Aven where the presence of high level dry passages was confirmed. Here a fresh wire was tied to the belay point and they set off down the continuation of the underwater passage which ran at right angles to the aven. The passage went quite straight and at a steady downward slope of 15°. A small cross rift with an air space was investigated after which the divers carried on down. The depth steadily increased until just as they thought it was sure to pass below the limit for oxygen breathing, at 30ft exactly, a cliff-like wall loomed up ahead. Looking up, it could be seen that this was the bottom of an elliptical pot hole, vertical and unclimbable for a bottom walking diver. Here the customary brick was left to anchor the line.

The next target was the right hand passage at the "Parting of the Ways" under Dip Sump. However on the way back, possibly due to the drop in level of the water from the previous time, the tell-tale bubbling of another tiny waterfall was heard overhead round the corner at the home end of Shower Aven, and on climbing up a matter of 10 feet a muddy chamber was discovered where for

the first time the divers could sit comfortably out of the water and remove their masks for a chat.

In homage to the shoals of niphargus (and there must be literally thousands of them in the Waterways), this was christened "Niphargus Niche". Here a window looked back on the water surface extending into Shower Aven, and a dry rift ran back over the top of the submerged passage towards the Aven: also a second dry passage ran back at a high level from Niphargus Niche at right angles over the water. This was unattainable owing to the greasy layer of mud which covered the walls.

Having warmed up the divers slid back down into the main passage en route for Dip Sump. The unexplored branch passage turned out in effect to be a continuation of Dip Sump and the divers emerged on the far side of the duck at the far end of the sump, into what is evidently the main drain of this part of the system, believed to have been entered on a previous occasion by John Bevan. A small culvert-like passage in a calcite vein with very rough wall full of snags for the equipment, and very similar to the submerged portion of Main Stream rising. It was noted that this passage carried on downwards at about 15° until it "sumped" again after about 50 ft. The outflow of this passage from Dip Sump is like the lip of a basin filled with water: the mass of water in Dip Sump is so great that it is almost static but it flows over the lip with some force. Blasting away the lip would lower the level right through the Waterways, but not enough to provide an air space through the deeper sections.

On the way back the small air space at the back of Pot Sump was re-entered but found to go nowhere. The divers returned to base at almost exactly 3 p.m.

October 8th 1960.

Set out from Hush Sump swimming with fins to discover what lay at the top of the 30ft pot at the limit of our present exploration: some difficulty was experienced with weighting at first which was not helped by the unusual murkiness of the water, due probably to a rising flood. The two divers got out of touch with one another at the terminal brick which held the end of the guide wire, but No.2, who had determined to sit on the brick for the time being and wait for No.1 to find him, was plunged into inky blackness by a shower of mud from above from above which heralded No.1's descent, on to the head of No.2. (No.1 said later that he thought he'd been grabbed by a giant niphargus when he felt No.2 clutching his legs).

The party then wired on to the brick and made the (official) ascent, after a false start up a blind water-filled solution tube 20 ft down, into yet another vertical-sided aven with no easy way out onto land. So were our hopes of at last setting into OFD II dashed! The usual layer of slime, coupled with vertical fluting of the rock, made leaving the water a difficult matter but with much assistance from the other, one diver struggled out and was able to sit astride a narrow bridge of rock which on the far side plunged down into a second pot, also static. The only dry way out of the chamber seemed to be via a small and inaccessible double window high up in one wall.

Far more interesting to us, potentially, was a small hole at the bottom of "Oxygen Pot" (thus named because its 30 ft depth is the limit for safe use of oxygen). This hole - about the size of the grate in the small common room - had been overlooked on the previous visit, but proved to be the entry point of the main stream water. The depth was too great for oxygen, as we were already at our limit of 30 ft, and the passage appeared to fall away. There was no means of knowing how deep we would have to descend before the floor rose again, and as the greater exertion of swimming as compared with bottom walking had meant a much higher rate of consumption of gas it was decided that it was time to return to base, which was regained 1 hr.10 mins after leaving.

The easiest swimming technique seemed to be a side stroke, lying on the right side, right arm extended forward tracing the guide wire, left arm crooked holding the aflo against the stomach so that the left hand could simultaneously work the reducer bypass.

October 9th. 1960.

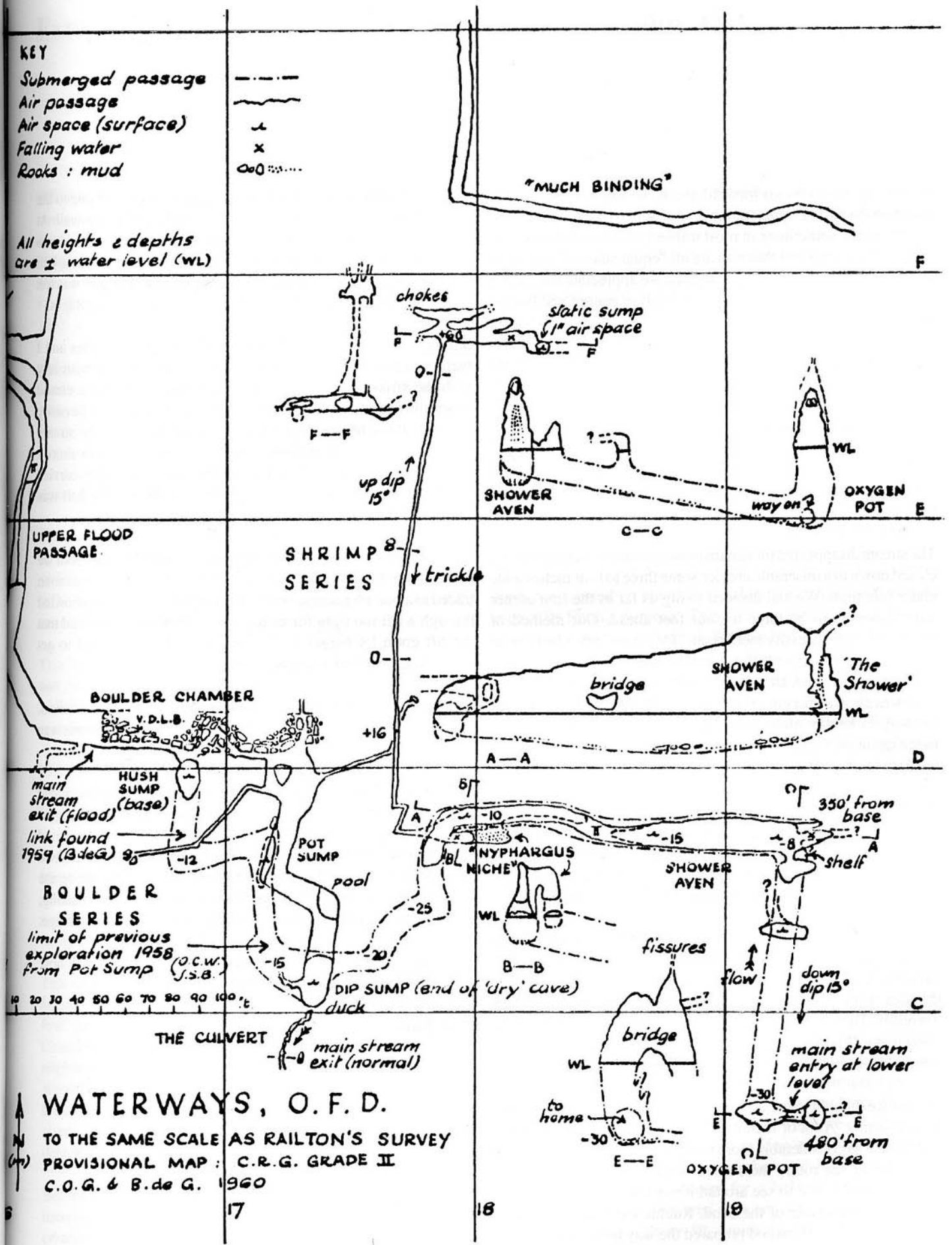
The original intention was to go straight down bottom-walking to the bottom of Oxygen Pot and investigate the main stream entry using large twin cylinders filled with oxygen giving 2 -3 hours, (determined by the $C0_2$ absorbent) endurance, but an incurable high pressure leak on one set made this unwise. Instead, it was decided to clear up as much detail as possible nearer home and the team set off for Niphargus Niche with a scaffold pole each, to try to get into the dry passage. The luscious mud soon turned this attempt into a real "greasy pole" competition, in which the greasy pole won every time: that is until one diver lay on the two poles set side by side and allowed himself to be walked up. Away went No.1 into a long rabbit hole of a passage, christened Shrimp Series, which after some 200 ft rising steadily up dip ended in a cross passage which contained several mud-choked branches and a small static sump through which an air bell could be felt. Near this a vertical shaft was climbed for 50 ft which ended in a number of small sharp edged solution tubes, still negotiable.

Proceeding then to Shower Aven, which on further exploration proved to be almost continuous with Niphargus Niche, a further landing was made (after some effort) and it was found possible to swim all the way back and into Niphargus Niche. An attempt was made to climb into the upper windows above the "shower" but the walls higher up, not washed by floods, were found to be too greasy. However, a swim around the air space allowed a great deal of detail to be filled in. Only one diver was able to indulge in this fun as the other in the effort of clambering on to dry (?) land had burst the wire loops which carried the large cylinders on the hooks on the back of his set and was confined to his ledge waiting to be tied up with wire. Both divers resolved that in future such strenuous landings should be avoided in view of the risk of damage to the breathing apparatus.

Time was now getting on and it was felt that the base party would be getting worried, so a return was made, collecting the maypoles on the way, and base regained some 3 hrs. after setting out.

This weekend had proved to be most profitable. Whilst it was disappointing not to have got into that tantalising OFD II, the objective of swimming up Oxygen Pot had been accomplished: the entry point of the main stream water determined: and much detail filled in of the dry passages in the system. The next target is clear: to bottom walk on oxy-nitrogen mixture (to allow a greater depth to be reached) and explore the main stream entry.

Once more may we thank our helpers. Like major mountain


KEY
Submerged passage
Air passage
Air space (surface)
Falling water
Rocks : mud
All heights & depths are ± water level (WL)
"MUCH BINDING"
F
chokes
static sump (1" air space
F—F
up dip 15°
SHOWER AVEN
WL
OXYGEN POT
way on
C—C
E
UPPER FLOOD PASSAGE
SHRIMP SERIES
trickle
BOULDER CHAMBER
V.D.L.B.
bridge
SHOWER AVEN
'The Shower'
A—A
D
main stream exit (flood)
HUSH SUMP (base)
link found 1959 (B.deG)
POT SUMP
pool
"NYPHARGUS NICHE"
350' from base
shelf
BOULDER SERIES
limit of previous exploration 1958 (O.C.W. J.S.B.) from Pot Sump
B—B
fissures
flow
down dip 15°
DIP SUMP (end of 'dry' cave)
duck
C
THE CULVERT
main stream exit (normal)
bridge
main stream entry at lower level
to home
E—E
OXYGEN POT
480' from base
WATERWAYS, O.F.D.
TO THE SAME SCALE AS RAILTON'S SURVEY
PROVISIONAL MAP : C.R.G. GRADE II
C.O.G. & B.de G. 1960
16
17
18
19

climbs, the two who go forward are at the top of a pyramid of effort on the part of a great number of people who can only sit and await results, sometimes in most uncomfortable conditions. We would like you to feel that you are all "equal sharers" with us in what we achieve, and to say how much we appreciate the willing hands that push us in while we're still full of energy and haul us out again when we're exhausted!

Brian de Graaf, Charles Owen George.

2. CWM DWR CAVE.

The re-opening of Cwm Dwr Cave presented us with four new "digs" which might lead to the missing miles of Ffynnon Ddu. Each "dig" was investigated and the one which took both the draught and the stream of the cave was decided on as the most promising.

The stream disappeared into a narrowing passage which eventually closed down to a miserable crevice some three to four inches wide and a foot high. We had decided to dig as far as the first corner which seemed to be three to four feet ahead. Our method of blasting was of necessity inefficient. "Deterrent" was plastered to the rock and tamped with clay. Usually three to five charges were laid at the same time, and after detonation a period of three hours or so was allowed for the smoke to clear. The usual procedure was to blast on Friday night, Saturday morning and afternoon and twice again on Sunday. Working this way it was an easy matter to dispose of 10 lbs. or more of "stuff" on a weekend.

The bend turned out to be eight feet ahead and on reaching it we were confronted with a second bend about three to four feet away. Having gone so far, and still being convinced that this "dig" had possibilities, we continued blasting. It was at this stage in the game that the Cwm Dwr contractors appeared on the scene.

A chance meeting with a company of SAS out on a weekend exercise was the sort of luck we were wanting. Stories of the vast cave which must be somewhere under their feet soon sold them the idea that Cwm Dwr would be the ideal spot for demolition exercises. They returned a month later, with a device for blasting known as a "Ffynnon Special" This device succeeded in making a hole big enough to take 14 lbs. of "banger".

At first we thought that the results of their "big bang" were rather disappointing. A lot of rock had been reduced to a fine powder and there was considerably more room at the first bend. We could not however see round the second bend. This was a sweeping curve and to be able to see around it we would have to remove completely the inside of the bend. Rubble clearing by Bernard Woods and Edgar Harwood prepared the way for another whack with "banger".

On the weekend of November 5th Charles George continued the process of demolition, which was considerably eased due to the fact that the SAS "banging" had loosened the solid rock wall. At 1 a.m. on Nov. 6th we could see past the blasted bend and into what looked like a chamber. A few feet of rock and rubble had to be removed and we were in. A half pound of "banger" was left to remove these obstructions and we returned to the cottages.

Sunday morning, and by 10am, Seaton Phillips, Charles and I were standing in a fair-sized passage which ran approximately with the strike of the rock. This was followed but soon closed down and ended with a dry mud fill. This looks as if it can be easily dug out. Back to our original dig, and we followed the stream which ran into a rift passage going down dip. We were shortly reduced to crawling and finally stopped by a miserable crevice similar to the one we had just dug through. Where the hell was Ffynnon Ddu II?

The water bid us farewell and disappeared into the crack, but we had lost the draught some little way back up stream. It was soon traced to a branch passage where after about twenty feet it howled through a rift too tight for us to follow. However it seemed that the rift got a lot bigger further on. Several people tried to get through, all without success.

The following weekend Bill Clarke popped into the extension, popped through the tight bit and popped out again. The passage widens out to an aven with a boulder choke floor.

On Friday 18th November, Brian de Graaf, Charles and I returned and once again failed to get through. No more "banger" was left to enlarge the squeeze. On Sunday morning we returned and followed Bill Clarke's knee steps to the aven. There are two possible routes from the aven. The first, twenty feet above the floor and the second at roof level (40 ft). Both require blasting, both take a draught and appear to open up into a bigger passage.

The original shaft is now in a dangerous state and work will now have to be concentrated on making it secure.

Clive Jones.

Extracts from the Personal Logbooks of John Osborne

Editor's Note: *For those younger members unfamiliar with the name, John Osborne was an SWCC member, a cave diver and a leading light of the explorations of Ogof Ffynnon Ddu in the late 1960s. He was also involved in the Balinka Pit expeditions, and shared many adventures with his good friend Rod Stewart (see* Rod Stewart - An Appreciation *in SWCC Newsletter no.115, 1995, page 3).*

Although he's no longer a member, he was at the 50th Anniversary Dinner in March of this year and very kindly agreed to lend me his personal logbooks to assist in the compilation of this publication. I'm extremely grateful to him for trusting me with such valuable historical documents, and I have chosen to include here three extracts which record significant chapters in the history of exploration of Ogof Ffynnon Ddu.

Ffynnon Ddu Developments. July 1966.

Since the discovery of Ogof Ffynnon Ddu in 1946 the development of the cave has been blocked by a boulder choke some quarter mile in the cave. Within this quarter mile lie all the ramifications of the cave now well known by all our members.

This boulder choke has been attacked seriously for many years and the work has produced three sumps, Hush, Pot and Dip, in addition to two more possible digs. The main stream is once more seen flowing out of Dip Sump.

Thus, for twenty years we have been faced by the fact that a large section of the Byfre between the sink and Boulder Chamber must flow in an unexplored cave, Ogof Ffynnon Ddu 2.

A dye test has shown the water takes eight hours to reach Dip Sump from the Byfre between the sink, and since water flows slowly in submerged passages it has been concluded that most of the route must be vadose at present. The distance from sink to rising is of the order of three miles.

This suspected cave has been dug for at the sink, the Hot Air Mines, Weighbridge, Ladies' Dig and Cwm Dwr to mention a few, but most of all from within the known cave in Boulder Chamber and in Coronation Series in Starlight. The divers have explored the sumps and in particular the dives in September 1960 proved significant. The underwater passage from Dip Sump was followed approximately 150ft to an air space with some falling water, Shower Aven. In the roof of this a side passage was detected.

Before the recent events are told may I introduce the newer members to SMITH who used to live in OFD. Smith is a mythical creature who used to be fed on Horlicks. His disappearance was reported some years ago and although he has never been seen, our recent discoveries prove his existence, perhaps.

Imagine poor Smithie's position. He owned the cave for thousands of years, then with almost no warning in 1946 came the sudden push into the cave, and within a few weekends Harvey was in. Not having prepared for this, Smith retreated to his strongest defences, Boulder Chamber, and spent the next few years moving and packing the boulders. He then had twenty years to consolidate the position.

On July 2nd, Dip Sump was found to be low and a long planned dive was put into effect by Charles [George]and myself. We swam through with only a little difficulty, on the ledge called Niphargus Niche, where the effect of the work by Bill Birch and Eric Inson was seen to have lowered the level two feet, making a ledge just right for leaving the kit. Lowering the level has, however, destroyed the musical effect of the water lapping the roof in Dip Sump, and known as the Magic Xylophone. We then swam to the end of Shower Aven and climbed out onto a small ledge.

Here, we erected an aluminium ladder which had been bought especially for this purpose. This fitted up into the small passage from where the water dripped. We climbed up into a dry, sandy floored passage. After crawling up into a dry series of smallish passages for 160yds we came to a balcony leading into a largish passage 10ft diameter, leading downhill to a deep pothole and upwards into a larger passage, after a small dig. When we returned that evening we had five likely ways on although none were very large apart from the pothole.

This is where Smith comes back into the picture. We were now at his second line of defences, having sneaked under the first whilst Clive caused a diversion in the boulder dig.

On Sunday, July 3rd, we returned to the attack supported by Terry Moon. We carried ladders and lifelines and rushed straight for the pothole. This descended for 90ft to a blank floor, of water-covered boulders. I can almost see Smith laughing.

Not daunted we attacked the other four ways on; one ended quickly, another led back into the lower passage and the third was a squeeze into a small chamber. This left the last as a small chamber with two small ways out. Almost beaten, we split up and each followed the passage of our choice. Mine dropped through boulders into a low crawl for 250ft into the first large chamber. Near the roof was a route out, also small. Here we caught Smith, because I heard Charles and Terry talking and wriggled out of a letter box in the wall of a chamber which they were just concluding did not go, (except for a hole in the floor which seemed 100ft deep). I lowered rope and we followed a draught into a side passage 2ft by 3ft. Smith tried to block this with a boulder 2ft by 3ft, but we pushed it over the edge of a 12ft wide passage which was then seen to stretch off into the distance to the left and appeared to be 100ft deep. We therefore left it and on the way back found a route down to the bottom of the first 100ft hole

without there being a way on. We returned with only the one really hopeful passage left which we were aware of.

This was the position when the stop press was requested for the last newsletter.

The Yugoslavia Expedition had been promised the ladders so that one last visit was arranged for July 24th and on this occasion we were joined by Rod Stewart, making a team of four. As on both the other occasions, helpers were easily found and more wood was carried in for the Boulder Dig which has been given a new lease of life. We first of all set off a charge in one of the new passages to make smoke. This was seen in Coronation Series. Hammer blows were heard in the Boulder Dig, but the radio device was not used as it is to be hotted up to increase the range.

We then went on in via Charles' route. Here a way on has been dug through the boulders but it is quicker. Soon the large passage was laddered and found to be 55ft deep. Whilst we were climbing Charles had climbed up and over the boulders and on down the passage, now he came rushing back to announce with forced restraint,

"IT'S OFD 2"

We were confident as we left most of the ladder and set off up the passage, this was as large as Broadway in Rawl and seemed to get bigger. One side passage was followed 150yds to a small stream but it was not really pushed. The main passage continued due north to a major fork. We followed the biggest passage which continued to get bigger, i.e 20 - 30ft wide and 50ft high and getting higher going east. The floor as one would expect consisted of fallen blocks often. This passage then opened to a crossroads with all ways vast. With some difficulty we chose one way which was followed by other choices. This continued for several hundred yards with a few formations in the form of crystal and rimstone pools.

By now it was obvious we had won. Our pleasure was only increased by rounding a corner to hear a stream roaring through boulders below. We climbed down into the streamway and then agreed to split up. Upstream the boulders forced us upward, up and up, climbing a boulder pile until we were an estimated 200ft above the original chamber, then the cone began to drop into the passage beyond. Above was a rock bridge with boulders the size of a small house on it. The way up could be seen by descending the far side a little but the roof top could not be made out. Some aven. The continuation was not explored. Several side passages were entered from the original boulder chamber and they all went on very large (Rawl-type).

Most interesting, however, was the downstream route. After 150yds this turned left and there was the main stream thundering down a boulder-strewn passage and nipping into a bedding plane at our feet.

It was immediately noticed it was much higher than when we came in, and was peaty. Upstream the water is always moving in rapids or cascades but marvellously no waterfalls in the main stream. After 480yds we came to a waterfall cascading down from at least 40ft above our heads. At 560yds there was another. The passage was very like stream passage with the roof out of sight. The boulder floor often contained sandstone blocks, making the floor very slippy. At 660yds we came on the first pothole and from then on the floor was one pothole after another, all about 5ft diameter and deeper than me. After 100yds of this we were both tired and at 800yds of stream we turned back. At this point the passage was still as big as ever, and still going strongly.

So ends the first stage of the exploration. What is now needed is a dry way in and in this connection the next trip must set off more smoke bombs, use the radio device, explore the first part better and even do a little digging.

Even on our return there was a large party waiting to help us in portering. Their presence is always appreciated and their cheerful help allowed us to recognise how tired we were feeling. Never again let it be said that the youthful members are not ready willing and able.

To summarise, [there is] approximately three-quarters of a mile of passage, most of it large, and half a mile is streamway. None of the main passages were explored to any end, rather the contrary. The lack of formations suggests high level series and a serious search may find the easiest route to be via Starlight in OFD.

Before we close, spare a thought for Smith. We have twice crept up behind him when he was watching for the frontal attack. He is now in full retreat, before he builds the next choke. Pass the Horlicks!

August 1966, OFD II

The new cave was entered in August (4th trip) to drill Rawlbolt holes and install skyhook. Explosion tests to Coronation Aven. Surprisingly we could hear almost nothing of the outside party but they could hear every word and the blast shook them. Bruce was within 30ft or so. The smoke took 20 secs to get through. Maypoles were used and no new exploration was done. The poles were left in.

When the Jug [Balinka] expedition returned we dived again (5th trip) with COG, JVO, TM, RS and C Graham.We dived straight for the stream via The Smithy and reached the terminal (1966) waterfall after 2700 yards. The stream was low and the trip was relatively easy. The by-pass was found on the return and the "moon milk" formation was discovered.

On Oct 8th (6th trip) we returned to the attack after the three week rest. No dry way had been found although parties had looked in Cwm Dwr. The Coronation Dig had been abandoned after the collapse on Sept 10th and, although open or nearly so, it was not considered safe to continue.

Thus on Oct 8th we still had the objective of finding a dry way in. After some discussion it was decided to push for the waterfall at the end of the streamway, and set up the radio and scale the waterfall. No attempt was to be made to gain contact with Cwm Dwr, although I wanted to do this.

Accordingly at 11.00 am Clive, Charles, Rod, Colin, Clare, Bruce and myself were helped up to Boulder Chamber by a mob of twelve or so including some from the RFDCC. We dived in two

parties with Rod, Colin and myself to ladder the pitches and keep ahead with the radio. Charles was to come in lightly laden but with the novices.

After an easy dive in cloudy water we tried to use the skyhook without success. The top is out of sight and the cord had twisted, the ladder jammed and eventually I climbed, anchoring the courlene to a rock. We set off, widening the route in places until we came to the choice of ways. Here Colin and myself chose to descend the 45ft boulder climb and the long way round, Rod the short and we arrived at the pitch within 30 secs of each other. After laddering and descending we waited for the others. Soon they appeared with the scaffolding poles (used in the original maypoling), having also used the long route.

We set off in a body, using the short cut found last time, and were at the stream at 2.30pm. A bite to eat and we set off.

The stream passage was fought once more but the walls were much drier this time and at the major oxbow it seemed warmer. The water was low (1" on The Step) but still tiring, and it was with some pleasure we reached the waterfall at 5.03. (The first party had arrived at 4.10 and had started transmitting at 4.15pm.) The waterfall was maypoled and it was noticed that the passage was then *down dip* and within 50ft became submerged in a very divable sump but of unknown length. No by-pass was seen over the last 200yds so we are now blocked.

Now we had arranged for [name illegible] to place fluorescein in at the sink at 5.00pm and now we waited for it. No signs were seen by 6.30 so we set off back. At 350yds a boulder choke in the roof was climbed by Clive and Colin, with Bruce, some way. Clive considered it rose at least 200ft, climbable but very loose. Bruce then dislodged a boulder which crashed into the passage below, crushing his ammo box. Still, an excuse for us to eat the contents.

We then started back and left the stream at 8.30pm (still no fluorescein) and were soon at the 50ft pitch. Here disaster nearly struck for Charles, self-lifelined up, found the rope had run through the rungs. He untied to climb the last bit when his antics dislodged boulders which touched him as they fell. clare also had a fall on the rocks near the bottom and, although not serious, both incidents weakened morale.

Rod, Colin and myself again de-tackled while the others returned and again Colin and myself chose the long way round. By the time we had crawled round to the 45ft boulder climb we could hear falling boulders ahead and we approached in some concern lest the others were cleaning the pitch when others were around. However, things were not that simple. Charles had also chosen the long route and he and three others were all in the boulders when Charles felt one move under his feet and he shouted for all to stop. He waited to see what was moving. Meanwhile Rod, using the short cut, had reached the junction of the routes and, hearing the others, sat down to wait. Suddenly he felt the whole floor move towards the boulder climb and he shouted for the others to get out.

At that moment Charles, who was in sight some 20ft down, saw a large boulder crash down the slope straight into him. It crushed him into the ground, smashed his helmet and pinned one hand. Unable to breathe properly, or escape, Charles shouted in despair. Clive and Clare threw themselves under cover and boulders fell past them onto Bruce, who threw himself down the last drop. He was saved by the first boulder being too big to follow him.

Rod now saw the wall and roof of the chamber above settle and the floor slide down to where Charles was. The chamber originally above Charles was almost gone and there was now no sign of anyone below. For a moment the boulders stopped, blocked now by Charles above, and Clive looked out to see what to do. Then we had a break.

The first rock to move was now forming the floor against which Charles was being crushed, when suddenly it dropped out, releasing Charles who was grabbed by the others. Although injured, all three then dropped down to join us, wondering in the bottom passages. Clive began to tell the tale when the boulders collapsed - harmlessly, now -and continued to move.

We then had to return and try the short but difficult route with Bruce and Clare suffering mild shock but no injuries and Charles with a crushed and immobile hand.

The top of the boulder choke was passed quickly and we de-tackled quietly and dived back. I was last to leave and, although having some difficulty with the old divers' cables in the sump, returned safely at 12.20am.

The largest party yet were found to be waiting with soup and cheer. Some 20 blokes and at least one girl took the kit and allowed us to come out empty-handed, leaving the cave at 1.30am.

We then learnt that the radio test had failed and that, although 120g of fluorescein had been put in, no trace had been seen anywhere. No rock signals had been heard but none had been sent seriously.

Although the trip was a failure technically we had achieved the major objectives. Oddly enough this time we seemed to have been less fortunate (or careful?) and several incidents showed that we were lucky to have escaped lightly. Subsequently we learnt that Charles had broken one finger, bruised his wrist and his skull.

The tests would indicate to me at least that we are not near the Byfre as yet, although tests on the Sunday cast doubt on the experience of the surface operators. The lack of fluorescein, however, was the most damaging and difficult fact.

Charles O George, Rod Stewart, Clive Jones, John V Osborne, Colin Graham, Clare Harvey, Bruce Foster.

April 8th 1967 Ogof Ffynnon Ddu - Diving
"The End of the Beginning"

Saturday started with a snow shower and the diving party permutated excuses to avoid the proposed dive. By the time Mike Coburn arrived with the air only Rod Stewart, Colin Graham and myself were willing to go. The objectives had been reduced to tracing air flows so various devices were packed and a short trip planned.

Fortunately Janet Holmes was leading the GSS around the cave so we palmed the kit on them and soon we were gathered rather reluctantly at Dip Sump. The GSS party then watched with amusement as we kitted up so with a show of bravery we dived into the water in convoy.

The conditions were ideal and we were able to watch each other swimming in clear water up the magnificent sump. I then saw a white object on the bottom and, thinking it may be the spanner, swam round to find it was a white fish some 2 " long with black eyes. It ignored me although I passed within 18 inches. Unfortunately none of the others saw it!

We de-kitted as usual and swam round the canal to find the courlene floated up the wall again but soon the pitch was laddered although I had to be anchored again.

With the small party the trip was fast and by 2.30 we were at the bottom of the 45ft. pitch and we then made straight for The Smithy. We had just finished a quick snack, and agreed to meet again at 7.00pm, when there was a loud clear bang. We packed up and rushed into the higher series by Big Shack 1. Rod and myself headed for the stream to try radio contact, with no success, but banger smoke was appearing. Once in Big Shacks the fumes limited visibility to 6ft and most of the smoke was coming from a passage 30ft from the stream. It ran into boulders at the end but Rod could hear hammer blows for a while. Then all was quiet and even the smoke cleared as the draught reversed quietly. We therefore "made smoke" until we couldn't see so we gave up and agreed to split up again.

I therefore went into Big Shack 1 and climbed into the crawl off near the roof which I had found last trip. After 20ft. of crawl I could hear the stream below in boulders so I looked for an opening. The obvious way I had pushed last time, so this time I looked at a drop of three feet down a tight squeeze of boulders. By removing two small stones I decided it was just possible head first, allowing for the bend of the body, to follow the hole to the left. This was tried and was easy enough - downhill. This dropped me into rather "uggy" boulders but in a space large enough to turn around. In the floor was a hole nearly big enough to enter but one wall was loose, small boulders. However at head-height was a window which looked into a chamber in the boulders and here the stream sounded loudly.

The only way was down however and it took half an hour to lift out the boulders, pack them and sound out the one wall. Even when it was open I lay there ten minutes balancing the risks. The thought of what a rescue would mean almost stopped me but eventually I tried it. Even then I went feet first, "so I could get a hand to the boulders", and turned around at the bottom. This was now mud-covered boulders and a ten-minute dig enabled three to be loosened and pushed into the chamber, and I crawled through to stand on the other side of the pillar box with 3ft between the two routes.

Now the way was in bigger boulders but the stream was impassable so I climbed 10ft. Nothing looked very nice but there seemed a chance of finding a second route if necessary so I pushed on 10ft. Then I noticed a boulder 2ft x 1ft square which had moved recently but it struck me that there was no reason for it to have moved. I looked around and a feeling grew inside me that we were onto something. Most of the rocks were smeared with mud on the top and with a shout I crawled down over a tin drum. The sound of water was actually the stream sinking in the Jama of Cwm Dwr.

In my excitement it took six minutes or so to get into the Jama but soon I stood there flushed with pleasure. Although tools were there there were no answering shouts and I was safe from being blasted.

I went up to the entrance to the Jama and back without seeing anyone so I checked the time; 5.45, so I decided to make the through trip and go out. By the time I reached the entrance pitch to Cwm Dwr I was almost done and the absence of a ladder did not help. I had a quick swill in the pond and presented myself at the club.

"Oh, you're out. Had a good trip?"
"Anything interesting?"
"No caving clothes in the hostel!" Historic words. Says I: "Let it go this time. I have just come up from Wales' deepest pothole."
No reply. Damn them!
"Where are the others?"
"Still in there!" Now signs of interest and finally, the confirmation we were through.

Then coffee was produced and a bite prepared while the message spread. Bruce took some convincing, then he rushed around to get changed (the only one interested enough!) and we went back in. By this time the others were really worried and when we reached the boulders Mike and Rod were nearly through, having forced themselves to accept I might be down there. Bruce's presence acted as a tonic and we all congratulated each other. Rod set off out, realising this was the only easy chance to do the through trip, and Bruce came back in.

Soon we arrived at the Smithy to find a worried Colin sitting in the dark waiting. After ten minutes he realised the fourth person was not Rod and surprise gave way to violent enthusiasm. Then Colin and Mike set off to dive back out and Bruce went back out.

Rod returned and the two of us moved slowly out, removing the ladder reluctantly from the 45ft pitch and effectively closing that first series again. A series of photographs were taken of the slot then reaction set in. By the time we surfaced in Dip Sump we were both tired but there was Daisy Day with GSS waiting with coffee! Morale improved and a gaily chatting party returned at 12.15am Sunday.

On the Sunday Clive and Eric led the attack on our route to enlarge and render it safe. At two points they chose to drive a fresh passage but the actual distance of unknown was proved to be only 15-20 ft! Once we know where, several routes should now be possible and now we can confidently say that for the divers this is: "The End of the Beginning"

JV Osborne, C Graham, R Stewart, Mike Coburn - Diving
Bruce Foster - in and out the dry way. Osborne and Stewart - the through trip in Wales' deepest pothole at 470ft!

The Connection of Ogof Ffynnon Ddu I and II

by Bob Radcliffe

The dry route through the Cwm Dwr boulder choke had been established for some time, as had the finest through trip in the country (from Cwm Dwr to Top Entrance). The major finds to Smith's Armoury seemed to bring forward progress under Pant Mawr to a temporary halt, yet new passage was still being found on virtually every trip underground. Those were the days. One part of the cave was still calling: the Dip Sump series. It was well documented by the divers, but still unseen by dry cavers, cut off by a 60ft pitch and a jammed skyhook device.

The following events are from memory as unfortunately someone has possession of the Club's logbook for this period (1968 - 1970).

Paddy (O'Reilly) wanted to survey the Dip Sump series, so Colin Fairbairn and myself dived through Dip Sump and dropped a ladder down to him. We retreated, arranging for Paddy to be sure to leave the ladder in place as I wanted to return to have a good look around. I had expressed an interest in looking for a route back to OFD I. I know that Paddy did not approve of this idea, but it would take several trips into the cave for him to complete his work.

As things turned out, Paddy stayed in for a mega trip and did not exit until he completed the section. The ladder was removed and, unfortunately, the skyhook jammed again. This made me determined to regain entry for good. A close look at the Divers' Pitch showed it to be unclimbable directly. The Divers' Pitch itself was on the right hand wall. The left hand wall looked far more promising, but the rock was rotten and everything you touched fell away. I returned with Eric Inson to attempt the climb. Eric was a good choice of partner. He was up in no time and into what turned out to be a very unpleasant and tight (well it was then) crawl. A short while later, some excited shouts indicated success. The climb was very dodgy at that time and remained so for some months. I think we had some diver's line on it (the thin stuff) - just to give some impression of security.

Dip Sump series regained gave the chance to have a good look around. I had not previously seen the large passages (towards what is now known as Easter Series). There was a great resemblance to some of the Waterfall Series. I hoped that there would be a lead up here, but felt that it could be a long way away (there was no survey to refer to). The 21st anniversary publication showed a survey of Shrimp Series. The end of the series showed passages possibly heading both east and west. The divers would, naturally have been more interested in heading east. By now Pete Cardy was as interested as I was in a possible connection.

We paid a visit to Niphargus Niche to retrace the steps of Charlie George, the first diver to visit the place circa 1960.

Pete was the first non-diver to reach there. The climb seemed impossibly difficult because everything was so slippery. It was only 10-12ft, but we had nothing to help grip and it was just too high to bunk up. After several attempts, Pete somehow managed to gain access. Shrimp Series itself was amazing. I had read of the divers climbing an aven at the end, and I had hoped that there would be something heading west at the top. There was not. At the bottom of the aven there was a potential dig. Eastwards went through a duck and on some distance to boulder blockages. Although they looked diggable and could have made an easier route to the site (bypassing the 90ft swim and the rest of Shrimp Series), it was decided to dig west from the foot of the aven. I imagined that it would probably connect with OFD I somewhere near Dip Sump.

The following weekend we were in the Cwm Dwr crawl at 7.00am. Rod Stewart joined us. He had helped us make a noise machine: very effective it was too. A party went into OFD I to listen for the high-pitched scream from the device. It was not heard, although we were able to exchange noises from hammer blows. We had taken with us the radio location device which we took across the canal on a rubber tyre. For those of you who have not been there, the route to Shrimp Series is very tortuous. The canal is very much like the Green Canal in Dan-yr-Ogof, but not as long. The sound connection gave us great encouragement. We set up the radio, pointing towards OFD I. I think it was Paddy and Sue receiving at the other side. Readings were taken from Boulder Chamber and from Waterfall series. The results plotted indicated that we were already in OFD I. Not a lot of help, but it did encourage us to think that there was not far to dig. Anyone caving around that time will appreciate the amount of kit we carried that day as the noise machine, the radio device and our lamps were all powered with Nife cells.

Over the following months, Pete and myself were to return every weekend. The digging got harder every time. The fill was almost like concrete and the dig filled with water between trips. There was further to bail each time. Various people showed interest and helped. This went on for nearly two years. There was not a great deal of progress although

considerable effort had been expended. We thought that if we could determine where our dig was heading, we could start at the other side. It was decided to put more effort into this. Voice connection was needed. The plan was to pull a telephone line through the sump; Pete made a brass connector that would allow us to tie on a new diving line and pull it through the sump. The new line was attached to a telephone line and pulled through. Voice connection was achieved. We were, however unable to determine anything about our whereabouts relative to OFD I.

Late in 1969, I decided to have a weekend off from the site and had a good look around the Waterfall Series. I felt that all possible sites would have been thoroughly pushed prior to the passing of Dip Sump, but I found a place off the main passage heading towards OFD II. Full of enthusiasm, I returned with John Aldridge and we started to dig. Progress was blissfully easy in comparison with Shrimp Series, it was through sand. The dig, however was very short lived because the stream running through Waterfall Series followed us in and flooded us out.

I then turned my attention to the OFD I side of Dip Sump and spent several hours looking at all the small passages with Peter Harvey and Gwyn Saunders. All had received thorough attention in the past. The events of the previous few weeks mulled over in my mind: I was intrigued with the major dig which headed up the timbered aven. The draught had been followed, but something did not ring true. The passage approaching the aven was well developed but suddenly closed into a calcite squeeze. Up until that point, the walls were well scalloped, the water flow having come from straight ahead. If the calcite were broken and the floor lowered a couple of feet, it would surely reveal the continuation of the passage. I returned with Nigel Ellis and Paul Tedd. Various members came to mock... "You're flogging a dead horse" and "Oh well, I've peed into it", and so on. It was probably that that brought it luck. The calcited floor boulders were dislodged and the floor lowered. At exactly the predicted spot the "wall" we were following was tested with a crowbar which disappeared into mud-filled passage. Horizontal progress was very easy. It was only necessary to push a bar or entrenching tool into the mud and it would run away on its own. My helpers on that day did not return again, but Pete Cardy and now Mick Day (who had, I believe, helped in Shrimp Series on more than one occasion) rejoined the effort. The more we dug, the easier things became. Pete was there either late on a Sunday or during the week, I can't remember which, but they left having made good progress. The following Saturday, John Barrows wanted to know what on earth I had been doing in there, as his water had turned brown midweek and he still could not draw any.

When we reached the site, something quite spectacular had obviously happened. The dirty brown muddy passage was clean and some railway sleepers left by the diggers of the sixties at the entrance to the passage had disappeared. Crowbars and shovels were never seen again. The draught no longer came down the aven, but it whistled from out of our dig. There was great excitement. We dug as hard as we could.

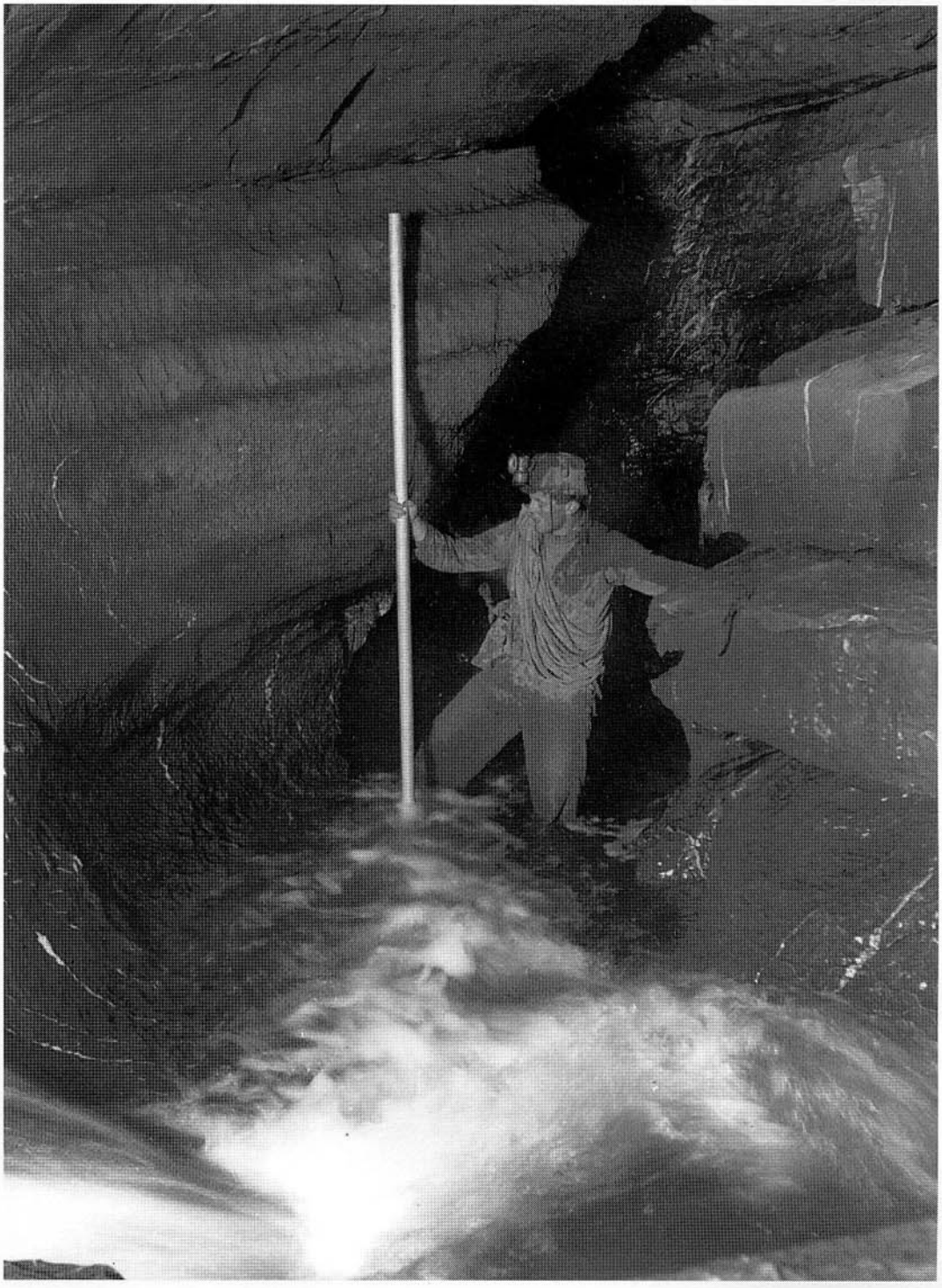
After a few more hours of furious digging we were through, still on hands and knees. To our right at floor level there were some beautiful formations. After a short way we could stand. The situation soon became clear. Calcite water-level marks on the walls indicated that we had dug the plug out from the bottom of a vast lake. The unusual formations had formed under water. The weight of the water had pushed the last few feet of dig through. Pete (and Mick?) had obviously had a very narrow escape on the last trip! We explored about 400ft of passage and noted several possibilities.

Mick had made plans in Cardiff for the following day, but knowing that we were clearly on to something returned to take part in the push.

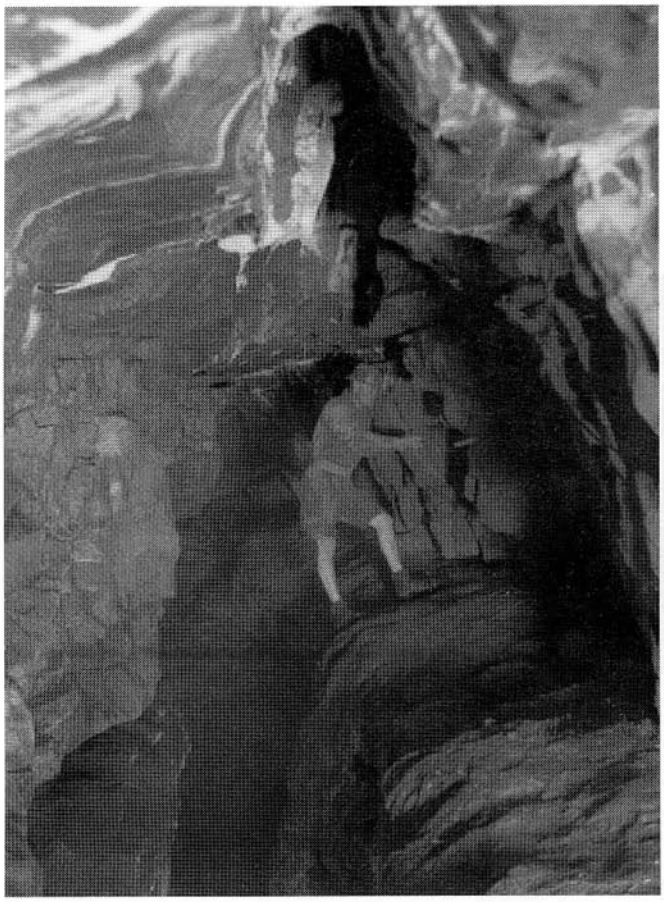
The following day, Pete and Mick went into Dip Sump series. I had no difficulty in getting helpers on the OFD I side. Whistles were blown, hammers banged and lamps shone. Voice connection was soon established. Unfortunately some calcite covered the boulders. Digging was carefully commenced. Gwyn Saunders and John Bevan reached through to shake hands with Pete and Mick. The last few boulders were pulled back, and John and Gwyn resisted the temptation and gave way to me to go first as it was my dig. Pete and Mick made their way out of OFD I to complete the first through trip. I made my way to Cwm Dwr. I invited two lads from UBSS to come - they had come in to help. I believe Tony Boycott was one of them. By the time I got out from Cwm Dwr, word had already spread far and wide. Glyn Jones had arranged a reception for me. I received a standing ovation from a large number of people who were awaiting my exit from the cave. The tourist trips were to start. The 400ft of passage entered the day before was aptly named OFD 1½.

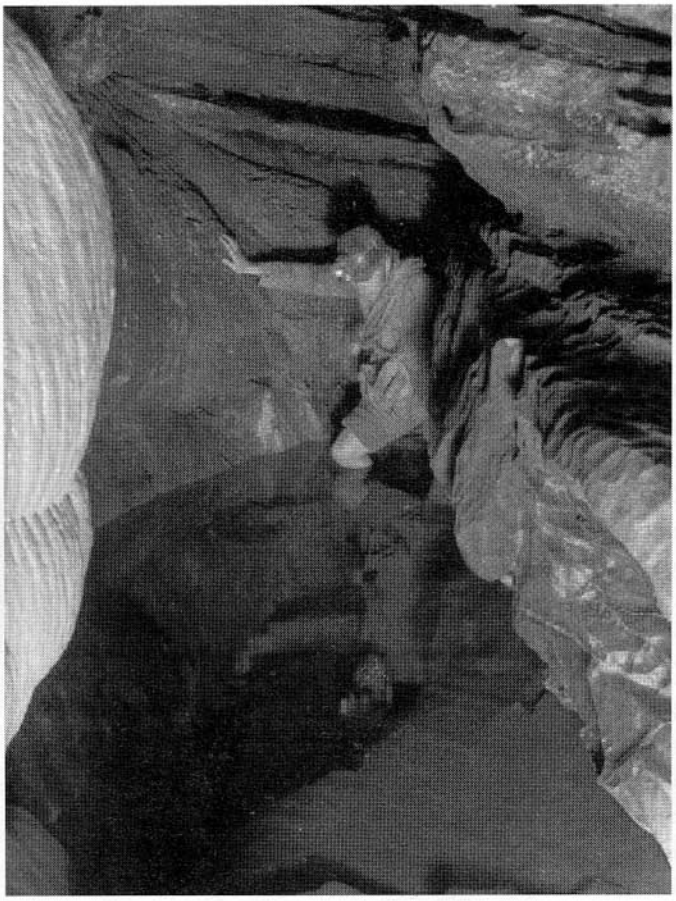
Thanks to Pete Cardy for assistance with this article.

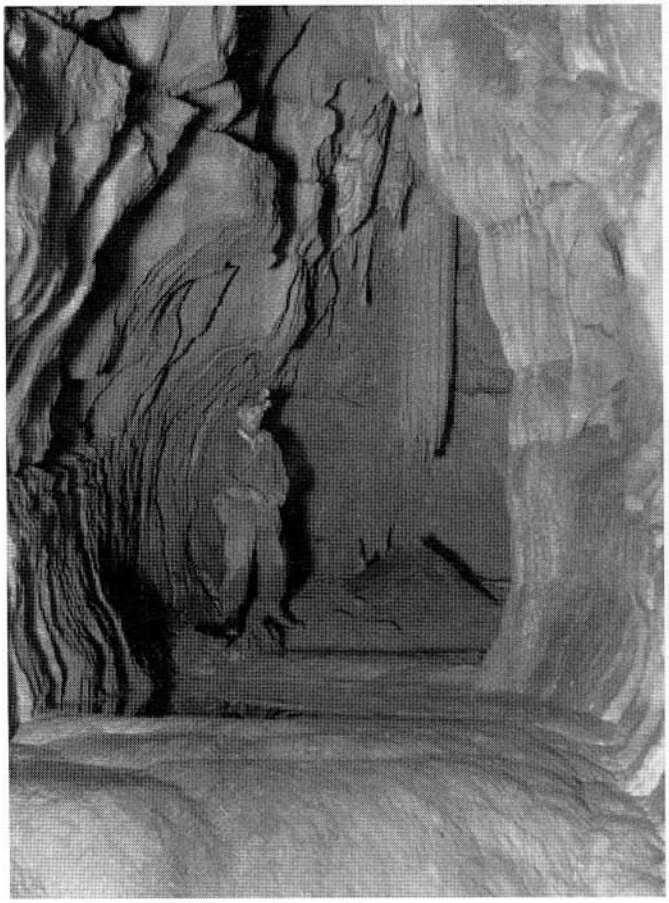
Photographs by David Hunt

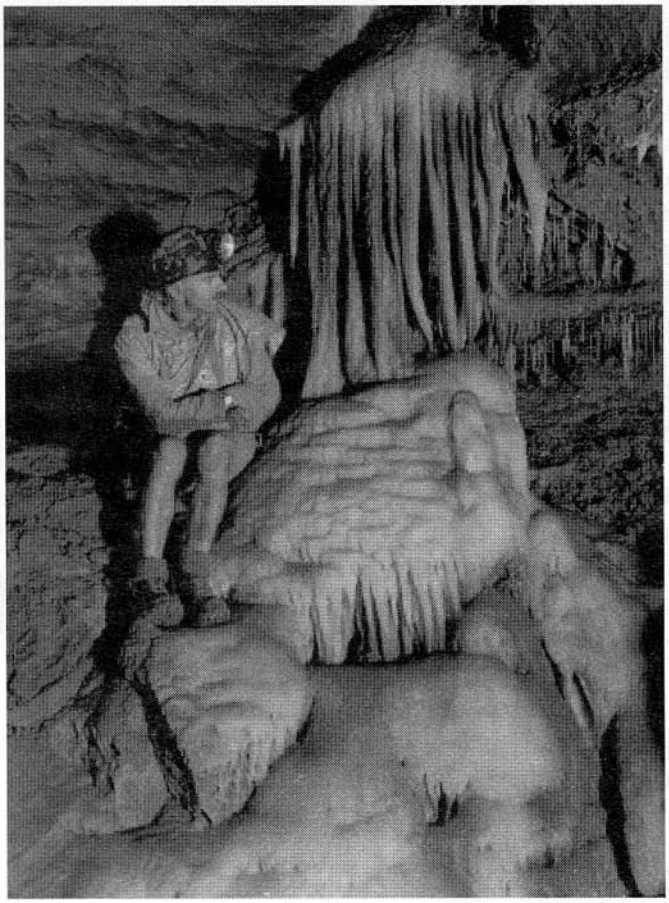


P. Densham in OFD I stream passage, by the sump. En route to climb to The Hanging Gardens, Upper Flood Passage, 20/4/52. Taken with flashpowder.

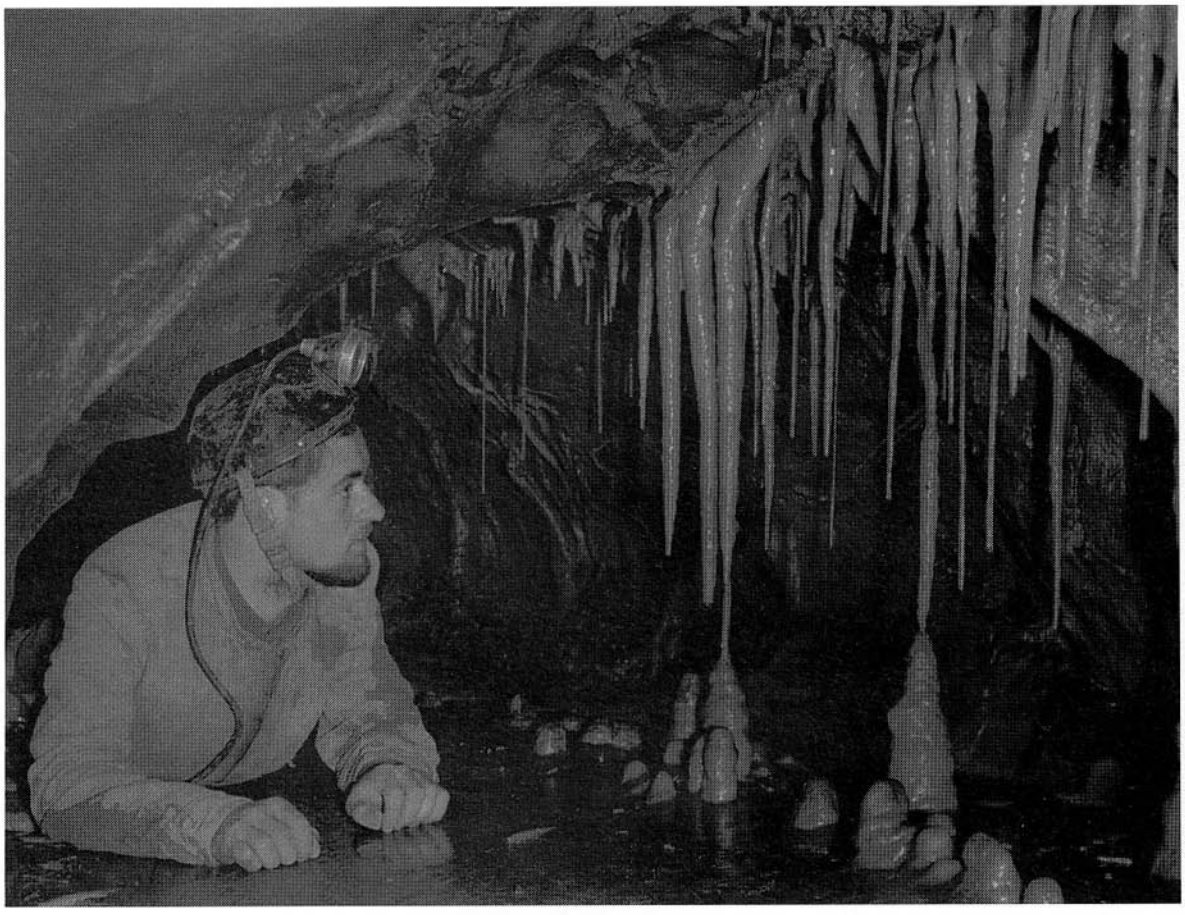


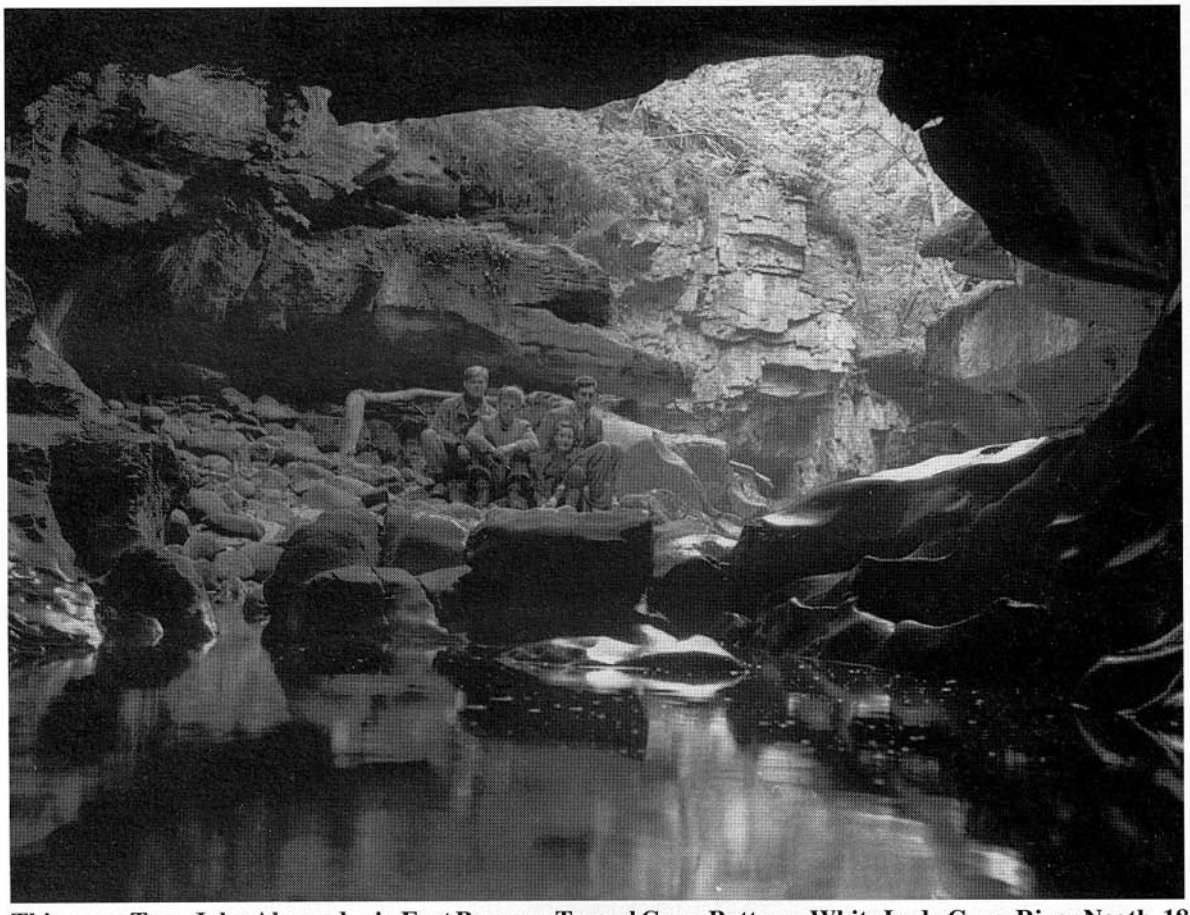




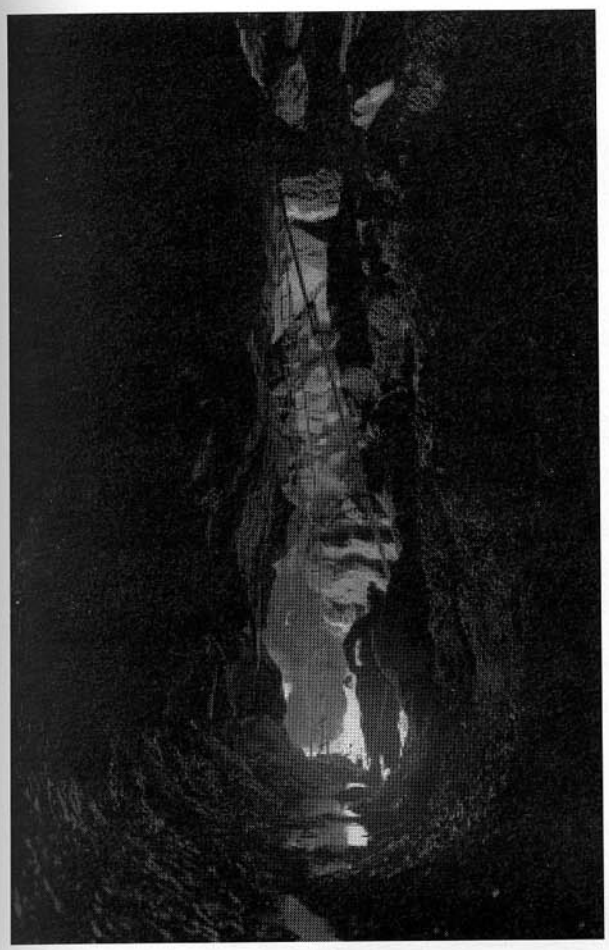


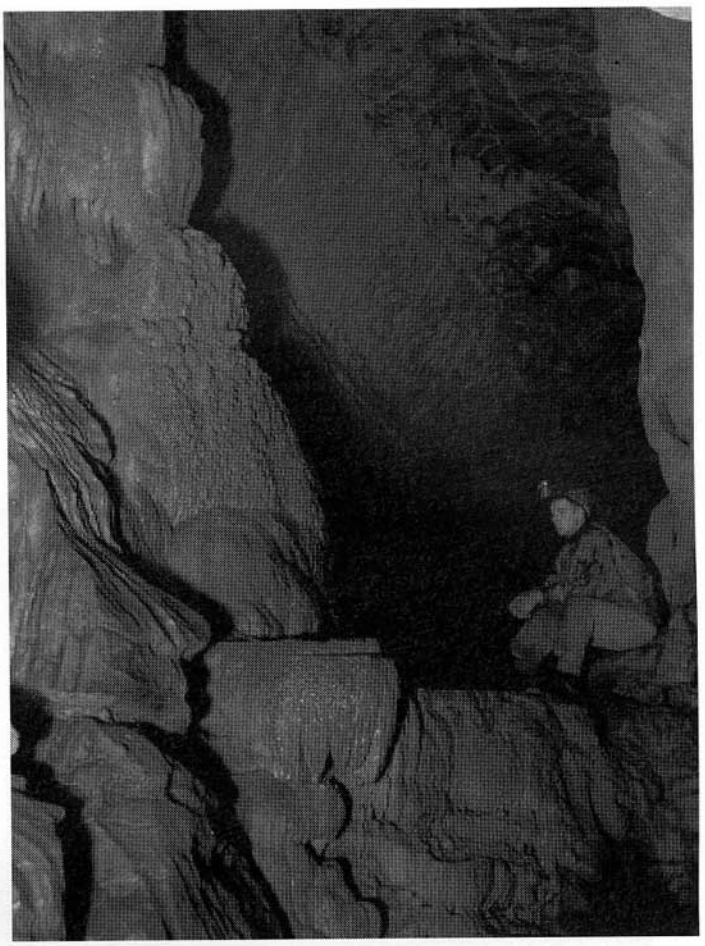
Opposite page: Top left - David Hunt on Travesty Traverse, OFD I, 11/5/52. Top right - Noel Dilly, Pluto's Bath, OFD I, 25/1/53. Taken with flashpowder. Bottom left - Bill Clarke in Toastrack Passage, OFD I, 22/9/57, also taken with flashpowder. Bottom right - Lewis Railton, Rawl Series OFDI, 25/10/52.
This page:Top - In the cottage at Pen-y-Bont. L to R; Bill Little, Bill Clark, ?, ?, David Hunt.
Bottom - Also in the cottage at Pen-y-Bont, 25/7/53, Lto R; Noel Dilly, Peggy Hardwidge, John Truman, Les Hawes.

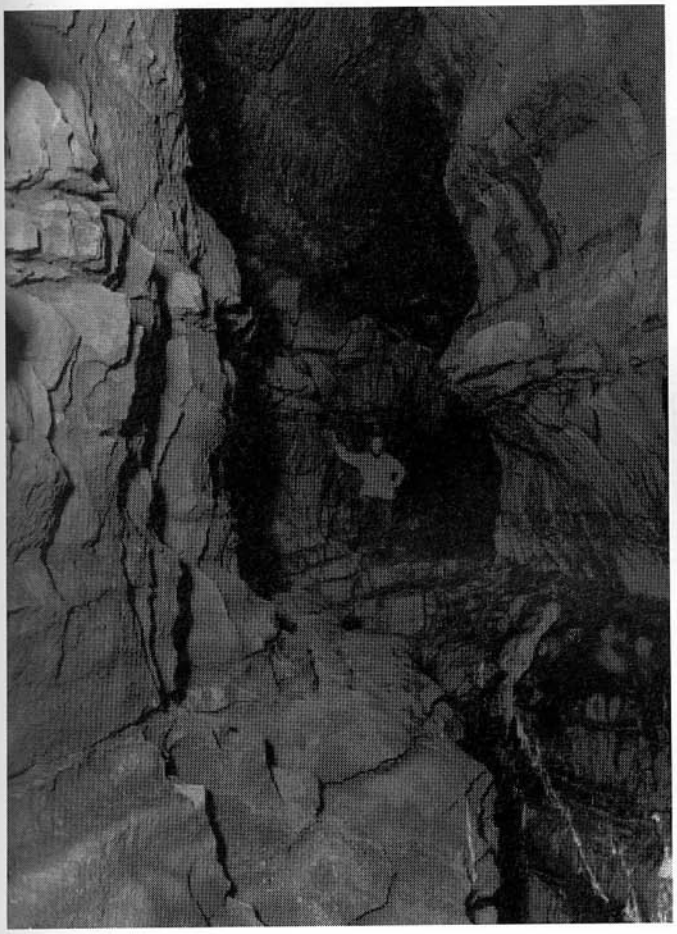


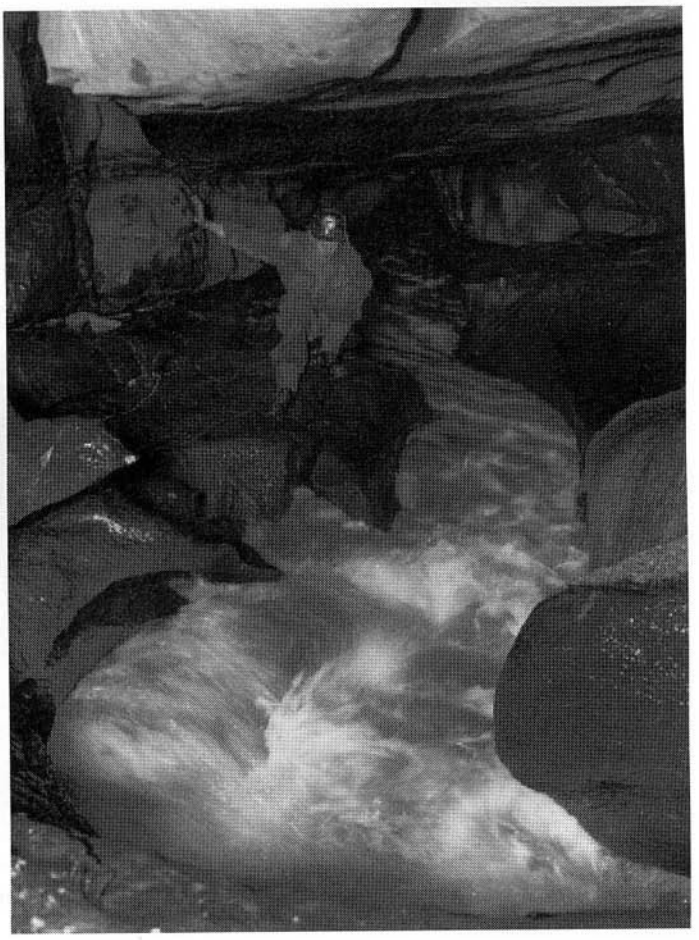


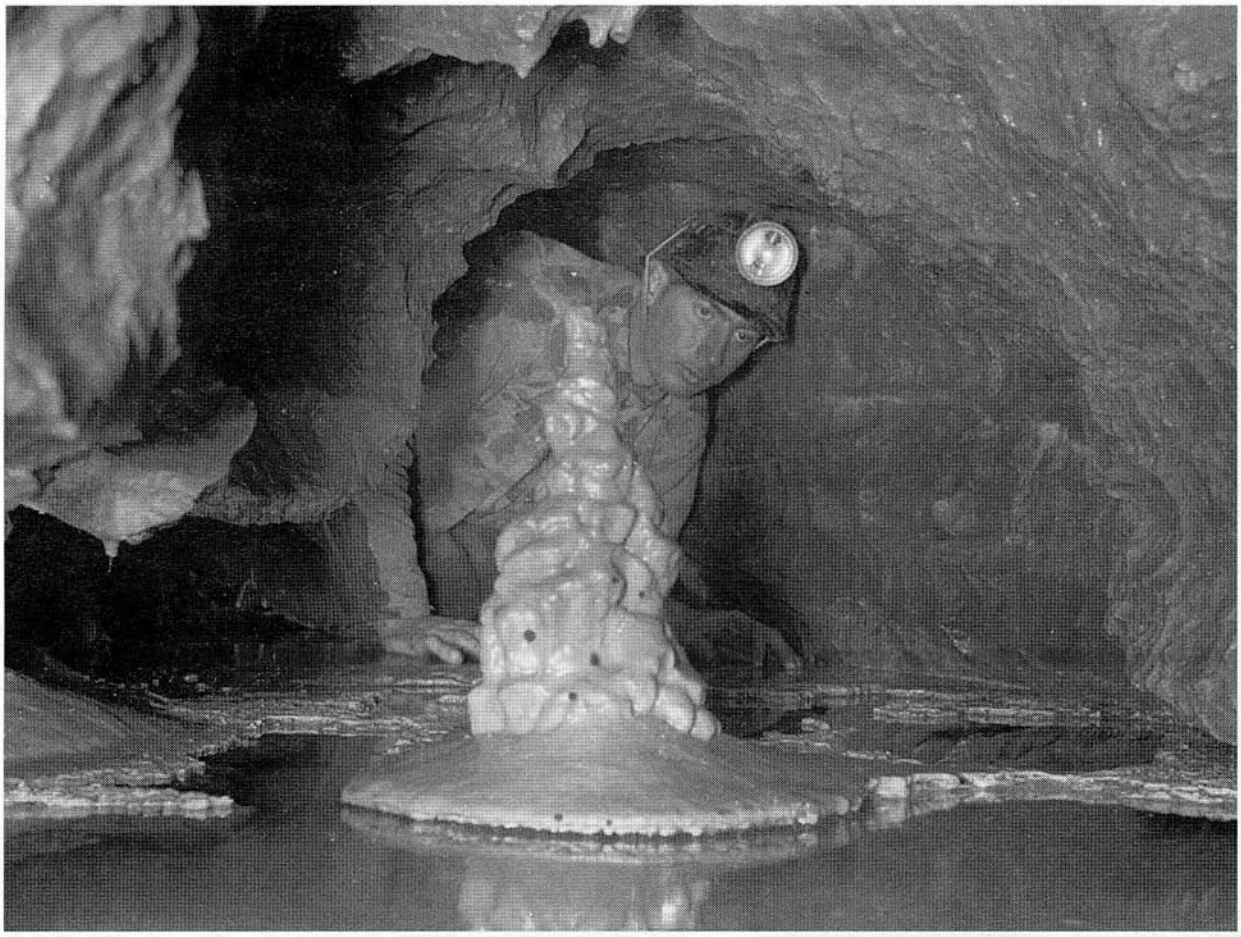
This page: Top - John Alexander in East Passage, Tunnel Cave. Bottom - White Lady Cave, River Neath, 18/1/53. L to R; Peter Harvey, Bill Little, Peggy Hardwidge and John Truman.
Opposite page: Top left - Maypoling in Upper Flood Passage, OFD I, 29/6/53. Top Right - Gwyn Saunders in The Cathedral, OFD I, 15/6/52. Bottom left - Les Hawes in Upper Flood Passage, OFD I, 3/2/54. Bottom right - Bill Little and a 3' flood at The Step, OFD I, 27/11/54. Taken with flashpowder.

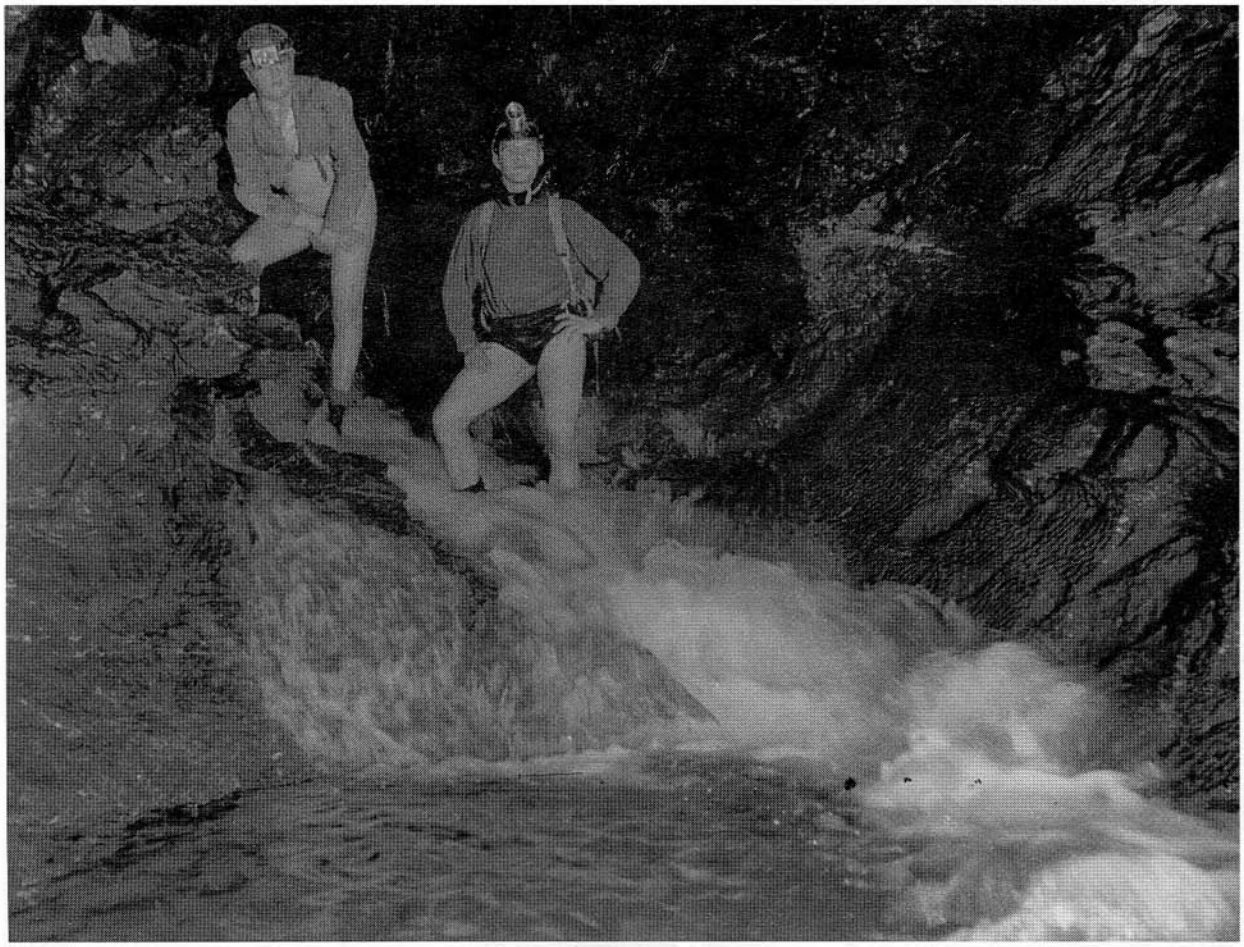




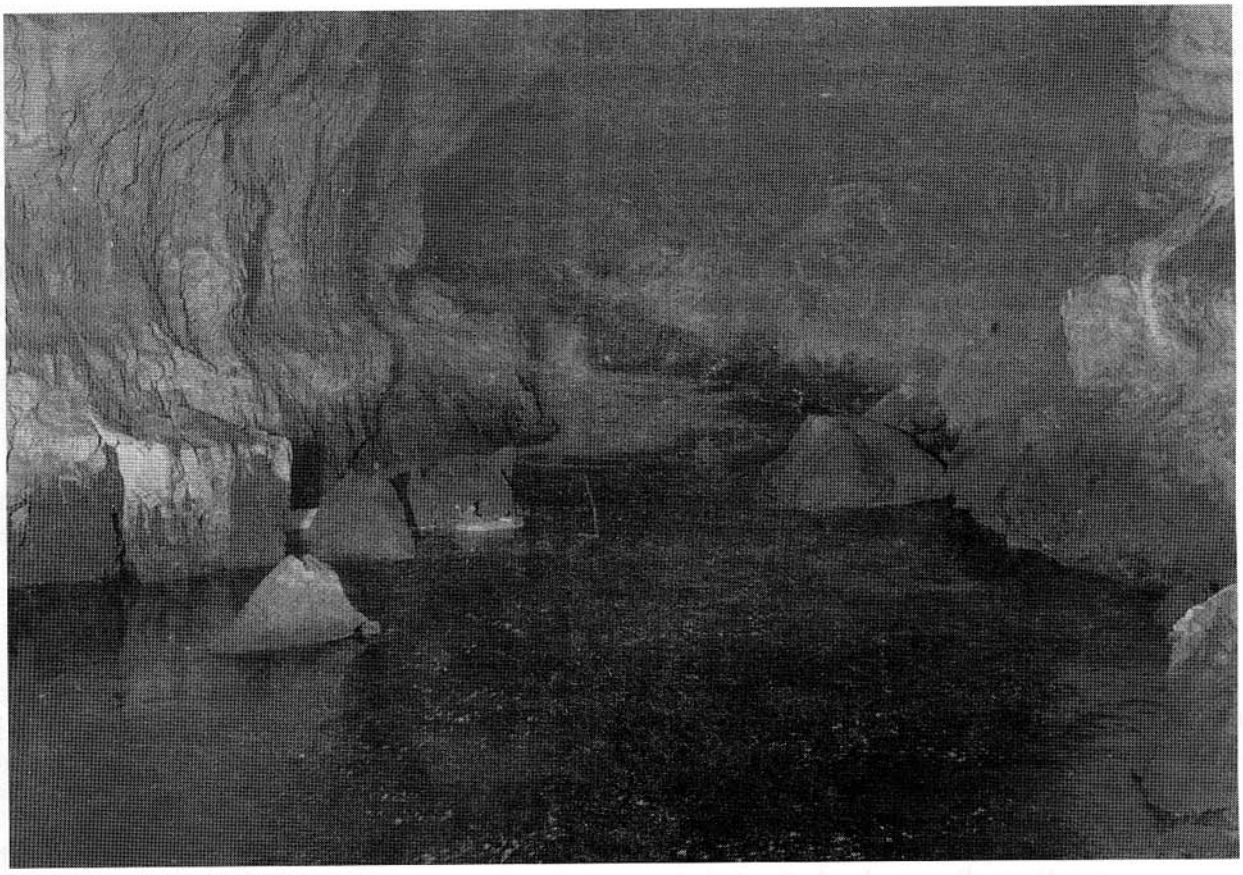








Top -John Truman at Swiss Village, OFD I, 17/11/51. This stal was subsequently removed as it was on the Escape Route. Bottom - John Bevan (on right) and unknown in Dan-yr-Ogof, 6/8/55.



Top: Arnold Jones with gours in Skocjanska Jama. bottom: Bill Birchenough in Malograjska Jama. Both pictures from the Yugoslavia trip in July 1959, written up in Newsletter no. 31, March 1960.

Through Trip

by Clive Westlake

During the 1960s the Swansea Valley felt a very long way from Derbyshire. In those far-off days we had to negotiate the dreaded Bull Ring Series of Ogof Birmingham, then find the right response to the somewhat obtuse welcome met at Penwyllt. Nevertheless Paul Deakin, the late Henry Mares and I successfully eluded these hazards one evening in September 1967. Although we all belonged to the Eldon Pothole Club and were active in Derbyshire, having the previous year connected Giant's Hole and Oxlow Caverns to create the deepest cave in the British Isles, we were much excited by the dramatic discoveries happening at the same time in the Swansea Valley.

Saturday 16th September dawned clear and sunny, so by 10.15 we were ready to go down Cwm Dwr. Not too far behind us was an SWCC team of Terry Moon, Hywel Ball, the late Colin Fairbairn and Mike Holhead. They were bringing radio location equipment to use in the further reaches of Ogof Ffynnon Ddu II, which were then known as the Clay Series. We said we were happy to help and they were pleased to show us the way, but probably doubted whether these unknowns from Derbyshire would make The Confluence, let alone the Clay Series! We were firmly told to use a ladder on the Cwm Dwr entrance pitch. At the bottom Henry found a dead rat which he put in his gear bag, saying it might come in useful. He and Paul had been down before so soon found the way as far as Big Shacks, where Colin and Mike caught us up and showed us the way to The Confluence. They waited for the rest of their team whilst the three of us set off upstream. Thirty years on, this is such a familiar, though still inspiring, place that I have difficulty in recapturing the sense of remoteness and strenuous endeavour I then felt.

By now Welsh and Derbyshire cavers had assessed each other and we were all sharing the loads of gear. I do not recall whether it was yet called Maypole Inlet, but it certainly had a maypole which we used to scale the first couple of cascades. A 40ft. ladder led us up to the level of Clay Series where Colin led us in a few circles before Terry took over and took us to the Trident; this spot had been used as a campsite in the recent weeks of exploration. We caved up Salubrious Passage, over the Arête and into Gnome Passage - again I don't know whether the names were then in use.

Five continued to what was then the final choke, leaving Hywel and Mike to put in a Rawlbolt at the Arête. We had been going for 3 hours 45 minutes so we were half an hour early for the pre-arranged radio-location, but Colin unpacked a walkie-talkie set. He said that it wasn't very useful as it didn't penetrate any thickness of rock, but when he switched on we could hear a conversation between groups on the surface. He interrupted and the resulting exchange of Welsh squawks vastly impressed Paul, Henry and me. Colin took the walkie-talkie to the very top of the choke where reception was deafeningly good. Next Paul and I bashed rocks on the walls and roof and those on the surface belaboured some innocent-looking patch of turf with shovels and bars. We could hear each other clearly and enthusiasm became near-hysteria when Henry discovered a dead rat! "I think we might have you out by this evening", we heard over the walkie-talkie from a distinguished-sounding fellow called Clive Jones. On the featureless hillside above there was no indication where to dig so we needed a radio-location. When a satisfactory "fix" had been achieved, Colin and Terry went to do other radio-locations and Hywel and Mike went to explore new passages which seemed to abound hereabouts, whilst Paul, Henry and I assailed the choke with bare hands. This was not difficult at first because we could collapse rubble from in front, then kick it down the slope.

After an hour of steady progress we found the choke more compact so Paul decided to bang it. A moment's reflection made us realise this would also blow up the surface diggers. Accordingly I went off to find Colin and Terry whom I found in what was to be called Big Chamber Near the Entrance, and we called the surface to warn them about the bang. Underground the fumes cleared instantly and we soon heard John Osborne reporting they were billowing from the surface dig.

By now all seven of us were at the choke, Mike and Hywel having explored as far as the head of a pitch for which they had no tackle. Excitement mounted as collapses at the digging face brought down earth, grass, the sounds of excavation above and then daylight. Instantly picks and shovels arrived through a low archway. The next strategy was to collapse the dig inwards because we now had the tools to move spoil down the slope. Sometime later we had opened a sizeable arch through which we could see two bare legs, reliably identified as Paddy O'Reilly's. He soon joined us, bringing a flask of very welcome coffee.

By now Top Entrance, as it soon became known, was securely established so it was time for the seven of us to emerge. For this defining moment we put Henry in front, because he had been the first to squeeze from Oxlow Cavern to Giant's Hole the previous year and this seemed a fitting way to surrender our record. Though it had seemed highly likely during recent weeks that Ogof Ffynnon Ddu had overtaken this record, that day's events were final proof. At twenty past seven we stood blinking in the evening sunshine. "Well, it's taken twenty-one years!" said Bill Little - and indeed amongst the crowd was Peter Harvey who'd started it all on 3rd August 1946. Paul reminded Bill of the further coincidence that they'd both taken part in the first Tunnel Cave through trip a few years before.

An impressive arsenal of equipment stretched around the dig; generators, timber, drills and floodlighting. Paul, Henry and I had one anxiety - where were we? Presumably we were still somewhere in Wales but we had no idea of the direction of Penwyllt! Rod Stewart, Bruce Foster, Sue Bradshaw and other stalwarts of that era escorted us down the hill. I have only hazy recollections of how we spent that evening, but the three of us were fit to cave the next day. We spent a few hours helping to survey in another recent discovery, Dan-yr-Ogof II, thus completing one of my more memorable caving weekends.

The memory still lingers and should I seem somewhat distant when passing through Top Entrance, you'll know what I'm remembering.

Top Entrance, A Personal View

(or, Five Loads of Redimix, Please...)

by John Harvey

During the 1960s we used the land on both sides of the Swansea Valley as our personal playgrounds. We asked no-one for permission to cave or dig on it or drive Land-Rovers over it. It was with this background that the search for the further reaches Of Ogof Ffynnon Ddu continued.

Many digs existed - some still being worked today - and we dug when and where we wished, the sole aim being to gain access to the cave we knew was there.

This search became even more frenetic as the divers, and later the dry cavers, reported the cave they had explored. After all, it was official club policy to find another, easier dry way into the system. The committee and some others were concerned about the risks they perceived that the explorers - especially the divers - took on these long trips. I well remember the time when Edward Aslett (the club Chairman at the time) invited John Osborne (one of the divers) to dinner and mildly chastised him over the risks he and his fellow divers were taking on those early great exploratory trips. So when John Oz and I started the Top Entrance dig one wet Sunday evening, after radio-location and communication suggested that an easy way could be dug into the cave (we removed one clod of turf and a half-bucket of earth with a huge and obviously ineffective explosion), I remember no-one urging restraint. The push was on to get into OFD and explore.

The succeeding weeks opened up the Top Entrance and, once word was out, vast numbers of cavers trooped in. If the entrance constructors weren't careful, then they were walked and climbed over. I remember that it was during these times that several of us had regrets over the opening of the entrance as it was clear that the cave was taking a lot of wear and tear in that area. This has persisted for over thirty years. Top Entrance, and the cave beyond, have always been available to the many visitors, especially during exceptionally wet weather which ruled out access to other caves in South Wales, and it has always been seen and used as an easy alternative to more challenging caving.

But how much better a system it would be if the only access were from Ogof Ffynnon Ddu I or Cwm Dwr. We would have the deepest, and one of the longest, caves in the UK with a tough access route that would aid the preservation of the cave and would enhance its reputation as a hard trip. All cavers' "jolly" trips would be in OFD I - as they were in pre-Top Entrance days - and, of course, there would be no wimp-out available on I-III-I trips!

So do we fill Top Entrance with concrete, or just keep it for access during rescue work? I suspect neither, but if there is a lesson from this tale then let others in South Wales, who are working to open another entrance to Ogof Draenan, learn from it. Desist. You are degrading the cave. Surveying will be easier and faster to complete but there's no deadline to meet, the work could go on for years. And if there is personal concern about evacuation following an accident, then don't go caving.

The People, the Techniques and the Wet Bits of Ogof Ffynnon Ddu

by Steve Thomas

Long before the discovery of Ogof Ffynnon Ddu, it was obvious to cavers that a substantial cave lay behind the resurgence "Ffynnon Ddu".

Graham Balcombe, the man behind the Cave Diving Group, organised an attempt at diving the resurgence during Easter in 1946 with his mate Jack Shepphard. They were using ex-Navy rebreathers and lead boots and managed to get fifty feet into the flooded passage before they were stopped by boulders.

When another way into the cave was discovered in August 1946, Mainstream Sump (at the top of the I streamway) was located on the second day of exploration. It wasn't until 16th. November 1946 that an attempt to dive this sump was made but unfortunately it became too narrow after only forty feet.

It is important to realise that although the sump penetrations were not of a grand scale, it wasn't the courage or determination of the divers that was lacking. It was the size of the diver versus the size of the passage that stopped them. As already stated, they wore large lead boots on their feet which effectively pinned them to the floor and made manoeuvring very difficult in all but large straightforward tunnels. They also wore thick rubber drysuits that were designed for sea diving. Around their necks and behind their heads was a large counterslung bag and strapped to their chest was the rebreather assembly that consisted of an oxygen bottle, various metal boxes and hoses. That wasn't all. Helmets weren't used for diving and they had to carry a device which they called an "Aflolaun" (Apparatus For Laying Out Line And Underwater Navigation), "Aflo" for short. This consisted of a large box onto which was mounted a light, a battery, a depth gauge, a line reel, and a compass. Although these had reduced in size over the years, they were still impractical although essential pieces of equipment. The divers were too bulky.

It wasn't until after the SWCC diggers had discovered Hush Sump, Pot Sump and Dip Sump in the Boulder Series in April 1957 that any further diving was undertaken in the cave. During the summer of 1958 John Buxton and Oliver Wells examined the sumps but made little progress. The following summer a dive was made that connected Hush Sump to Pot Sump after approximately thirty-five feet by Brian de Graaf. He then dived the rising at the top of the OFD I streamway and had the same problem as the divers thirteen years previously i.e., that the sump became too constricted for further progress after forty feet.

On the same day, Gothic Passage Sump was dived. As elsewhere, the passage was followed for only a short distance before it became too constricted for the diver. Divers were still too bulky.

Then in the autumn of 1960, Charles George and Brian de Graaf dived from Hush Sump and found the underwater way on and into Dip Sump, which was very large. They bottom walked to Shower Aven which is at the end of a large canal and carried on to Oxygen Pot, so called as the depth here was the deepest that they could safely go to on oxygen rebreathers. This was a distance of approximately 480 feet and was an outstanding feat of cave diving at the time.

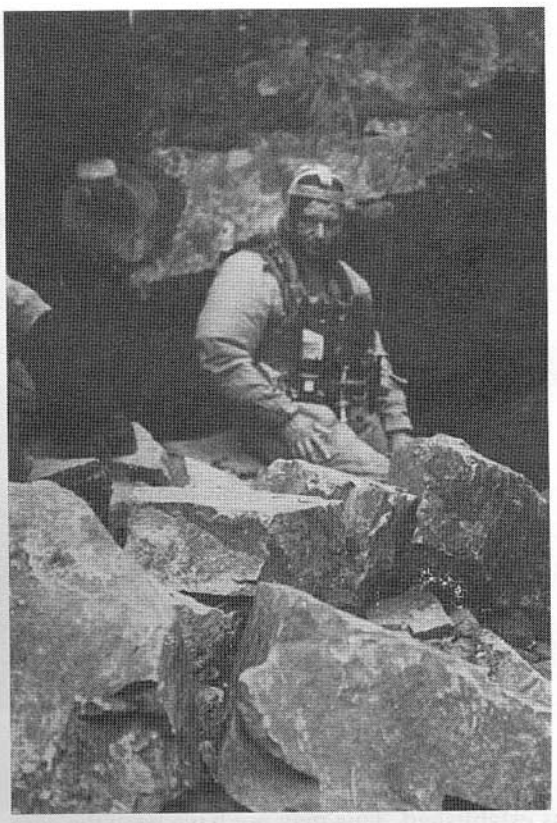
In January of 1961 the divers returned to the bottom of Oxygen Pot with a different gas mixture in their rebreathers which allowed them to exceed the thirty feet maximum depth limits of oxygen. Unfortunately, the old problem of diver/sump dimensions stopped them going further into the low bedding passage as the way on upstream became extremely constricted and proved impossible to follow.

Interestingly, Charles George had started using fins instead of lead boots at around this time whereas de Graaf was still pinned to the bottom. Other than that, the equipment was largely unchanged when compared with previous divers.

In 1965 the resurgence was extended to approximately 125 feet via a squeeze. The water was found to be issuing from impenetrable holes in the floor which is still the limit of exploration today.

The big breakthrough came a year later in July 1966 (as if there is anybody in SWCC who doesn't know that!) The water conditions were low and the trip had been planned for a long time. Charles George and John Osborne took a rigid aluminium ladder through Dip Sump and put it up to a ledge at Shower Aven. They eventually discovered the connection with OFD II and the rest is history.

The important fact to bear in mind is that between the dives in 1961 and the breakthrough in '66, many things had changed for cave divers. The bulky rubber drysuits had been replaced with neoprene wetsuits and the large rebreather units had been replaced with open circuit compressed air units, (scuba). The divers were free to swim so could travel much more quickly through the water and could wear their wetsuits for caving beyond the sumps. Also, they didn't have to carry an Aflo so they had their hands free to do other things (like carrying a ladder). Helmets were worn and a standard caving lamp provided the illumination. Many normal cavers used this readily available diving equipment to get through Dip Sump and into the extensions until the



Pictures of diving at the Ogof Ffynnon Ddu resurgence in 1946 kindly loaned by Peter Harvey

dry way was established. This may not have been the case had the rebreathers and drysuits still been in use.

In January 1970 John Parker went into Ogof Ffynnon Ddu to dive the mainstream sump that had stopped the earlier divers after 40 feet. He was much more streamlined with his wetsuit and open circuit breathing system and penetrated the sump for 250 feet. The passage was constricted and John had to dekit to get past one tight corner. This proved that the new techniques and equipment were much more suitable for pushing underwater Ogof Ffynnon Ddu. Other than John's dive, there had been very little interest in anything underwater since the breakthrough as most efforts had been focused on pushing the dry cave.

Then in 1972, a streamlined Martyn Farr, using scuba, squeezed through the constriction at the bottom of Oxygen Pot and found his way to an underwater junction. He turned left, heading roughly north, and shortly surfaced in an airbell with a dry passage heading off. The underwater way on from this airbell was a vertical descent where he immediately encountered the line running from Shower Aven to Oxygen Pot. This was an airbell that had been entered by Charles George via this vertical passage during his explorations some years earlier but he had not been able to explore the dry passage at the time. Martyn took off his diving equipment and followed the passage which quickly led to the top of Shower Aven. Had this been known in the early sixties, then Ogof Ffynnon Ddu II may have been discovered much earlier than it actually was.

On a subsequent dive, Martyn used the airbell, which he called Shower Aven Upstream Airbell, as dive base after carrying the diving equipment through the dry way and swam back to the underwater junction and headed south. After a couple of dives he had reached a point that was approximately 350 feet from the airbell. At the furthest point, he found himself in a muddy rift but couldn't find the way on.

Obviously, the streamlining of cave divers was proving to be very effective and Gothic Passage sump was extended to over 300 feet by Martyn during the early seventies. Also, many of the sumps in other parts of the cave were receiving attention and the static sumps in The Pit were connected to Oxygen Pot and Pwll Twll by diving. Many other sumps in the cave were tackled but even with the reduced size of the divers, sumps in areas such as The Waterfall Series and The Railton-Wild series, downstream Dip Sump and Top Waterfall sumps were still too small to progress very far.

Other than an attempt on the streamway sumps in Cwm Dwr in 1977 underwater exploration in Ogof Ffynnon Ddu ceased. The large passage between Dip Sump and Oxygen Pot was used for underwater photography and in the late seventies and eighties the place became a popular training site. Tourist cave diving had appeared by this time which involved diving a sump purely for diving it.

Cave diving techniques moved on considerably from the mid-seventies and especially through the eighties and so the '90s cave diver is an evolved creature. Many of the risks are still there but many have been catered for. We don't just use a caving cap lamp for illumination - we dive with maybe four or more lights, some turned off as back-up, and often using up to 50 watts in a single light. We use twin sets (two bottles) of between 200 and 300 atmospheres pressure, we use the thirds rule so that a failure in one breathing system leaves sufficient air in the other to get out with. We have trained ourselves to lay line in a safer manner, regularly belayed and running through the largest part of constricted passages using "snoopy loops" (large elastic bands made by cutting up an old car inner tube; these are stretched over boulders and projections and the line is then attached to it).

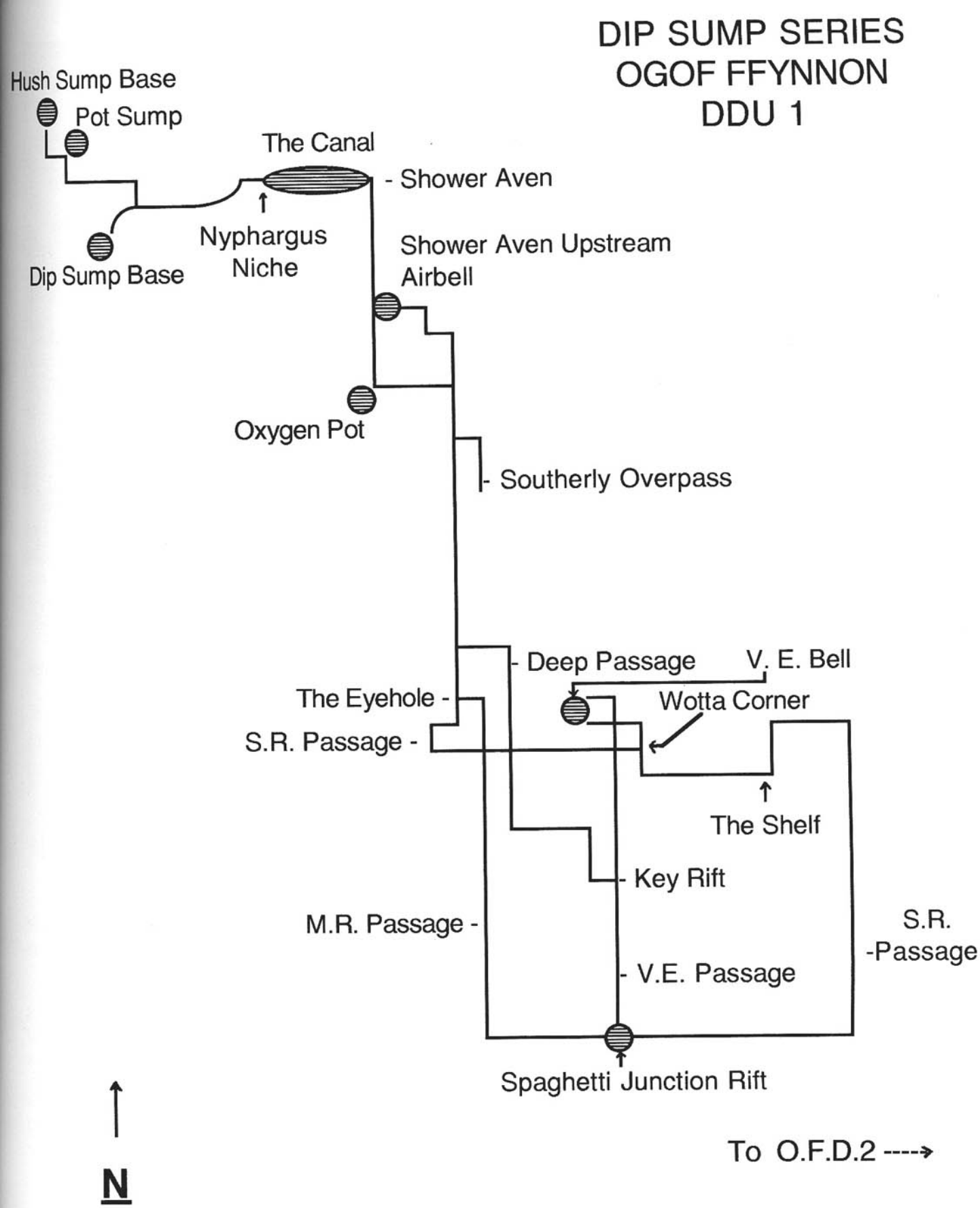


Diagram of main lines in sump complex (not a survey)

SLT - Feb '96

Above left: Charles George preparing for the discovery of OFD II. Photo loaned by Clive Jones.
Above right, cave diver (possibly Luke Devenish?), photo by David Hunt.
Opposite: Steve Thomas in Dip Sump Series, photo by Gavin Newman

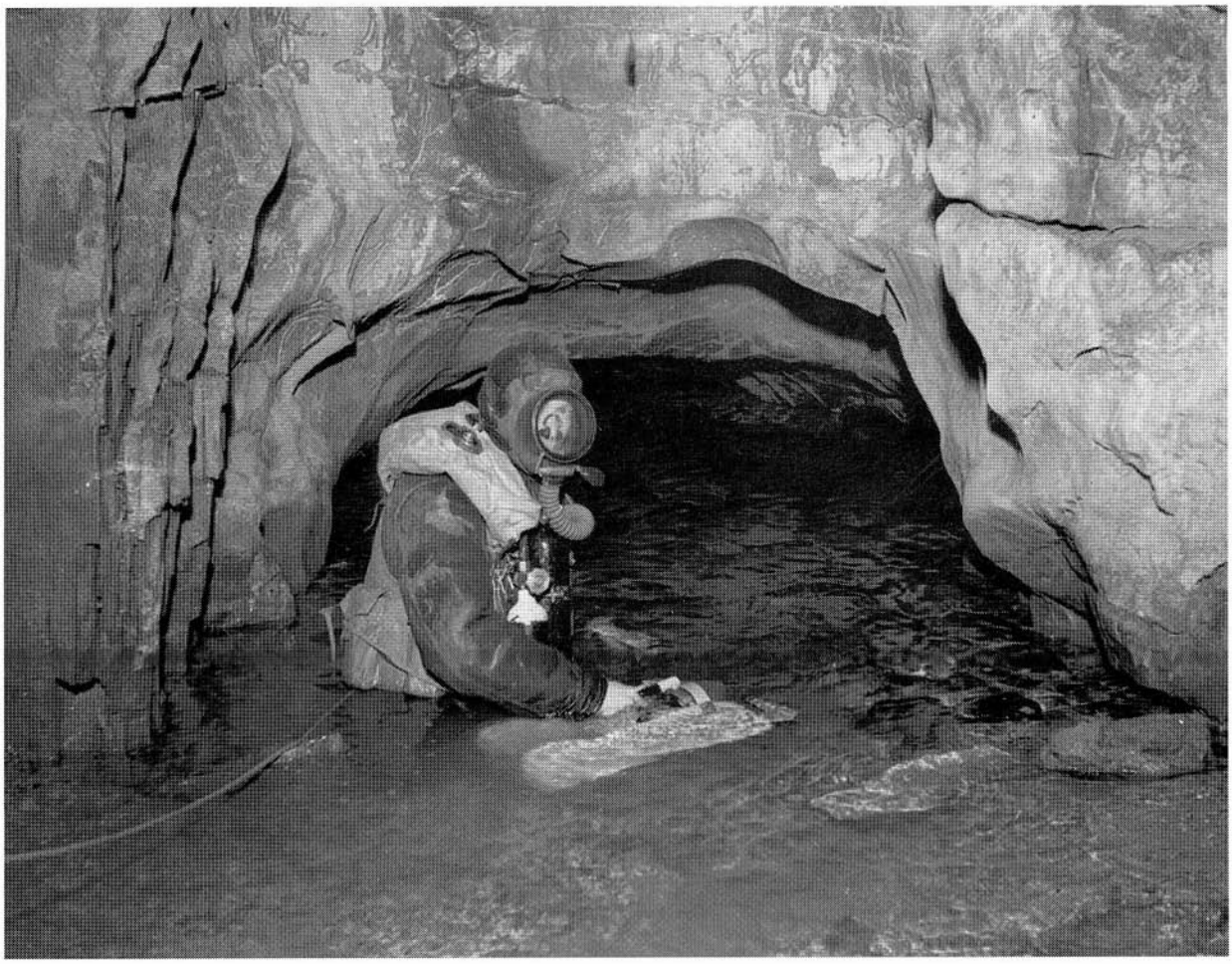
We have control over buoyancy so that it is possible to stay off the floor when possible thus reducing the amount of silt that is stirred up which destroys the visibility. On the longer dives, we have gone back to using drysuits. These have come a long way from the rubber bottom walking suits and allow us to stay in the water for considerably longer before the cold becomes a problem and they also allow variable buoyancy.

One of the most noticeable changes in cave diving now is that the diver does not have to think to himself about getting in and out as fast as possible. He can take his time to search a particular area and explore at a much less frantic pace than he would have twenty five years ago.

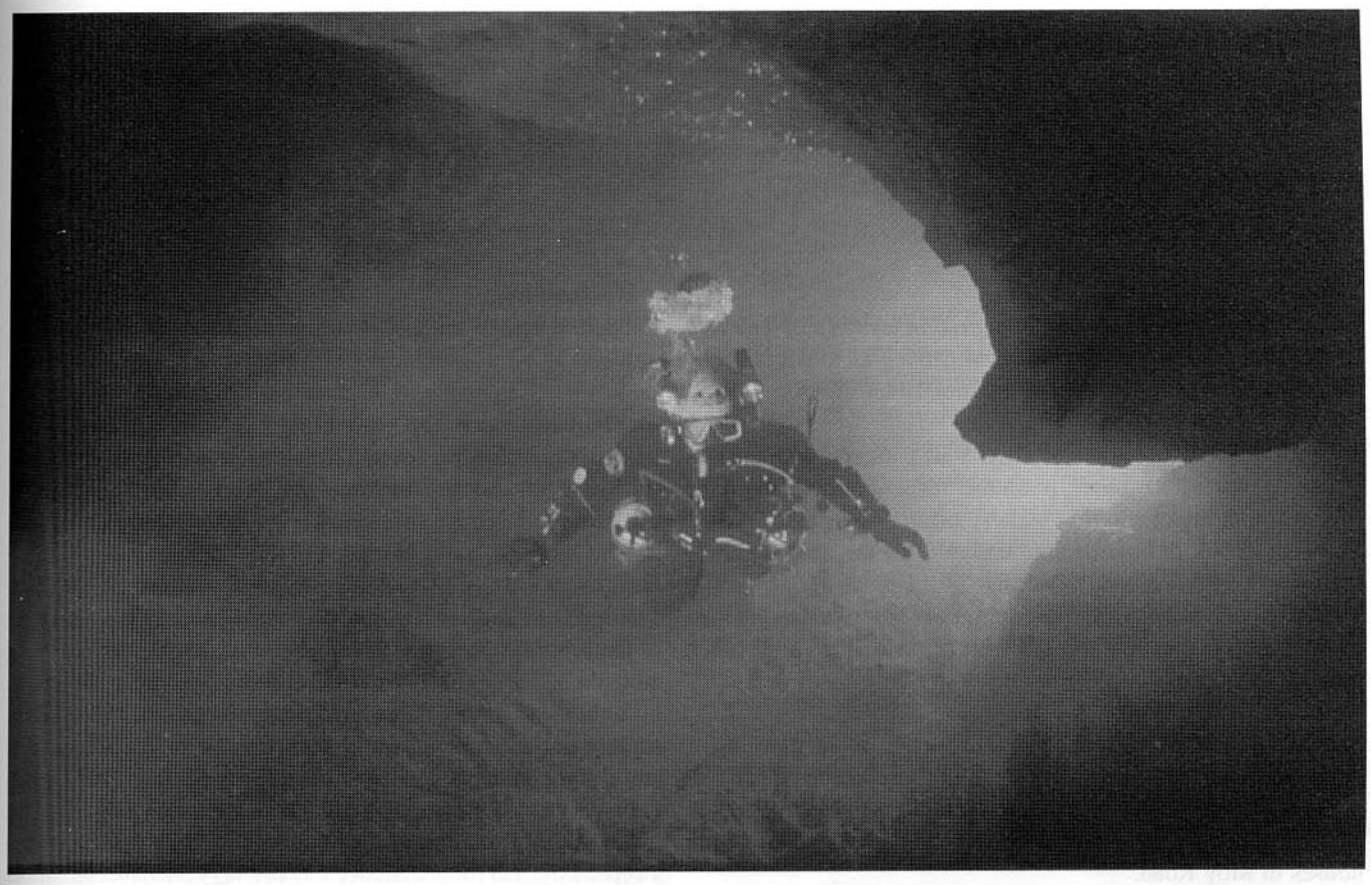
On my first dive to Shower Aven I was alone as my partner, Dominic, had a piece of equipment fail just before he got into the water. During the dive I was amazed to see that the sumps had the original wire that was laid in the early explorations still there in places. Also a twenty- or thirty-year-old orange line ran the length of the sump and various other lines that ran parallel to existing lines or just didn't seem to do anything abounded. None of the lines contained any belays and it was incredible that there had been only one line-related incident during any of the training dives.

I spent a number of dives ripping out what I could of the old line and laid a single line from Hush Sump to Oxygen Pot with junctions in the appropriate places. The place felt a lot better to dive in afterwards and I started looking towards extending the sump complex. Systematically the place was searched and some new bits and pieces were found although divers (who hadn't been beyond Oxygen Pot) assured me that I hadn't found anything new.

One weekend, Clive Westlake asked if he could come along on a dive and have a look. That was it. He has been diving the Dip Sump Series with me for the past couple of years on a regular basis and we have extended the system to well over a kilometre (3,300 feet) of sump in an aquatic maze and it is still ongoing. The limit reached by Martyn Farr in the silty rift has proved to be an important place as many different passages are now known to converge there and there is a good possibility of making an underwater



This page, top and bottom: Cave divers in the sump in Tunnel Cave, photos by David Hunt. Opposite page, top: Steve Thomas in Dip Sump Series, photo by Gavin Newman. Bottom right: Steve kitting up, again by Gavin Newman.

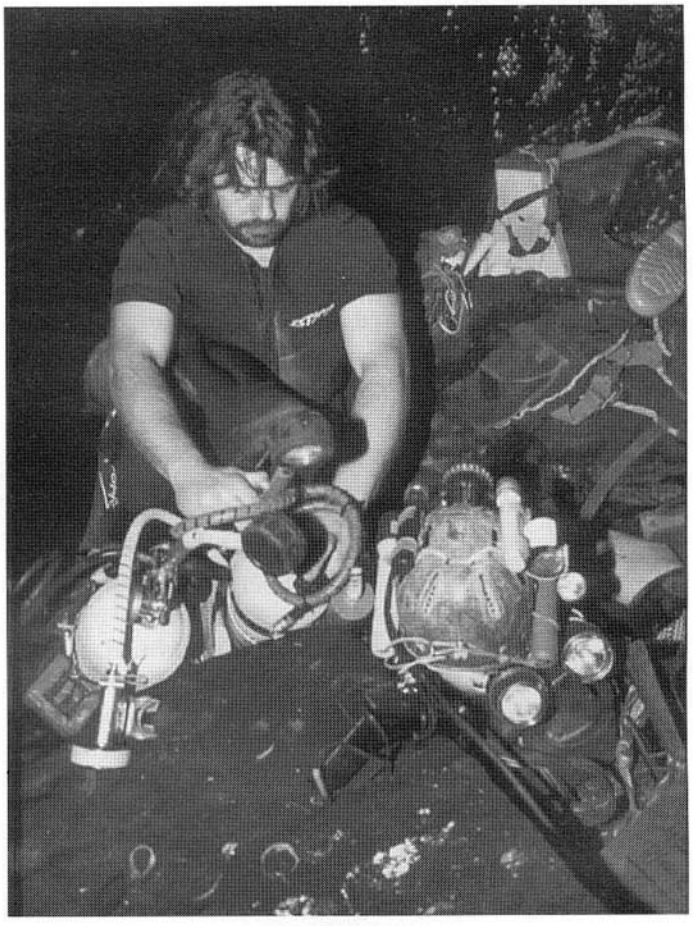


connection to the mainstream sump at the bottom of Ogof Ffynnon Ddu II (just downstream of The Confluence).

We have also explored a network of sumps that we have called the Divers' Pitch Sumps as they are located in large lake chambers beyond a squeeze at the bottom of the Divers' Pitch. These are static during normal water levels but can be a raging torrent in flood, showing little sign of backing up. We have found a diving connection linking this area to the sumps in The Pit and another aquatic maze with loops and airbells. The area is begging for more attention as there is still enormous potential here and there is a real possibility of connecting this lot with the Dip Sump Series. (Many thanks to the SWCC members who have carried diving gear to the Divers' Pitch area via Cwm Dwr with us).

Despite the slow progress over the years, the quality of underwater Ogof Ffynnon Ddu has been well worth the wait. Diving here can provide some of the best underwater scenery in Wales and divers entering the system for the first time with us have been known to come out with a big smile on their face.

What a place!



Reflections on the Aberfan Disaster

by Frank Baguley

The article which follows first appeared in issue 16 of The Red Dragon, *the journal of the Cambrian Caving Council, in 1990. It is reproduced here by kind permission of the Editor.*

The proposed closure of the Merthyr Vale Colliery, with the loss of jobs for some 500 miners, is another form of disaster to hit the small community of Merthyr Vale/Aberfan in the past 25 years. There had been an intermediate threat when the proposed new trunk road from Abercynon to Merthyr Tydfil threatened physically and psychologically to split the community into two, but this was diverted to a higher route to the west of the village after much protest.

But the first disaster was that which happened on the morning of Friday October 21st 1966 when the colliery waste tip on the mountain slope above the village collapsed and engulfed the primary school, part of the secondary school and some of the houses in Moy Road.

I was involved in that tragedy in four capacities: as a cave rescuer, as a dental surgeon, an administrator and a researcher. An Army Dental Officer was also called in to assist professionally.

It was only a short while before that I had returned from the South Wales Caving Club Balinka Pit Expedition to Yugoslavia, of which I was the deputy leader and equipment officer. One of my duties there was to recover and identify the bodies of four partisans who been shot and dropped down the 996ft shaft of the Balinka Pit Cave. I was able to identify the remains of four individuals which had been disintegrated and scattered by falling rocks throughout the years, from examination of their teeth and jaws. Whilst I could not state who they were, as I did not have their dental records and as their dentist had been "disposed of", my estimate of their ages tallied with that in the partisans' personal records register, which was still being maintained! Little did I realise then that I would be called upon to help to identify the bodies of some of the children killed in the Aberfan disaster, some weeks later.

On that fatal morning of October 21st 1966 I had driven to my work from my home in Aberdare, to the clinic in Merthyr Tydfil, in dense cloud and drizzle, a typical autumn journey. It was the last day of the school term prior to the half-term vacation. I held a general anaesthetic session that morning, and just about 9.30am one of the health staff came in to inform us that there had been an accident at Aberfan Junior School, a wall had collapsed and seventeen children had been trapped. I ended the session, and taking my dental technician with me I drove down the main road to Aberfan. As I looked across the valley, I could see the terrible black forked tongue of the tip-slip, engulfing the school and houses, and I commented to my technician that it was more likely to be one hundred and seventeen, rather than seventeen, children trapped. It turned out to be one hundred and sixteen: I was one out.

The houses next to the school were completely engulfed, and smoke was curling up through the slurry from the fireplaces in the ruins. The first house was that of my technician's blind uncle and aunt, they didn't have a chance. They could not have known what had hit them.

I pulled my Land-Rover into Moy Road just getting to the ruins of the school, which was as far as one could get. The street was covered in boulders, tree trunks, trams, sleepers and so on, brought down by the deluge and the rush of water following the rupture of the two main water supply pipes to Cardiff. It was an awful sight. I changed in the street into my caving clothes, which I always carried in case of a callout, and went up the steps to the lower school yard. Part of the junior school had been completely swept away, and the remainder was in a very unstable, precarious condition, having been distorted obliquely. None of the doors could be opened, and the only access was by ladder to one high ground floor window. Miners from the Merthyr Vale colliery were already working there in the main hall, while enormous chunks of masonry lay scattered all around the floor or perched above. The children had only just left this hall to go to their classrooms after assembly. The classrooms on the mountain side of the school were full to the roof, not just to the ceiling, with the black slurry containing trees, boulders and so on. In parts the roof was missing and one could see some of the overcast sky. The slurry was between fifteen and twenty feet deep. We worked on removing the slurry bit by bit, by placing corrugated sheets as static conveyor slides to push the muck out through the window, with workers either side of the sheets, like canoeists with spades instead of paddles. To get each body out as they gradually moved into each classroom meant having to remove a column of debris and slurry weighing approximately one ton. Miner's lamps and Dowty hydraulic jacks were brought over from the pit to help in supporting dangerous walls and perched timbers. Medical teams were in the forefront with emergency equipment in case they were needed. None of us thought of the dangers around us. We worked like navvies. It was just after 11.00am, only two hours after the slip had occurred, that the last child to be brought out alive was recovered. She was carried out into the yard by the genial village policeman, Sergeant Jones (now deceased). That photograph won the award of the year for a young local press photographer. The thought of it is still vivid in my mind and brings a lump into my throat.

As a change of work, some of us went up onto the field of slurry above the top school yard: it was like a Flanders shell-riddled battlefield, still occasionally moving. The purpose was to fill sand-bags, to help build a breakwater to divert the rush of water away from the operational site. It was ironic that the very material

which had caused the disaster should now be used to help in the reparation work!

The parents of the pupils were in the playground of the infants' school next to the junior school. The edge of the deluge had just missed it. They were anxiously awaiting news, and could not absorb the enormity of the disaster, hoping beyond hope that their own children were safe. They could not accept the situation, and when it came later to identifying the bodies some of them could not do so because they still hoped that their dear ones were alive.

I worked there all day and returned to Merthyr Tydfil and home, taking six policemen with me to the police station near the clinic. We had great difficulty in getting to the town because of the numbers of morbid sightseers blocking the main road and preventing the essential services getting through.

I went up to club headquarters the next day to organise a squad of self-supporting cave rescuers, who would be able to work in wetsuits in the wet weather which still prevailed. I broke down as I recounted the events of the previous day to club members. A team was organised, but was not allowed to pass (all roads into Merthyr Tydfil now being controlled) because there were now so many (hundreds of) helpers on the site that they were inflicting injuries on each other with equipment, being so closely packed. It was like an ant-heap which had been disturbed, a seething mass of workers. Heavy machinery had also been brought in to help in the operation to dig into and remove the slurry, which was about thirty feet deep. Some individual cavers had managed to get through to help.

When I returned to the clinic on Monday morning I received a request from the policeman in charge of the operation, asking me to produce a list and record cards of all the children at the school, as some of them could not be identified, and also because the police claimed there were still two complete classes (about 80 children) still unaccounted for. It so happened that I had done a dental inspection at the school only a few weeks prior to the disaster and, as was my practice, I always made out a dental record for every child on the class registers, even for the absentees (so that they could be sent for check-up when they returned to school). The police reckoned there were 256 children in the junior school, from the admission register. All the class registers had been lost or destroyed in the deluge, but the admission register had survived. It recorded the names and so on of each child who entered the school and each one should have been struck through when they left for various reasons, such as going on to secondary school, leaving the district, or deceased. But this had not been done, with the result that the police had counted every name NOT struck out as being present in school. I pointed out that the first such name on the register was that of the son of Police Sergeant Bound who had been transferred to Aberdare, and was in school in that town. But that did not impress them! So the search went on for two phantom classes in the upper yard. There had been two prefab classrooms in the upper yard but they had been completely wiped out in the first rush of the deluge, but the police maintained there must have been more there. They did not believe my figures and list of names, so they instituted a CID-style search by producing a proforma which members of the police force took around the village asking the occupiers of every household still standing to give particulars of themselves and their neighbours so as to find out who lived in the village altogether. This was before the age of computers. By Friday, they came to the same figure with which I had already presented them!

I would add that I was not responsible for accounting for the 28 members of the public who were lost in the disaster, only for the children who attended the schools. That fell within the responsibility of the Medical Officer of Health for the borough, Dr. Robin Williams, who was also our CRO medic.

I spent the whole week in that chapel which served as a mortuary, as the police's operational HQ, and as sleeping and eating accommodation. Parts of mutilated bodies lay at one end of it, while at the other end six morticians were busy cleaning up and embalming the bodies and making a marvellous job of restoring the features of the badly injured children. The deluge had been an enormous "tumbling machine", its force was such that a car outside the school was completely flat. The minister of the church had lost his children in the disaster, but he was still spending his time comforting other parents.

By Friday, one week later, there was still one child left to be recovered, namely Vincent Parfitt. I had to remain until his body was found, in order to identify him. He and a fellow pupil had been sitting on the top of the wall which separated the upper yard from the school. It was as high as the gutters of the school, though at the same level as the top yard.They heard this rumble coming out of the mist behind them, but could not see anything and decided to make a bolt for it, but went in opposite directions. His friend survived, but Vincent tragically ran straight into it, and the slurry cataract swept him over the wall into the school yard below. It was the evidence of his friend which enabled the police to piece together a picture of where he was likely to be found under nearly twenty feet of slurry. It took nearly a week to recover his body. He was in a well-preserved state, although he had lost a leg, but his little one-tooth partial denture which I had made for him was still in place. That was my last task, and I was able to return home and take one of the Red Cross workers from Swansea with me, so that we could have a good bath, feed and rest. I'm afraid I broke down again when I related the story to my wife. I had known all these children: they had been my patients. I could not help it. It was a harrowing experience, which I shall never forget. We both returned the following day for the visit of the Queen and Prince

Philip, when one of those presented to the Queen was Dr. Robin Williams.

With regard to the fourth aspect in which I was involved, I was asked a few weeks later by Captain Nigel Knott, the Army Dental Officer (who returned to his normal duties at Honiton in the middle of the week) if I would join with him in the preparation of a professional article on the problems which we had encountered in the identifications for publication in the dental journal. I agreed, and two cases were selected. I then had the task of visiting the parents, some of whom had moved to the neighbouring valley, to explain to them what we intended to do, and asking for their assistance in the project. The identification problem had been enormous because of the large number of children in the 7-11 age group, an age range at which their teeth were in a constant state of shedding and eruption, and all being very similar with the exception of those who had had some dental work done on them.

The parents were most co-operative, and provided photographs of their loved ones. The article was jointly written by both of us and eventually the galley proof was submitted to us by the editor for final checking, and it was ready for publication. But when it was printed my name was left out, I was told because I was not a member of that professional organisation, the British Dental Association (although I was a member of another professional body). I was disgusted. I had been "used", and it was unforgivable after all the delicate fieldwork I had undertaken in approaching the parents. Such is life!

Observations on the Disaster

The inhabitants of the village, and the headmistress, had for years complained about the possible danger from the spoil heap built on the mountain slope above the village, over a spring.

Mr. Robens from the National Coal Board denied that this spring existed, but it was shown on the OS maps and villagers could remember bathing in the stream before the tip was built. There is no doubt that a surge of this resurgence following the very wet weather, combined with the dumping of "tailings" from the washery onto the tip contributed to the start of the slide, by "kicking out" the foot of the tip and so causing it to slump.

In addition to my practical efforts at the scene of the disaster, I also gave generously to the Disaster Fund, but it grieves me that my employers then claimed from the fund for the reimbursement of my salary for the number of hours I had spent working there. Equally I felt aggrieved because the NCB also claimed money from the fund in order to help pay for a survey of all such tips in South Wales, checking for movement and for water content. Ironically my son was employed on this project. It takes a disaster like this to make some bodies move and take action.

I would express my appreciation of the services provided by the miners, nursing bodies, ambulance service, fire service, civil defence, the police and last but not least the Salvation Army for providing refreshments for the workers from the start.

Just before I retired in 1985 I inspected the infants' school there (now called Ynysowen School) and noted that for the first time for nearly twenty years the school was beginning to recover its numbers, after a whole generation had been wiped out. When we arrived in our new home here in Ystradgynlais, there was a welcome card awaiting us from the headmistress of the infants' school: a thoughtful gesture, which was appreciated.

During the weeks following the disaster I was interviewed several times by the author of the first book to be produced on the incident, in order for him to get some first-hand information.

It is possible that cavers may be called on in future to assist in major disasters such as the Armenian earthquake and the Lockerbie air crash, but at least in such cases there would likely not be the personal connection that I had had in the Aberfan disaster. It was the harrowing experience of knowing the victims which will remain vividly in my memory for the rest of my life. I hope that such a disaster will never occur again, and that the national bodies pay more attention to the demands and complaints of the public on similar issues: after all, they could be right.

Further Reading:

Aberfan: The Story of a Disaster, Tony Austin, Hutchinson, London.

The British Dental Journal, January (?) 1967.

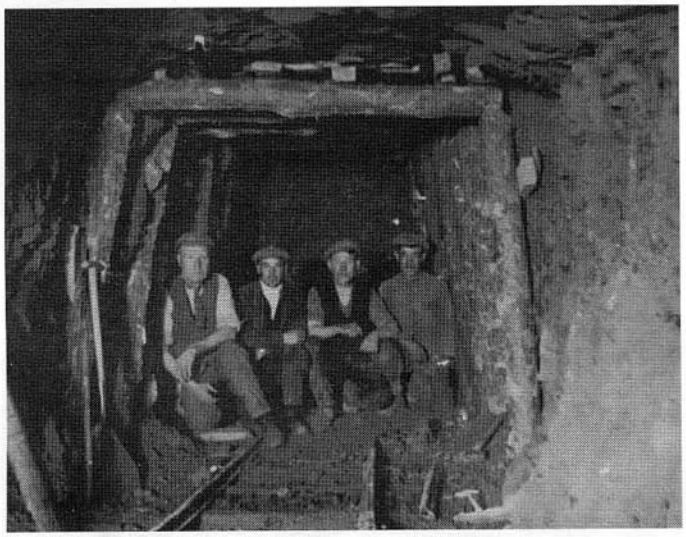
Photographs from the Collection of Mrs. Lena James

Editor's Note: *Lena James (* néePrice*) is the daughter of Davy and Gwen Price, who used to keep the Gwyn Arms in the days when the club was formed. (It was her father, of course, after whom Davy Price's Hall in Tunnel Cave was named.) She still lives in the valley, and very kindly agreed to lend me the photographs which follow over the next two pages.*

Right: the entrance to Dan-yr-Ogof, circa 1939.

Below: cavers outside the Gwyn Arms. On the extreme right is Lena, next to her father and mother, and crouching in front of them is Lena's brother Arthur. Next to Mrs. Price is Ted Mason, and next to him (with cigarette) is Arthur Hill. Crouching in front of them is Don Lumbard, and sitting in front of him (also with cigarette) is Gerard Platten. Looking at this photograph, Clive Jones said: "I can still hear the singing now..."

Bottom: bones from Bone Cave on display in the long room at the Gwyn Arms, circa 1939. On the right is Arthur Price.
Top left: Dan-yr-Ogof, circa 1938. On the left is John Williams, 3rd from left is Davy Price.
Top right: Sir John Hunt visits. He's on the left, next to Mrs. Price, and the other side of her is Sir John's assistant. Lena is in the doorway, her son Martin in front. The other lady is the wife of photographer Thomas John Davies, who took the picture. The car just visible on the left is Clive Jones' first car, a Standard 10. Clive says he was in the pub at the time!



How Old is Ogof Ffynnon Ddu?

by Keith Ball, Gareth Davies and Derek Ford

1. INTRODUCTION

It seems appropriate on this, the fiftieth anniversary of the club to put this august event in its geological context by considering the age of what is probably our oldest cave system.

Whenever we consider the age of a cave we are, at once, confronted with difficulties. We can begin by talking about limits of confidence from which we can assign relative ages, but the difficulties in assigning more definite (absolute) ages are great, even with modern methods of age determination. Any sample, when its age is determined, is often only assumed to describe a single geological event; however, the size of the sample restricts the scale of interpretation of the result. In other words, what appears to be a single event to the educated eye may actually be a series of events, e.g. several layers in a speleothem that are interpreted as one. The resulting interpretation, or misinterpretation, is that a single age is often or usually assigned to an average age for several individual events.

It is estimated that the Carboniferous Limestone, within which the cave has developed, is about 350 million years (Ma) old. The cave is obviously a more recent feature, but our interpretation begins when the cave was first entered in 1946. This span of 350 million years doesn't help much in defining a limit to the age of the cave. However, there is also a more fundamental problem: what is exactly meant by an age for any cave.

Ogof Ffynnon Ddu has several active streams and those passages are either slowly eroding or filling. Where the cave is eroding the volume of cave passage is increasing, where the cave is filling, the volume of cave passage is decreasing, and the rock outside is also being removed. Our discussion therefore must consider the way the cave is formed and whether we can detect any periods, during the extremely long history of the cave, when the rate of evolution was more rapid or when there was a relative standstill in the processes. There is a quite likely to be a continuity in any cave production during which development was faster for some time and then slowed down during others. However, even within the same cave currently we have zones where there is active erosion, e.g. in the stream passages (see above), and there are other zones in the cave where time is standing still; little happens apart from some drips from ceilings and these are sparse. Inevitably also, we may have to look outside our immediate area of interest for evidence for absolute dating (of events or a single event) and equally inevitably the precision to which we can assign ages decreases with age, because the number of events that have occurred is greater and we cannot determine which have been preserved and which have not. This is a rather typical geological problem, in that we never know how incomplete the record is.

We can thus classify our discussion into two broad areas and look for evidence from data which are outside the cave and from information gained within the cave itself.

2. RELATIONSHIP WITH EXTERNAL FEATURES: EVIDENCE EXTERNAL TO THE CAVE

2.1 Erosion Levels

The main source of information externally is from erosion surfaces which may be relatively dated from evidence obtained elsewhere. In our discussion we will point out that there is considerable uncertainty in assigning ages to these features. However, the information is improving gradually so that we hope this assembling of the evidence may subsequently help to yield more precise data as further knowledge is gained.

It is quite clear that there are certain geomorphological features (valley floor elevations, erosion surfaces, elevations of nick points, etc.) in the immediate area that can be related to both specific and general features in the cave system.

A thalweg (i.e. a curve that would join all the lowest points in a stream channel or valley), in streams in the vicinity shows evidence for periods of standstill and rejuvenation (evidence of steepening of thalwegs or changes in cross-sections of valleys).

There are also erosion surfaces that are extensive in Wales and there is abundant evidence for these occurring in our region. The neighbouring landscape shows evidence of long periods of stability interspersed with periods of more rapid change. Brown (1964) has identified a stepped land surface profile in Wales, comprising three elements. Brown thought these to be peneplains (final stages of fluvial erosion cycles), which are gently rolling lowlands caused by very long term denudation. George (1976) on the other hand regarded the erosion surfaces as wave-cut platforms because the surfaces cut across rocks of different hardness. Both authors agree on a probable Tertiary age. Since this spans about 65 million years it does not help greatly in assigning a more precise age to any part of the cave system which might be concluded to be related. However the surfaces are widespread and apparently undeformed and may safely be concluded to post-date the Miocene (Table 1) earth movements (these were periods of severe folding which gave rise to the Alps and resulted in substantial folding in rocks as close to our area as southern England). They are in any case later than Eocene because they cut across igneous dykes of that age. One particular and very extensive erosion level is at 1400 feet (425m) above Ordnance Datum (OD) and this is widespread in the upland areas.

The stepped profiles can be traced into coastal regions and can be shown to be upward continuations of coastal profiles. For a discussion see George (1976). We can identify zones within the cave in which there are extensive well developed chambers and very large passages which are at similar absolute height. These are particularly well developed at about 1400'(425m) as exemplified by the series of large passages and chambers near the top entrance of Ogof Ffynnon Ddu II. Similar zones are also present at about 1100'(330m) and at 800'(265m) OD. These other zones are also

characterised by an overall similarity with big chambers and large cross-sectioned strike-oriented passages. It has been suggested that each zone is formed close to a stand-still in the water table and the different heights indicate a possible pulsatory decline in water table level with time.

Let us first look in greater detail at the 425m level. As stated above there are abundant large chambers at this height in Ogof Ffynnon Ddu II. Furthermore they show evidence for water table development, or at least extensive modification, by the presence of sub-horizontal dissolution grooves. These take a long time to develop at the water surface and will be the subject of a separate paper.

There seems a convergence of opinion regarding the development of passages in relation to the water table. Previous ideas assumed that a sub-horizontal conduit would be formed at or near the water table over a time interval (The Water Table Stream Theory of Swinnerton). The Ford-Ewers model invokes the presence of phreatic loops (almost like U-tubes) extending below the water table. Railton (1956) noted the presence of phreatic loops, although he did not call them that, in Ogof Ffynnon Ddu I and showed that they extended down dip to an absolute depth of 10-20m, below a postulated water table. Smart and Christopher (1989) showed how, in a plot of loop crest altitude against amplitude that there was a reasonably linear relationship. Their analysis however, was based upon the assumption of one cycle of erosion. Ball and Jones (1991) argued on the basis of the chemistry of the cave forming processes that the main cave development would take place in the upper part of the phreatic zone.

In an extensive review of the literature, including very detailed reviews of world-wide cave surveys, and by application of the concept of a fracture flow net, based upon the Hagen-Poiseuille equation of flow, Worthington (1991) showed that sub-horizontal master conduits (tiers) tended to form at a relatively constant depth below the water table. The position of the water table and the tier depth is controlled by the local landscape. The tier is thought to form beneath the water table because of a combination of different factors, related to physical and chemical properties. Worthington's model profile matches the profiles of most of the world's cave systems, including those active systems that have been extensively explored by divers. The water tables of some of these have remained stable for extensive periods ranging from 0.3 to 10 million years BP (Before Present). He derived an equation relating the depth of circulation below the water table, the angle of dip and the length of the ground water basin (catchment). Using this equation the calculated depth of circulation for tiers below a water table in the Ogof Ffynnon Ddu and Dan-yr-Ogof catchments is about 20 metres.

It is interesting to speculate that in relation to the current resurgence, which is at 182m OD there should be a tier developing at about 175m OD. Since the position of the current resurgence can only be relatively recent, within the last 10,000 years, the tier is probably still only just developing.

Whichever model we accept, and the truth may contain elements of all of them, we have a likely close relationship between the position of the water table at any period with large passages and chambers developed close to the water table in the upper part of the phreas. We therefore conclude that the main chambers at the top entrance series at about 425m OD could have been developed in response to a water table at a slightly greater elevation (440-450m OD, and this corresponds to an erosion surface at the same relative height (440-470m OD, Brown, 1964; George,1976; Crowther, 1989). It should be noted that many of the larger passages are about 20m in height.

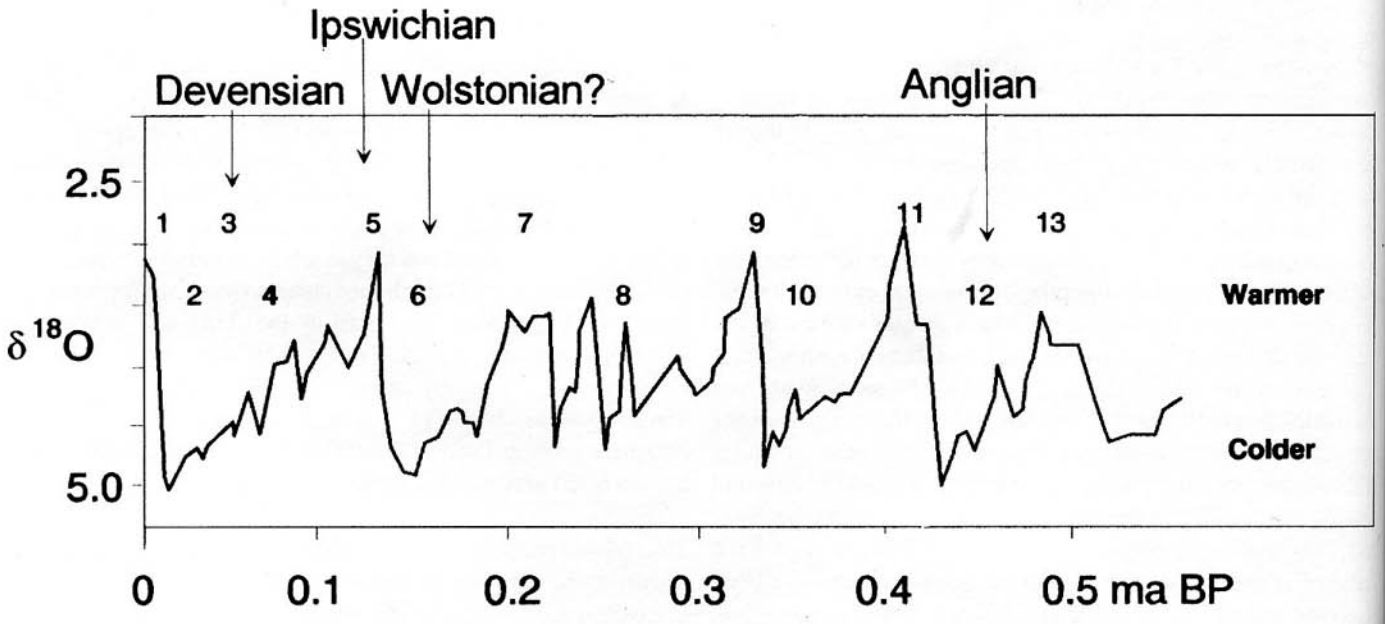


FIGURE 1

It is therefore reasonable to assume that the Top Entrance series was mostly developed at the same time as there was a higher water table and the presence of an erosion surface at approximately the same height along with the position of nick points in the longitudinal profile of nearby streams is a compelling indication of a genetic relationship.

We have to consider evidence from outside our immediate area of interest to give a possible indication of absolute age.

R.O. Jones (for the Tawe) in 1939, O.T. Jones in a number of papers culminating in one in 1951, and George in a number of papers culminating in another in 1976, studied thalwegs in a large number of rivers in South Wales and concluded that the coastal base levels for many of these related to heights at about 580 feet (187m, The Nant Stalwyn stage), 400 feet (125m, the Fanog stage) and 200 feet OD (60m, the Talley stage). They correlated the 425m inland platform with the approximately 190m erosion surfaces in the coastal areas. In a very comprehensive survey of landform and structure in both Tawe and Nedd catchments, George (1976) was able to relate postulated thalwegs from high level tributaries, wind gaps etc. to confirm the probable longitudinal profile of the major rivers in relation to changed base levels.

If we look at the positions of the uppermost nick point in the area of our immediate concern we find that in the Nant Byfre the nick point is at about 1400' (460m). In the head-waters of the River Tawe (upstream), a well developed (highest) nick point is at 1500' (490m). Down valley at Ystalyfera the highest nick point in tributaries is at 300m. In the Pontardawe/Glais area it is at 220m. These nick points are difficult to relate to each other because of the absence of high ground in the intervening areas, but the fall in height is reasonable and it is postulated that these are related. On the coast there are clear erosion levels in Gower and in the coast line between Neath and Margam where there are erosion levels at about 180-200m.

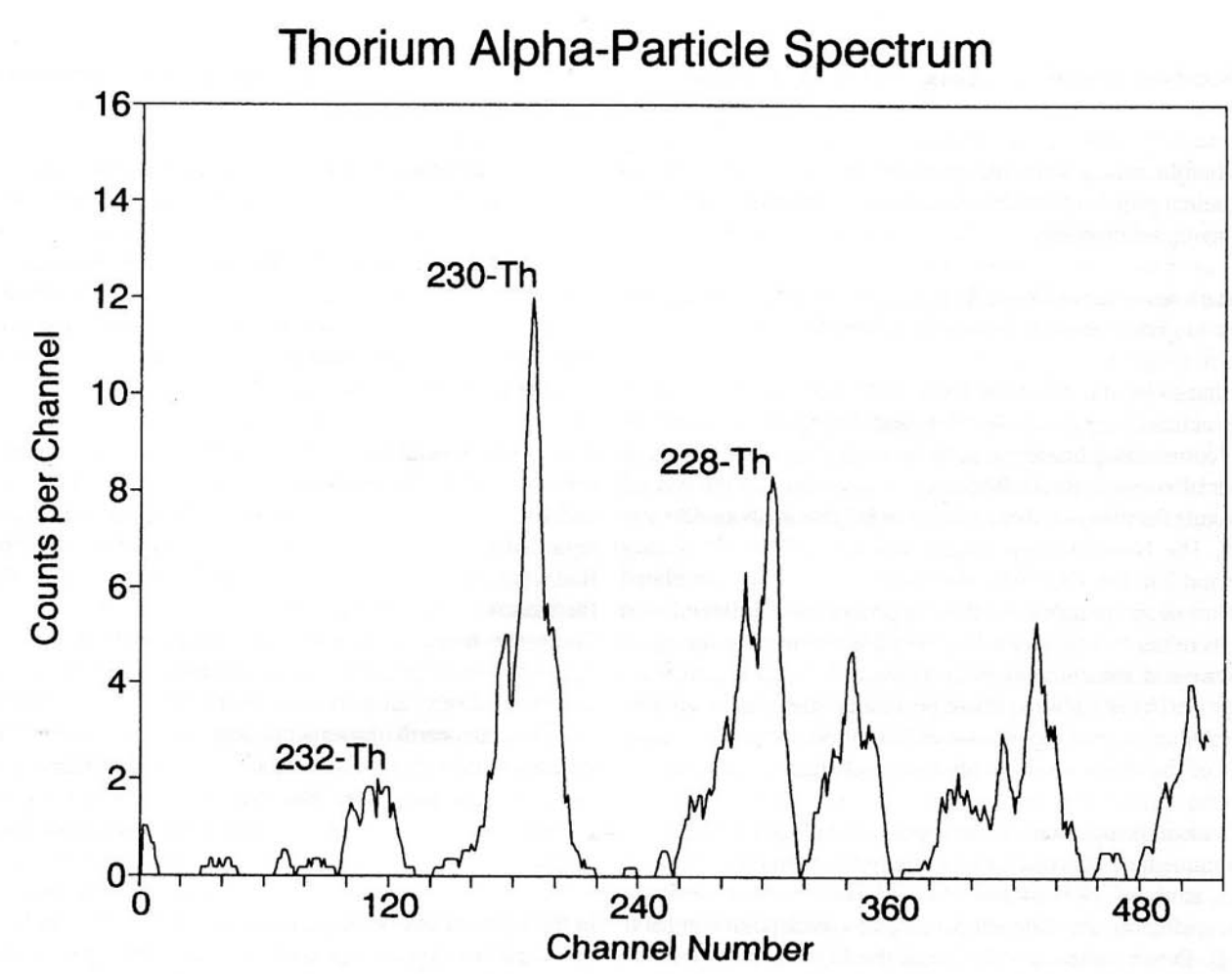
The 190m coastal erosion surface is difficult to date precisely because although it cuts across many rock types, the youngest on the coast is in the Carboniferous. It is covered by glacial drift and so the surface predates at least the oldest glaciation. We can get some idea of the limits to a possible age, not quite locally but by observing that this 190m erosion surface bevels the Lundy granite where a good age of 54Ma (i.e. Eocene) is confidently given (Edmunds et al. 1975)

Again this does not help much but by following the same coastal erosion surface around the coast through Devon and Cornwall into SE England we can observe that an erosion surface at about 190m OD is overlain by sands with abundant fossils, and related to solution pipe infills in the chalk of the North Downs (Gallois, 1965). These are the Lenham Beds and have been dated as Coralline Crag age i.e. they belong to the Pliocene, the last epoch of the Tertiary era. The fact that the erosion surface is overlain by the Lenham Beds does not necessarily mean that the erosion surface is coeval with the deposition, it could have been earlier, but the chances are that it might be only slightly earlier. The base of the Coralline Crag is found at different heights and is almost at sea level in the north of Norfolk. However the Coralline Crag in this area is of deeper water type and likely to have been deposited at a depth of greater than 70m beneath the surface of the sea (Funnell, 1995). It is therefore plausible that it is related to a depth of 190m or thereabouts. Funnell (1995) equated the main decrease in global sea level during the Tertiary to the onset of the first continental glaciation in the northern hemisphere. This did not mean that glaciers or ice-caps developed in our area but that some of the precipitation was locked up in glaciers in the zones in and surrounding the Arctic Ocean. Using data from deep-sea cores he suggested that these processes were initiated at about 2.5Ma BP i.e. Pliocene. There is general agreement from Eyles (1996) who also pointed out that valley glaciers were in existence before this and even reached the sea in mountainous areas such as Greenland, Norway and Baffin Island.

In the same general area in the South Downs, near Beachy Head, similar fossiliferous sandstones at a lower height of between 160 and 190m have yielded fossils of Red Crag age which are now regarded as early Pleistocene. There is a problem with dating the Red Crag; it is classified as Pliocene by some and by others as Pleistocene. The current consensus is very early Pleistocene. There are however severe problems in making this type of extrapolation over such a great distance. The harder rocks of Wales and Cornwall were more resistant to deformation during the Miocene earth movements and we should therefore pay greater attention to evidence, where it exists, from these areas for our particular purposes., and maybe treat with more caution evidence from the more easily deformed rocks of south-eastern England.

In the Upper Tawe Valley a tier at about 335m (1,100ft) is well developed in caves; large chambers and strike passages at this elevation have developed in both Ogof Ffynnon Ddu and in the Dan-yr-Ogof and Tunnel caves on opposite sides of the valley. Furthermore there are well-developed nick points at this height in both active and dry valleys in the vicinity. This erosion level can be related to the 125m coastal platform but in our general area this is indifferently preserved because of erosion by the later 60m coastal platform. However the surface can again be traced around the Bristol Channel and is well preserved in Cornwall and Devon. In the regional memoir for the area (Edmunds et al 1975) this erosion surface has been dated with reasonable confidence also as late Pliocene. This is because of its relationship with the Late Pliocene St. Erth beds in Cornwall which have a characteristic fossil assemblage. The beds are of deepish water type and could be related to the 125m local platform. Support for this is based upon the fossil evidence. The St Erth Beds lie at about 30-35m OD. Reid (1890) identified fossils of Mediterranean affinities and showed that these commonly occurred at a depth of 80-100m. Mitchell (1966) found foraminifera which suggested a depth of >20m and on the basis of the large number of species suggested a depth of 25-100m. Both estimates indicate that a relationship with the 125m OD wave cut platform is plausible. The major problem seems to be with the age of the deposit, which has been variously estimated to range between Eocene and Pleistocene. The British Geological Survey's current estimate is late Pliocene.

A further very well-developed coastal platform is at about 60m and relates to an 250m erosion surface inland. The 250m local level is complemented by large chambers and strike oriented passages in Ogof Ffynnon Ddu I and also in Dan-yr-Ogof and Tunnel Caves. It is very difficult to assign an age to this platform since although it is demonstrably younger than the 125m platform and in turn this is overlain by the Older Drift (see later) all we can really say with confidence is that it is early Pleistocene.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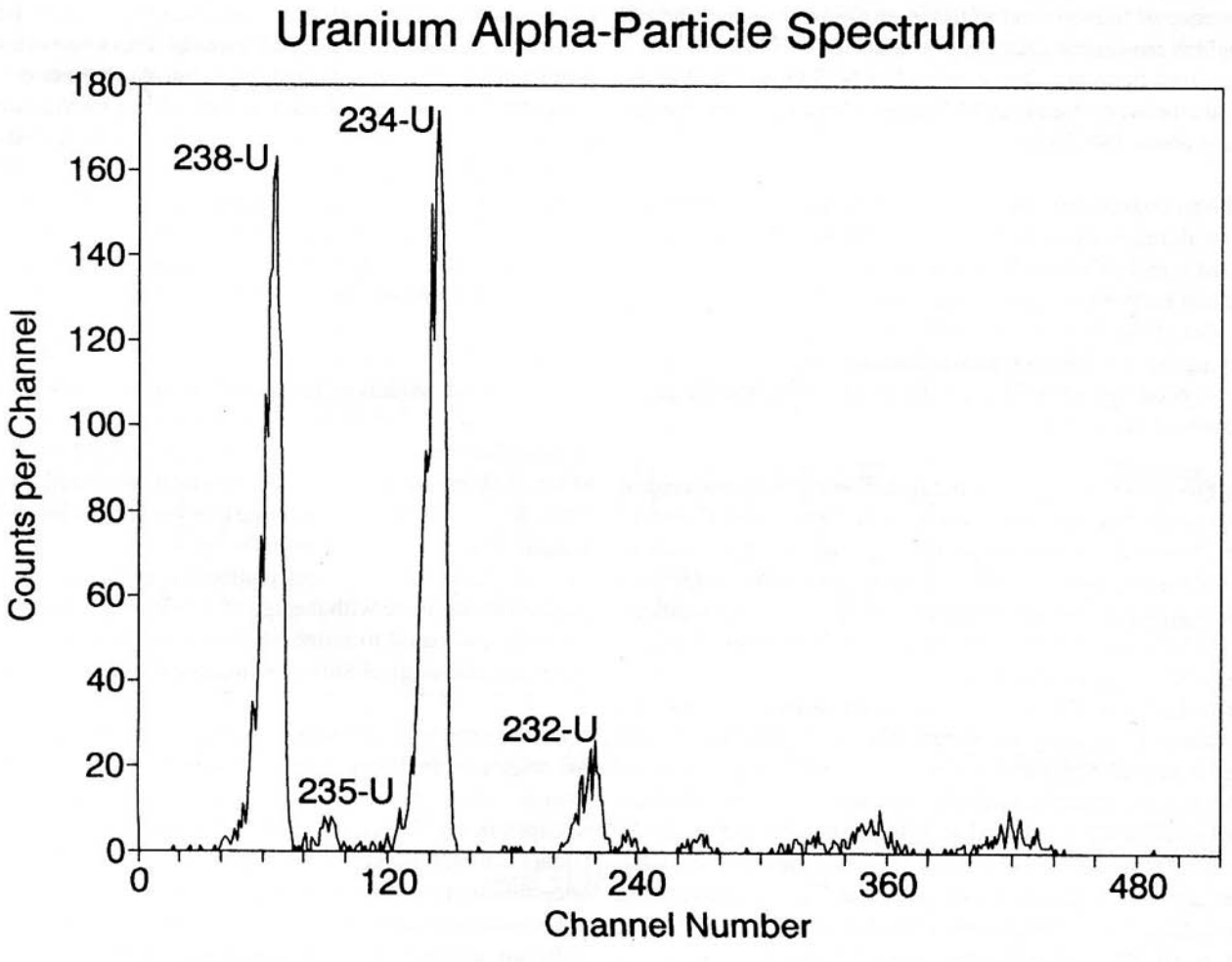
Uranium Alpha-Particle Spectrum
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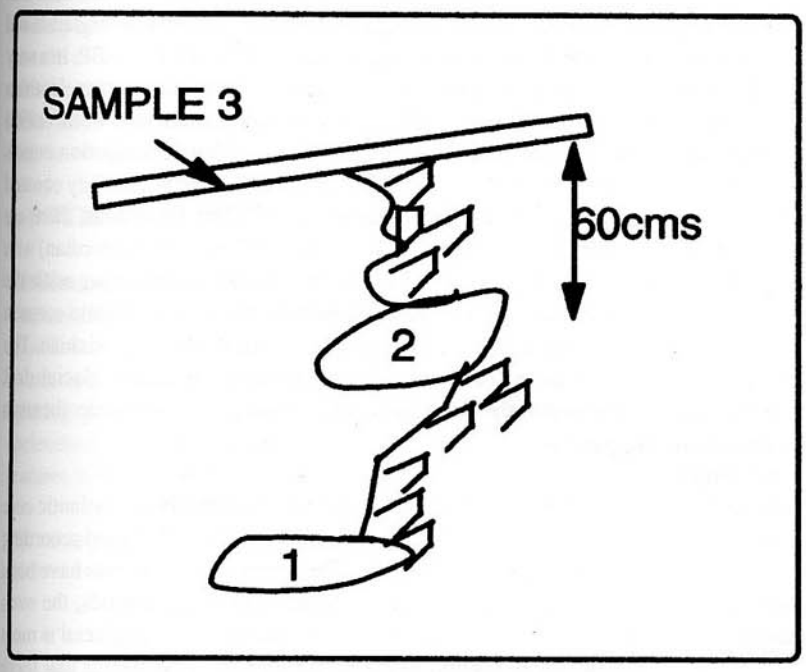

FIGURE 3

So to summarise this part:
Our potential age limits to the cave are maybe reduced because if the 250m local erosion level is related to the coastal 60m platform then all we can say is that it is post Paleogene.

There is a circular argument about the 125m coastal erosion surface but the best we can say at this moment is that it is Late Pliocene. This places it older than about 1.8 Ma.

The local 425m surface (= 190m on the coast) is older but the best we can say at this stage is that it is older than late Pliocene. It is plausible to date this period of peneplanation as coming to an end at about 2.5Ma coincident with the first major global sea-level change associated with northern hemispheric glaciation as does Funnell (1995). It is attractive maybe to relate the initiation of the platform forming event to an earlier relatively major tectonic event, the most convenient is that occurring during the Miocene, so that the grading of the early Tawe/Nedd drainage was referable to a base level stabilised during post Miocene times, initiated about 7Ma BP and coming to an end about 2.5Ma BP.

Table 1

Tertiary / Pleistocene Age Ranges (Ma)

EPOCH	AGE START	EVENTS
Pleistocene	1.8	Ice Ages.
NEOGENE		
Pliocene	7	Cooling conditions
Miocene	26	Uplift, tectonism.
PALEOGENE		
Oligocene	38	Deep weathering.
Eocene	54	Uplift and erosion
Paleocene	65	

2.2 Glaciation

Up to recently we have tended to regard the Pleistocene as being essentially a few glacial episodes separated by warmer interglacials. More modern dating techniques have shown that the glaciations were largely confined to the last 850 thousand years (ka) within the approximately 2 Ma of the Pleistocene. The exact ages are difficult to determine but there is evidence in Europe there were at least four major episodes interspersed by warm periods (the interglacials). During the glacial times there were periods of amelioration in the climate and these are called interstadials. In an effort further to define the Pleistocene climatic regime, cores of sediments have been retrieved from deep portions of both the North Atlantic and Pacific Oceans. The cores provide a virtually complete record of sedimentation, over an extended period.

The warmer and cooler periods of the Pleistocene have been related to the variation of stable isotopes (especially the oxygen isotopes O-18 and O-16) with respect to a standard, either a belemnite fossil, or an agreed mean value of ocean water or SMOW (Standard Mean Ocean Water). Foraminifera grow in the sea, their calcium carbonate skeletons equilibrate with sea water, and hence reflect the isotopic composition of the sea. When these creatures die the skeletons collect on the sea floor and hence preserve, in the sea-bed layers, the isotopic composition of the surface layers where they lived.

Because of the mass difference, water molecules containing O-16 tend to evaporate at a faster rate than those containing O-18. The clouds and moisture in the air are therefore enriched in O-16 and the sea is relatively depleted. If the moisture falls as rain then it flows back to the sea and there is ultimately no difference in the oxygen isotopic composition of the sea water. If however the moisture is trapped as ice then the O-16 does not flow back into the sea and the sea is depleted in O-16. The rate of sedimentation on the sea bed is assumed to be relatively constant. This may not be so, and so uncertainties can creep into the age estimates from this source. Nevertheless the oxygen isotope record from the deep-sea drilling record indicates at least seventeen separate periods of intense cold during the Pleistocene; all of which may not have given rise to glaciation on land since sufficient precipitation may not have accompanied the freezing conditions to give rise to glaciers. Also difficulties in correlations result from how one can separate interstadials and interglacials. In Atlantic cores these are often indistinguishable. The biggest problem is determination of the absolute age of the warm and cold periods, or interpretation of this Marine Isotope Stage record. Imbrie et al., (1992) have attempted this by tuning the temperature variation with atmospheric data. At the moment we are only sure of the absolute age of two events, the warmest period of Stage 5, stage 5e, at 120-125 ka,

and the magnetic polarity reversal at about 780 ka. The other events are chronologically attributed and are based upon the variation of O-18/O-16 ratios from north Atlantic sediment cores, and the hypothesis put forward by Milankovitch based upon the Earth's orbit around the Sun and wobbling of the earth's axis (pointing the poles away from the sun at the apogee or toward the sun at the perigee). Milankovitch recognised a major periodicity at 100 ka (corresponding to the major glacial events) and with shorter frequency periods at 40 ka and 22 ka. To assume that the chronology is universally applicable assumes that the assumptions made about the sedimentation rate in the sediment core are correct.

Even though there are numerous speleothem ages that span the last 350,000 years, and the record shows distinct gaps that correspond with warm and cold stages, the speleothem record does not exactly correspond with the Marine Isotopic Stage boundaries probably because speleothem growth, or lack of it, is not always dependent upon surface conditions.

Bowen (1978) states that there were no fewer than eight glacial episodes in Europe and that most of these occurred in the last 700 ka. In Wales there is direct evidence for two periods of glaciation. The earlier one was by far the most severe and widespread and would have destroyed evidence from any earlier glaciations. The later one is less intense and deposits from this (the Newer Drift) rest upon the earlier (the Older Drift). Our area of immediate interest was dominantly an area of glacial erosion so that any remaining surface drift deposits are likely to be from the very latest, waning, stage of the last glaciation.

It is possible that the only evidence for earlier glaciations may be found in the cave sedimentary deposits, and even that record is very likely to be only partially complete. Indirect evidence for an even earlier Welsh glaciation is from the English Midlands where there are glacial erratics of Welsh origin in one of the earlier glaciations (pre-Hoxnian, Horton, 1989). So we have direct evidence for two glaciations and indirect evidence for another. It seems from the search of the literature that the Older Drift is originally related to the Wolstonian Glacial Event and this is separated from the Devensian (= Newer Drift) by the Ipswichian Interglacial (Figure 1).

Recent work suggests that the Wolstonian may be mis-classified. The type area for the Wolstonian glacial deposits (gravels, clays, tills, sands etc.) is in the village of Wolston in Warwickshire. More recent dating suggests that in fact this may be an Anglian event. This sort of situation illustrates the difficulty in erecting a temporal classification based upon often separate and isolated terrestrial deposits with little opportunity for independent age determination. The main advantage of relating age determinations to deep North Atlantic core is that there was likely to be continuity of sedimentation throughout the Pleistocene, the availability of oxygen isotopic data from foraminifera contained within the sediments means that better estimates may be made for the likely temperature changes over the northern hemisphere, and moderately accurate age measurements mean that these can be dated.

There is another problem when the age of the Ipswichian Interglacial is considered (Cullingford 1985). There is general agreement that this started 128 ka ago. Some workers argue that this gave way to the Devensian Interglacial about 118 ka before present (BP), but that interstadials interrupted the early Devensian at 100 and 85 ka. Others argue that it makes more sense to incorporate these interstadials in the Ipswichian interglacial and place the Devensian younger limit at about 75-85 ka BP. In a very comprehensive study of the statistical distribution of speleothem ages Gordon et al (1989) and Baker, Smart and Ford (1993) showed that there was a maximum in their distribution curves related to the period between 135ka and 80ka which they equated to the Ipswichian interglacial. Within the Devensian there are further discrete interstadials at about 65 ka BP (Chelfordian) with the Upton Warren interstadial at 42 ka. In this paper we relate the ages in the cave to ages obtained in the North Atlantic cores in preference to ages obtained for any but the post Ipswichian. The main reason for this is the uncertainty in dating glacial drift deposits and the short age ranges observed for the speleothems in the caves.

Figure 1 is a profile for the upper part of the North Atlantic core and shows dates for the major climatic events identified according to the oxygen isotopic ratios. The various major events have been numbered: the odd numbers relating to warm periods, the even numbers the cold. It seems that the major Anglian glacial is most appropriately related to event number 12. This means that there are three major cold episodes, post-dating the Anglian Glaciation, that are not represented by recognisable glacial deposits. It may be that there was insufficient precipitation for ice caps to have formed. The upland areas of South Wales, being well inland with a northerly aspect, may have supported small ice sheets or semi-permanent snow fields during these episodes, but in any case there would probably have been a substantial reduction in the flow of available water into the caves.

We have to look elsewhere again to gain some insight into the likely conditions in a pre-existing cave system in response to glacial conditions. In this case we must look to the conditions existing in northern Canada and Norway rather than depend upon evidence from Alpine caves where the conditions were unlikely to be similar, although observations from here would be useful.

Any deposits during glacial times in the caves would tend to remain unconsolidated. During the waning periods of the ice sheets torrents of water would be introduced into the cave which might effectively remove these unconsolidated sediments, and maybe remove any speleothems produced during previous interglacial/interstadials. During the glacial episodes it is uncertain what the conditions underground were like. It is possible that the caves were predominantly dry since there was no available water to get into the cave system. Isotopic evidence from the carbonate rock aquifer beneath parts of Minnesota suggest that, underneath that ice sheet, there was no recharge of the aquifer during the glaciation that was related to Marine Isotopic Stage 2 (i.e. the last glacial maximum; Alexander, Alexander and Lively, 1987)

The evidence from Castleguard Cave in Canada, and those parts of it that are under the Columbia Icefield, is that some water still circulates (i.e. there is some speleothem drip). It is also possible that cave formations were still being formed deep within the Ogof Ffynnon Ddu cave system where geothermal heat flow might have been sufficient to promote a slight flow of water. On the other hand geothermal heat flow might have been sufficient to keep the cave flooded with water since the outlets would have been frozen and blocked. In either event there would have been

relatively little growth of cave formations. During waning of the ice sheets seasonal effects would have been severe. In Arctic Norway the resurgences are often iced up, with water backing up into the cave system until it totally fills with water, only to be released during the spring thaw. Cave systems can be visited under summer conditions in Canada even though the major part may be covered by a glacier (e.g. Castleguard Cave).

3. INTERNAL EVIDENCE

3.1 Uranium series dating

One technique that has developed greatly over the past 25 years or so is that of uranium-series dating. and this has been applied to attempt to clarify the mysteries surrounding some of cave forming processes. However the step between obtaining a speleothem age and relating it to geological/geomorphological features is fraught with difficulties.

The table gives a simplified version of the U-238 decay chain.

THE URANIUM-238 DECAY SERIES

Isotope	Decay	Half Life
U-238	α	4.468x109y
Th-234	β	24.1d
Pa-234(m)	β	1.18m
Pa-234	β	6.7h
U-234	α	2.48x105y
Th-230	α	7.52x104y
Ra-226	α	1602y
Rn-222	α	3.825d
Po-218	α	3.05m
Pb-214	β	26.8m
At-218	α	2s
Bi-214	β	19.7m
Po-214	α	1.64x10Ä4s
Tl-210	β	1.32m
Pb-210	β	22.3y
Bi-210	β	5.02d
Po-210	α	138.3d
Tl-206	β	4.19m
Pb-206	stable	

Normal uranium comprises two isotopes with atomic weights of 238 and 235. U-235 is only present as 0.7 percent of natural uranium and can thus be safely ignored for our purposes. The decay chain of U-238 can be separated into two sections by Ra-226, earlier isotopes have long half lives whilst later ones are short lived: in geological terms the decay is almost instantaneous. If uranium were to be completely separated from its daughter products and left undisturbed in one place it would take about 1.6 million years for equilibrium to be re-established (91% in one million years) in which state the ultimate daughter product, Pb-206, is produced at the same rate as U-238 decays. One might think at first view of the table therefore that if you could reasonably expect that U was constant, all that you need to do is to measure the amount of U-238 parent and the amount of Pb-206 daughter to determine the age of the feature e.g. a stalagmite. Unfortunately this simple expedient is rarely possible, the main problem being that Pb-206 occurs naturally and is thus not entirely derived from uranium decay. The other problem would be getting sufficient precision to produce a reliable determination of the amount of Pb-206 in the sample, in a short time relative to the half life of the parent U-238.

3.2 Chemistry of transport and deposition of uranium.

Although uranium is only present in tiny amounts in most rocks it is almost ubiquitous. In limestones it is usually present at the one or two parts per million level (= gms per ton). However it is where it occurs that is particularly fortunate for the speleologist interested in age determinations. The uranium is often uniformly distributed in rocks (for the technically minded it is largely confined to the organic portion of the cement of clastic limestones). Rarely it is found elsewhere e.g. in hydrocarbon bleb like minerals, but these are sparse. It is also concentrated in phosphate minerals in limestones but these are generally stable during weathering. During weathering of limestones the classical reaction takes place where carbon dioxide, water and the calcium carbonate of the limestone react to produce more soluble calcium bicarbonate.

These reactions take place in the soils and upper parts of the limestone. Ground water tends to migrate downwards and carries the dissolved calcium bicarbonate. During weathering the uranium originally found in the rock matrix is released and is transported in solution, as carbonate complexes. The ground water tends to be rich in bicarbonate ions and consequently has a resultant high pH. Uranium tends to form very stable soluble complexes under these physical/chemical conditions (for the cognoscenti they are bicarbonato and tricarbonato complexes).

When the ground water emerges into a void filled with air, the air in cave passages usually has a lower carbon dioxide level and the carbon dioxide from the ground water is thus lost by equilibration with the cave air. Calcium carbonate is re-deposited as stalactites and stalagmites. Some of the uranium is also co-precipitated and incorporated within the crystal structure of the formation. In the weathered rock the chemistry of many of the uranium daughter products is such that these are quite insoluble during the weathering processes and remain behind bound onto such mineral residua as clay and secondary iron minerals. Thus uranium can become mobilised and separated from its daughter products, especially the thorium and protactinium isotopes (the immediate daughters) and subsequent radium isotopes.

One of the daughter products is however U-234. In practice this is usually more soluble than the parent U-238. This is due to alpha recoil reactions. U-238 decays by alpha particle emission which has a palpable mass. Action and reaction are equal and opposite so that as the alpha particle is projected in one direction the U-234 particle is nudged in the other. The recoiling often results in deformations in the crystal lattice and loss of electrons (alpha particles are helium nuclei devoid of electrons); a U-234 atom in this state may more readily pass into solution, because its charge is often not neutral. The result is that there is a slightly increased activity of U-234 in ground water over the activity of U-238. If uranium in solution is ancient enough then secular equilibrium should exist (where every time a parent U-238 decays there is a decay of the daughter U-234). Where this results, despite the different masses, concentrations and half lives, the activities are

the same. In other words the Activity Ratio (AR) is one. As we have said, because of recoil and other effects, in practice, rarely does ground water have an AR for U-234/U-238 equal to unity; this makes it possible to fingerprint ground water with its AR. Unfortunately this AR is highly variable, and this relationship is often reflected in speleothems, even in deposits from the same cave and often from the same cave passage.

In obtaining an isotopic date for a speleothem, there are assumptions that have to be made: the first assumption is that decay rate of the isotope is known precisely, secondly that the amount of daughter product is known at the time of deposition (i.e., that there was none), thirdly that the system is "closed" (no parent or daughter isotope is added or removed since deposition), and fourthly, that sufficient decay has occurred so that the daughter products can be measured and those results are accurate, precise, and representative of the sample being dated. U-234 decays by alpha emission to Th-230, and conveniently in a carbonate solution at typical cave pH and Eh (redox potential) conditions, U-234 would be soluble when its daughter, Th-230 would not. Therefore using these isotopes, the second assumption (above) would be met. Th-230, in turn decays to Ra-226, and this would slowly grow into secular equilibrium with its ultimate parent (U-234).

In considering the fourth assumption, calculations and experience indicates that in 500 years enough Th-230 would be present to make a representative measurement, and that in 350,000 years the AR of Th-230/U-234 would be indistinguishable from unity. So, from the previous discussion speleothems can feasibly be dated using Th-230/U-234 if they are between 500 and 350,000 years old. These results refer to the use of alpha spectrometry (see later), if using the more sensitive and precise mass spectrometer, the age range is greater; from 100 to 600,000 years. One other proviso is that the speleothem contains enough uranium so as to make the measurement accurate and the practical lower limit is a uranium concentration of 0.1 ppm.

3.3 Analytical methods

A thin flat source of uranium and thorium extracted from the speleothem must be prepared for measurement of alpha-particle activity. Either alpha-spectroscopy of mass-spectroscopy can be used to measure the disequilibrium between U-238/U-234 or Th-230/U-234, but in both cases the samples cannot be analysed without some considerable preparation. For alpha spectroscopy, the sample of speleothem is completely digested in strong acid and then the radionuclides are co-precipitated with iron and a small amount of non-naturally-occurring, known-activity, uranium and thorium isotopes as tracers. The precipitate is then re-digested, uranium and thorium separated using solvents, and ion exchange columns, and these solutions further purified with solvents that remove daughter products. Thin, flat, pure sources of thorium or uranium oxides are prepared by electroplating or evaporation from the final solution phase on to stainless steel discs.

Alpha particles emitted from the samples are counted as they penetrate a solid state surface barrier detector of gold on a semiconductor. The discs are counted until sufficient counts are obtained for each isotope. Limiting factors for the number of counts that can be obtained are the amount of uranium in the sample and the activity of the background. Background counts are caused by daughter products embedding themselves in the detector and which subsequently decay to other daughters that themselves emit alpha particles. Figure 2 shows a typical uranium and thorium spectrum from a typical speleothem sample.

For mass spectroscopy a source of the purified uranium or thorium salt is deposited on a filament of a rare element (usually rhenium). The isotopes are ionised thermally and are passed around a curved path in a strong magnetic field, their relative abundances being measured by the differences in mass. Mass spectroscopy is more precise than alpha spectroscopy, and the amount of sample required is also smaller, which allows more precise sampling of (for example) layers in a speleothem. In comparative studies this method yields much better resolution of ages along the growth axis of a deposit.

Because the speleothem contains U-238, some of which will have decayed to U-238, a further correction must be applied according to the equation:

$$[^{230}Th/^{234}U] = [^{238}U/^{234}U](1-\exp(-_0 t)+(1-[^{238}U/^{234}U])(_0/(_0-_4))(1-\exp(_4-_0)t)$$

where $_0$ and $_4$ are the decay constants of Th-230 and U-234 respectively and ^{230}Th, ^{234}U and ^{238}U are the activities measured in the sample at age t.

An uncertainty in the calculated age may be caused by the presence of appreciable activity from naturally occurring Th-232, which interferes in the thorium spectrum. This isotope is the parent of the thorium decay series. Th-232 is often found in detritus (clay, silt) which may have become incorporated in the speleothem as, for example, a mud layer. Isotopes from the uranium decay series may also be introduced by this process so that the separated uranium daughter elements may be contaminated by Th-230 that has decayed not only from the U-234 in the speleothem but has been introduced from the Th-232 and Th-230 in the mud layer. The Th-230 in the detrital component is indistinguishable from the Th-230 from decay of the U-234 in the speleothem. This extra Th-230 component violates one of the assumptions previously outlined and causes uncertainty in the calculated age. If the initial Th-230/Th-232 ratio is assumed to be a value that can be extrapolated from the measured ratios in several "contaminated" samples (calculating with respect to half-life and decay to the present) then the value at time = zero can be used to correct the age for the Th-230 that has decayed from the U-234 in the sample. In practice the correction is only valid if the Th-230/Th-232 ratio is less than than 20 when it is possible that some of the Th-230 did not result from decay of the U-234 in the sample.

3.4 Sampling

Any formation growing in a cave can theoretically be sampled, but aesthetic considerations dictate that beauty is respected. Incidentally the classically attractive stalagmites and stalactites are usually the least useful for dating purposes, usually because if they are preserved they are relatively young and not particularly interesting when the antiquity of the cave passage is sought. Care has to be taken that the formations collected are not currently active, this is obvious since in this event the spread of values obtained will include material that has been recently deposited. Formations are often concentrated in zones where they are clearly

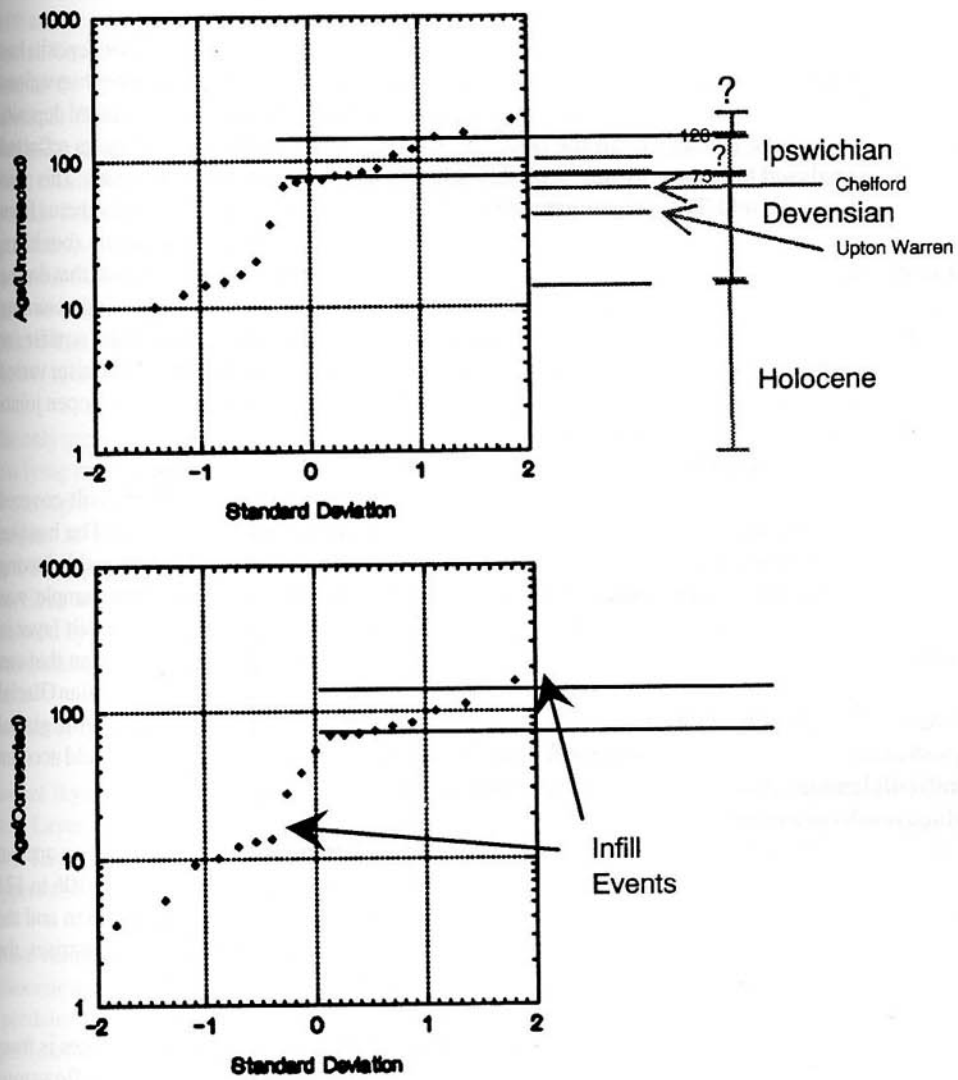

FIGURE 4

of several generations. Conduits carrying the calcite bearing fluids may take the same course at different times as conditions allow, so that it is quite likely that several generations of calcite formations are observed at any one locality. Quite often the hiatus in deposition is reflected in a clear difference in crystal structure or by the presence of clay enrichment banding.

Another important factor is that the calcite formation selected must mean something in the dating philosophy. There is not a great deal of point in analysing formations in which there is no relationship with some other feature. In this work we have carefully selected material that may be related to other features in the cave. The principle of superposition is applied. If a stalagmite is found overlying a deposit (silt or gravel) then it is clearly younger than it. If it is found buried in the deposit or is located on, say, a boulder buried in the deposit then it is clearly older. Bearing in mind that there may be composite ages due to superimposed growth we need to treat the data statistically to start with to determine which are the most common dates and also by relating these to other presently undatable deposits we can start bracketing ages for some of the infill events which have occurred in the cave.

One of the major depositional events observable in the uppermost passages of Ogof Ffynnon Ddu is a deposit of fine silt/clay/sand. This is widespread and found throughout the cave. It is continuous, the deposit can be followed into the bowels of the cave, where it seems to bear the same relationship to those observed near the surface. It drapes over pre-existing features, it is found at greater depths deeper within the cave. It is banked up higher on the upstream (up dip) side behind boulders and lower on the downstream side. It gives the appearance of having been deposited whilst the cave passage was largely filled with water and settled out from this medium. The most plausible explanation is that it was deposited whist there was still a gentle flow of water through the cave or where there was some sort of density stratification at times. The deposit is quite distinctly layered with layers ranging from about one millimetre to about a centimetre and which might be concluded to result from seasonal or storm input of detrital material. The most likely source would have been fine rock flour carried into the cave during melting phases of glaciers.

4. RESULTS

Before we discuss the results in detail we should point out the limiting factors in any discussion of relative ages. The inferred relationship we make between speleothem ages and Pleistocene events (glacial or interglacial periods) are based upon the latest chronology that applies to Britain. However, it must be stressed that the dates that have been assigned to the various warm and cold periods in the Pleistocene are not necessarily accurate, as the whole time scale is dependent on two datable events: the age assigned to Marine Isotopic Stage 5e (between 120 and 125 ka)

which is based upon coral and speleothem ages from the Bahamas and a magnetic reversal age at 780 ka which is independently dated from volcanic eruptions.

We present the ages we have obtained from speleothem samples in the following so we can discuss all isotopic data in relation to the age that was calculated. Unfortunately some samples that were collected and analysed did not yield acceptable results, as can often be the case. Other samples have not been analysed because it looked like they were too dirty (muddy) and might yield Th-230/Th-232 ratios of less than 20, thus yielding unreliable ages. Several sites that we sampled proved interesting enough to re-sample and re-analyse. It can said that the results are fairly typical; the oldest date was obtained from a site in the 425m tier, even though young speleothems were evident in both tiers, as is always the case. Every effort was made to collect samples that had some geological relationship to a detrital deposit, or had an obvious relationship to a feature in the wall of a passage. Of particular interest was the silt that is a consistent and major feature in the cave (see above). In describing, sometimes in great detail, the sampling we would like to illustrate some of the problems in interpretational methods as well as giving an indication of the uncertainties which creep into any dating system from the analytical methodology. Numbers should not be taken too seriously.

The passages leading to the top of Arête Chamber in Ogof Ffynnon Ddu II are characterised by a predominantly canyon-like shape with the floor covered by the sandy/silt laminated deposit. This is in places several metres thick which results in a smoothing of the original floor. At about 1 to 2m above the upper surface is the remains of a former floor composed of flowstone with sand, silt, and gravel cemented to its underside. The first sample gave an age of between 62.5 and 74.7 ka. Another piece was collected and dated, and the age of that was between 91.8 and 109.9 ka. Both these samples, which showed distinct layering, are rather muddy (although the 230-Th/232-Th ratios are both less than 20) and it is therefore not surprising that the ages do not compare too well although when the errors are taken into account there is some overlap. If we take the mean age then we get about 85.0 ka, an age that is interesting as it fits into the late Late Ipswichian/ early Devensian times. Prior to this, during the main Ipswichian Interglacial, conditions were likely to be such that the aquifer was draining freely, the gravels beneath the flowstone suggest that a turbulent (high energy) stream carrying a respectable detrital load used the passage.

The deposit we dated is now stuck to the wall about 1.5 metres above the present floor which comprises unconsolidated silt/ sand, so whatever flowstone and other material filled the passage 90 to 110 ka ago was removed. The fill (flowstone related) might have occurred in relation to an earlier end glacial event (Wolstonian?). Later, after the flowstone and fill was removed the floor was washed out and new fill deposited at a lower level.
Several samples were collected and then resampled from a large outwash pocket below a small aven in a chamber about 20m west of Bagpipe Chamber (for a sketch section see Figure 3, the numbers are sample codes). There are several separate flowstone deposits in the pocket. All the samples except the oldest sample have very low 230-Th/232-Th ratios, so the ages of the younger deposits are rather uncertain, but do either overlap or compare reasonably well. We have a mean age for each layer of about 144 ka, 39 ka and 13 ka. The oldest layer predates the Ipswichian Interglacial; the middle layer falls close to the Upton Warren Interstadial within the middle Devensian, and the upper layer follows the last full glacial re-advance.

The story here is that a very complicated set of floor deposits has accumulated with an equally complicated history. The observations made at the site suggests that after filling, water-washed deposits from the floor, to be followed by additional filling, as reflected by the 130 ka range of ages of the floor deposits. This was accompanied by collapse of boulders carrying speleothems from above. The aven above the drip pocket, the deposits (boulders, silt, sand, flowstone, obvious flowing water) suggests that during the period of time that the aven was in existence, and assuming that the aven was connected to the upper zone of the aquifer (or the surface) the movement of ground water into the aquifer varied as a result of variable ice cover or as till was fed into open joints and cave passages that were subaerially exposed.

Another sample was collected from beneath the silt-covered boulder pile above the rope down into the Chasm. The boulder had a stalactite on it and was clearly on its side presumably having fallen from the roof or walls. Significantly, this sample was draped with silt, so it is interpreted as predating the silt layer in the upper (425 m) tier. The only reliable interpretation that can probably be made is that the silt is related to late Devensian Glacial times or the early Ipswichian Interglacial. Certainly, the glacial meltwater associated with the retreat of an ice front could account for a large influx of sediment into the cave.

A sample from Edward's Shortcut is a broken part of an ancient flowstone floor remnant. The age of this sample was 106 to 121 ka. The mean age 113 ka is within the early Ipswichian and the sample is covered by the sand/silt infill. This summarises the results obtained from samples in the 425m tier.

At the 335m (1,100ft) level (tier) the oldest range of ages is from a sample collected in Cwm Dwr. This was from a flowstone remnant on the wall of a passage which is currently dry, but has been corroded. The age range is 132 to 200 ka, however the 230-Th/232-Th ratio is quite low (13) so this corrected age range is proposed rather diffidently. The uranium concentration of this sample is also approaching the lowest limit for obtaining a decent age, adding to the difficulty with the data.

Another age from the same deposit was in the range 60 to 90 ka. However this particular sample had been heavily corroded and the rest of the analytical data support the conclusion that it is meaningless because the 234-U/238-U Activity Ratio for this portion is less than unity. The ratio for the other portion (above) was greater than unity, although because of the analytical problems the two sample dates are statistically indistinguishable. Because of these problems re-sampling would be appropriate but finding a dateable deposit might be difficult. Despite the difficulties with the dates, the range of ages for this Cwm Dwr sample do span the same time period as other samples we have dated, although they are the oldest in the 335 m tier. Th-230 from the detritus would make the age too old, but until we can date a whole suite of contaminated samples a correction for these samples cannot be applied. The corrosion suggests that uranium might have been leached from the sample after deposition, so we can not take the ages too seriously.

Three samples were collected in the vicinity of the lower part of Salubrious Passage and from the area of the Trident and Judge formations. Both upper and lower parts of one sample were dated, with an age range for the lower part of 40 to 67 ka (corrected for detrital Th; 230-Th/232-Th ratio of 4). The upper part yielded a date of 21 to 33 ka with its isotopic composition essentially identical. The sample was collected from a boulder in the floor that had a flowstone/ stalagmite growth on it. The deposit looks like it resulted from an infill period that was subsequently partly eroded. The thorium ratio for this is very low and thus any speculation as to the accuracy of the age and its meaning is understandably muted. It is possible that the speleothem grew prior to stage 4 (which was a short glacial) and then after a standstill in speleothem growth (ice cover, frozen soils, etc.), growth recommenced until the onset of the last ice advance.

The only other dates we have for this tier are from a stalagmite that was lying broken on top of the sandy silt that blankets the floor in passages surrounding the Cross Rift. As it turned out the sample, at least from a mineralogical point of view, when sectioned longitudinally, was the most spectacular. This deposit was clean and almost translucent, the flank of it was prepared and analysed by thermal ionisation mass spectrometry. The dates are summarised in the following table:

Section of deposit	Date (ka)
Lowest layer	14.2
Next Layer Above	11.2 to 13.2
Next Layer Above	9.1 to 9.3
Uppermost layer	3.4 to 3.8

These results document almost continuous growth through the Holocene and if the 14.2 ka age is as good as the data suggest then it predates the accepted date of when the Holocene began (i.e., significant amelioration of conditions after the last glacial maximum (Marine Isotopic Stage 2). However a late Devensian interstadial has been postulated coming into effect at about 14 ka. It is generally agreed that the glaciation came to an end about 10 to 12 ka ago following a minor re-advance. The dates from this deposit suggest that the glaciation had ended earlier and, since the stalagmite was deep within the cave, the passage had largely dried out but there was still some movement of ground water. Again we can visualise a similar situation to that in the Castleguard Cave, Alberta, Canada.

4.1 Statistical treatment.

One obvious way of overcoming some of the difficulties in treating the possibilities of composite ages is to treat the data statistically. This has been undertaken by Gordon et al (1989), and Baker, Smart and Ford (1993) who carried out a rigorous statistical treatment of a large number of published and unpublished analyses including some from the major caves in the Upper Tawe Valley. They were able to identify groupings of ages on the bases of frequency. The frequency distributions accorded to the main Ipswichian Intergalacial and to several events within the Devensian, some of the latter relating to well defined interstadials.

The data that are collected in such a study as this are often not normally distributed, but are more often log-normally distributed. We use a logarithmically transformed probability plot analysis to indicate which are the most common ages (Figure 4). The log-probability plot of the data can be resolved into two separate linear components with mean ages of 84 ka and about 7 ka. Where the relationships can be established the 7 ka subset consistently post dates the major infill event. Again where the relationships are clear the 84 ka average dates predate the silt infill event. The 84 ka average is clearly within the Ipswichian interglacial or early Devensian glacial. It is plausible to consider that the silting episode(s?) occurred towards the end of the glaciation, during the waning phases when there was likely to be an abundance of water, the erosive power of which may have removed earlier deposits, and when there was an abundance of fine rock flour from the ground moraine of glaciers.

There is sparse evidence for an earlier infill event where we have remnants of stalagmite cemented gravel attached to walls. The age for this is earlier than about 190 ka.

5. CONCLUSIONS

When we started upon this work we assumed that the cave system was relateable to a small number of separate events consistent with a pulsatory decline in local base levels attributable to a concomitant base level adjustment caused by sea level changes. Subsequent work has shown that the evolution of the cave system is much more complicated than at first suspected. In particular the effect of glaciation may mean that hypothetical models of cave development erected from studies of cave systems which were south of the Pleistocene glaciation fronts may have to be abandoned in favour of either new or extensively modified models.

The upper tier of Ogof Ffynnon Ddu is concluded to relate to a water table and base level at or about 425m OD. Evidence comes from the large number of large chambers and passages at a constant absolute height, along with evidence from sub-horizontal dissolution grooves. This erosion level (420 to 470 m OD) can be related to periods of standstill in the longitudinal profile segments of active rivers and dry valleys in the vicinity. By analysis of longitudinal profiles these can be followed to the coast and there is evidence that the related 190m coastal platform is early Pliocene. The study of temperature analysis of deep-sea cores and other geological information suggests that peneplaination related to this came to a halt about 2.5 my ago.

The 335m level is not as well developed but may be related by similar arguments to a coastal 135m platform. This has been related to the late Pliocene since this platform in Cornwall has been well documented, with related fossil evidence.

Another erosion level at 265m locally relates to a very extensive wave-cut platform at 60m on the coast but this is currently difficult to date. It is likely to be earlyish Pleistocene since it has some of the Welsh Older and Newer Drift on it.

These conclusions are largely in accord with the findings of Gascoyne, Ford and Schwarcz (1983) who showed that the main landforms (and their related cave passages) in the Yorkshire Dales were in place, prior to the major glaciations and that these later phenomena had relatively little effect on valley entrenchment. They calculated erosion rates for valley downcutting at between 2 and 5 cms per thousand years, but such rates are difficult to confirm for our area because of the pulsatory nature of the base level adjustment.

Uranium-series dating only gives measurements for speleothem growth related possibly to a penepenultimate, the last (Ipswichian) interglacial, some interstadials within the last (Devensian) Glaciation and to the Holocene. Maxima in the age histograms only give evidence for major speleothem growth related to the Ipswichian Interglacial and the Post Glacial, Holocene event. There is a good clustering of ages related to the 70-90ka period. There are a few ages between these major growth events, but not many and these can be related, with caution, to interstadia witnin the Devensian. There appear to be no ages related to the 15-25 ka interval that was the peak of the last glaciation. What ages there are, are from speleothems that are survivors from separate stalagmite growth phases in a cave subject to severe episodic glacial flooding and scour.

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Berger or Balinka?

by Clare Jones

It wasn't until after both speeches had been delivered on that most enjoyable occasion, the Club's 50th Anniversary Dinner, that I realised I was the only person in the whole wide world who had taken part in both these memorable expeditions. I felt that this fact should not go unrecorded and that I was qualified to make a few comparisons between the two.

Due to the chauvinistic attitude which pervaded the caving club in the early sixties the only way I was able to get on the Balinka Pit expedition to Yugoslavia was to marry someone already signed up. This was duly carried out with four months to spare before departure. For the Berger expedition fortunately things were different; as long as you had the money you were in.

Not being an expert in the "clockwork" side my role was largely domestic in '64. On this expedition virtually all our food was taken out with us, much of it given by the manufacturers. We had a central store protected by and looked after by Les Hawes and Gordon Clissold. Where did all the cornflakes go? We split into small groups for catering, using the rations supplied. I was delegated to look after John Harvey and Bill Birchenough.

On the second Balinka expedition (1966) cooking was communal, supervised of course by the ladies - me, Joan Webley, Ella Baguley and Eileen Davies. Eileen's experience in catering for large numbers was invaluable. Each day we were allowed the services of a "spare man" to do chores like peeling potatoes and fetching water.

Sponsors were easier to find in those days, especially if you had someone like Noel Dilly around who was prepared to entertain and "bullshit" managing directors. Thirty years later their generosity had been exhausted.

On the Berger expedition more of our food was bought locally. Gone were the dried egg powder, Ryvita and baked beans. In were fresh fruit curries, spaghetti bolognese (including vegetarian version) all à la Nevitt and Heyward. You could cook for yourself if you preferred, but after a hard caving trip nothing was more welcome than a meal ready and waiting for you.

Travelling to Balinka was an expedition in itself. All together in an overloaded, unhygienic Red and White bus had a certain charm about it. Friendships were made and lost even before arrival.

The 1993 Gouffre Berger Team

Even Iain Miller's Escort would have been a more reliable form of transport. Everyone was expected to arrive at the relevant campsite ready for the Berger Blitz by any appropriate means. There was freedom to arrive in your own way and in your own time.

It is hard to compare the caving experiences because the two caves could not have been more different. No doubt everyone was hoping to find a Berger-like cave at the bottom of the Balinka shaft but it was not to be. In 1964 the shaft was descended by only one person - Bill Birchenough - to 720ft. This was of course a team effort. Two years later it was bottomed at a mere two hundred feet or so lower. Everyone was able to descend and look around the large chamber with its pathetic little blocked passage at the end. I found the trip worthwhile partly because Derek Webley and I were able to collect numerous bugs. One was a new subspecies of beetle which was subsequently named after Derek. Others had the job of examining the macabre remains of four partisans who had been killed presumably before they made their rapid descent. Their importance did much to smooth our expedition organisation and were responsible for the wonderful hospitality following the trip. In actual fact there were human remains in many of the other caves round about but they didn't merit the same publicity. It seems Yugoslavia has always been a violent place.

Anyone who has descended the main shaft of Gaping Ghyll by winch will have a vague idea of what was involved. However a more active participation was required in Balinka. Walls had to be fended off with the feet and if you weren't quick enough on the ascent lumps of rock would threaten to snag you. Sometimes communications worked and you could shout to the driver to stop. Often at night the system broke down. It seemed a very noisy shaft with rocks constantly falling down. Having a roof over your head was comforting.

An equivalent depth would have taken a mere fraction of the time in the Berger. Techniques, needless to say, have changed. Today Balinka would not be such a problem to descend and the disappointment when it closed up not so deeply felt; there are always other shafts. This disappointment was more than compensated for by the many new friends we made amongst the locals and the memorable parties they arranged for us.

Going to a completely new, unexplored area is very different from visiting a classic. It is not really fair to compare the experiences underground. The Hall of the Thirteen is one of my personal wonders of the world.

I feel privileged to have been on expeditions to both these places. What will caving be like in another thirty years from now I wonder?

For further information;

SWCC Twenty-first Anniversary Publication, pp 103 - 257: *The Balinka Pit Expedition*, by Those Involved.

SWCC Newsletter No. 113, 1994: Gouffre Berger Special Edition

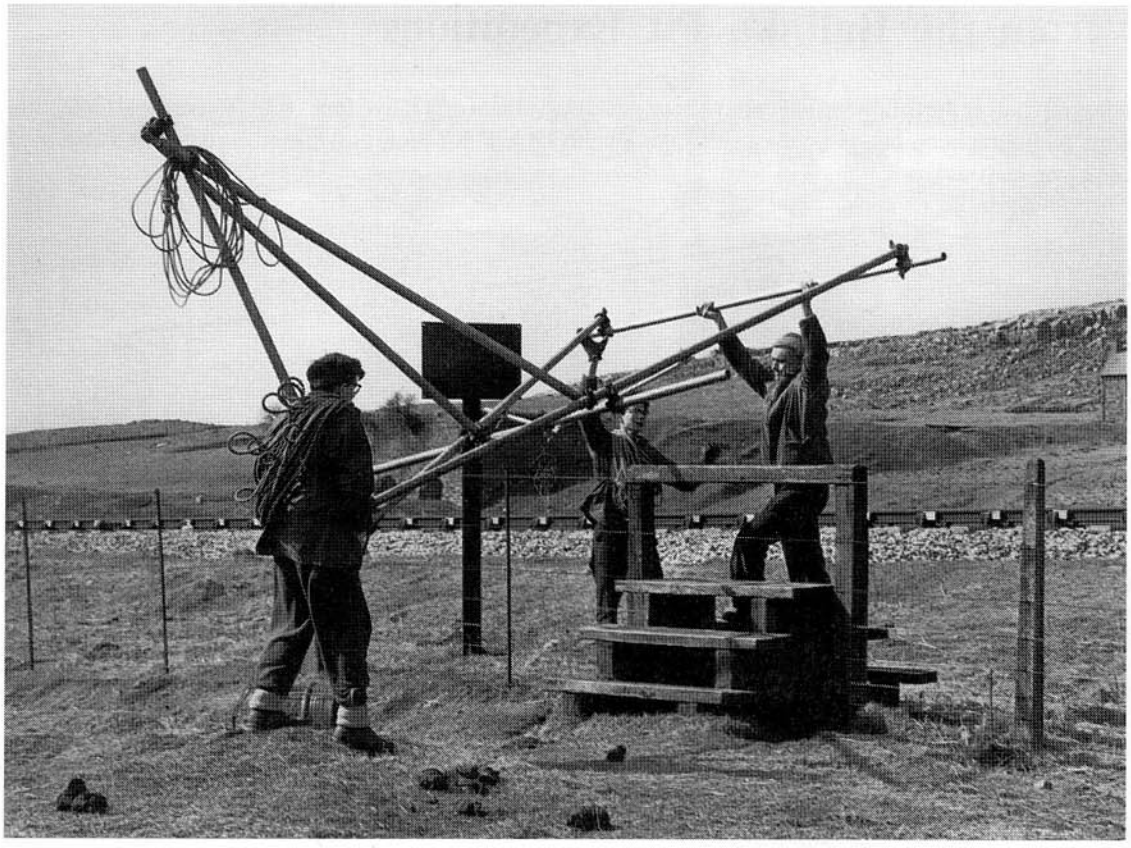
Photographs from the Balinka Pit Expeditions

Editor's Note: all of the photographs over the following pages have been generously loaned by Clive Jones from his personal collection. They were taken by various photographers, but as none of them are labelled it has not been possible to credit those concerned. Apologies if you recognise some of your work.

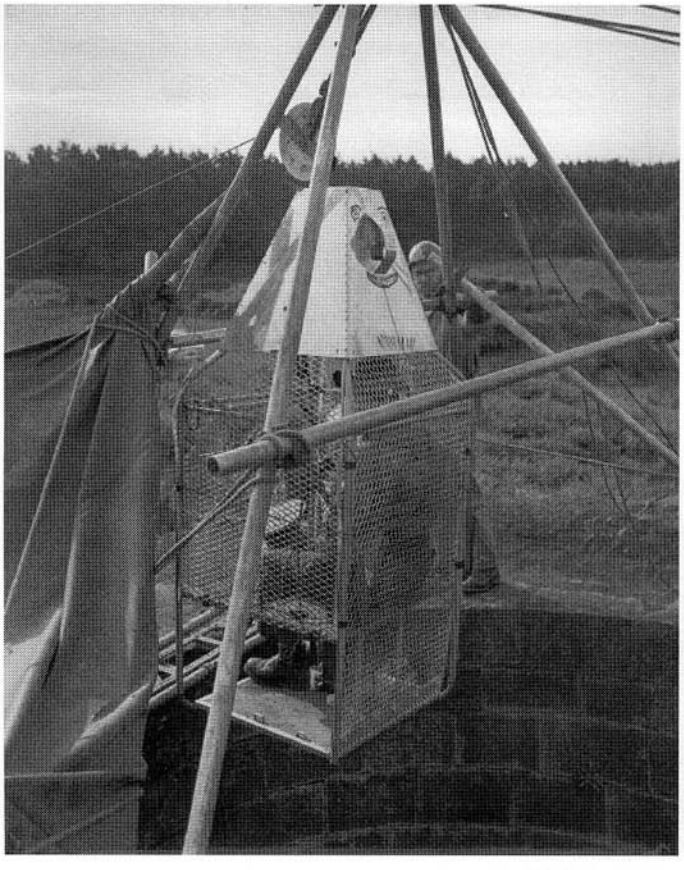
Top left: Bill Birchenough dismantling one of the two Velocet motorcycles used to build the Balinka winch.

Top Right: The main winch cable drum.

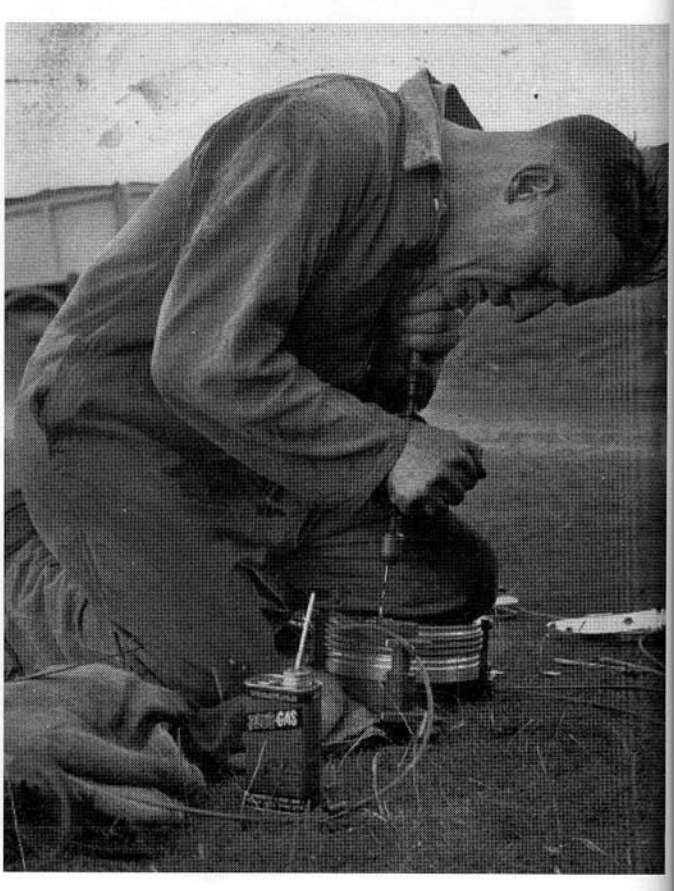
Bottom: the team were unable to find a drive wheel large enough for the winch. The answer was to build a foundry and cast their own wheel, using alloy from a crashed aeroplane.



Early experiments with a boom that didn't work

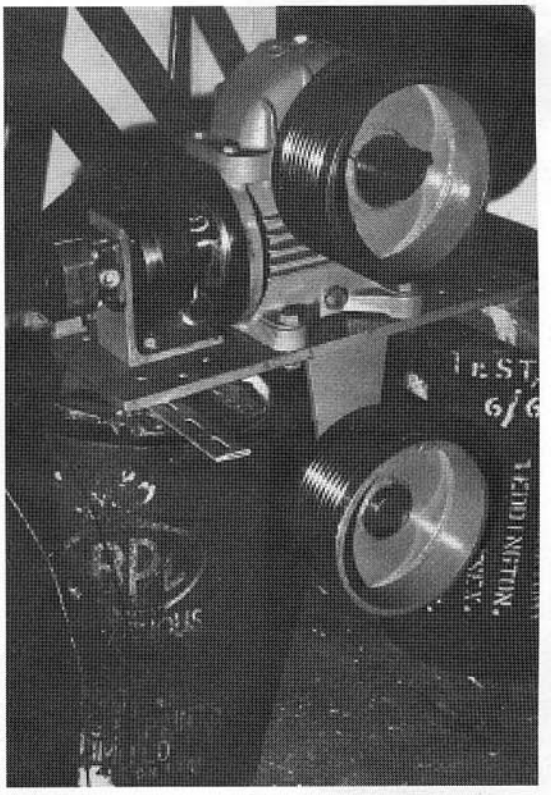


The cage mk.II on test over a 200ft. mine shaft in the Forest of Dean



Frank Baguley working on the winch

The Balinka Pit team, 1964. Left to right: Edward Aslett, Derek Webley, Roy Morgan, Les Hawes, Gordon Clissold, John Osborne, Rhydian Roberts, Dennis Kemp, Gwyn Thomas, Clive Jones, Bernard Woods, Noel Dilly.



Above: the finished winch

Left, top: the team couldn't afford rucsacs. Here, Clive Jones and Frank Baguley are constructing packframes from some "acquired" TV aerial tubing and firehose.

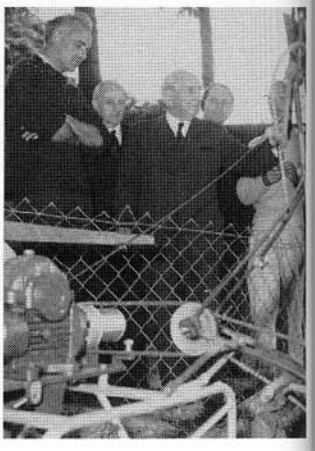
Left, bottom: on the bus.Hywel Ball on guitar, with (L to R)Alan Coase, Mark Skinner, Peter Millett, Dennis Kemp

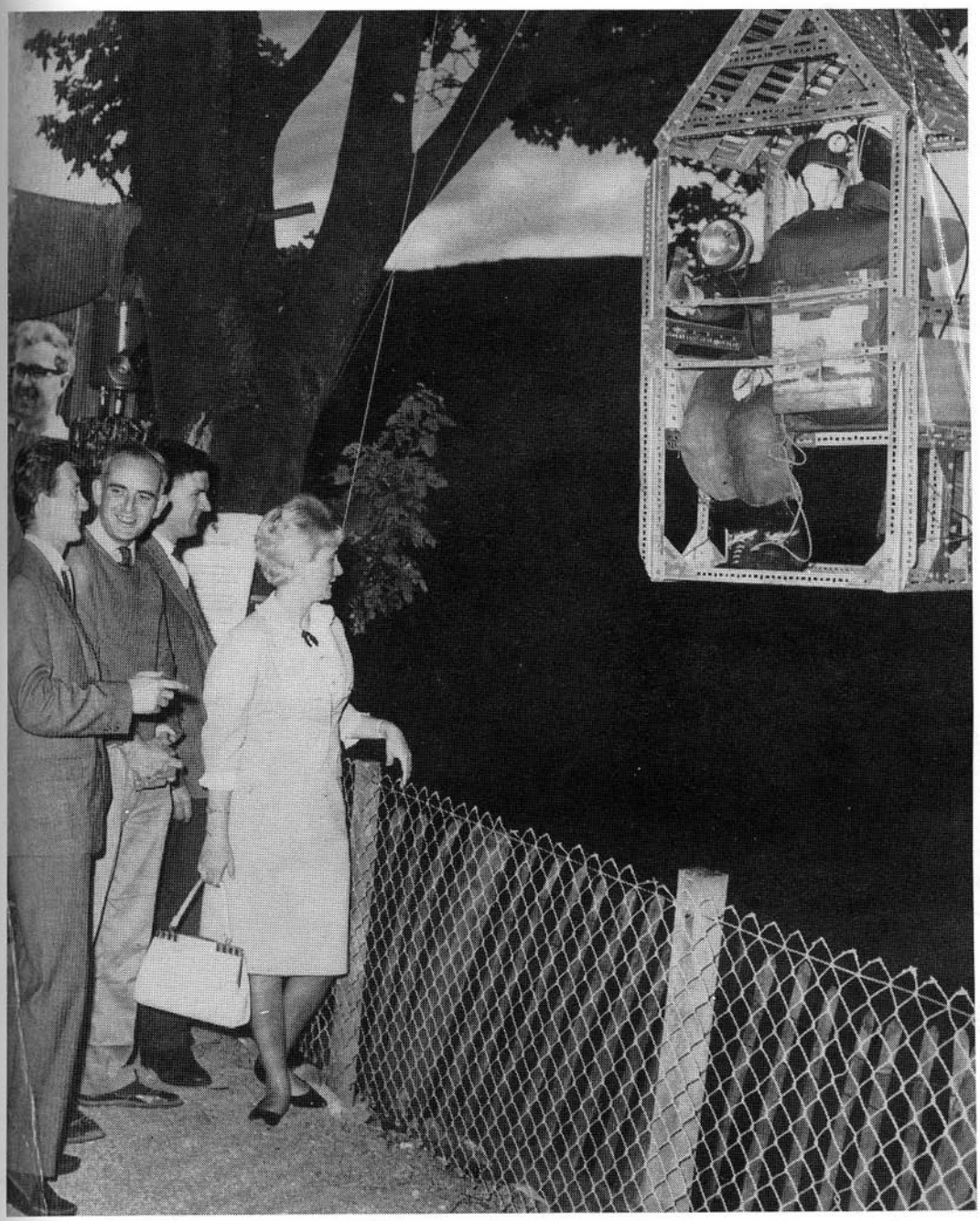
Top left: Gordon Clissold with equipment specially designed for surveying the shaft.

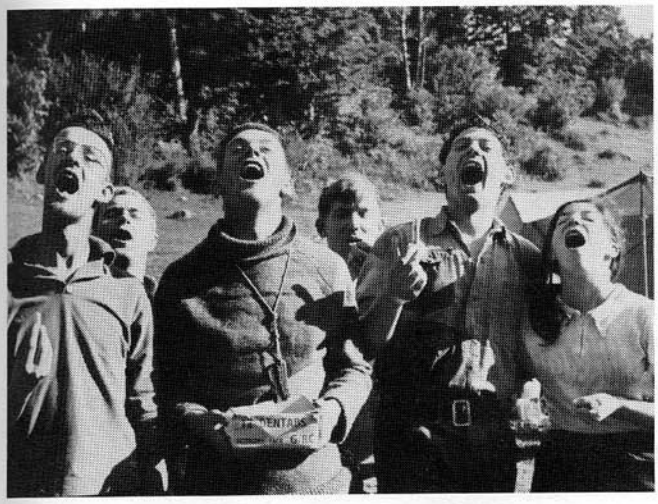
Top right:top of Balinka Pit, Rod Stewart on left with locals behind him and the cage in the background.

Left: The cage descending the first drop at the top of the shaft.

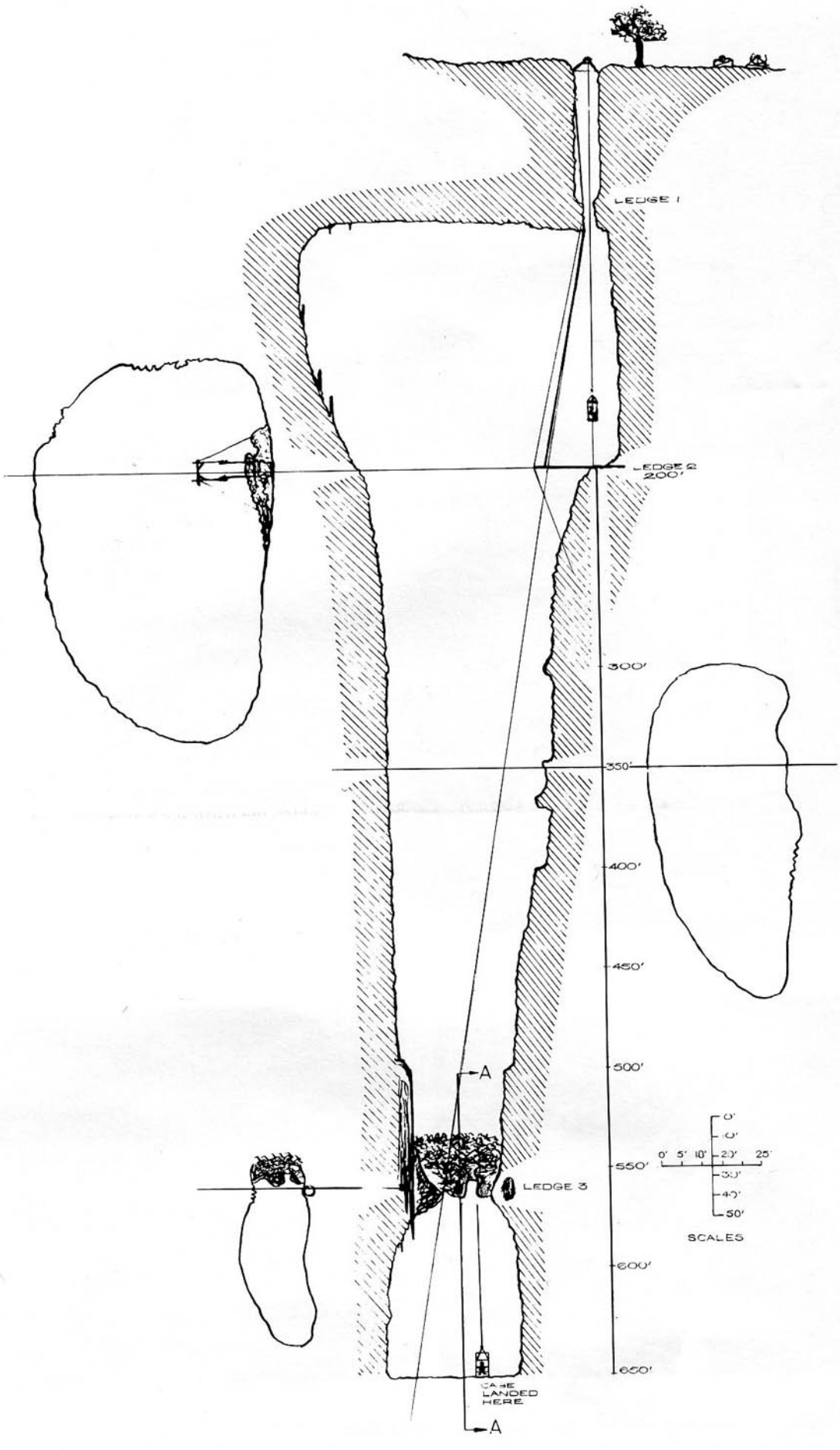
Below: James Griffiths, then Secretary of State for Wales and the Llanelli MP, opening the Balinka exhibition at Dan-yr-Ogof.







Top: the cage being demonstrated at the Balinka exhibition at Dan-yr-Ogof. Above left: team members participating in the "daily gargle": Noel Dilly insisted that each member cleaned their teeth and gargle each day. Above right: the team at one of the parties held in their honour.


LEDGE 1
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SCALES

Balinka Pit Photographs Loaned by Frank Baguley

Here are three pictures from the Balinka expeditions. The top two are of the group of six members who attended the presentation of the awards to members who were involved in the 1964 and 1966 expeditions to the Balinka Pit in (the then) Yugoslavia. The ambassador, Professor Zaropec is placing the award to the club on Frank Baguley at the Yugoslav Embassy in Belgrave Square, London, on December 12 1966. The award is the "The Order of the Yugoslav Flag with Golden Star", which was the highest award that could be given to a civilian. We were informed by the British authorities that, under British protocol, it cannot be worn here except in the presence of the Yugoslav President or his representative! The award was made because the expedition descended the 996ft shaft and recovered the remains of four partisans who had been shot and dropped down the shaft during World War II because they had disagreed with the local "committee". It was later discovered that they had been right, and one of the purposes of the expedition was to recover the remains and hand them over to the authorities to receive a proper burial and for a memorial to be erected to them. Frank Baguley and the late Derek Webley descended the shaft in the cage and on ladders to "identify" the remains as being those of four persons, using their dental and archaeological expertise. It was not possible to name them using their dental records, as their dentist had also been "eliminated" by the occupying powers so the records were not available. Only the ages of the victims could be assessed, and they tallied with the records which the partisans and police kept.

Those in the photographs are, from left to right: Bernard Woods (leader, 1966), Clive Jones (leader, 1964), Bill Birchenough (1964 and 1966), Rod Stewart (1966, now deceased), Frank Baguley (1964 and 1966, deputy leader), Dr. Edward Aslett (1964), Professor Zaropec, the Yugoslavian Ambassador.

The ambassador and his wife came down to South Wales the following year as guests of honour for the club dinner. They were both keen mountaineers, and spent a busy weekend at Penwyllt and in Brecon enjoying the country above and below ground. Being a qualified engineer, he was fascinated by the winch and other equipment which the expedition had made and used for the descent. He said it was the best weekend they had spent in Britain, free from protocol and the like.

The third photo is of, from left to right, Colin Graham (then club secretary), Frank Baguley and the late Bill Little wearing the hand-embroidered bonnets which the Yugoslav people had presented to members of the expedition.

Frank Baguley

The Chemical Investigation of Cave Waters

by George Bray

Introduction

The purpose of this publication is to celebrate 50 years of the SWCC. For ten of those years a cave chemistry research programme was operating at Penwyllt and this account attempts to indicate something of what was achieved and some of the difficulties. This is not the place for detailed accounts of chemical methods or for pages of results: in general these have been published and references are given to allow anyone interested to gain access to them (Refs. 1 to 10). If this account focusses on the science, it is because the science had to be more or less right before any progress would be possible in unravelling the chemical history of waters in caves.

Background

As the work started almost thirty years ago, it is worth setting the scene. In caving terms the extensions beyond The Long Crawl of the Dan-yr-Ogof system were recent enough still to be topical (Ref. 11) and the Top Entrance to the Ogof Ffynnon Ddu system was relatively new. As far as cave chemistry was concerned the pH meter seemed to reign supreme and water tracing in cave systems was done by dye testing. In more general terms the first Severn Bridge had been open just over a year and petrol was about 4/6d (23p) a gallon.

Early work on waters from Dan-yr-Ogof

The programme originated at a meeting at the home of Alan Coase to discuss the work of the Easter 1968 camp in Dan-yr-Ogof. It was suggested that the exploration work be supplemented by chemical analysis of cave waters in an attempt to gain additional information about the cave. The idea seemed to be that cave waters might carry a sort of chemical fingerprint showing where they had been before emerging in the cave. Looking back on it, this was far too ambitious at the time as not nearly enough was known about the chemistry going on in South Wales caves.

From the outset the chemical work was run as a school-based project. Much of the development work was done in the school laboratories in London and sixth-form students did some of this and some of the chemical work in Wales. It was something of a culture shock for them to be doing chemistry in which no-one knew the answers and the whole purpose of the work was to find out what those answers were. Once they realised this they did very well and for some of them this work was an introduction to a career in chemistry. All of the chemical methods used were within the scope of the London "A" level chemistry syllabus, and there was no access to sophisticated analytical techniques.

The early work was a result of discussions with Noel Christopher and Bill Little. For the Easter 1968 work water samples were taken from within the cave and associated surface sites and analysed for a fairly limited range of quantities in the laboratory at the rear of No. 10 cottage at Penwyllt. The room was bitterly cold and so damp that labels fell from some of the reagent bottles after a few days. It became clear that some of the standard water testing methods needed modification if the maximum information was to be gained from cave waters.

For the summer of 1968 methods were modified but an urgent task was to make sure that samples did not deteriorate when taken from the cave. Three sites within Ogof Ffynnon Ddu were chosen and three samples were taken from each. One set was analysed immediately in a temporary laboratory set up at The Toast Rack in the cave. Another set was left in the cave for several days and the third set was carried about in the back of a Mini. On analysis in the cave no significant difference could be detected between the results and it was concluded that it was in order to take samples to Penwyllt for analysis. This was probably the first laboratory to be set up underground in Britain and possibly at all. No item of glassware was broken and there was no spillage in the cave.

A lot of work was done on samples from Dan-yr-Ogof but the result which attracted attention was that the water in Mazeways Main Sump was not the same as that in the Mazeways Entrance Pool. It seemed that there would be no magic way of sorting out the problems posed by the cave.

By the end of 1968 a useful collection of examinations were being made:

Total hardness: a measure of the all the calcium and magnesium compounds dissolved in the cave waters.

Calcium hardness: a measure of the calcium compounds dissolved in the waters.

Magnesium hardness: a measure of the magnesium compounds in the waters. Originally this was found by a difference method but a direct method was introduced and gave better results.

Alkaline hardness: a measure of (mainly) the calcium and magnesium hydrogen carbonates in the waters: this is the "temporary hardness" of school chemistry.

Limestone attacking power: (aggressiveness) a measure of how much calcium carbonate a water can dissolve if left in contact with it. [It is usual to quote all hardness and aggressiveness values as ppm (parts per million or mg. per litre) $CaCO_3$.]

Electrical conductance: all metallic compounds dissolved in water contribute ions into the water and these ions conduct electricity through the water. For dilute solutions of a pure material higher concentrations give higher conductance. This investigation seemed new to cave chemistry in Britain.

pH: a measure of the acidity/alkalinity of the water. pH 7 is neutral, lower pH values indicate acidity and higher pH values indicate alkalinity.

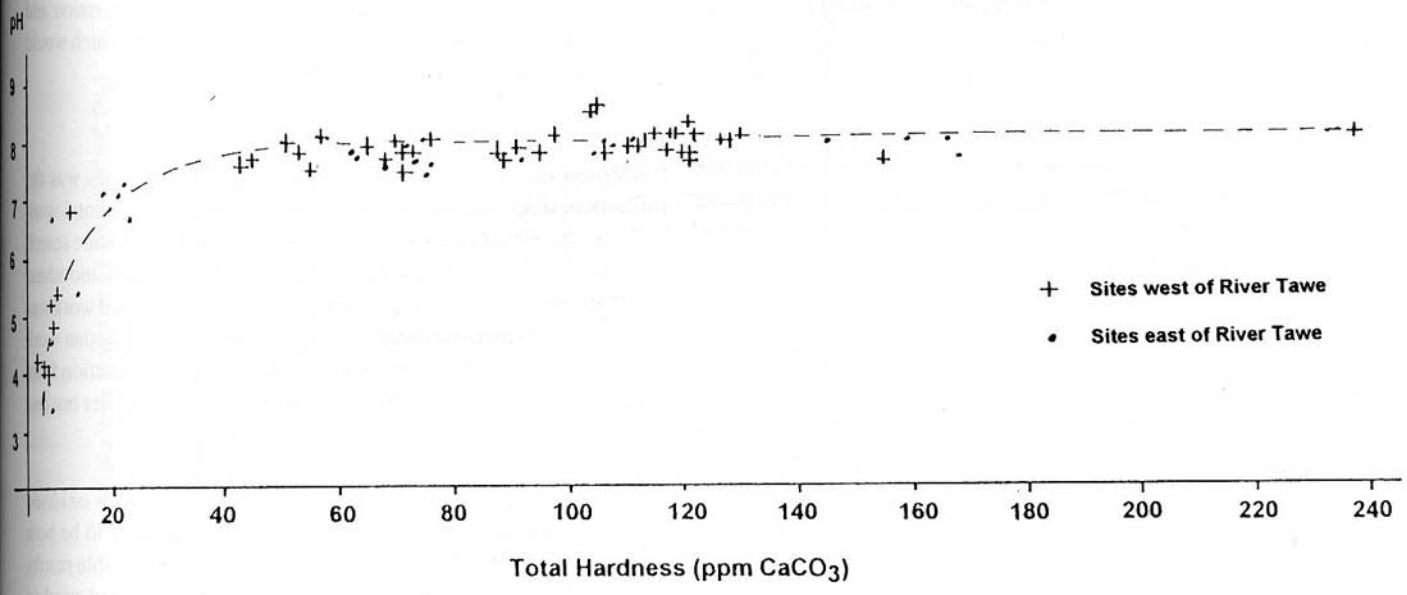


Figure 1 GRAPH OF pH AGAINST TOTAL HARDNESS

On the basis of "when in doubt, plot a graph" it seemed worth attempting correlation between some of the quantities. When electrical conductance was plotted against total hardness an encouraging straight line graph was obtained. Later work was to confirm the value of this relationship. Initially a point lying off this line would have been thought to be erroneous: now it would indicate a sample from a site of more than usual interest. That so many points were on or near the line indicated that the general chemical balance of the cave waters was reasonably similar. It was surprising that this relationship had not been found before.

pH measurements had been made at Easter and during the summer of 1968. The graph of pH against total hardness showed that for South Wales cave waters pH became more or less constant above a hardness of about 40 or 50 ppm $CaCO_3$. Of all the published work it was this which drew most adverse comment. This reaction was not encouraging as anyone willing to sacrifice pre-conceived ideas could have obtained a similar result after a few hours of experimental work with cave waters. (Figure 1, which shows all published results.)

It seemed that some of the cave chemistry work was being done at that time by non-chemists and this meant that the literature had to treated with considerable caution as it might not be based on sound experimental work. There were some notable exceptions. Bob Picknett had produced a very painstaking study of calcite solutions at 10°C (Ref. 12) and Roger Stenner, a meticulous worker, had produced a method for measuring the limestone attacking power or aggressiveness of cave waters and allowed use of it in advance of the formal publication (Ref. 10). This method was perhaps the most significant development in the experimental cave chemistry of the time.

Even in those days there were doubts over the safety of the use of large amounts of dyes for water tracing through caves. Tests using small amounts of dyes were not very successful, possibly because of the variable quality of the activated charcoal used in the detectors and Bill Little even tried the use of badly burnt toast in some detectors.

At this early stage some results posed a puzzle. It seemed reasonable to think that, if the limestone attacking power of a water entering a cave at the sink were to be added to the total hardness of that water, the result might be something like the total hardness of the water found in the cave, but the arithmetic did not add up. For example, for water entering the Pwll Byfre sink for the Ogof Ffynnon Ddu system,

Aggressiveness at Pwll Byfre: 17 ppm $CaCO_3$
Total Hardness at Pwll Byfre: 24 ppm $CaCO_3$
Total: 41 ppm $CaCO_3$
Total hardness at Ffynnon Ddu: 106 ppm $CaCO_3$

It was felt that this hidden limestone attacking power deserved further investigation.

Interlude

The idleness enforced by a protracted cancer treatment encouraged thought along several lines. The brownish colour of waters at cave sinks was said to be caused by organic matter and most of this colour had gone by the time that the water had passed through the cave. Pure speculation suggested a possible explanation for the loss of the organic matter and for the apparent gain in total hardness. It was to be another six or seven years before there would be any experimental evidence to support this idea.

Of more immediate value was a successful application to The Royal Society's Scientific Research in Schools Committee. This gave very useful financial help and the benefit of advice from Dr. J.A.W. Dalziel, then Reader in Inorganic and Analytical Chemistry at Chelsea College, London.

Back to Wales

By the summer of 1969 there had been some improvements to methods. An improved conductivity bridge had been made and tested but a lot of time was wasted with a high precision pH meter which was not happy with modern electrodes, and which would not work at all at Penwyllt.

A good deal of work was done on Dan-yr-Ogof samples but little was worked out about the system although the difference between the waters in Mazeways was confirmed. This work was possibly as good as could be done at the time without the expenditure of a wholly disproportionate amount of time on anaytical work (Ref. 9). It was unfortunate that publication of this work was delayed so long that much of the caver enthusuiasm for Dan-yr-Ogof work was lost.

Difficulties began to arise in getting the water samples from Dan-yr-Ogof delivered when promised or correctly labelled. The students were keen to get some work done and it was decided that, for the time being at least, work would concentrate on trying to work out the puzzle of the hidden limestone-attacking power of waters entering caves at their sinks.

The New Laboratory

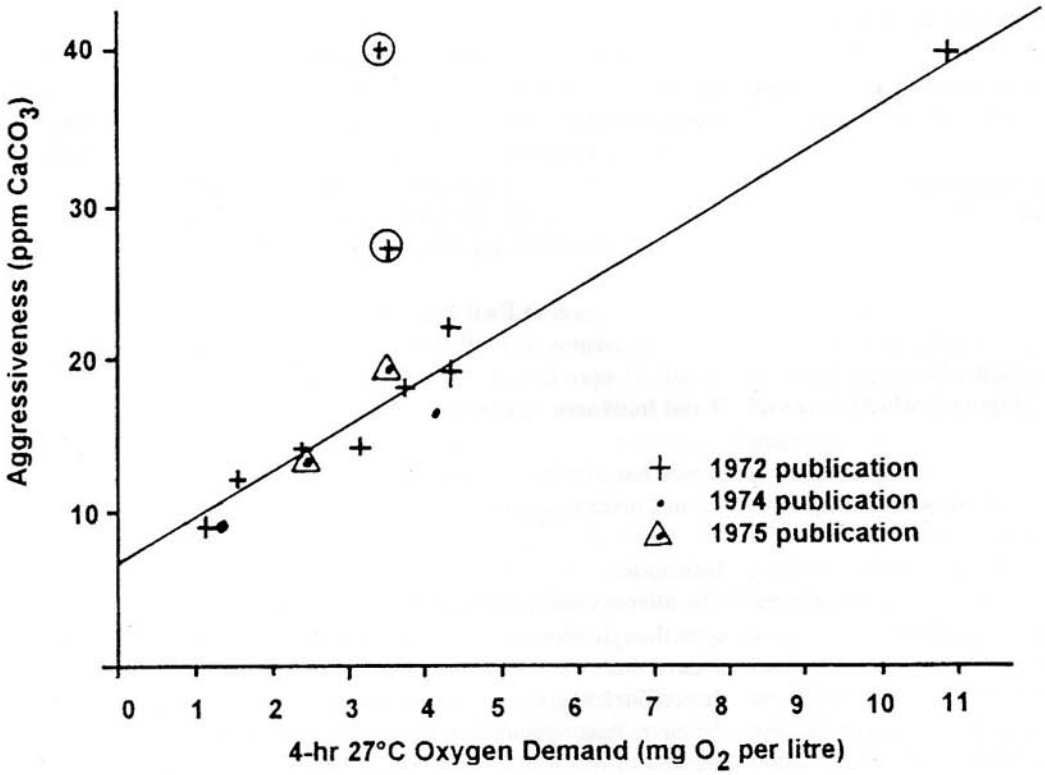
By the summer of 1971 there was available at Penwyllt a new laboratory in the upstairs front room of No. 2 cottage. There was a run of lino-topped benches, storage for glassware and chemicals, and mobile bench-high units. Gas, water and electricity were provided and there was an extraction fan. This was constructed, mainly from discarded furniture, by Frank Baguley and Laurie Galpin. It proved to be a most efficient unit in operation and allowed a great deal of work to be done at Penwyllt which would otherwise have been extremely difficult.

Oxidation Studies

It seemed that a major unknown in the cave processes was the influence, if any, of the organic matter. Little experimental work had been reported in the cave science press and a literature search suggested why. The chemistry of investigations of moorland waters was very complicated and much of the published work was in Russian: at the time there was great emphasis in Russian work on the ability of peat to remove metallic ion contamination from water, presumably in preparation for treating water after nuclear attack (the "Cold War" was at its height).

There were several methods for the estimation of easily oxidised organic matter in water but only one of those proved to be both suitable for use at Penwyllt and able to give reproducible results on cave waters. This was a modification of a method used to examine waters for sewage contamination, and required the use of potassium permanganate in acid solution for 4 hours at 27°C. There was good visual indication in that a clear purple reaction mixture indicated a water low in organic matter and a murky reaction mixture indicated high organic matter content. A replacement portable pH meter by Pye-Unicam proved to be very reliable and to give excellent results.

It was found that waters entering caves at sinks were higher in organic matter than those leaving resurgences. For many surface samples there seemed to be no sensible link between limestone attacking power and pH: water at Pwll Byfre was almost neutral yet was aggressive. There was, however, a link between the initial limestone attacking power of a water in a surface stream, and the amount of easily-oxidised organic matter in that water (as shown by the 4-hour 27°C permanganate value or "oxygen demand"). (Figure 2, in which the ringed results were from sites giving waters containing free sulphuric acid.)

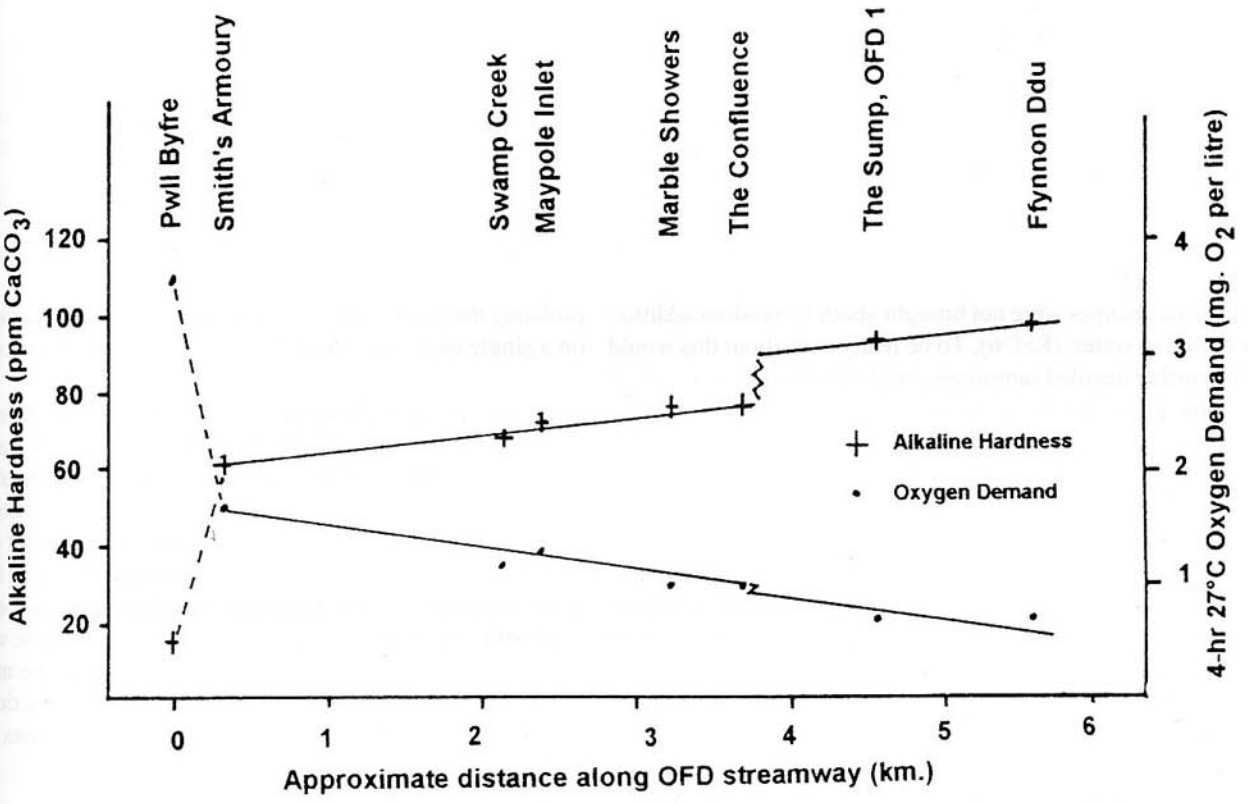


GRAPH OF AGGRESSIVENESS AGAINST OXYGEN DEMAND

Figure 2

A speculative account of what might happen to the organic matter in a cave system was published as a basis for further discussion. This suggested that the organic matter is oxidised in the cave streamway to produce new materials, including carbon dioxide, which then attack limestone and generate additional hardness into the water.

What was needed now was some evidence from within a cave



CHANGES ALONG THE OGOF FFYNNON DDU STREAMWAY

Figure 3

system. Fluctuating water levels during the study period had provided opportunity to add to what was known about the effect of high water levels. It was found that the balance of the water at Pwll Byfre was changed completely, possibly as a result of material entering the Byfre Fechan stream from the marshy area to the west, and that the hardness at the Ffynnon Ddu resurgence under flood conditions did not fall as far as might be expected. It was clear that floods in caves did not simply dilute the materials in the water passing through the caves. (Ref. 3).

Ogof Ffynnon Ddu

It was decided to concentrate work on the Ogof Ffynnon Ddu system. This was said to be relatively straightforward with most of the active streamway known and much of it accessible to cavers. The open moorland above the streamway was not likely to generate pollution within the cave and controlled access to the system meant that it might be possible to set up long-term experiments which would not attract interference. At the time, 1971, there was a need to get going as much exploration and scientific work as possible in the system to try to gain protection from the serious threat posed then by increased quarrying.

The following year saw a co-operation with Paddy O'Reilly which allowed water samples to be taken from sites within Ogof Ffynnon Ddu, including Smith's Armoury, the vital site at which water from Pwll Byfre first enters the cave. The straight-line distance from Pwll Byfre to Smith's Armoury is only about 300m and it was surprising how much the water had changed between these points. Total hardness and alkaline hardness had increased and the easily oxidised organic matter content shown by the 4-hour 27°C permanganate value (oxygen demand) had decreased. It was possible to calculate a ratio:

Increase in alkaline hardness Pwll Byfre to Smith's Armoury (51) ≠ Decrease in oxygen demand Pwll Byfre to Smith's Armoury (2.12) = 24.1

It was unfortunate that the sampling team could not visit many sites within the cave on a single trip and fluctuating water levels meant that other results were not consistent with these values. However, the general idea that a reduction in easily oxidised organic matter was accompanied by an increase in alkaline hardness through the cave seemed to be confirmed: this was regarded as a preliminary study. (Ref. 5.)

An opportunity to make a more detailed study arose the following year (1973). Mick Day persuaded a group of 11 cavers that they wanted to go into Ogof Ffynnon Ddu to collect water samples. The group was organised in teams so that the important sites could be visited within a few hours and possible problems caused by fluctuating water levels could be avoided.

The results were most encouraging. Total hardness and alkaline hardness levels rose through the cave from Smith's Armoury to the Ffynnon Ddu resurgence, with a sharp break at the entry of the much harder water from the Cwmdwr Stream. The easily oxidised organic matter content (shown by the oxygen demand) fell through the cave, again with a discontinuity at the entry of the much cleaner water from the Cwmdwr Stream. It was possible to show the changes on a plot with the approximate distance along the cave streamway as one axis. (Figure 3).

When the change in alkaline hardness for unit change in oxygen demand was worked out, it was found that the ratio was reasonably consistent through the cave and this encouraged the

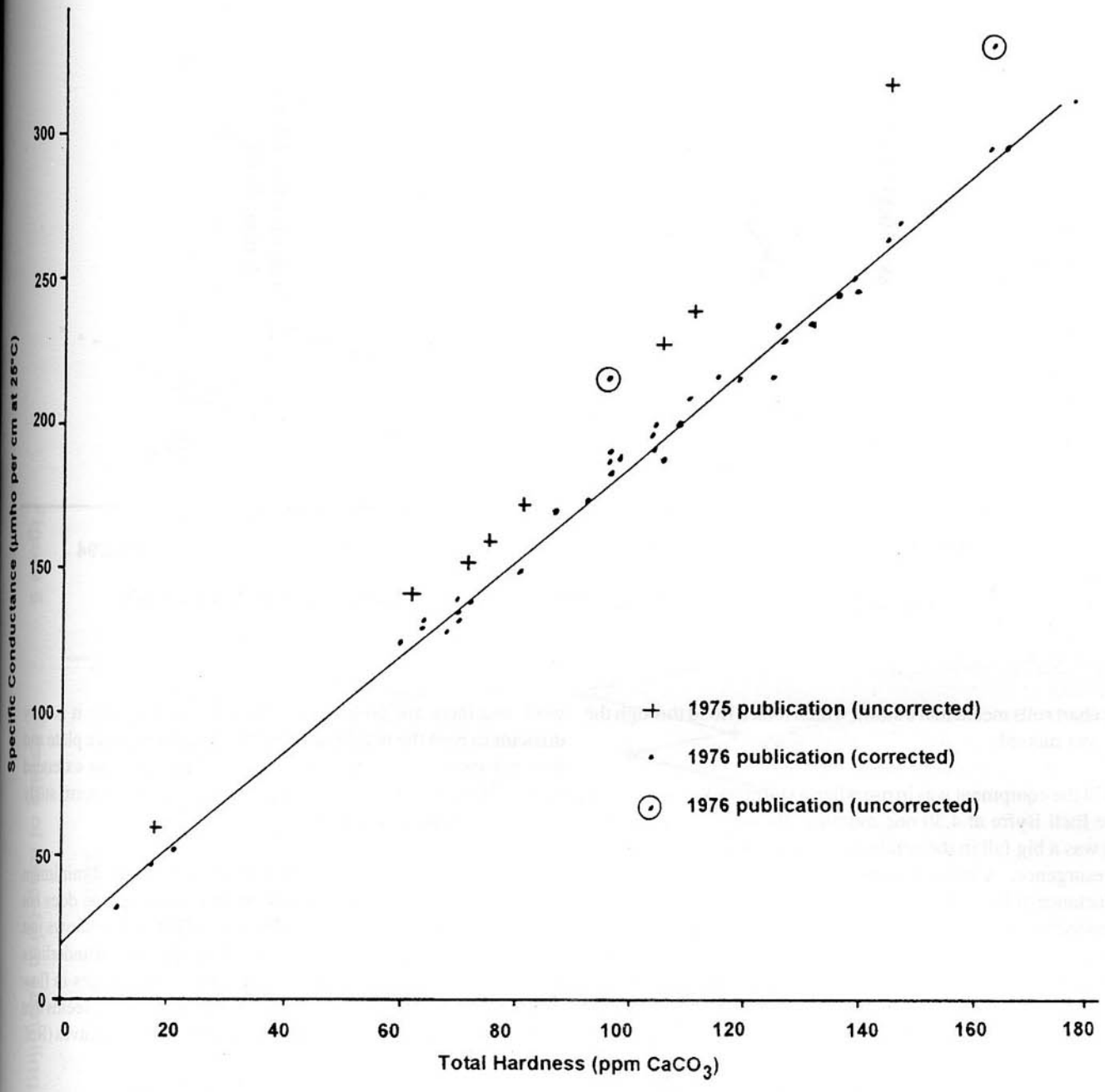


Figure 4 GRAPH OF ELECTRICAL CONDUCTANCE AGAINST TOTAL HARDNESS

There had been suggestions that there might be entry of cave water into the River Tawe between the stream carrying water from Ffynnon Ddu and the Penwyllt bridge. The conductivity meter was used to search the bed of the River Tawe including all of the pools, but no evidence could be found of entry of harder water. Similarly an idea that cave water could enter the River Haffes from the south was shown not to be the case.

Continuous Recording at Ffynnon Ddu

There had been much informal discussion at Penwyllt on the merits of recording a flood pulse through a cave, with Bill Little and Noel Christopher particularly keen that it should be tried. Early attempts by analysing samples from Dan-yr-Ogof gave a lot of work but not much information.

When a second conductivity meter and a chart recorder became available (a Walden Precision Apparatus CQ 75) it was decided to try recording at the Ffynnon Ddu resurgence. Thanks to the generosity of Sylvia and John Barrows a conductance meter and chart recorder were installed in their cottage, a very robust home-made conductance cell was installed in the resurgence pool and the cable link under the road made via the conduit carrying the water pipe to the cottage. For the first two summers of trial, only base levels were recorded: unfortunately a visit to London to collect

idea that the changes were not brought about by random addition of percolation water. (Ref. 6). To be really sure about this would require further detailed samplings coupled with measurements of flow rates along the cave streamway, and this could be very difficult.

Small Sample Work and Scanning

The home-made conductivity bridge was very accurate but slow in use and it had been replaced by a direct-reading conductivity meter (Walden Precision Apparatus CM 25) with a digital voltmeter applied to the chart output to increase the discrimination of the meter. This gave outstandingly good results and was quick to use. To allow comparison with published conductance work, samples were measured at 25°C.

Detailed work requires large water samples (two 500ml samples from each site) and a single team would find it very onerous to visit many sites within a cave on a given sampling trip. The availability of a rapid conductance test allowed an alternative sampling regime to be tried. From each site only a 66ml sample was collected, allowing many more sites to be visited on a given trip. The total hardness/electrical conductance relationship was established from large samples and this allowed total hardness to be worked out from the conductance measurements.

The first trial of this method was in 1972 with Paddy O'Reilly doing the sampling. The results showed that the total hardness rose along the streamway from Smith's Armoury to the Ffynnon Ddu resurgence, with a discontinuity at The Confluence where the much harder water from the Cwm Dwr Stream joined the main stream. The Cwm Dwr Stream had interest as it appeared that the hardness fell, although no calcite deposition was seen. It was thought that water from some previously unsuspected source was joining this stream. The general trend in the main stream was followed by tributaries and trickles, but at a hardness about 30 ppm $CaCO_3$ higher than in the main stream. Unfortunately the opportunity to make sodium and potassium measurements was lost as access could not be gained to the necessary equipment in time. (Ref. 4).

The method was extended to include a measurement of limestone attacking power (aggressiveness) and, by summer 1974, everything was ready for a full-scale trial. Mick Day planned and organised the sampling, which involved 13 cavers working underground and three on the surface. Each site required two samples. The main sample was taken in a 66ml bottle and this was used for conductance measurements and for sodium and potassium measurements (in the laboratory small amounts of water were removed into 15ml Holpots and taken to London for examination by flame photometry). A second sample was taken in a 25ml bottle and a small amount of AnalaR calcium carbonate was added at the site for the aggressiveness test. It was possible to arrange for different sampling teams to visit certain sites to check on the reproducibility of the method. At the time this was probably the most extensive sampling of a British cave to be made on a single day: more than 100 pairs of samples were collected.

Back at Penwyllt each sample was held at 25°C and the electrical conductance measured: there was no need to transfer water from the sample bottles and there was no need to filter the unreacted calcium carbonate from the aggressiveness sample. After measurement of conductance, some of the main samples (48 of them) were chosen at random for total hardness estimation by titration. Sodium and potassium compounds put fast-moving ions into a water and contribute to the electrical conductance of the water but do not register in hardness determinations, so all the measured conductance values needed to be corrected by subtraction of the electrical conductance caused by these compounds: data exist for 25°C.

The corrected electrical conductance values were plotted against total hardness and a straight line was obtained. This allowed the total hardness of the main samples to be found and, as the change in electrical conductance caused by calcium carbonate addition was known, the limestone attacking power or aggressiveness of the water at each site could be found. In figure 4 the points from uncorrected values can be seen to be generally higher, while the corrected values give less scatter about the line.

In general the trends found earlier were confirmed. Sodium and potassium levels were reasonably constant along the streamway as far as The Confluence. The anomaly in the Cwm Dwr Stream was confirmed: there was loss of hardness towards The Confluence and this was accompanied by a loss of sodium content. This suggested that there was additional relatively soft water entering the Cwm Dwr stream. Examination of the values near The Confluence suggested that the Cwm Dwr stream adds some 18% of the water leaving The Confluence.

The inlets near the Marble Showers were softer than most inlets and this suggested that the water enters from close to the surface.

It was thought that unusually high sodium levels in some trickles in OFD I were caused by contamination from a dump of road salt beside the Penwyllt road.

High potassium contents (but not sodium contents) near Heol Eira were noted and there was speculation that these might arise from the washing of NiFe cells at SWCC HQ at Penwyllt. (Ref. 8)

With careful organisation the work of such a sampling can be done quite quickly and, although it might not give the ultimate in precision, it does allow a large cave system to be scanned for interesting/unusual sites. If a small-scale method could be worked out for estimating organic matter content, a real step could be made to achieve the aims set when the programme started.

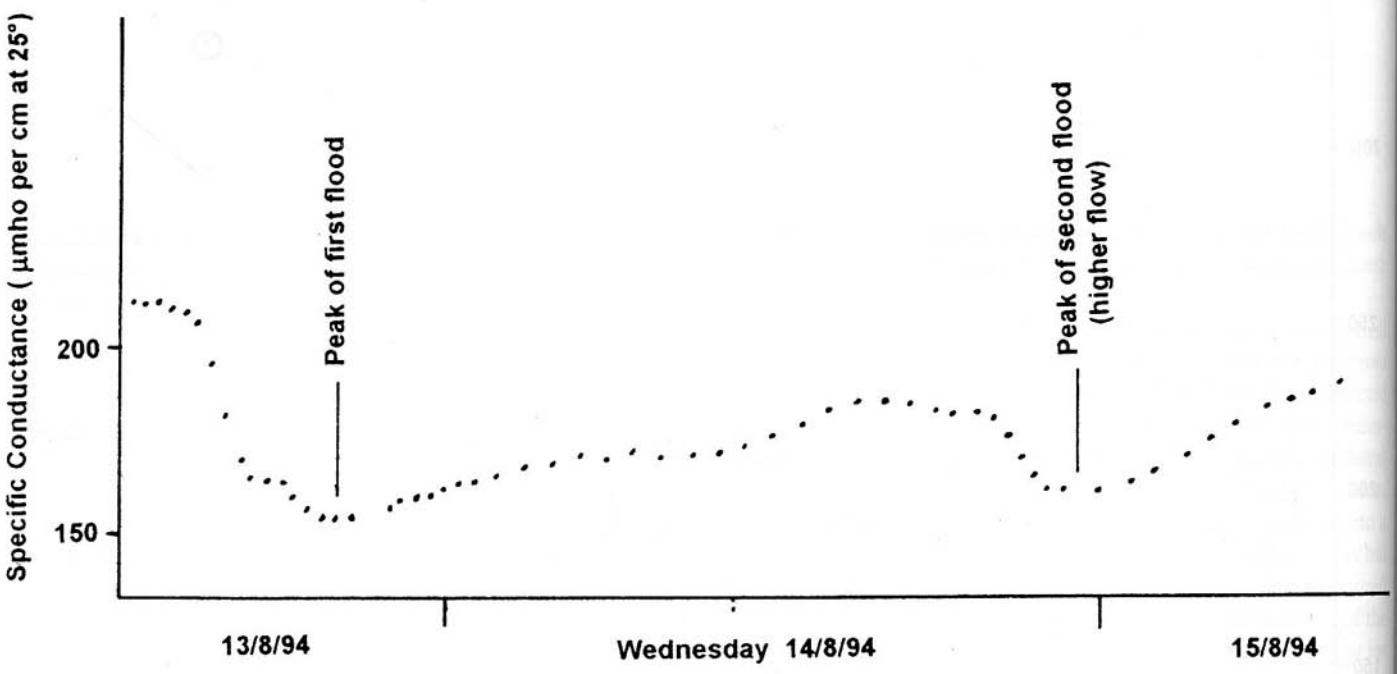


Figure 5 ELECTRICAL CONDUCTANCE CHANGES DURING FLOOD

more chart rolls meant that a storm which took a flood through the cave was missed.

In 1974 the equipment was in use when a storm broke on the moor above Pwll Byfre at 4.30 one morning. By about 2pm that day there was a big fall in the conductance as a flood passed reached the resurgence. A second storm gave a bigger flood but the conductance did not fall as far. After that there was a gradual rise in conductance as the cave regained its usual equilibrium: it seemed to take far longer for the conductance to recover to normal than the flow. Apart from anything else it was interesting that there was only an interval of 10 hours between the onset of heavy rain and the flood reaching the resurgence. (Figure 5) (Ref. 7).

Attempts were made to include a conductance method for recording depth. The equipment worked but only base levels were recorded until a storm caused a power surge which destroyed the input stages to the chart recorder.

It was felt desirable to try to monitor the input to the cave at Pwll Byfre and in 1977 Laurie Galpin laid a cable to the site from the SWCC HQ. A simplified conductance device was buried near the sink. Even though the cable was buried for most of its length it picked up a great deal of electrical interference but the experiment came to an end when it was found that the sheep had started to chew the cable.

Long-Term Experiment

The water board had installed a stage plate at Ffynnon Ddu and in 1977 a chart became available to translate the readings of water height on the stage plate into water flow. At weekly intervals from August 1977 to September 1978 (apart a few breaks) Don Howells, helped by Laurie Galpin, took a reading of water height and sampled the water at the resurgence, then analysed the samples for total hardness at Penwyllt. This was a great deal of work and there are problems with such an enterprise: it is very difficult to read the height of turbulent water on a stage plate and it is not easy to maintain reagent standards over an extended period. However, the results represent the first long-term study at Ffynnon Ddu. (Figure 6).

The immediate observation is that there seems to be a minimum value below which the total hardness at the resurgence does not fall, irrespective of water flow. (Figure 7). This result shows just how complex is the chemistry within a cave system and underlines the danger of trying to monitor relatively small changes in flow rate through a cave system solely by chemical means. It seems that a similar situation is found on some streams in Mendip caves (Ref. 13).

Another point which arises is the length of time it seems to take the chemical system within the cave to recover after a flood, unlike the flow rate which drops very quickly (something which was suspected from a previous recording).

For the record, base flow was 0.02 cubic metres per second (20 litres per second) with a hardness of 100 ppm $CaCO_3$, corresponding to an erosion rate of about 63 tonnes per year. In this study maximum flow was recorded on 26th March 1978 with a rate of 1.35 cubic metres per second. The hardness then was 57 ppm $CaCO_3$, indicating that, at that peak, the rate of calcium carbonate loss was equivalent to about 6.6 tonnes *per day*. A further observation was that the rate of erosion was proportional to the rate of flow. (Figure 8). This result had been noted for the solute load of the River Avon (Ref. 14) but it was interesting to have it confirmed for the Ogof Ffynnon Ddu system.

Closedown

By about 1979 it was evident that a move to an apparently similar job in another school was not a success and there was just not

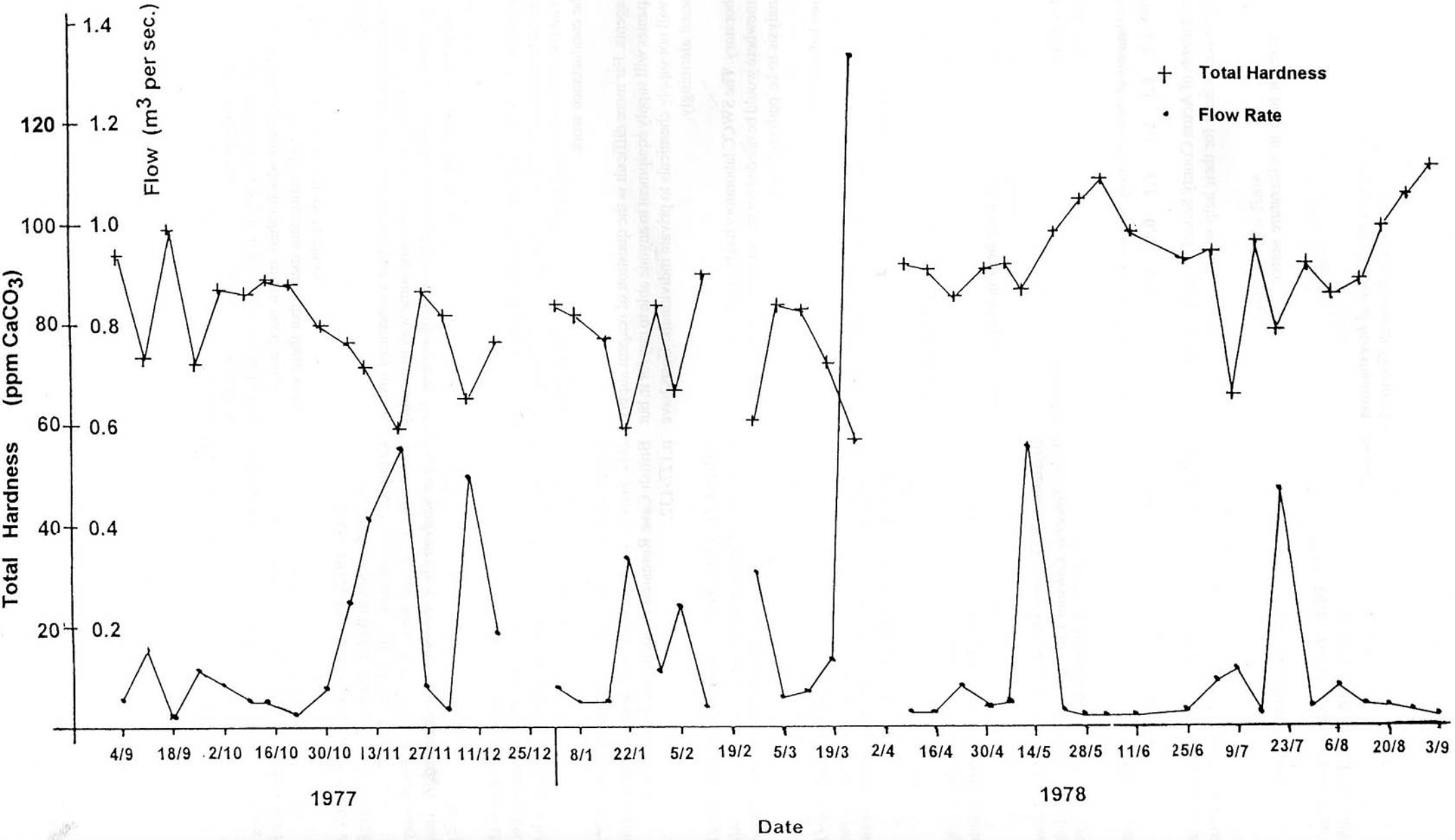


Figure 6 Results of long-term sampling, Ffynnon Ddu

enough time to allow any further development work in cave chemistry. Additionally problems at home made it impossible to get to Wales at a predictable time, if at all. It was unfair to hold Royal Society equipment which others might need and it was returned. In 1985 very early retirement meant that there was no longer access to school laboratory facilities.

Postscript

The work in Ogof Ffynnon Ddu developed a scheme of investigations which, taken together, could come some way to meeting some of aims set originally for the Dan-yr-Ogof system. For someone to resume the work, several difficulties would need to be overcome:

1)Equipment. Even the simplest equipment is very expensive now and it would need to be borrowed or purchased. Perhaps the major item would be a thermostat tank sufficiently precise enough for the conductance work.

2)Reagents. Far more difficult is the question of reagent supply. Companies will supply equipment to anyone able to pay for it, but they will not supply chemicals to private individuals. Costs have increased alarmingly.

3)Laboratory. The SWCC laboratory has been turned into a store, so somewhere would be needed for the equipment to be set up and the analysis to be performed safely.

Acknowledgements

This work could not have been done without very generous help from a lot of people. The author thanks most sincerely all those people mentioned above and:

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Cavers too numerous to list for their help in collecting water samples, often in very difficult conditions.

The Royal Society's Scientific research in School Committee for financial help.

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Mr. E.V. Nutt for help in a literature search.

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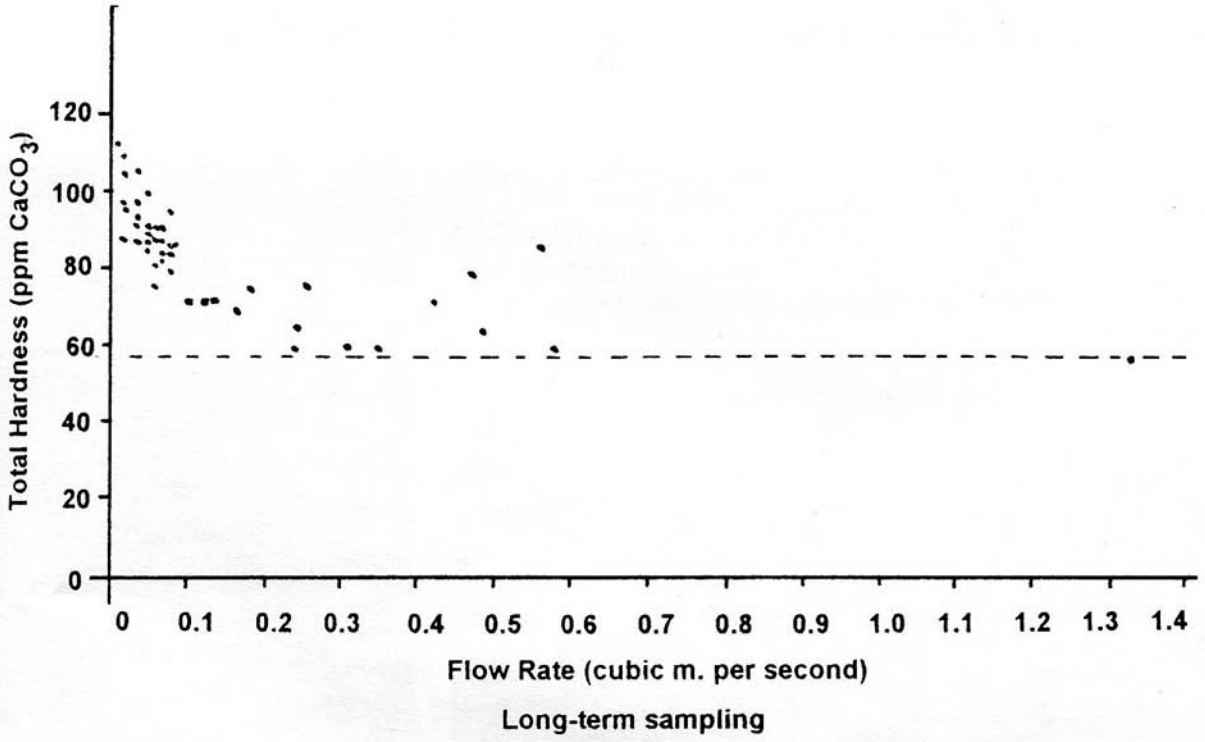


Figure 7 Graph of Total Hardness against Flow Rate

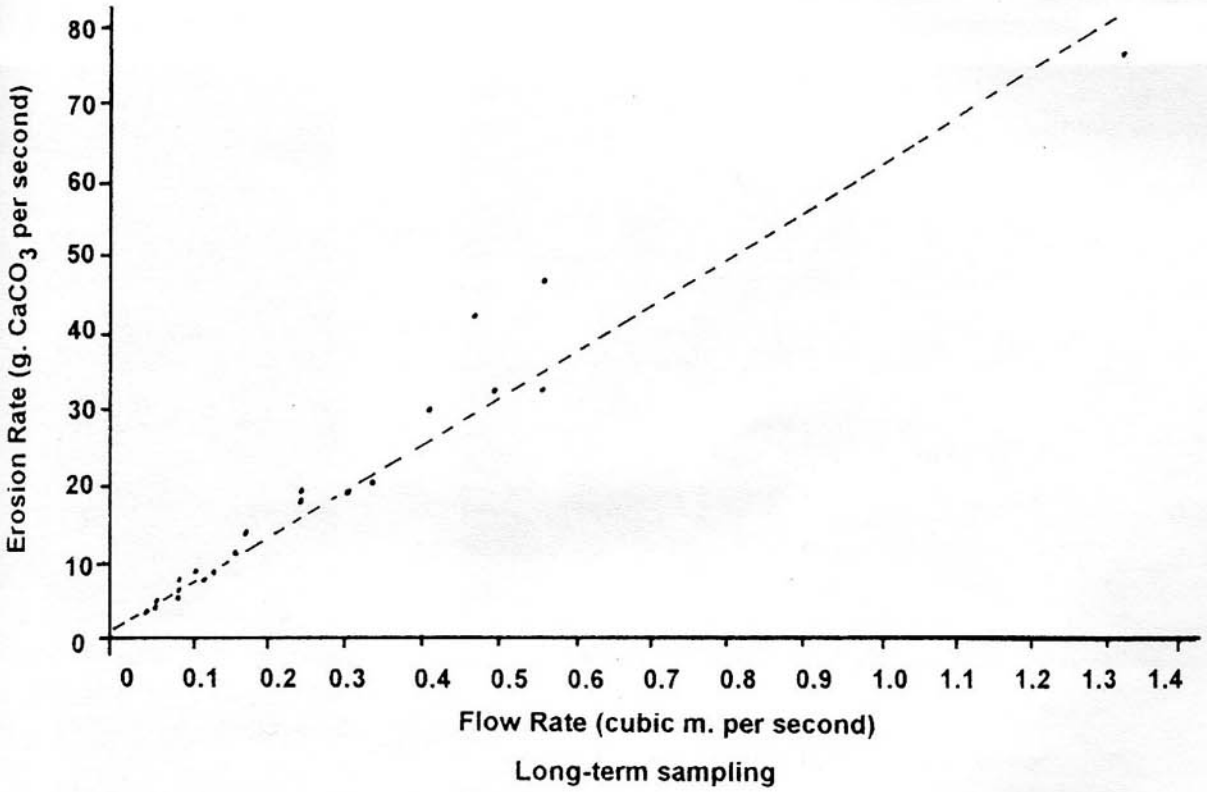
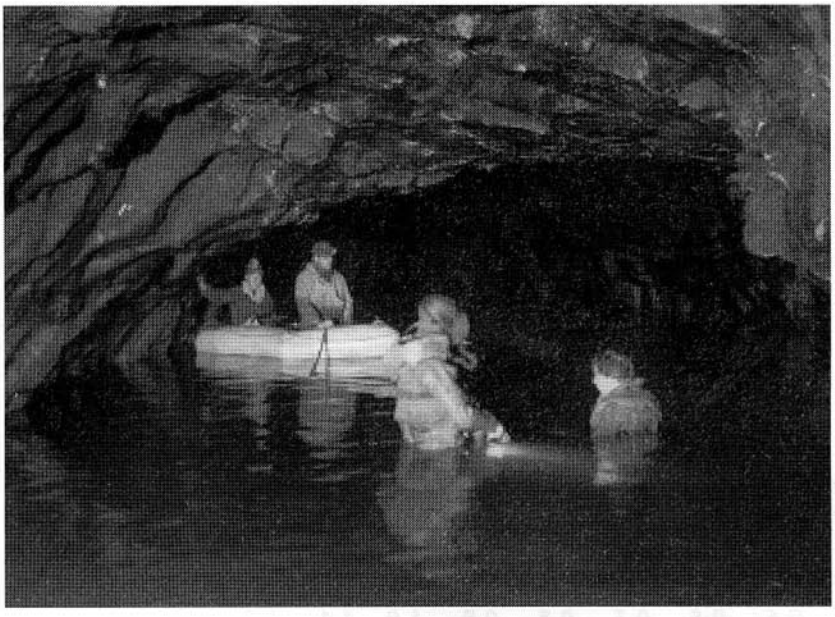


Figure 8 Graph of Erosion Rate against Flow Rate

Photographs from the Collection of Les Hawes

This page - Top left: Bill Clarke (in hole) and Les Hawes at Ffrydiau Twrch, Coronation Day 1952. Top right: Les Hawes at The Column, Ogof Ffynnon Ddu I in the early 1960s. Bottom right:David Jenkins, Toastrack Passage, early 1960s. Bottom left: Diving the lakes in Dan-yr-Ogof, 1953. In the dinghy, Les Hawes and Bob Davies, in the water two cave divers from Derbyshire



Opposite page -Top:outside the old cottage, circa 1958. L to R: David Hunt, Clive Leyman, John Hartwell, Sybil Bowden-Lyle, Clive Jones, Les Hawes, Brian Jones, Glyn Thomas.
Bottom left: the bottom entrance to Tunnel Cave, around 1954/5. A trip to use "Uppit" ladders (designed and built by Lewis Railton) to ascend Steeple Aven. (See SWCC Newsletters Nos 11 and 12, both 1955, for more details.) L to R: Edward Aslett, Lewis Railton, Glyn Thomas, Brian Jones.
Bottom right: David Hunt photographing The Antlers in Ogof Ffynnon Ddu.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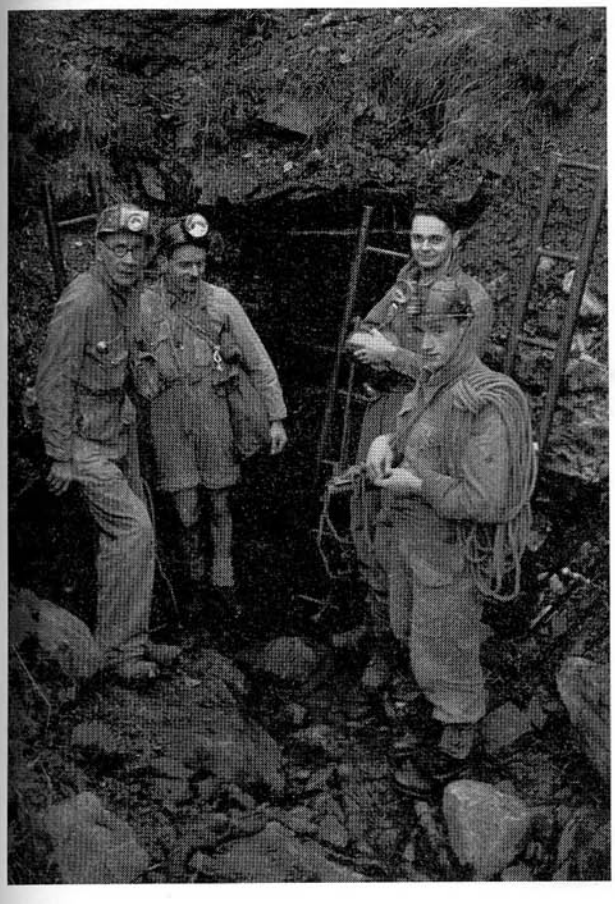


Dan-yr-Ogof: The Breakthrough of 1966, A Personal View

by Noel Christopher

This is a personal account of the events of Easter and summer 1966 when the first great breakthrough of the 1960s was made. I believe it to be accurate: if I have got some details wrong, I apologise - memory is a fallible thing after 30 years but to me as I sit typing at my word processor (technology not even dreamed of then) the events are as fresh as yesterday. Most of the key people are either dead or no longer members. It is therefore a personal account for posterity.

It was some time in the spring of 1964 when working at BP Llandarcy that, after a year of university caving on the Mendips, I found Penwyllt by a route that I can no longer remember. However, I remember on that first weekend meeting Bill Little and Lewis Railton - he was ill then, even to my eyes and within a few years was gone. But I was enriched by contact with the man who set standards of cave surveying which have yet to be surpassed.

I was elected a member of the club in 1965 with the help of a recommendation from Charles Freeman. I also became friendly with Alan Coase. He appeared at the club and disappeared into the depths of Dan-yr-Ogof for interminable periods of six or eight hours. This seemed amazing to one who was used to three- and four-hour trips on Mendip being long ones.

The year of 1964 was notable because Dan-yr-Ogof was reopened to the public and cavers after many years of being closed, at this time the cave was virtually as left by the pre-Second World War explorers. This to the SWCC, without a major breakthrough for ten years, was a great opportunity. It must be said that this was made possible by the generosity of the late Dr. Price who encouraged us greatly.

The times appear from now to be antediluvian, we all drank a lot, especially on Saturday night in the Gwyn Arms, and talked of our exploits. Wetsuits were largely unknown and lighting was mostly by carbide with electron ladder being the height of caving technology. Cave divers - those still alive - were still on oxygen re-breathing equipment.

There had been no major breakthroughs in Britain for several years and a new breed of cavers with better equipment were about to break on to the scene.

During the intervening period I had been on several pushing trips into Dan-yr-Ogof either with Alan, Bill or Bryn Thomas. Small finds were made, Lakes 5 and 6 were explored but nothing major was found. All attention became focused on the Long Crawl. This was, in those days, intimidating: over 500 ft of flat-out crawl with only one turning point, at about halfway. It was very cold and draughty: the Z-bends (now removed) required careful technique and the end was even lower and tighter. But a few people had heard falling water here! This called for the thin brigade, which at this time was led by two people - Bruce Thomas and Eileen Davies; in those days they were the cream.

Some time before Easter 1966 two other cavers, Pete Ogden and Terry Moon, pushed the final squeeze to a small chamber above a drop which, without ladder, they were unable to descend. They put their initials in the mud and retreated.

We planned a big push in Easter 1966 but it was wet and no trips beyond the Lakes were possible until the Monday or Tuesday, by which time I had gone back to work. When Bruce and Eileen made an assault on the squeeze they also got through. They too were defeated by the drop. However, they returned later with a ladder and entered what is now known as Gerard Platten Hall. They soon realised the size of the breakthrough and returned with the news to the rest of the party, including Bill Little, Alan Coase and Laurie Galpin plus one other I cannot remember.

These six then passed the squeeze, all with varying degrees of difficulty - especially Alan with his relatively large bulk. They explored to the Green Canal and were overawed by places such as Flabbergasm Chasm and returned on a high. Now Dan-yr-Ogof Caves took a hand and issued a press release about the huge finds: "Over a mile of new passage - still continuing" and so on. Alan, a noted cave photographer even then, returned home for better equipment and various things were put on hold until the weekend. In the meanwhile the news broke in the press and I remember reading about six-foot stalagmites in the Bristol Evening News and ringing Bill for details; this was real news!

This was the first and greatest breakthrough in ten years.

In those ten years, scientists other than archaeologists had begun to study caves. Derek Ford had completed his thesis at Bristol. Dingle Smith was at work also at Bristol and biologists such as Ann Mason-Williams and Geoff Jefferson were beginning to understand cave ecology; some of these people combined in the CRG to propose a study of the new cave. Dr. Price supported the wish for a proper scientific study. This, combined with the wish of most of the caving fraternity to see this new find, became a potent and finally explosive mixture, after the parallel discoveries in Ogof Ffynnon Ddu later in that year.

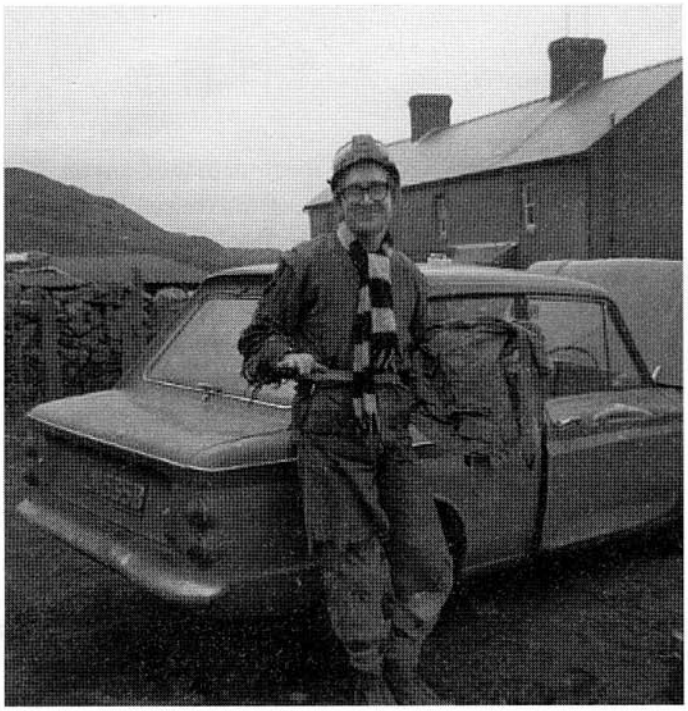
The next weekend the club was alive with anticipation. Everyone who could cave was there and Bill Little had a plan. If I remember correctly Bryn Thomas and I were on support party No. 4, bringing in conservation tapes! It didn't matter to me - I was to see the promised land. In we went, the tight squeeze at the end had been chemically modified by now to ease it but the final chamber was still very cramped until further modifications were made. I can still remember The Canyon with a single set of footprints down the middle and the first sight of the six-foot straw at the end of Flabbergasm. Earlier in the day the "Originals" had crossed the Green Canal and were mounting an assault on the Abyss. By the time we crossed they were down the Abyss and were arguing about which of the "Originals" were to explore what is now Thixotropic Passage. The impasse was broken by Noel Dilly (not one of the Originals!) who climbed over the Saddle and set off, followed spluttering by Alan Coase. After a while they returned with stories of another stream with the passage continuing, then we all exited. I remember Alan telling a gathering in the dining room about the day's finds to a hushed and attentive audience. Some time during that weekend a notice went up about the wishes of the Originals. I clearly remember Bill Birchenough politely, but firmly, telling Alan Coase that that sort of thing was not on and after the intervention of the club secretary (John Osborne) it was taken down. The next day John Bevan, Bryn and myself fully explored the Four Pots area to the entrance of Virgin Passage; the pool of which we left for the biologists. If we had pressed on we would have soon found the Washing Machine and the link with Salubrious Passage. I was not to be denied, however, as soon afterwards Noel Dilly and I were exploring Salubrious when he recognised a side passage and within a few minutes we popped out in the floor of the Canyon. The same day Alan Coase and another team passed the pool in Virgin Passage to close the bigger loop! Which miffed me as I had left it for science.

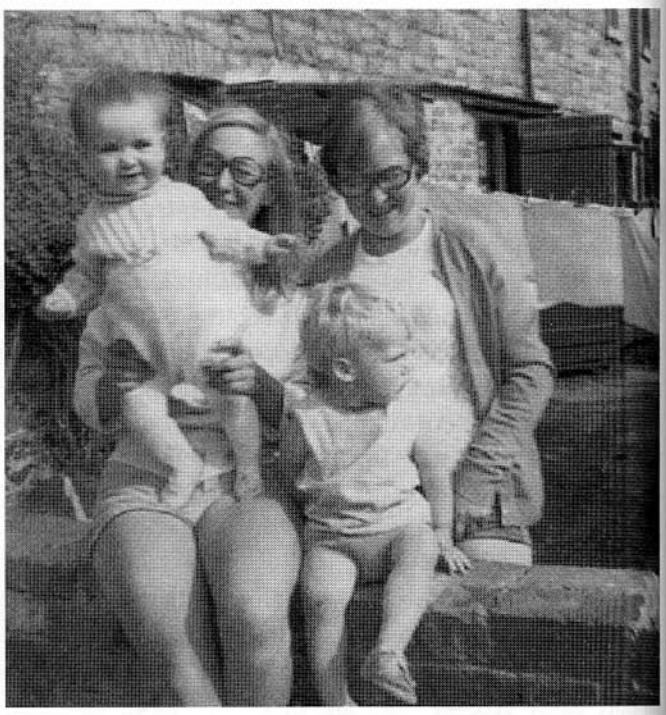
That was about it for a few months: various small side passages were explored, at some stage someone climbed into Dali's Delight and pulled the rope up after them - this required Bryn and I to free climb it and the rope we installed was there for many years.

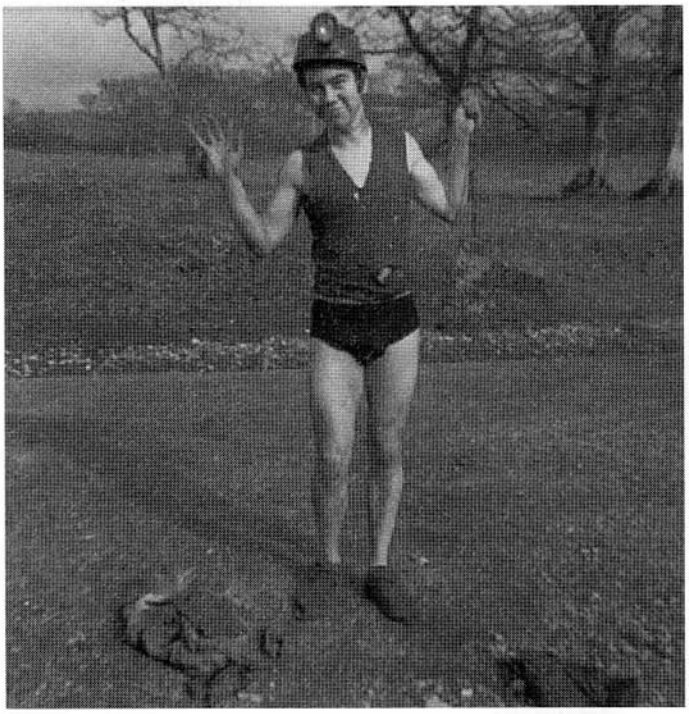
This was the year of the Balinka Pit expedition which included most of the Originals. As they left another map was put up with three biological reserves marked. This limited us to the upper levels up to the Green Canal, an area which was already thoroughly explored. This caused, upon return, an almighty row. In the autumn someone climbed above The Rising at the top of Highway and The Great North Road was found. If we had been allowed a free run in the summer, would those of us not on the expedition have found The Great North Road? - I have asked myself this many times. I could not personally have made the free climb, but there were others around who may have. But in the final analysis did a few months really make much difference, if the cave was properly studied?

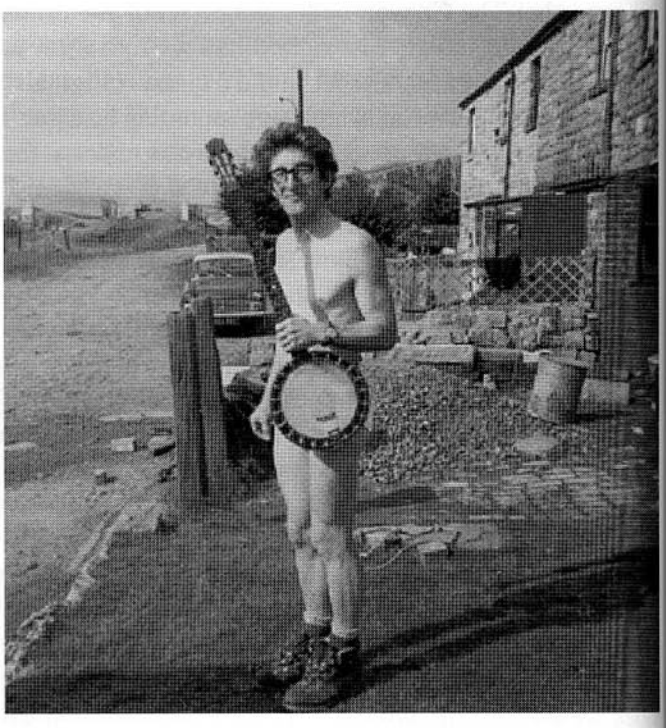
There was still much work to do, tapes to install, the survey to make, a rescue dump to install and lots more chemical modification of the Long Crawl. I still have fond memories of Dan-yr-Ogof, but gradually I transferred as the summer wore on to Ogof Ffynnon Ddu where even bigger finds were in progress.

Photographs by Dot Williams









Top left: Idris Williams in his "best caving gear", 1968. "Hillman Imp panel-beating by drunk, Kershaw Terrace in background". Top right: Days and Cardys, July 1971. Bottom right: Eric Inson plucks his instrument, 1971. Bottom left: Hywel Ball at Llethrid Swallet, winter1965/6.

You Are What You Eat!

by Dr. Lisa Williams

FACTS AND FIGURES

World Health Definition - nutrition: determining the kinds and amounts of foods that promote health and well-being.

Essentials: Water, Carbohydrate, Protein, Fat,Vitamins and Minerals

Basal requirements - 2,000 kcal/day - fit, healthy individual sitting around just breathing.

Add 500 - 2500 kcals to this for daily activities, i.e. caving etc.

The most important part of daily intake is thought to be protein. 1g/kg body weight is the suggested, amount of protein that should be eaten. For your average 70kg man this should be 70 g protein per day. Two types of protein are available; animal and plant, animal protein contains a good mix of amino acids including essential ones, i.e. those that the body is unable to make. Plant protein is less mixed and hence a variety of plants need to be eaten to provide a balance.

Fats are a compact high energy food, they are made up of fatty acids some of which are also "essential". Fat, however, is expensive, it makes up a much larger proportion of Western diets than it does in the developing world.

In a reasonable diet calories should also come from carbohydrate intake. Carbohydrates are essentially constructed of sugar molecules. In animals they are seen in the form of glycogen - a storage for carbohydrate, sucrose, glucose, lactose, etc., that are smaller sugar molecules. In plants carbohydrates form building blocks; cellulose being an indigestible (to humans) sugar used to make rigid structures and seen in our diets in the form of fibre. Starch is also a plant carbohydrate.

Once protein requirements have been decided upon, 50% of the rest of our calorie intake should come from fats, 50% from carbohydrate.

Minerals are also an important input.

Lack of: Iron	-	anaemia
Iodine	-	thyroid disorders
Zinc	-	skin ulcers and immune problems
Copper	-	anaemias and ? raises cholesterol levels
Chromium	-	insulin resistance (a form of diabetes)
Fluorine	-	dental decay.

Conversely in excess many are toxic.

Excess: Copper	-	brain damage
Aluminium	-	dementia
Iron	-	overload syndrome

Vitamins are an organic requirement necessary for good health, but don't supply any energy.

A, D, E, K - are fat soluble
Vitamin B complex, (B1, B2 niacin, B6, B12) and vitamin C are water soluble.

Again in excess some produce toxicity, e.g. Vitamin A content in polar bear's livers is so high that if eaten can have lethal consequences and Vitamin B complex, although often taken, have psychiatric side effects, with mood swings and even hallucinations. And fluid intake;

2.5l fluid is lost per day. (1.5 urine
(400 mls from lungs
(500 mls sweat
(100 mls faeces

Kidneys actually filter 180 litres per day. They concentrate this fluid down to 1.5l and can actually concentrate it to 500 mls/day. The largest fluid loss is via sweating. 50 mls per hour is a reasonable volume, this can increase to 1.6 litres per hour in hot, dry conditions, or during exertion.

So that's what we should be eating and drinking, but what actually happens to this and how does all this affect caving?

Most of the energy our bodies use is made available through various cycles involving carbohydrates. Fat and protein can be converted into carbohydrate, and if this is not available, muscle and fat stores are used for energy production.

70kg man has 2500 kcal stored as carbohydrate:

400g muscle glycogen, 100 liver glycogen, 20g glucose

112,000 kcal are stored in other forms

80% = fat
20% = protein

AT REST -Glucose is used.

EXERCISE -Glycogen in muscle is used to make glucose.
-there is increased uptake of glucose from the blood.
-there is an increase in production of glucose from glycogen stored in the liver, this however is quickly used up.

Once these stores have been exhausted, glucose production from fat and protein stores commences. Hormone changes make this possible.

-Insulin levels fall in the blood.
-Glucagon and adrenaline levels rise.

(Insulin lowers blood glucose levels, e.g. after a meal. Glucagon and adrenaline raise glucose levels)

STOP EXERCISE -Glucose no longer being used up - blood levels rise. Insulin is released and this makes the liver and muscle take up glucose, and store it as glycogen, hence things go back to normal.

WHAT ABOUT	DIETS	Vs EXERCISE	Vs STARVATION
All use carbohydrate initially to produce energy, then use fat/protein stores	use fats and proteins	use fats	use proteins
	lowers muscle bulk	raises muscle bulk	lowers muscle bulk
	lower BMR	raises BMR	lowers BMR
BMR basal metabolic rate. i.e. tick-over rate.	now have less muscle to burn off energy and store more fat in the long term.	more muscles use up more energy	burn less energy! conserves more of stores.
	BAD	fitter and slimmer	

Overlying all of this are our cycles: ruled by sun and moon, i.e. night and day.

As with most hormones insulin is produced in a cyclical fashion, timed not only with night and day, but also with our usual eating patterns. i.e. at lunchtime, our insulin levels rise in anticipation of a meal.

These variable insulin levels can cause problems to people who do prolonged exercise.
e.g. caving through lunchtime.

- Anticipatory rise in insulin levels
- fall in glucose available
- don't eat because of caving

Therefore feel tired and hungry

Another Example;
Eat a Mars bar:
- instant rise in glucose levels
- rise in insulin levels
- reduces blood glucose to a low level

Therefore instant energy rush followed by feeling tired and hungry again!

IF YOU REALLY DIDN'T WANT TO READ ALL OF THIS ARTICLE THEN THIS IS THE BIT YOU SHOULD READ!!

Pre-exercise:	get fit:	-this increases available muscle;
	eat well:	-makes "work" (caving) easier.
		-it increases glycogen stores.
		-programmes the body into rapid mobilisation of energy stores.
Immediately Pre-exercise: (night before long trip)		-fill up all possible carbohydrate stores to maximum capacity, i.e. eat losts of pasta, potatoes, rice etc., but not too much fat or protein.
During Exercise:		-eat protein and fats, these take a while to digest - hence give a sustained energy release.
		-AND/OR eat complex carbohydrates, these release some energy quickly, but also give a sustained release.
		- dried fruit, nuts, cheese, pepperoni (sandwiches!)
Long Long Trips:		-24 to 48 hours- need energy replacement, fluid and warmth. Hot drinks, dried foods, e.g. packet pasta or rice dishes.
		-More than 48 hours -need variety and taste plus energy replacement, fluid and warmth. This is where pre-packed meals come into their own

MOST IMPORTANT FOR CAVERS:

Remember to drink: 1% fluid loss is said to produce 10% loss of performance.
Dehydration leads to tiredness, lethargy, headaches etc.,

Overexposure

by Caitlin Day

Ian Cardy came up with the idea that we write an article for this publication. After all, some of us have been coming up to the club for twenty-five years or more. Thinking about it, Ian always used to come up with the "good" ideas and never did any of the hard work then either. (Just kidding Ian.) Dens, assault courses, even go-karting down the hill seemed like good ideas at the time - until we were caught by Jopo.

My earliest memory is of getting up ludicrously early to walk with mum (Judy Day), and the other kids down to the little bridge over the railway. We would wait to wave at the drivers of the trains which still used to run back then. It is only the older "kids" that can remember this. I suppose the trains must have stopped running in the mid-seventies. The gang were open to newcomers, but any who wanted to join had to pass strict initiation tests before being welcomed into the fold. Rhys Williams was particularly unlucky to catch Ian in a sadistic mood and was told he had to eat a large piece of sheep s**t. I can't remember whether he did or not.

Looking back (as we are all so old now!), it seems like an idyllic time. Endless summer days of adventure and mischief straight out of an Enid Blyton novel. Unlike the Famous Five, we seemed to be forever in and out of trouble.

Both the working and disused quarries provided an excellent playground. We were only allowed to play where it was considered safe. We could go into Cwm Dwr Quarry or the quarry immediately behind on the condition that we didn't try and climb in certain areas. We did of course. On no account were we to enter the main working quarry (let alone attempt to climb), unless we had a responsible adult with us. Who did the matriarchs of married consider sensible? Pete Francis was one! The lure of the big quarry was too much and Stuart Major persuaded Ian, Hywel (Jopling) and myself it was worth a try. (I hold up my hand here and admit that I bottled out.) But Hywel and Ian, egged on by Stuart, started to climb. If they had succeeded they would have had something to boast about to the other kids for weeks. Instead they got stuck. I'm not sure how far up, but it seemed a long way to an eight-year-old stuck at the bottom. There was nothing left except for me to run for help. This was greeted by disbelief, turning to anger and eventually found expression in sore backsides all round.

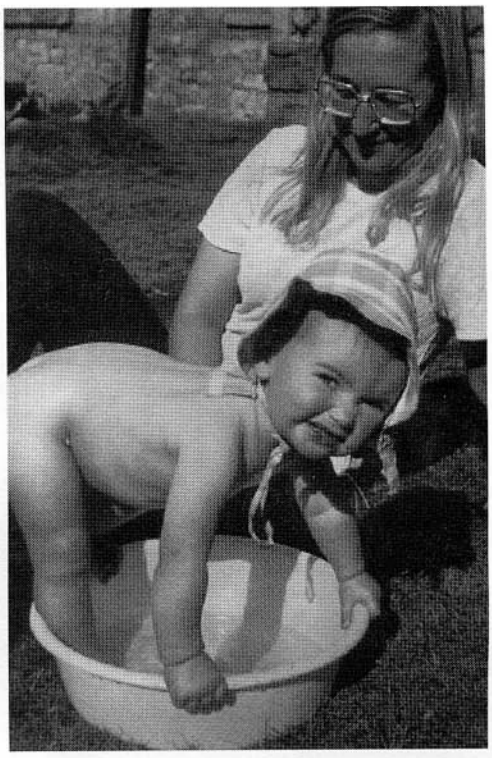
The big stockpiles of finished stone were also excellent to climb and slide back down. This pastime was not restricted to the younger element. I have distinct memories of Heather sliding down these heaps on a tea tray after a couple of gins. There were also lots of excellent places to hide amongst them from the irate quarry manager who was always threatening us with arrest. One time a police car appeared while we were playing and we were convinced that he was after us. We can't remember who it was (probably Ian again) who came up with the idea of burying the little ones - Ceiny (my sister), Andie (Jopling) and Twigs (Jay) - in one of the piles of finer stone. The rest of us ran for cover in Cwm Dwr Quarry. They lay there too scared to move for what seemed like hours before the older gang saw the police car leaving and went to rescue them. We were even dirtier than usual that day which warranted proper showers instead of the usual bowl in front of the fire or sink.

We are sure that many people were kind enough to take the time to play with us but a special mention of Pete "King of the Kids" Francis, Kev Davies, Gwyn Saunders, Stevie West and Simon Amatt must be made. Do you remember the old sink outside main quarters? If you do you will undoubtedly remember the squeals as one or other of us was threatened with a dunking. Do you remember the big inner tube? Being rolled around the car park curled up in it? Gymnastics with Simon on the lawn?

Wet weather days were not so good. We would be confined to married quarters. In those days children were not allowed in main quarters under any circumstances. I once had a nice curry shampoo courtesy of Peter Harvey for getting in the way while trying to inform my mother the baby was crying. Tempers were frayed and squabbles broke out. There were upwards of six families on really busy weekends and we all have the greatest admiration for the mums. They kept us occupied, sorted out arguments and above all restrained themselves from murdering us. One such weekend was spent trying to convince a very small Bethan Jay to use her new musical potty so we could find out what the tune was. Another was spent teasing our second youngest member about her announcement that Ian Cardy was her boyfriend and that they were going to get married. Most of us fell down the stairs but we managed to avoid any serious injuries. Even when Andie Jopling took to car diving (as a four-year-old she managed to open the child safety locks on Mick Day's Rover and fell out of the moving vehicle), there was nothing more serious than cuts and bruises.

The Rover was great too. For those of you who never met TDR 446, Mick Day had an old Rover 100 to which he added a van back (amongst far cleverer things like an overdrive). The size of this vehicle meant that it acted as an impromptu minibus with several of us sitting in the boot of the car. We must have covered a sizable chunk of south and west Wales in the endless quest to "keep them quiet". It was also an ideal "babysitting" vehicle. If no-one wanted to miss out on the pub, we would accompany our parents to the 'Shunt (Ancient Briton), but remain outside in the back of the Rover, in a tangle of sleeping bags, to be rewarded at erratic intervals with bottles of Coke and packets of crisps.

As we grew up, running battles started over how late we should be allowed to stay up on party nights. Our first brush with alcohol



Above: Caitlin and Owain, 1971. Right: Judy Day and Caitlin, also in in 1971, photo by Joan Mawson.

came at one of these legendary events, where as under 10s we were supposed to be in bed, but had been overlooked. A scavenging party was arranged and we went around nicking drinks that the unwise had left unattended. This was probably the only time that we went unpunished as it was felt that we had done that ourselves already. One comment that has been made whilst I have been writing this is that there seems to be less nudity at the parties these days.

Growing up at a caving club also meant that we did go caving (even Ian Cardy, Ceinwen and Andie Jopling!) These trips were normally huge and hilarious and all sorts of tall stories about "Smithy" would be told. We also had our little triumphs. During the filming of the programme about OFD for the *Worlds Without Sun* series a BBC assistant was shamed into caving by a five-year-old Cait who was busy being "important" underground with her daddy. Dominic Foster would go on for hours about how he was old enough to cave in shorts like his dad. Bruce eventually relented, a decision Dominic was to regret when his shorts parted at the seam and ended up as a skirt.

Perhaps one of the more memorable trips came when we were slightly older. A big group (Days, Cardys, Joplings, Jays, Joneses and so on) had gone for an amble around Cwm Dwr. Brock's daughter Sam had got cold and tired and Dad decided to send the other kids out ahead to stop them getting cold and to pass a message to whoever was available to bring a rope over to the entrance. Judy and Marge made tea for all the tired cavers and counted the number they needed from the ticket off the board. There was a slight problem when they realised that they had one cup too many. A headcount was made but all the kids were accounted for. It was only then that someone realised Brock was missing. He had been at the tail end of the party and had somehow been locked in. He was found at the entrance unable to get the door open.

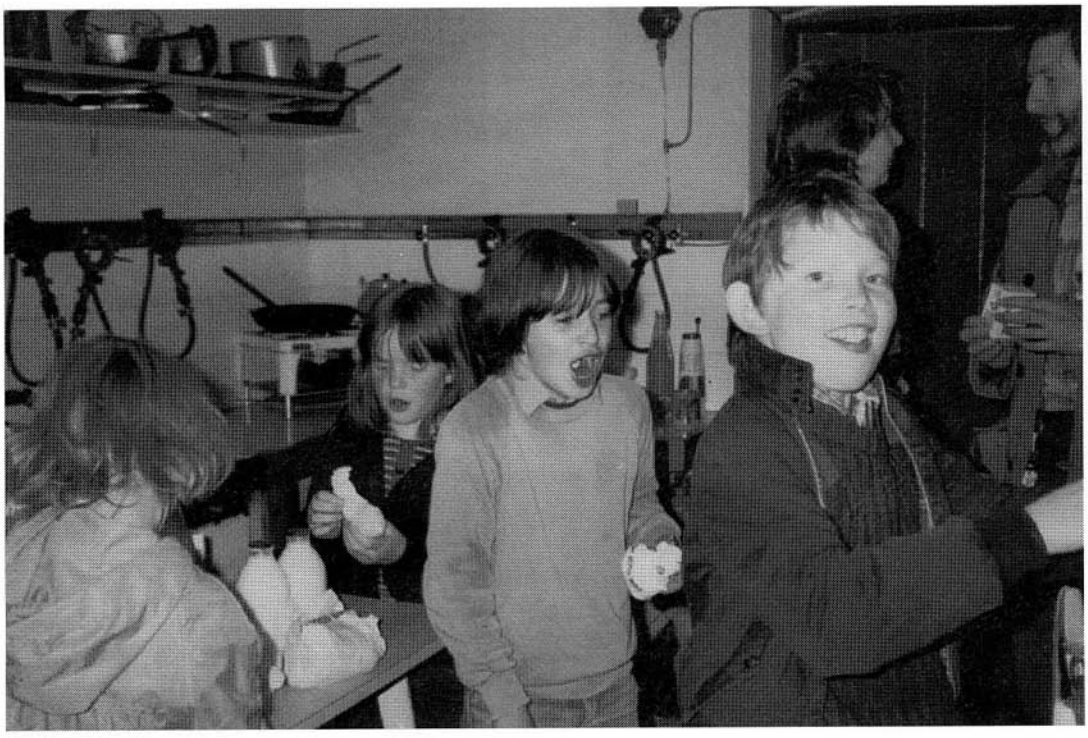
A callout on a Sunday was usually welcomed as it meant two things - we could stay longer and would probably miss some school. It wasn't until 1979 when Gough and Fitton were lost in the streamway that we learned the lesson that caving can be dangerous and even tragic.

It is a shame, although not altogether surprising, that none of the caving club kids are now what you would call serious cavers. A couple, noticeably Owain and to an extent myself and Twigs, were acceptable cavers in their own right but have become more involved with other interests. Rhys seems to be an exception rather than a rule, but he was not up as frequently as the rest of us. We were prevented by our parents from doing too much too soon. Dan-yr-Ogof for example, was forbidden until you were 14 or 15, but when you grew up with it, it loses an edge to its excitement and becomes somewhat tarnished. Talk to any of the kids and you will get a similar answer. Don't get us wrong. We still enjoy caving and we love the club as a second home but very few of us go there more than five or six times a year. But when we do it feels like a homecoming. This is where, we think, we had the best childhood you could wish for and grew up with an amazing support network that few people are lucky enough to have access to.

I could go on forever telling stories. Learning to drive in the quarry, Ceiny and Andie trying to drive the dumper truck off the edge of the quarry, Hywel and the kiwi fruit and the mud mine! But I reckon I have drowned you with enough nostalgia. Maybe you will hear more for the 100th Anniversary Publication.

It would be nice to know what happened to those childhood friends who have disappeared: Shauna and Fiona, Stuart and Bruce, Daniel and Esther, Jane and Sarah (from Keighley) and countless others we have probably forgotten.

And for those of you who are still taking bets on who will have the first third generation sprog - you're too late. Bethan (née Foster) has beaten us all to it.



Above: the kitchen in cottage no.5, November 1982

Today's SWCC Childhood

by Caitrín Richardson (age 11) and Bethan Moore (age 8)

Most of the day is spent nicking hammers and getting jobs done, for Kelty that is, but otherwise we build dens and generally get old junk to put in it. Children that are not old enough to be in the older ones "group" tend to ride bikes, play on the climbing frame and generally moan that they are bored (which we all do sometimes). We all occasionally go swimming or on outings but often enough we are bored. Children of Megan and Christopher's age usually play in the sandpit, or hang around their mothers and fathers. Sometimes they hang around the older children and most of the time they nag people to lift them on the swings. Babies spend all day crying, giggling, eating and sleeping but otherwise they tend to be quite quiet (sensible aren't they). The dens usually are in trees but nowadays they are a mixture of things. Here are some of the places some are made in: the brickworks, the quarries, the streams, the hills and any holes we can find. At the caving club there are about three bikes so we sometimes go bike-riding but most of the time we just muck about in our dens. We now have a den file with things like this in it, for instance we have Who's in the Den, The Rules, A Map of All the Dens, What You Have to Do to Join and Who You Are. Sometimes we have a meeting, it is usually in our main base. Usually when we have made a base as soon as they know the grown-ups pull it down but sometimes we are lucky and they just raid them instead. Yes adults (with some exceptions) are marauding bandits.

And Finally...

At the party at the end of Clwb50 week, **Bethan Moore**, **Hannah Lister** and **Caitrín Richardson** took to the stage and recited a poem they had written to commemorate the 50th birthdays of both SWCC and Jopo. So here it is...

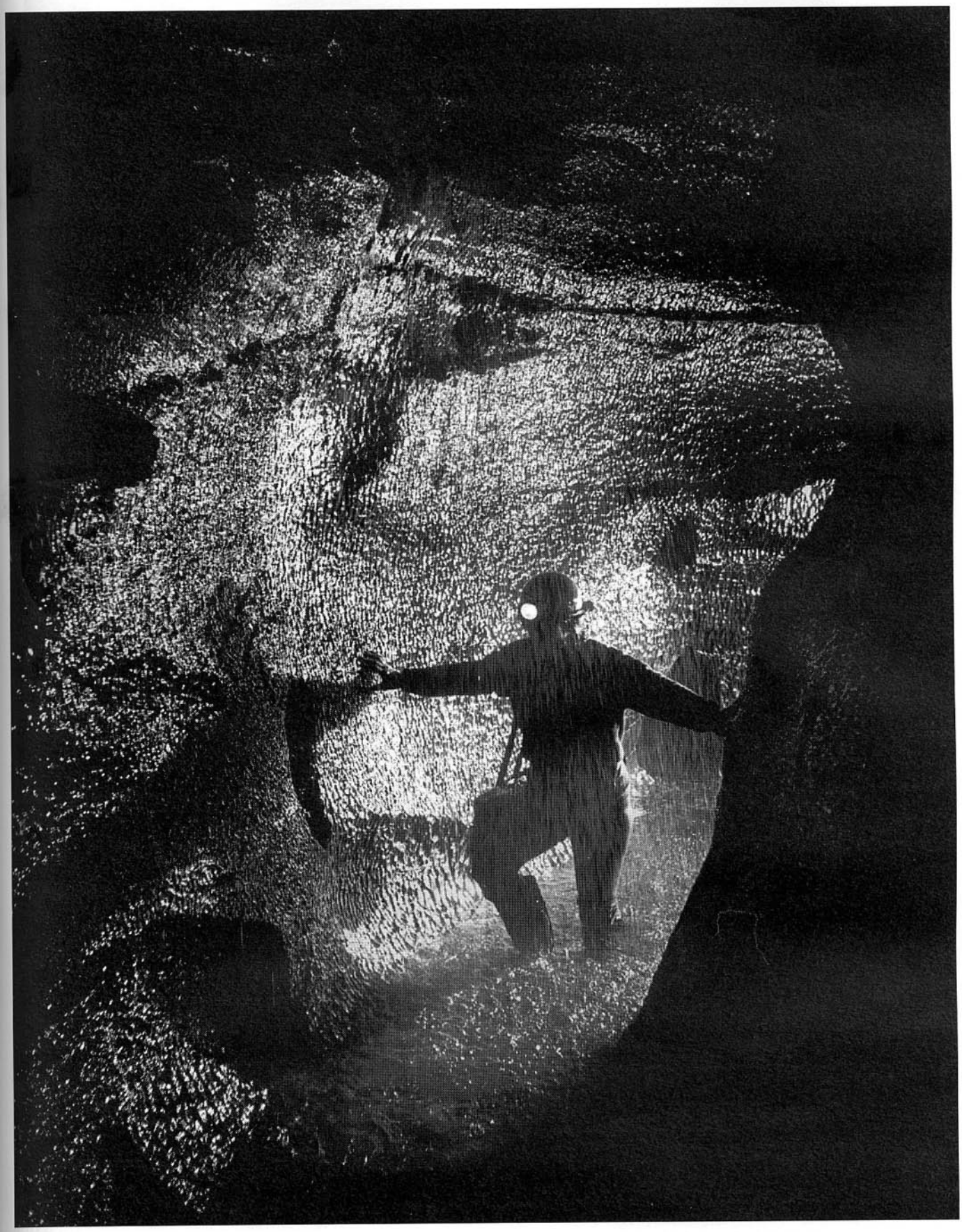
So it's "Happy Birthday" caving club
And "Happy Birthday" Jop
We're very pleased that either
Have never been forgot.

Thanks to the Soup Dragons
We have always been well fed
And when the supper's finished
We are glad to go to bed.

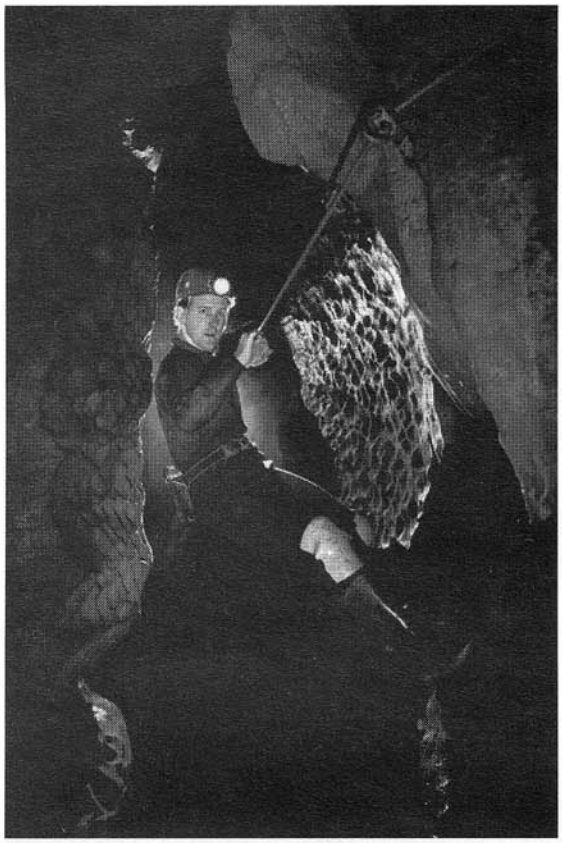
Going up the hills
And going down the caves
Beats sitting around moping
And being a totoal laze.

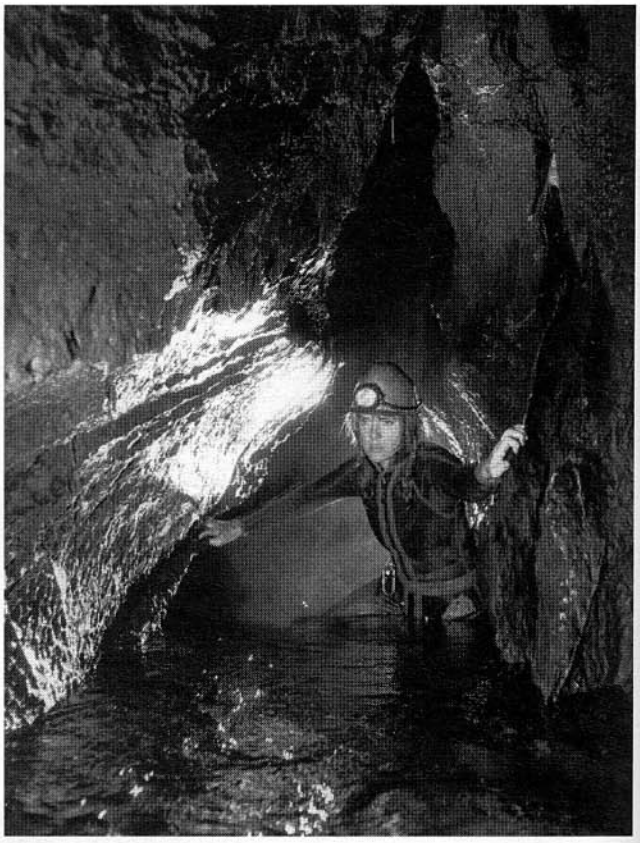
The thrills and spills of caving
Have always been such fun
Let's hope the rest of this evening
Is a very happy one.

Photographs by Chris Howes FRPS



Judith Calford in the Ogof Ffynnon Ddu streamway





Top left: Steve Kings on the Airy Fairy, Ogof Ffynnon Ddu I
Top right: Jane Mitchell in Llygad Llwchwr
Bottom: Judith Calford at the Candlewax formations, Dan-yr-Ogof

Speleothem Dates from the Upper Tawe Valley

by N S J Christopher, P L Smart, J N Andrews and J Gunn

INTRODUCTION

During the years 1982 to the spring of 1984 an opportunity existed for the authors to obtain samples of speleothem from the caves of the upper Tawe Valley and to date them by the Th230 / U234 method (Gascoyne 1977 & 1978). The objective of this work was to date the minimum age of the caves and to obtain any ancillary information about the extensive clastic deposits and ancillary breakdown found in the caves.

The principle caves in the area are Dan-yr-Ogof (37 km), Ogof Ffynnon Ddu (50 km), Pwll Dwfn, Pant Mawr (15 km) and Tunnel Cave. Additional minor caves include Ogof yr Esgryn, Powell's Cave and Hospital Cave. All these caves exhibit different features. The cave that exhibits the greatest stratigraphic and topographic range is Ogof Ffynnon Ddu, followed by Dan-yr-Ogof. Additionally, Ogof yr Esgryn occupies a high-level position on the west side of the valley. Therefore these three caves were the principal objectives for this study.

The collection of samples and their subsequent analysis was undertaken by the authors, assisted by various SWCC members who are acknowledged below. Special permission was necessary for collection in Ogof Ffynnon Ddu II as this is a SSSI. Sample preparation, including photography and sectioning were carried out at Manchester Metropolitan University with the assistance of JG. After separation of the isotopes by NSJC, the radiometric counting and calculation of age was performed at Bath University, School of Chemistry by JNA. Additional to the speleothem collection stratigraphic recording and interpretation were carried out at the time of sampling.

The British Pleistocene

The geological period in which we live is known as the Holocene or Flandrian Stage. Prior to this is the period known as the Pleistocene which consists of a period of fluctuating climatic conditions varying from similar to or warmer than present, to intense cold conditions. It is known that the whole of Wales and mainland Britain was extensively covered by ice at least twice. These are known locally as the Devensian and the Pencoed or Paviland glaciations and also referred to as Old Drift. The Devensian is the most recent glaciation finishing only some 10,000 years ago (10Ka ,1Ka = 1000 yrs). Within the Devensian the main ice advance was between about 17Ka and 26Ka. After 17Ka to the end of the Devensian at 10 Ka there were minor ice readvances. During the most intense period of the Devensian, the present study area was extensively glaciated. This is similar to the North Yorkshire caving area, but unlike the Mendips and Derbyshire which were outside the area covered by ice. These areas would be subject to intense periglacial conditions and have a climate similar to the Siberian tundra of today. The Devensian Stage lasted back to about 115Ka, the exact start being a matter of debate. Between the onset of ice accumulation and the beginning of the Devensian, were a fluctuating series of warm periods (interstadials) and cold arid periods. During the Ipswichian Stage, between 117 and 135 Ka, the climate of Britain was 1 - 3 degrees Celsius warmer than present and sea levels were consequently higher.

Prior to the Ipswichian back to the Pliocene, the next older geological period, is a period of approximately 2.3 million years and it consisted of a sequence of approximately 22 cold and warm periods. Of the cold periods at least two and probably three were glaciations. The more recent of these is generally referred to as the Anglian Glaciation. It is not known if the deposits, locally attributed to the Pencoed or Paviland glaciation, are a relic of the Anglian or the earlier Kenn glaciation. They were previously assigned to the Wolstonian Stage, the period immediately before the Ipswichian. Recent research has thrown considerable doubt on the existence of a glaciation in the Wolstonian. The Paviland or Old Drift deposits must therefore represent one of the earlier glaciations. Additionally, there is evidence of another glaciation in SW Dyfed (Bowen, 1989). Therefore the caves of the Tawe Valley have been subjected to a wide variety of climatic conditions in the last 2.5 million years. A pictorial representation of the Pleistocene is given in figure 1.

Various techniques are used to date the Pleistocene. Some are relative, e.g. tree ring patterns and paleomagnetic studies. Some represent climatic patterns e.g. fauna or beetle assemblages and the variation in stable oxygen isotopes in carbonate marine sediments. Finally there are the radiometric methods based on C14 or U/Th. C14 is only useful back to about 50 Ka. U/Th is capable of dating carbonate deposits back to 350,000 yrs BP. This leaves a period in the early to middle Pleistocene where other techniques e.g. ESR become useful. Additionally, there are comparisons with the O16/O18 curves which can be relatively dated by assuming uniform sedimentation rates.

FIGURE 1 A REPRESENTATION OF THE BRITISH PLEISTOCENE

(Modified after Anderson 1993, with data from Shackelton & Opdyke 1978)

Stage	*Age on Ka*	*Climate*
Flandrian	present	temperate
Devensian *with interstadiald including* *Upton Warren* *Chelford*	10 - 115 c 40 80 - 85	cold, glacial at end of stage
Ipswichian	115 - 134	temperate
Wolstonian		cold
Hoxnian	280 - 330	temperate
Anglian	390 - 420	periglacial and glacial
Cromerian		temperate
Beestonian		periglacial and glacial
Pastonian	c 600	temperate
	hiatus	
Bavantian	c 1600	cold
Antian		temperate
Thurnian		cold
Ludharmian	2050	temperate
	hiatus	
pre Ludharmian		temperate
Piocene	2300 -	warm temperate

Caution must be exercised with the use of the speleothem record because lack of speleothem growth does not necessarily equate with glacial conditions. There are a number of alternative explanations: a lack of percolating ground water of the appropriate chemistry for stalagmite growth or arid conditions with a lack of water and low soil temperature and consequent low bacterial activity reducing soil air CO2.This will limit the carbonate content of the water to the point where speleothems stop growing. In glacial conditions, surface water will be frozen also preventing speleothem growth. Additionally, if a cave is capped by impervious strata; and no water percolates downwards, no stal will grow; but a fully mature cave can develop. Therefore, speleothem dates give only a minimum age for cave formation. Finally, growth cannot commence until the drainage of a phreatic passage or the conclusion of active vadose entrenchment. Despite all these limitations, useful results have been obtained, which correlate well with other indicators (Baker et al, 1993) and are throwing fresh light upon the British Pleistocene chronology.

Results

A total of 60 samples were collected from sites of stratigraphic and chronological significance. Despite careful selection subsequent examination of the samples revealed that approximately 50% were too heavily contaminated with detritus for reliable dating. This is principally due to the poor lighting conditions in caves. It was possible to date 29 of the remaining samples, using a method similar to that described by Gascoyne (1977, 1982). Subsequent investigation of the data set has suggest that only 16 of the dates are fully reliable (Gordon et al, 1988) The principle problems are low chemical yields of either uranium or thorium (<10%) or detrital contamination (Th230/Th232 ratio <20:1). However, in this paper, the full data set will be discussed.

The distribution of dates is plotted against time and compared with oxygen isotope and speleothem stages in figure 2. A composite stratigraphic column, relating the dates to the clastic deposits and erosion phases identified in the caves, is presented in figure 3.

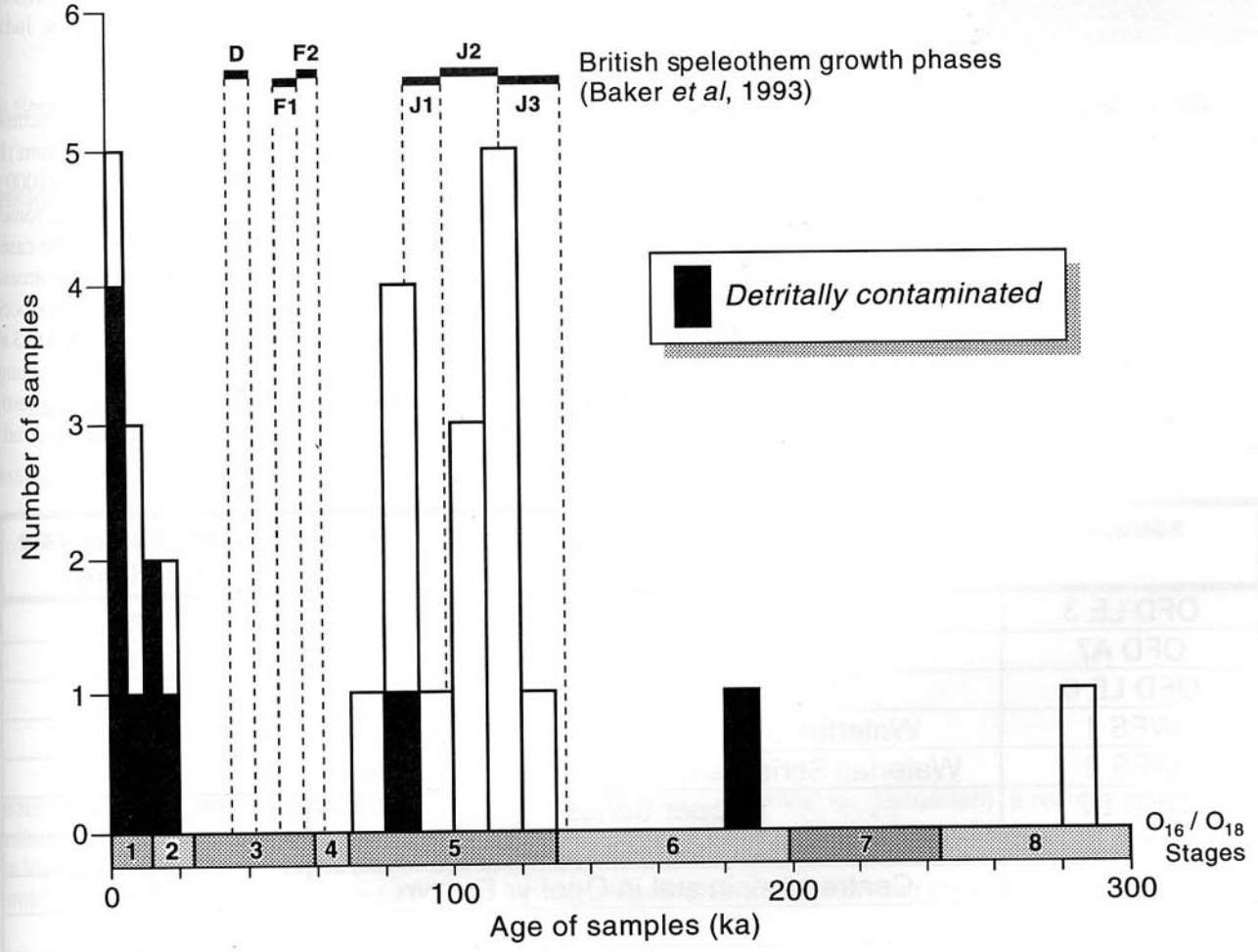
Discussion

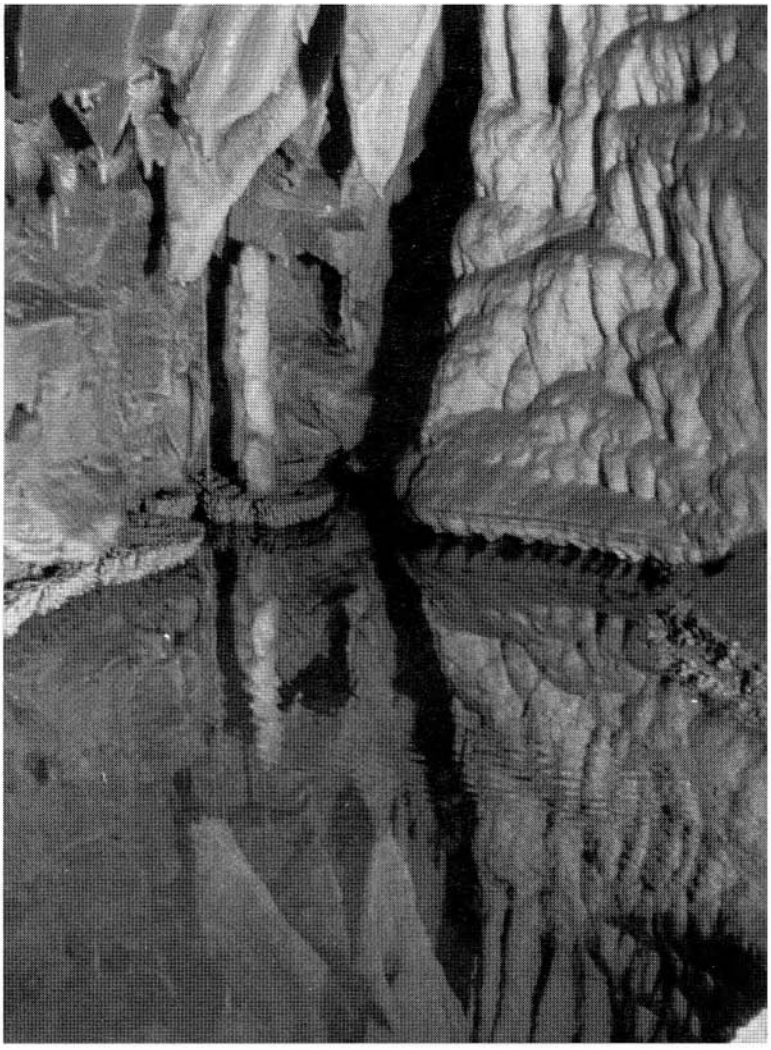
These dates are the first published for this caving area. Examination of figure 2 shows that the majority of the dates obtained were Ipswichian or younger. There are only two dates older than the Ipswichian. These are OFD A3 (uncorrected basal age 180 Ka, corrected age 88 Ka) and OFD TE 7 (uncorrected age of 282 Ka) The significance of the former is in doubt as the thorium yield was only 6% and the Th230/Th232 ratio of 3 indicates substancial detrital contamination. The uncorrected age of OFD A3 would correlate well with a date from Robin Hood Cave, Creswell, Derbyshire (Coles et al, 1985) and the Marsworth Interstadial (Green et al, 1984). It also correlates well with the "Pre Ipswichian phase" of British speleothem growth (Gordon at al. 1989). However, in view of its heavy contamination, which would make it older than its true age, its corrected age is probably more correct and would fit with the group of redeposited stal dates from OFD 1, suggesting a late Ipswichian Stage 5a age. The date for OFD TE 7 was obtained from a relic flowstone cap, covering a long since removed fluvial deposit. It is analytically sound, having good yields and high thorium ratio. This date indicates deposition in Hoxnian times. Therefore the Top Entrance series of OFD II was in its present form at least before the Hoxnian period. The clastic deposit which it formerly capped is presumably of Anglian or possibly earlier age. This illustrates the complexity and severity of erosion to which the cave has been subjected.

Another significant feature of figure 2 is the clear break in deposition between 76Ka and 13Ka a substantial period of the Devensian. What is particularly surprising is the absence of dates associated with the warmer phases if the Devensian at 35 - 42 Ka and 55 - 60 Ka which have been identified in similar Mendip and Derbyshire studies. (Atkinson et al 1978, Ford et al 1983 and Baker et al,1993) for the whole of Britain and NW Europe. This may be an artifact of the sampling and the small number of dated samples or may be a true reflection of the particular climatic conditions of this area of South Wales. The sole exception is a solitary sample from Dan-yr-Ogof dated at 76.3 Ka, which may represent deposition in the Upton Warren Interstadial period. If this hiatus in deposition is confirmed by later studies it indicates particularly arid and dry conditions in upland Wales during the middle and early Devensian. Additionally, the sharp reappearance of stalagmite growth at 13 Ka suggests that deglaciation occurred rapidly in this part of Britain.

Figure 3 is an attempt to synthesize the results into a single diagram and relate them to the fluvial deposits. It includes the dates from all the principle sites sampled. The most complete sequence is constructed for Ogof Ffynnon Ddu which contains extensive fills.

The most significant feature of figure 3 is that the fill in Ogof Ffynnon Ddu is of dominantly Devensian age and of two distinct periods. The coarse Brown fill is well characterised in a number of locations, e.g. the areas of the Bedding Chambers and Upper Arete Chamber of OFDII, and OFD I Entrance Series contains stalagmite of Ipswichian age and therefore must relate to the late Devensian glaciation. This Brown coarse clastic deposit contains





The Candle in Ogof Ffynnon Ddu I, circa 1965, before it was vandalised. Photo by Noel Christopher.

early Devensian stal, and therefore indicates a high-energy deposition environment; presumably glacial out-wash in the late Devensian. The Red Mud, of Dan-yr-Ogof Upper Series and Waterfall Series in OFD I, is both different in character, being a fine grained mud indicating a low energy environment of deposition. The Red Mud is present in two caves on opposite sides of the valley at approximately similar altitudes. It is reliably dated to early Devensian times in both caves, suggesting an extensive area of ponding covering the Upper Tawe valley. It indicates a clear change in conditions after the 97 Ka age of the sample DYO B6, whose analytical results are excellent and may represent a relic of the, postulated, early Devensian glaciation.

The caves as we know them existed in Ipswichian times apart from some breakdown, clastic fill and speleothem growth; but as we have seen suffered extensive erosion and redeposition in late Devensian times. As for the undoubted complex history of the cave before the Ipswichian only one glimpse has been revealed by the sample TE 7 from the walls of Sand Passage close to the Chasm in Top Entrance Series of OFD II. This date of 267 Ka (corrected) or 282 Ka (uncorrected) is firmly within the Hoxnian period and capped a clastic deposit of presumably Anglian or earlier age. Top entrance series is therefore much older than this. How much older can only be estimated. Christopher and Smart (1990) have argued by analogy with vadose entrenchment rates established for Yorkshire (0.5 - 2 mm/year) that it would take of the order of 780,000 yrs to develop the Traverses and OFD III Streamway . This suggests a minimum age of approximately 1million years for the Vadose entrenchment and an unknown, but probably equal, time period for the preceding phreatic phase.

Vadose Entrenchment Rates

A number of samples were taken from the sides or floors of passages that hang above vadose trenches. These can be used to establish a range of entrenchment rates for comparison with rates established for other areas (Table 1, below). Elevation data has been taken from published surveys of the caves. (Railton 1953, Coase & Judson 1977).

Gascoyne and Ford (1983) have reported entrenchment rates of 5 - 20 cm/1000 yrs and Smart (Pers. Comm.) has measured a higher rate of approximately 30 cm/1000 yrs in Sarawak for a very active tropical system. Therefore, some of these rates are much higher than the accepted range. In the case of the DYO B7 samples there are at least two underlying areas of phreatic development , during which deposition could not occur, which would explain this high value. The samples OFD LE 3 and A7 are clearly discordant suggesting that this stal is much younger than the passage. The rate for sample LE 6 is also high suggesting that abandonment of this route by the mainstream has occurred in recent post-glacial times.

sample	location	entrenchment rate cm/1000y
OFD LE 3	Floor of Rocky Nook Chamber	109
OFD A7	Stal on Floor of Dugout	176
OFD LE 6	Wall of Traverse Passage	37.9
WFS 1	Waterfall Series, wall of Much Binding	25.2
WFS 2	Waterfall Series wall of passage in Dry Way	20.3
DYO B7	Upper Series	44.1
DYO 6	Fallen block in Red Chamber	24.5
BC 1	Centre of main stal in Ogof yr Esgryn	36.8

FIGURE 3: COMPOSITE GEOMORPHOLOGICAL COLUMN BASED ON SPELEOTHEM DATES FROM CAVES OF THE UPPER TAWE VALLEY

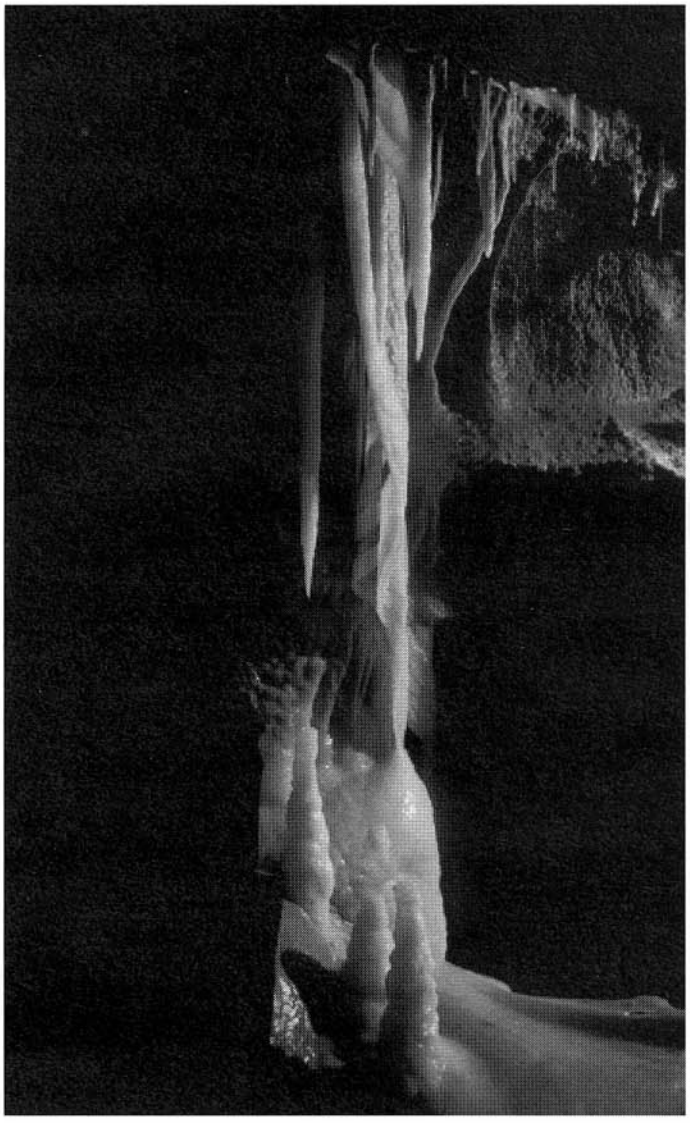
OGOF FFYNNON DDU

SITE	SAMPLE AND STAGE	AGE (Ka.) (uncorrected)
Crome Passage	TE 8	5.7
Arette Chamber	TE 15 Base	9.7
Powells Cave, Wall	PWC Ia	6.6
Traverse Pass OFD I	LE 6*	9.95 ?
	.....	
Crawl	OFD A8	14.0
Rocky Nooks Ch. (Floor)	LE 3*	14.8 ?
	.....	
	Brown Fill (F4)	
Chasm Passage	includes: TE 17	(92.0)
Ent. Pass. OFD I	OFD A3 *(base)	(180)?
Wall by Fault. OFD I	OFD A4	(108)
Bedding Chambers	TE 12 (mid)	(127)
	.....	
	V4	
	.....	
BCNE	TE 3A* (Base)	88.0 ?
Waterfall Series.	WFS 1	81.5
Arette Ch.	TE 16* (Base)	84.0 ?
	.....	
	MAROON FILL (F3)	
	.....	
	V3	
	.....	
Waterfall Series	WFS 2	106
Sand Passage	TE 6* (top)	117 ?
Chasm	TE 10*	120 ?
	.....	
	F2	
	.....	
	V2	
	.....	
Sand Passage	TE 7	282
	.....	
	V1 (incision of roof Tube at TE 7)	
	.....	
	P1	
	Phreatic development of roof tube at site of TE 7	

DAN YR OGOF

SITE AND SAMPLE	AGE
B9* Sand Chamber(Base)	3.4
B8* Boulder Chamber	4.7
B1* Wigmore Hall	11.1
.....	
.....	
V	
.....	
B 7 Upper Series DYO I	76.3
.....	
RED MUD	
.....	
V	
.....	
B6 Upper Series DYO I	97
A6 Red Chamber	105
.....	
Ogof yr Esgryn (Centre of stall boss)	117
.....	
F	

KEY: Results marked "*" and ? doubtful due to thorium contamination(see text for discussion). 5 results not used in this synthesis. Dates in Parenthesis are from samples not in their original position of deposition.
V = Vadose Phase, P = Phreatic stage, F = Identidied fill
Numbers after stage names refere to Oxygen Isotope stages after Shackleton and Opdyke 1976



The Tiger Stripes, Tiger Aven, Ogof Ffynnon Ddu I, circa 1965 (shortly after discovery). Photo by Noel Christopher

The two Waterfall Series samples are in the correct range and suggest that the vadose incision of Upper Stream Passage in OFD I has taken place since approximately Ipswichian times. A similar rate is established for DYO 6 which gives a similar age for the show cave and present river cave of Dan-yr-Ogof. However the exact province of this sample is not known, the altitude is taken to be that of a likely ledge, but it does establish a likely minimum age for that part of the system.

The high rate for the sample BC 1 from Ogof yr Esgryn is calculated to the river entrance of Dan-yr-Ogof, it would be even higher for the valley floor. We therefore must ask why the sample is not even older (it was taken from the core of the boss, but not its base) and does suggest, if it is contemporaneous with the abandonment of this resurgence point, that the glacial downcutting of the Tawe valley was considerable.

Old Stalagmite Deposits

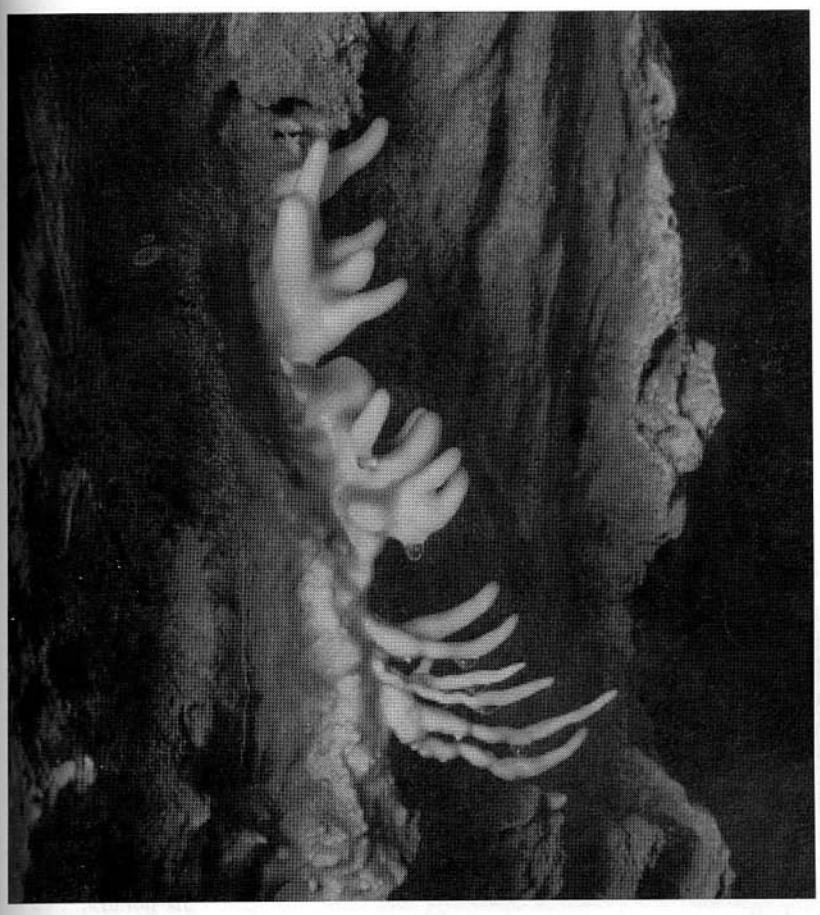
The authors have been disappointed by the almost complete absence of pre-Ipswichian stal material in the cave, the sample TE 7 being the oldest found. Some comment is necessary. There are two immediate explanations. Firstly, the cave may have been capped for much of its early history by the overlying Namurian grits, which were impervious to percolation water necessary for stal formation. The removal or disruption of these in Mid-Pleistocene times allowed deposition to proceed. Secondly, the stal exists but has not been identified, being in as yet unsampled or buried under later Devensian fill. This is likely - the most promising locations being the upper series of OFD III and the highest development levels of DYO. These are both remote and physically demanding areas to reach.

The existence of a thick layer of siliceous marl (Rottenstone) only a few metres above the Top Entrance lends weight to the former explanation. However, it is difficult to reconcile this explanation with the concept of cave development by exposure to a prolonged period of subariel weathering as favoured by O'Reilly (1977) and Eldridge (1984) or the proposed Tertiary age of the, locally, well developed Interstratal Karst and related solution collapse features, such as Pwll Byfre (Crowther 1990). This latter evidence suggests that the surrounding landscape has been subjected to prolonged and extensive weathering. Therefore, remnants of the stalagmite may exist and remains unsampled, its scarcity is due to it having been extensively removed by subsequent periodic erosion; the violence of which can be seen in the remaining recent deposits.

These results and the interpretation are clearly preliminary, posing as many questions as answers and much further work will be necessary on the stalagmite deposits in the caves and the clastic fill before the full erosional history of the Tawe Valley and surrounding area is understood.

Acknowledgements

The authors wish to acknowledge the cooperation of the management of Dan-yr-Ogof Caves, particularly Mr. Ashford Price, in allowing free access to their caves. To the Nature Conservancy Council and The OFD Cave Management Committee for permission to sample in OFD II , The committee of SWCC and Mr. J Barrows for permission to sample in OFD I. Finally to the late Mr. W (Bill) Little for his encouragement and Mr. S A Moore in his capacity as Cave Warden for accompanying the authors on sampling trips in OFD II. Finally all other cavers who have contributed by accompanying the authors or by discussion of the results. One author, NC, wishes to thank Dr Chris Smith for assistance with an earlier draft of this article.



Helictites in Lowe's Passage, Ogof Ffynnon Ddu I

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The Speleotaff

The purpose of this brief description of Welsh cavers is to assist the English, and other cavers to understand and to be more tolerant of them. It has been written in the hope that it will stimulate someone to carry out similar research on the Anglospeleophile. John Winterson Richards defines xenophobia as an irrational fear of foreigners, probably justified, always understandable*.

The Welsh, being a primitive people, are still very tribal and hence have fewer surnames than do the English. To compensate for this they give each other nicknames. These are often very descriptive of the lifestyle of the person concerned. Some classic examples include the twins, Dai Dip and Dai Strike. Dip was very fond of the women and said to be on on a downward slope whilst Strike was more level-headed and a leading light in the trade union movement. Sam Sump was a heavy drinker, often seen full to the roof on a Saturday night. Blodwen Dead End; terminal piles are her problem and she is often heard screeching from her harness on some of the larger Yorkshire pitches. Recently she has learned a few words of an operatic aria and has been able to disguise her agony as singing. Willi Anticline lives with his father's sister in the village of Clyne near Neath. Ianto Phreatic has down-on-their-luck cavers sleeping in his attic and so it goes on, the list is almost endless.

This tribal ancestry leads them to fight amongst themselves, so feuding and vendetta are second nature. This is their greatest weakness and will eventually lead to their demise. However give them a common enemy and they get on like an house on fire, usually a holiday home.

This fight-for-anything attribute has given them a tendency to overreact to almost everything. In fact they are the only race to overreact to overreacting. This gave Enrico Evans, the famous Welsh physicist,the idea of the runaway reaction which led him to design a Taffy bomb, which was later copied as the atom bomb.

The most difficult thing to cope with is their tendency to take the piss out of everything. This is done as away of relieving stress or as mind clearing prior to serious problem solving. It is rumoured that *The Goon Show* was modelled on a strategy meeting of the Free Wales Army.

The Welsh are inclined to be visionaries but they do tend to get some odd ideas and to then get involved in some strange projects. Who else would dream of setting up a colony in Patagonia of all places? They do however do better abroad than at home, where financial success implies that you have cheated. Two successful Welsh exiles were Owen Tudor who fathered the best kings and queens to sit on the English throne, and Sir Henry Morgan, who rose from running a thriving sea-going smash and carry business to become Deputy Governor of Jamaica

The Welsh cavers are usually born of Welsh parents in Wales. Despite this promising start they were soon found to have a singing voice that would shame a castrated frog and were seen to enjoy a glass of wine even when unlimited beer was available. What was even worse was that in the field of religion the most that they could achieve was a place as a just tolerable mediocre loose head prop forward. They were therefore encouraged to emigrate to England.

Those who could not face this prospect either became cavers or joined the disciples of the many missionaries touring Wales in the hope of bring civilisation to the rampaging masses in the valleys. Two equally hopeless endeavours.

Those who joined the South Wales Caving Club were surprised to learn that caving in Wales was started by English caving clubs and that the Welsh cavers did not exist prior to the invasion of the wealthier English. They also found that the English had a greater love of animals than they did. That is, with the exception of sheep, but the less said about that the better.

It took them a time to realise that when the English referred to their Internationalism they were pining for the return of the Empire and not the Five Nations rugby.

Some say that there is a love/hate relationship between the English and Welsh cavers. How naive can you be? There is no love. There is no hate either, as how could a nation whose people regard being crowned at an Eisteddfod as the pinnacle of achievment hate a people who crown each other, on a regular basis, at football matches.

The final difference to note is that the Welsh wear their hearts on their sleeves and have a tendency to over-communicate. This puzzles the English who are taken aback when meeting a Welsh caver for the first time to hear his or her life story and to be questioned about their own personal lives. The initial reaction is to clamp up. This grieves the Speleotaff who then goes off in a huff to join the Welsh Nationalists. May God help them. The Welsh Nationalists that is.

Annie Nonimous.

*John Winterson Richards, *The Xenophobe's Guide to the Welsh*, Ravette Publishing. Available at all international airports, except Cardiff.

The Boa Constrictor

by Pete Francis

I'm not sure if it was the earthquake, the fire or the tarantula that happened first. Things are a bit hazy after all these years. But it was definitely after the helicopter ride, the boa constrictor and the flood pulse. And, of course, the TV cameras and that Prince of Wales thing were way before that.

Come to think of it, it was the fire first, then the tarantula, then the earthquake. But as I was the only one to wake up for that I can't verify it all that well. Indeed, as the others slept soundly through it all, only the international reports of it being six or seven on the Richter scale, and those four vulcanologists being killed when the volcano blew its top off, could give me any proof that I'd lived - well, dozed in fact - through it all. It had been a bit of a damp squib really. A lot of concrete ceilings wobbling like jelly and then back to sleep again. After all it had been a bad day. First the fire; well, no, first the flood pulse. The fire seemed rather subdued after that. But the fire had destroyed my climbing etriers! We'd only put the candle next to the Suunto compasses to dry them out. The humidity in the caves was so great that after half an hour's surveying you couldn't see a thing. The cardboard box they were on seemed sturdy enough and in that Amazonian dampness you'd never have guessed it would have ignited. Still, only a quarter of the room had caught fire. I was more upset about the tarantula really.

Perhaps we shouldn't have gone down the road to the pub - well, mud track to the bamboo hut really - and had a drop of jungle juice. But most of the expedition stuff was still intact and you could definitely see through the Suuntos once you'd wiped the soot away. After all that the tarantula should have known better and just loped off somewhere to hide. When we'd extinguished everything I was adamant that we leave it alone so that I could photograph it in the morning. I'd missed an excellent opportunity for that when I'd had the twelve-foot boa round my neck. But the others, with evil in their eyes, made short work of it with their machetes. It looked a mere cuddly toddler compared to the monster that had jumped for me as a last refuge when the flood pulse hit. Lucky the dozen or so bikini-clad girls were out of the way by then.

Thinking back on it, it seemed unreal that only two weeks before we'd faced the national TV and press in Quito, the capital of Ecuador. It all seemed another country, with me being introduced as Prince Charles's personal caving companion: well I am Welsh and he is the Prince of Wales. Presley Norton, our sponsor there, never missed an opportunity to interest other sponsors and so lighten his load, and before the night was out the expedition was fully financed. To be fair, from the blurb he'd put out you couldn't help but be impressed as we appeared a formidable half dozen. Between us we'd done everything there was to be done in the world of caving. We did our bit by drinking an American haulage contractor under the table and taking him up on his promise of two four-wheel-drive trucks before the hangover wore off. That turned out not to be such a good deal as it sounded at first, as by the end of the expedition we'd written them both off. What do you expect when you find inner tubes repaired with cotton stitching closing up the tear?

Anyway, perhaps it was good that the Suunto compasses had misted up, even if that had inadvertantly led to the fire. If they hadn't, then we wouldn't have come across the bikini-clad girls near the waterfall, half a kilometre into the cave. Despite their male protector having a powerful paraffin lantern they were having difficulty in seeing where to place their bare feet. True, we felt rather overdressed in our full caving regalia but they'd eagerly accepted our helping hands as we gallantly escorted them out. It was annoying the way some of them kept stopping to wait for us to catch up but we'd reached the entrance with five minutes to spare. We'd even waved them goodbye before the metre-high flood wave surged out of the cave. That was when the big spider had jumped! The water had filled the four-metre deep swimming pool outside the cave with silt and we'd had to waste a full day hosing it away before it was fully operational again and we could carry on with our cave surveying. The three lads who'd followed us the five hundred miles from Quito and were now camping on the edge of the jungle seemed unfazed by it all. Deep in their hearts they knew we were on to something big that mere fires and earthquakes could not stop. The whole population of the country knew that we were really after the lost Inca gold that the Spanish Conquistadors had failed to find. The TV send-up had only helped to confirm that. What man in his right mind would travel from the other side of the world to merely explore caves if no gold was involved? Perhaps that was why the helicopter pilot had agreed so readily to give us a lift. We'd come across him by chance, just parked on a muddy clearing to the side of the corrugated earth road we were driving along. A quick chat in sign language and the best hitch I'd ever had started. He seemed bored and happily flew us over the jungle in any direction we wanted for a few hours. True, it didn't help identify any new cave sites but it was great fun and a chance to see something different from the base of trees and those endless creepers. We later sat in Michel's bamboo palace, chatting about the day's events; he was a farmer there in the Ecuadorian rain forest. I never quite understood what it was he farmed in the jungle. But it seemed better than what he'd left behind in Europe: one season in Butlin's at Pwllheli and he'd taken to the rain forest for good, vowing never to return. His spider monkey carefully ate the mites she miraculously found in my hair - life was good (and I still had hair).

In the end the six of us only found about ten kilometres of cave but I think the pleasant things outweighed the unpleasant ones. That is, if you don't count the boa constrictor, the vampire bats and the whip scorpions, but perhaps you should ask Pete Cardy about them, as really they're another story.

The 1980 Ecuador Expedition consisted of Pete Cardy, Don Grubb, Simon Amatt, Phil Rust, Mike Coomley and Pete Francis. It was funded completely in Ecuador by subscriptions raised by Presley Norton.It helped explore, map and remove archaeological remains from caves, to help identify sites of early human occupation in areas ranging from the Pacific coast to the headwaters of the Amazon. The earliest artefacts dated back to 3500 BC. John Hoopes, an American archaeologist, accompanied the expedition. All remains found and a full expedition report including cave surveys were deposited with the Anthropological Institute of Ecuador before the expedition returned home.

Pete Cardy turned grey after the expedition. Don Grubb quickly went to Africa and married an African princess.Simon Amatt never stopped talking about Africa during and after the expedition and Phil Rust changed his name to Don after being repatriated home - eventually. We never saw Mike Coomley again and Pete Francis took sixteen years to get even this much about the expedition down on paper. The "Day of the Drunk" has been, however, left completely unmentioned and shall never be alluded to again. Nor will our infiltrating the National Oil Refinery and the subsequent court-martial of several officers of the Ecuadorian Special Forces who were guarding it, and waved at us rather than shot at us as they should have done. And, of course, Von Daniken was wrong: there were no spacemen - we think. Still it would make a good excuse for another expedition!

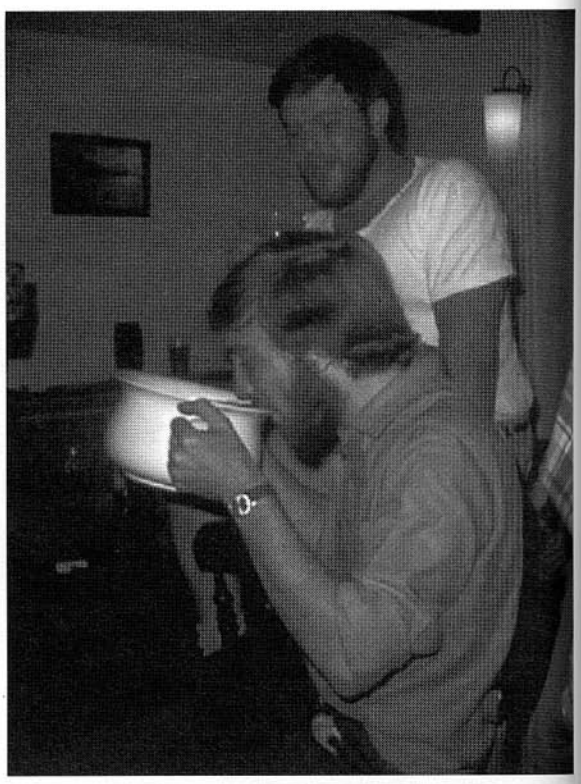
Photographs by Denise Knibbs

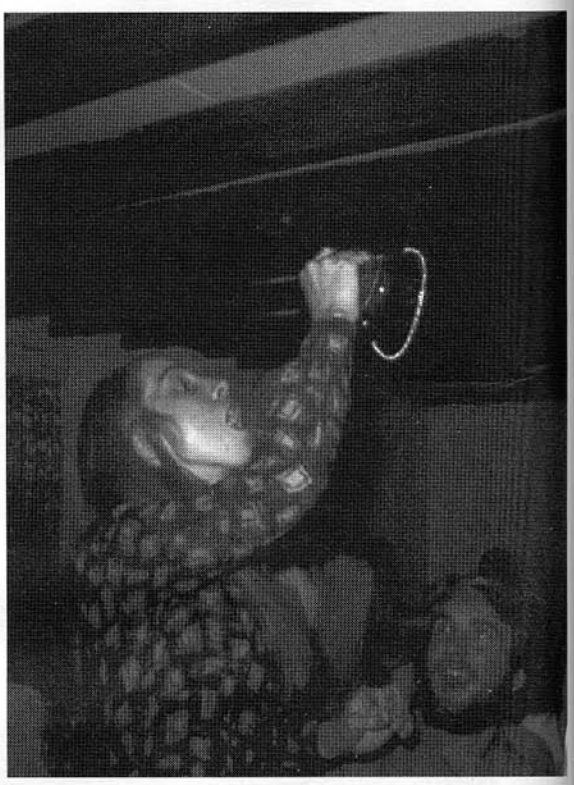
All three pictures this page: digging at Chasms Dig, 1972

Top: the HQ, April 1976.

Middle: outside the cottage, also April 1976. L to R: Peter Harvey, Gwyn Saunders, Roger Smith, Marge Jopling, Les Cardy. The dog thought to belong to the Jopling family.

Bottom: sunbathing, June 1979. L to R: Bill Clarke, Gwyn Saunders, Ian Todd, Daphne Richards, Bill Perkins, Brian Clipstone.





Photographs from Gary Jones's birthday party, September 1971.
Top left - Eric Inson on the guitar with, among others, Ken Maddocks, Jem Rowlands and Neil Jones.
Top right - Gary with pot, Glyn Jones in background
Above left, top - Pete Francis, Denise.
Above left, bottom - Eric on guitar, Jem Rowlands on banjo, Alison Stone, Ken Maddocks, Peter Harvey, John Harvey, Mrs Inson.
Above right - Gary watches as Alison demonstrates her drinking technique.

Obituary: Miss Winnie Williams

by Gary Jones

In the late 1960s Penwyllt village looked as if it might undergo a revival. The caving club had recently bought Powell Street, the post office was still open, many of the houses were still lived in (except Patti Row, where the Galpins had an unofficial *pied à terre*), the railway was in working order and Ty Mawr had recently been bought for renovation. In the village the two characters who impinged most on club life at the time were Mrs. Burton and Miss Williams. Mrs. Burton was the mother of the quarry manager ("don't worry, I won't let him quarry the caves away") and lived next door to the club. Her house is now the unsightly pile of rubble south of the car park. Several of us "younger ones" used to regularly call in to see her and would be given tea and biscuits. I suspect this largesse was because she thought we were the deserving poor (before designer-label outdoor wear we took pride in wearing the most outlandish and scruffy clothes possible). Colin Fairbairn and I, always broke, had a black market arrangement about picking Mrs. Burton's rhubarb, which grew next to the Ty-Bach.

Miss Williams was altogether different, she appeared to me a far more eccentric character. Said to have been born in, and never left, Penwyllt she carried on a lifestyle which seemed totally unchanging. She lived alone in what was arguably the windiest and wildest spot in the whole place, but with the finest view. Unlike Mrs. Burton, who seemed to enjoy the bustle of weekend visitors, Miss Williams mostly preferred her own company. She kept hens, a constant source of eggs in the summer months, and she also kept the club keys.

Friday evenings after school were a frenzy of activity for those of us who lived down the valley. Who would be first up to the club? I lived in Skewen and would often cycle up. Bob Radcliffe lived in Mumbles, even further away, and being older, became motorised first. He had a tiny Honda 50 which produced an appalling high-pitched whine as he struggled to wring every last ounce of power out of it. Often I would be at Pen-y-Cae or even on Penwyllt hill and I would hear this faint buzzing, like a distant angry hornet, as Radcliffe closed and eventually overtook me, leaving me to eat dust in his wake. (20mph, flat out!) My only consolation was that he frequently fell off on the bend at the bottom of the hill (which is why the hedge there still has holes in it). The prize in this race was the opportunity to collect the keys from Miss Williams at Ty Mawr.

This ritual of "collecting the keys" gave one a feeling of responsibility. Miss Williams often left the keys under a bucket or bowl. This was when she did not want a chat. If she wanted a conversation you could spend ages on the summer doorstep while she told you the comings and goings of the village. For me it was a privilege to be treated as an adult and an accepted part of the community of Penwyllt. Often I received an egg or two, "for breakfast", as well as the keys. I have memories too of wild black nights in winter when the solitary street light at Ty Mawr was the only beacon. The wind would whip through the clump of pines, casting long spooky shadows. Finding the keys under a whole procession of rusty old buckets and bowls was like hunt-the-thimble in pitch darkness. On nights like this Miss Williams was reluctant to come to the door but might, if you were lucky, turn on the outside light to help in the hunt for the keys.

Back at the club, the first job was to light the boiler (no central heating) and if it were really cold we'd light the fire in the kitchen (where the fridge and hot water boiler are now). As the cottage thawed and the wind roared sleet past the windows we'd think how rough it was at Penwyllt. Miss Williams, however, spent almost her whole life alone in this hard and demanding place and loved it even more than we did.

A community is made up of the people who live in it. In those optimistic years Miss Williams seemed to me part of the fabric of Penwyllt, and part of the background to growing up. Now she is gone one of the landmarks which we took for granted all those years ago has gone with her and the place is poorer for it. I guess most of us lead softer lives now.

The Formation of Helictites - Answers? Or Questions?

by Dave Edwards

It is said that "the road to hell is paved with good intentions". This article has that sort of history and, were it not for the advent of the 50th Anniversary Publication and the deadline pressures involved, would probably have remained that way for ever.

I remember gazing in wonder at the spectacular profusion of helictites in Pant Mawr on my first visit there many years ago, and querying their origin. No positive explanation was offered and theories were few and far between. I was surprised: this was the early 1970s and I was still somewhat awestruck by the breadth of knowledge contained within the membership of SWCC. One popular theory at that time suggested that air currents caused growth direction changes. Somehow that did not feel right to me and I decided to investigate further - but I didn't.

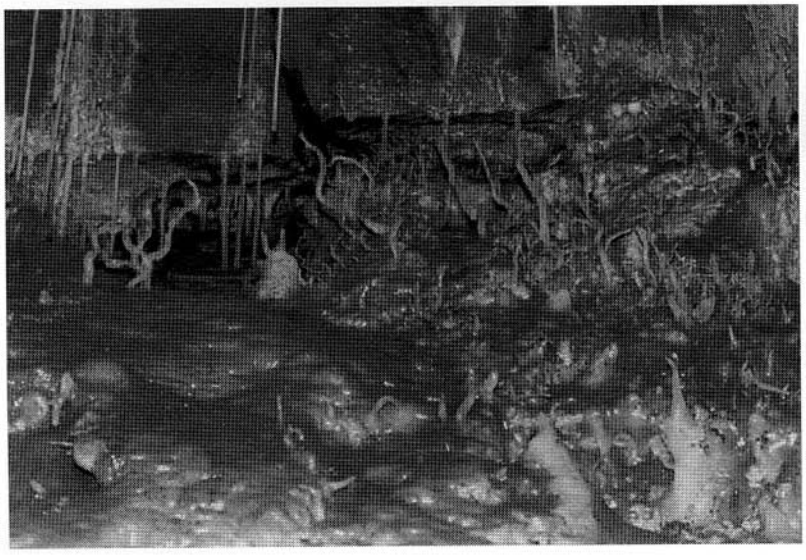
My own pet theory at the time was that microscopic impurities in the crystal growth were causing changes in growth direction and I hoped that the X-ray photograph may show evidence of this. The results were disappointing. The lab, being under commercial and financial pressure, could not spend too long on this unofficial project and supplied only a few photographs and an analysis chart. Their original sketches of the sample showing the shape and the X-ray target points are shown in Figure 1.

As a brief explanation, the four numbers BR4827 to BR4830 refer to what are known as Laue photographs. Figure 2 shows photo number BR4830 (in fact, a scanned picture of a film plate). The black spots are individual groups of atoms and it is their position relative to each other that identifies the crystal structure. Figure 3 shows a simplified representation of the principal behind Laue X-ray photography.

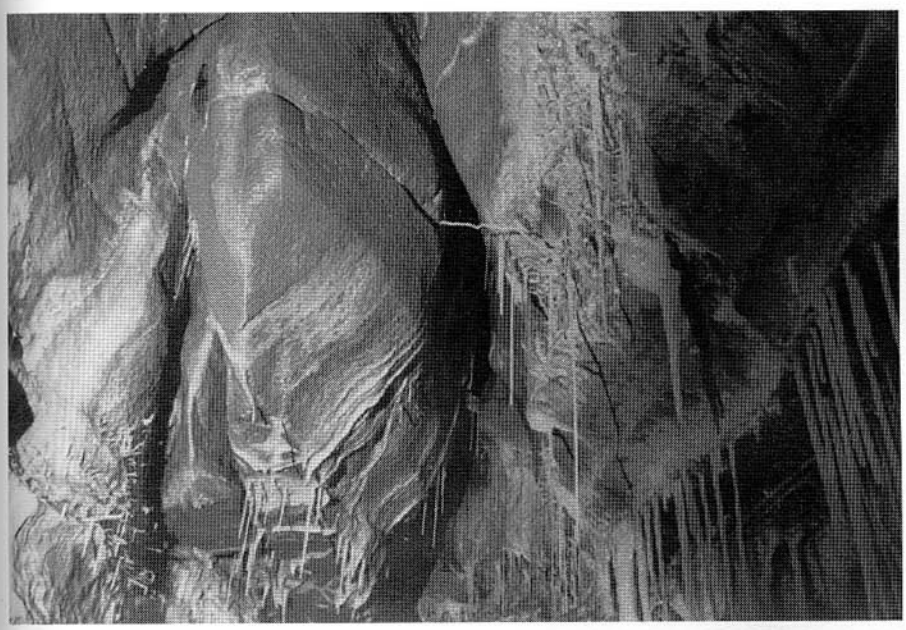
Finally, in Figure 4, I have included the analysis chart which was produced using a technique called X-ray Fluorescence. The other elements which occur besides calcite (i.e. iron, silicon, aluminium, potassium, chlorine, sulphur and titanium) are exactly those which would be expected in material from the earth's crust. Note that the vertical scale is logarithmic and elements other than calcium are in relatively small quantities. The original chart is about 15 inches by 30 inches so the reduction is somewhat extreme!

The world rotated, I changed jobs, the subject was forgotten again.

More years later, during a particularly slow caving trip, I had time to ponder a small but highly eccentric helictite. As the club library was by then turning into a well-organised area, and as my interest was again aroused, I decided to see what I could find. A brief trawl through the library references yielded a veritable goldmine of information from just two sources. The first, *History of Cave Science* by Trevor Shaw contains many historical references and information. The second was a clear plastic wallet labelled "Formations", containing separate articles on various subjects (aragonite, calcite bubbles) and a hand-written article by John Hartwell entitled *Helictites - An Unusual Type of Cave Formation.* Also included, in a brown card cover complete with rusty staples, was an old, faded and rapidly deteriorating photocopy of a National Speleological Society Occasional Paper entitled *The Origin of Helictites* by George W. Moore; Geologist, US Geological Survey, dated Jan 24th 1954. Unfortunately, the article is too long to include verbatim and the photographs are too poor to copy. I have therefore decided to include in this article a brief synopsis of the paper and to include the line diagrams which I have managed to scan. I have included the abstract in full because it was this short statement which, initially at least, seemed to show that the whole subject had



Helictites in Pant Mawr



Pant Mawr: note the helictite in the centre of the picture. Photographs by the author.

been relegated to the status of "been there, ticked it off, got the T-shirt". The abstract reads as follows:

Helictites are elongated cave deposits similar in some regards to stalactites, but differing from stalactites in that they are curved and develop in apparent disregard to gravity. Growth is accomplished by deposition around the orifice of a narrow canal which follows the centre of the helictite. Helictites are composed of an aggregate of crystal units each with a slightly different crystallographic orientation than the next. Wedge-shaped increments of deposition cause rotation of the c-axis of successive crystal units which result in the curvature of helictites. Opposed to this curvature and tending to create deflection in the opposite direction is the crystal habit which favours a greater rate of growth in the direction of the long axes of the crystal units. The physical variables which control the relative importance of these two factors, and therefore the direction of growth, are believed to be the rate and periodicity of flow through the tube.

The paper continues by attributing the term "helictite" to one C.S.Dolley (1886) from the Greek root *helik* - a spiral. (In Shaw's *History of Cave Science*, the term is attributed to Samuel Zenas Ammen, an American writer [1843 - 1929].) Moore then lists a wide variety of processes previously suggested to explain the curious growth pattern. The list includes twenty entries from a variety of authors dating from 1878 to 1952 and includes "Condensation of vapour containing lime"; "Deposition along horizontal

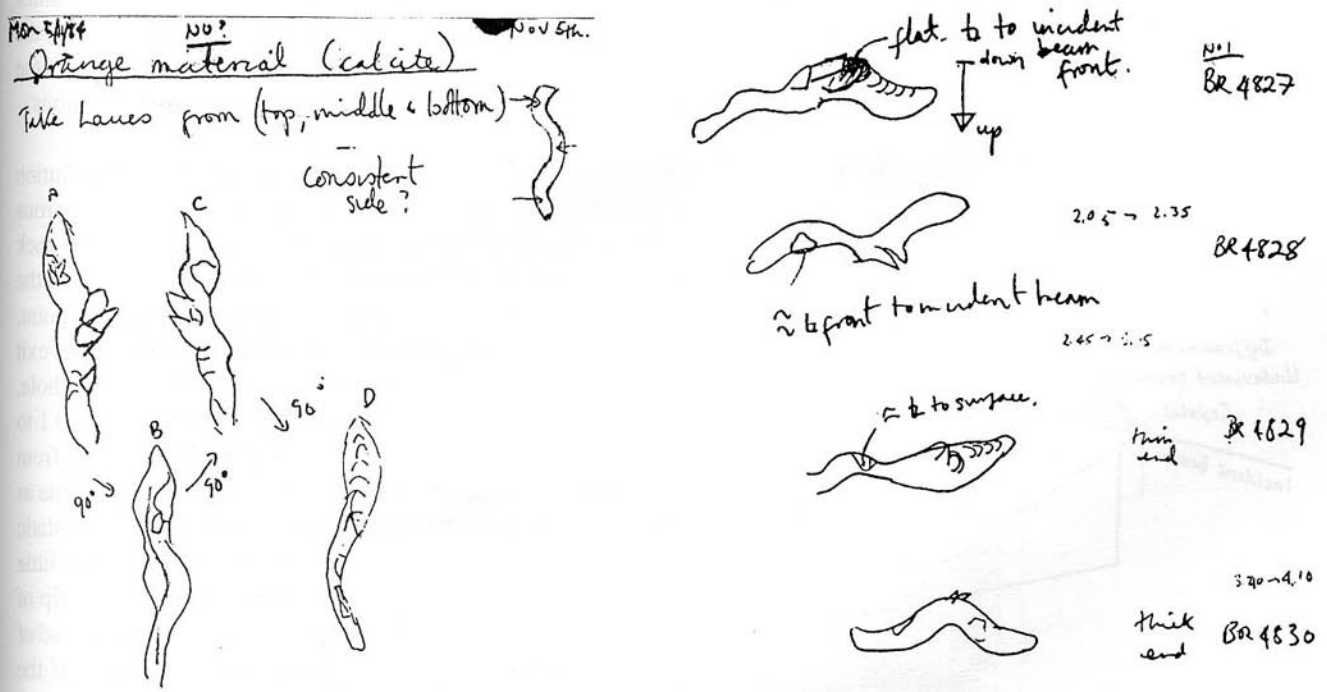


Figure 1: Both sides of laboratory sketch of helictite sample

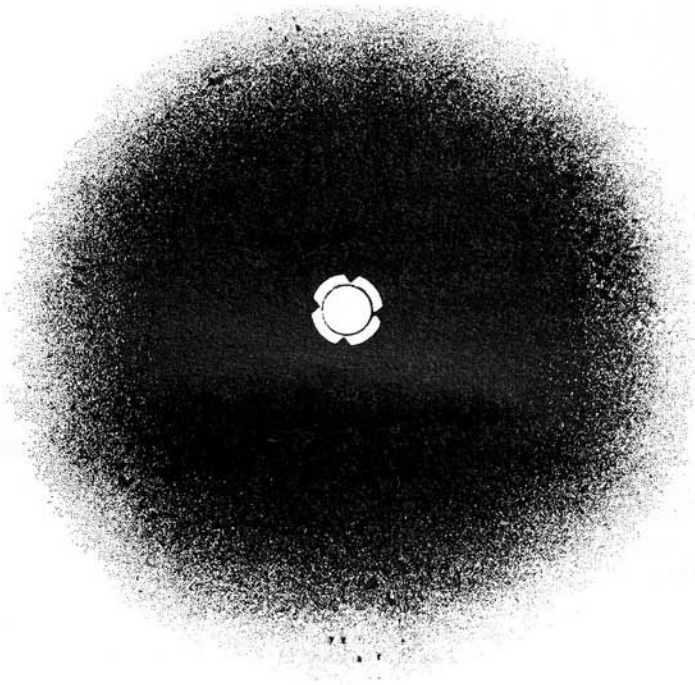


Figure 2: Laue photograph number BR4830

spider webs"; "Deflection by air currents"; "Deposition as lateral outgrowths having fungi as a starting point" and so on.

The following two paragraphs are a precis of the next section of Moore's paper:

It is now generally accepted that all cave formations have essentially the same origin. Carbon dioxide dissolved in water forms carbonic acid in which calcium carbonate, commonly the main component of limestones, is to a certain extent soluble. The amount of calcium carbonate that can be held in solution varies with the amount of carbon dioxide dissolved in the water: i.e. more carbon dioxide, more calcium carbonate can be dissolved, and vice versa. It therefore follows that if the carbon dioxide level of a solution is reduced, calcium carbonate will be deposited. In ordinary surface air, and cave air, the carbon dioxide partial pressure is considerably less than it is during its passage through soil and vegetation and it is this aggressive solution which dissolves limestone until it becomes saturated. Once this solution meets an air-filled cavity, the excess carbon dioxide escapes and a large proportion of the dissolved calcium carbonate is deposited as formations.

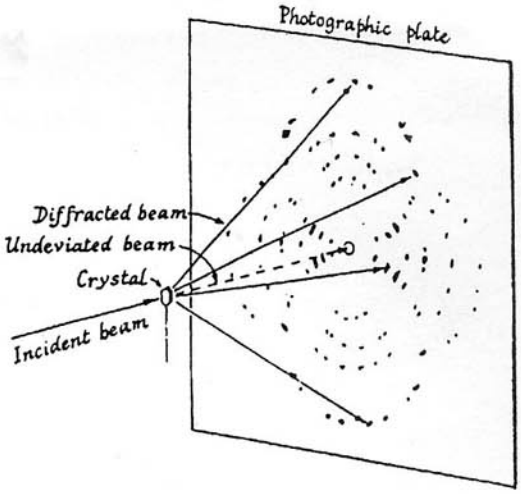


Figure 3: Principle of Laue photography

In the particular case of helictites, the saturated solution meets the air-filled cavity through small holes in porous sections of the rock under hydrostatic pressure. The rock face may be at any angle and the initial deposition of the calcium carbonate appears to spread around the exit point. Gradually, the deposition concentrates around the exit point and the water continues to exit through a central hole. This hole is reportedly very small, in the region of 0.1 to 0.3mm in diameter (.004 to .012 ins). Water emerging from this hole is thought to evaporate at roughly the same rate as it emerges. The rate of emergence is controlled by hydrostatic head and capillary action, and gravity therefore has little effect on the development. The drop formed on the tip of the helictite diffuses back away from the tip in a myriad of tiny cavities and irregularities where it evaporates. If the flow increases to a point where a drop is formed then gravity will take over and a tubular stalactite will form from the tip.

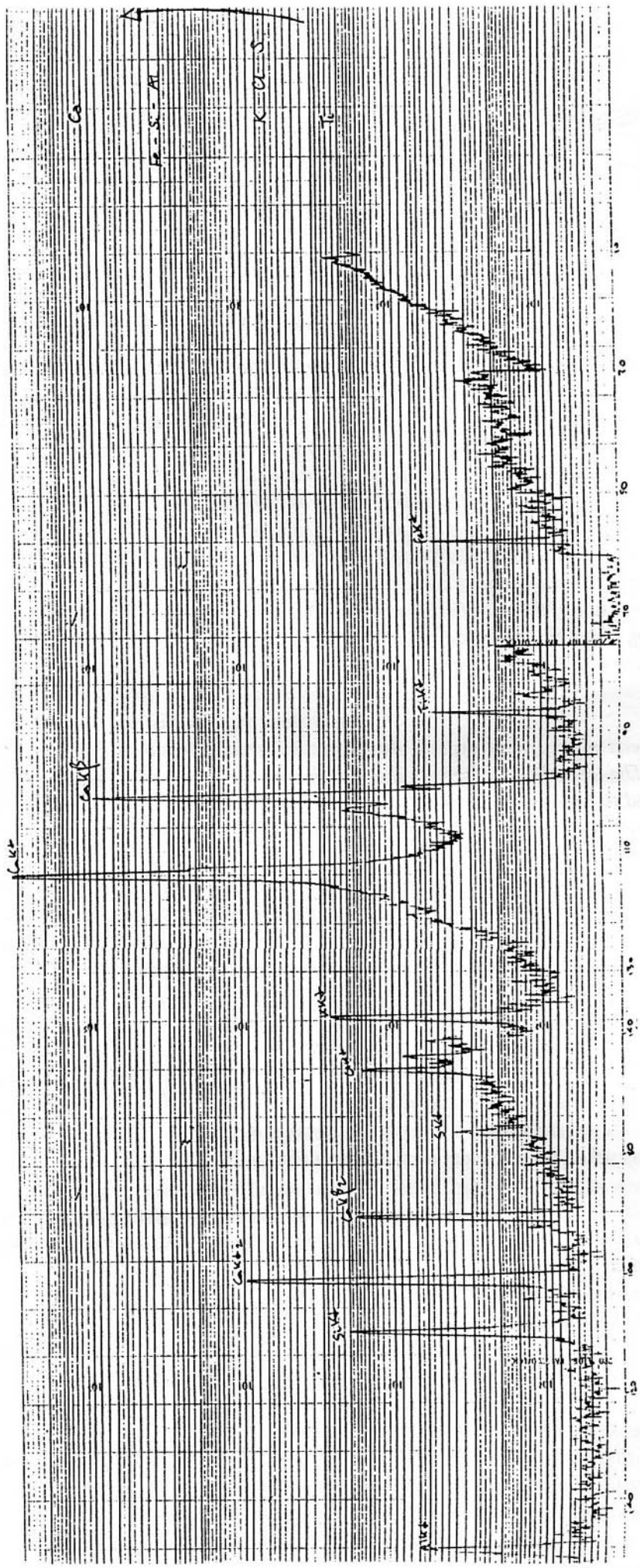


Figure 4: X-ray fluorescence chart

The remaining section of Moore's paper, italicised, is included verbatim:

No adequate explanation has been presented for the curvature of helictites. One suggestion is that an obstruction of the central canal may cause deflection. If there were sharp changes in direction they could perhaps be attributed to obstruction of the tube. On the other hand, a smooth curve several centimetres long would require a series of obstructions always on the same side of the tube, for if there were only a single obstruction, a sharp change in direction would be made and then growth would continue straight in the new direction...

Another factor which has been proposed to explain the distortion is air currents. The chambers in which the helictites were studied seemed to be entirely devoid of air currents. Fog from one's breath rose straight to the ceiling. In addition, there is no pattern to the direction of curvature. Hull (1940) used controlled conditions in his laboratory experiments yet the artificial helictites are twisted.

In an effort to determine exactly how curvature is related to the internal structure of the helictite, a number of thin sections were cut and studied. It was found that the helictites are made up of a group of crystal units with a slightly different crystallographic orientation than the next. The crystals are elongated at an angle to the direction of growth. The orientation of the c-crystallographic axis of successive units progressively changes throughout the length of the specimen.

From a single helictite, eight parallel thin sections 1cm apart were cut and the properties studied with the universal stage. This helictite has been restored in Figure 7. The illustration shows that while the stalk twists in several directions, the c-axis continually rotates clockwise. In addition, it can be noted that the canal which passes through the centre usually follows the convex side of each curve. This fact is even more striking in helictites with smaller radii of curvature. In these specimens, where the curvature reverses, the tube crosses abruptly through the helictite in order to be on the outside of the curve once again.

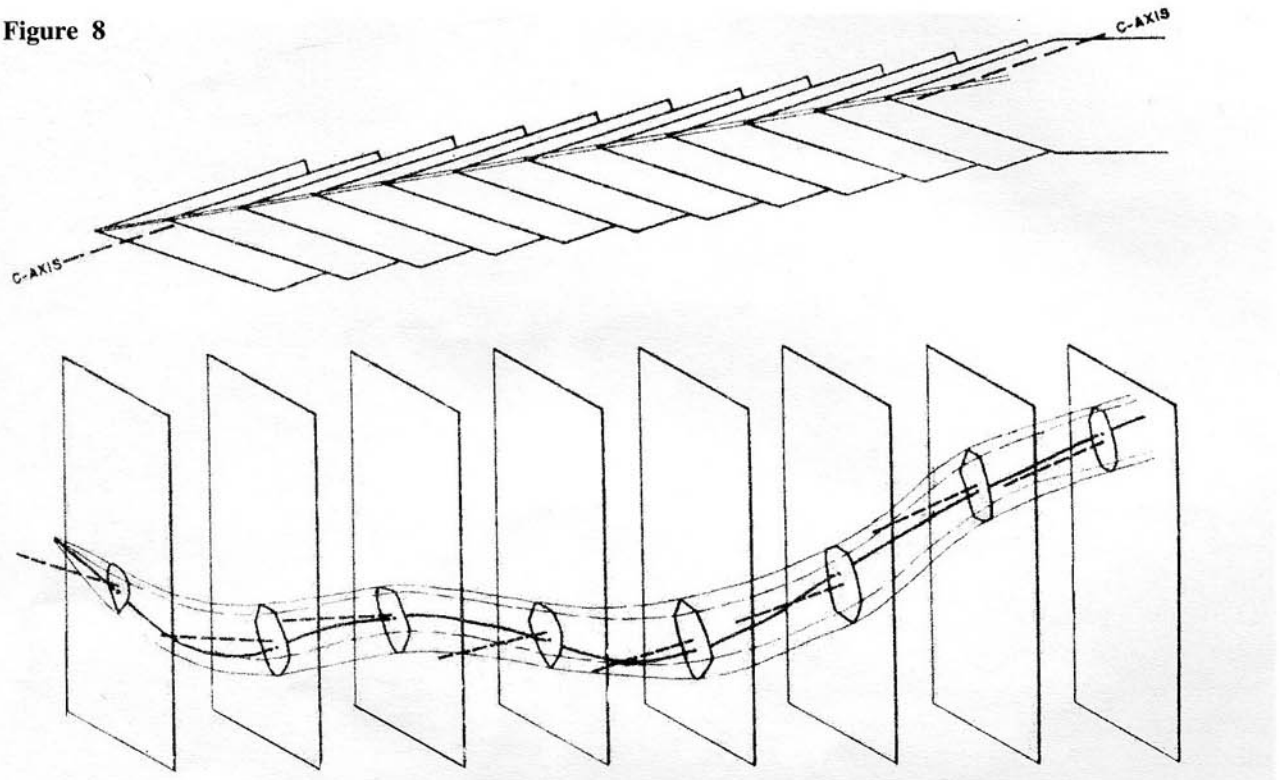
(From a photograph) we may now attempt to reconstruct the tip of the helictite as it appeared in an earlier stage of development. Superimposing the longitudinal outline of a tip on this section reveals that since the crystals are orientated diagonally across the specimen, one side of the tip was parallel with the c-axis while the other was nearly perpendicular with it. This leads to a possible cause for curvature in the helictite. (Bragg [1937]) has shown by X-ray analysis that calcite crystals are elongated in the c-direction. Therefore growth is more rapid in the c-direction than perpendicular to it. Referring to Figure 8, the effect of more rapid growth in the c-direction is illustrated. Fluid leaves the tube at the tip and diffuses back as a film along the surface an equal distance on all sides. With evaporation, however, greater length is developed on the left side as a result of the crystal habit. The c-axis maintains a constant direction and angular relation with the direction of growth in this hypothetical case.

But the helictite (in the photograph) curves to the right. Also the direction of the c-axis does not remain constant but progressively changes to the right. This rotation is accomplished by some or all of the crystal units being wedge-shaped. Several discrete wedges can be seen in the section. From these facts it may be concluded that another set of processes may cause helictite distortion in a direction opposite from that outlined previously. The condition produced by wedge-shaped crystal units is illustrated diagrammatically in Figure 9. Wedge-shaped increments are added in the c-direction and perpendicular to it.

As a result of the angular shape of the crystals, the left surface is warped. This warping is confined to the surface and represents merely a series of steps denoting the limit of crystallisation in the c-direction.

The cause of these wedge-shaped crystals having an orientation which continually rotates to the right is not obvious. A possible explanation may lie in the amount of fluid which is supplied to the helictite. In the wet season the entire end of the helictite is dampened and deposition occurs over a large area. In the dry season, however, the small quantity of water supplied may evaporate before it moves very far from the tip. This will tend to build a thicker layer near the tip and create a wedge.

Moore's **Figure 8**



Moore's **Figure 7**

A possible reason for the slightly different crystal orientation of the next wedge may lie in the fact that since evaporation is complete during periods of drought, all of the ions in solution are precipitated. Silica and sulphate may be deposited as opal and gypsum. Gypsum is common in cave deposits and opal has been reported from a South Dakota cave by Tullis and Gries (1938). This thin layer of foreign material is parallel with the surface of deposition and not the crystal axis. The next layer of calcite could be deposited parallel to this new surface creating a rotation of the axis.

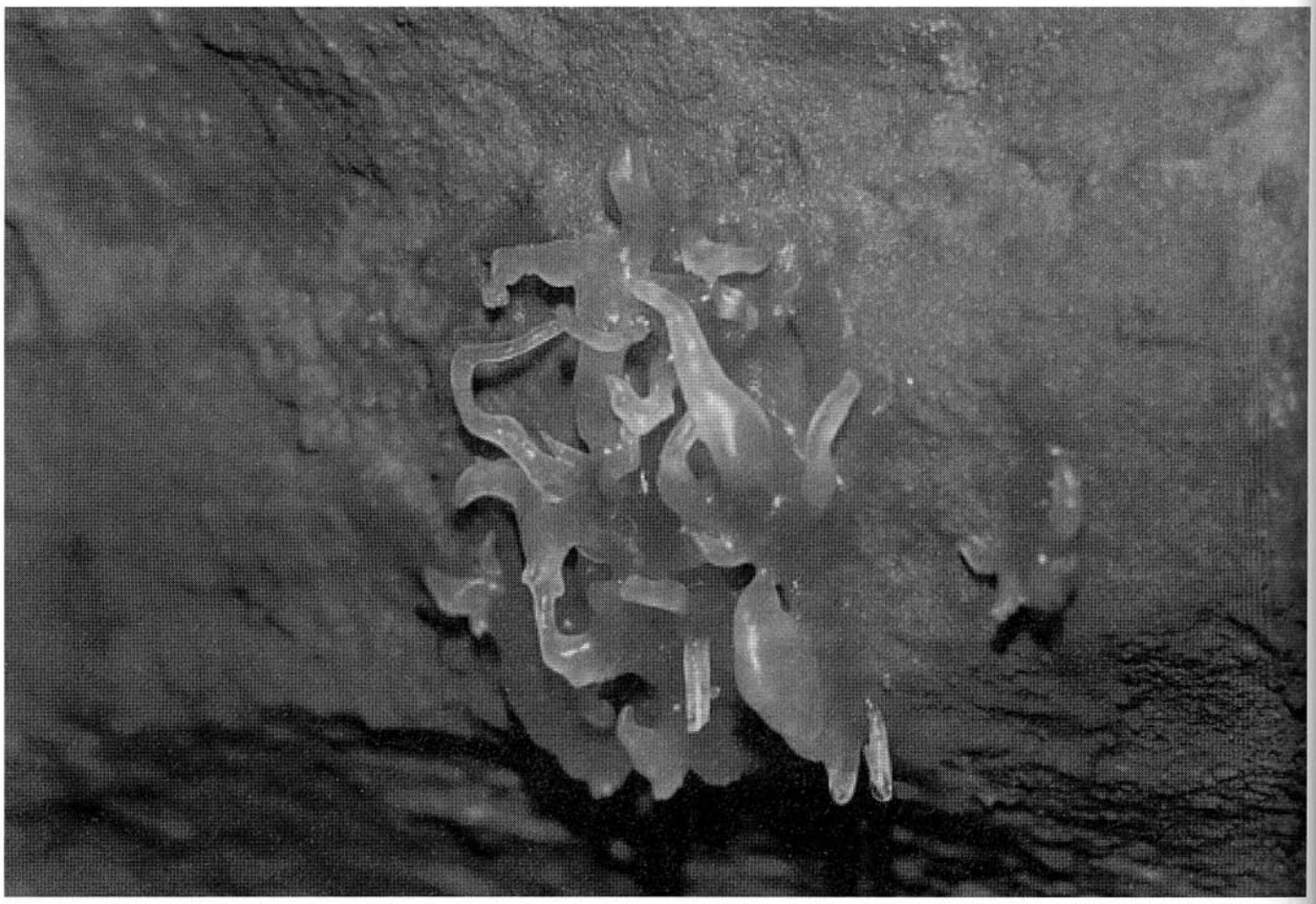
The final result, in any case, is that there seem to be two different opposing processes which may occur. The elongation in the c-direction causes the helictite growth to be deflected in one direction, and the existence of wedge-shaped crystal units results in curvature in the other direction. In actuality, both effects take place simultaneously. When one predominates over the other, curvature is in the direction favoured by that process. Since only the wedging effect causes rotation of the c-axis, this rotation will always occur in the same direction regardless of the direction of curvature of the helictite. This has been shown empirically in Figure 7.

Branching forms may result from a partial or complete crusting-over of the orifice during dry periods. Resumption of flow may result in the fluid forcing its way out from two rather than from a single outlet.

The ability of calcite to form in an aggregate of crystals each with a slightly different orientation suggests possible applications to other problems of crystal distortion. Block structure (Buerger, 1932), an irregularity in the cleavage faces and crystal faces of certain minerals (as galena and pyrite) may result from a similar ability of these minerals to change their crystallographic orientation slightly possibly as the result of a microscopic layer of an impurity.

CONCLUSIONS

It is proposed that the term helictite be restricted to curving forms with central canals. The specimens originally described by Dolley (1886) contained this tube and the word helictite suggests a helical nature. However, it is not implied that helictites as described here are the only forms of eccentric cave deposit, since similar features without central canals have been described for which other names have been proposed. Also the term should not be restricted to calcite deposits as aragonite helictites containing central canals are known. It is possible that other minerals may form helictites.The present study indicates that the growth of helictites is caused by water containing calcium bicarbonate issuing from a small canal under the action of hydrostatic pressure and evaporating completely around the outlet of this tube on the tip of the helictite. Wedge-shaped increments of deposition cause rotation of the c-axis which is believed to result in curvature of the helictites. Opposed to this curvature, and tending to create deflection in the opposite direction, is the crystal habit which favours a greater rate of growth in the direction of the long axis. These two factors alternate in their relative control over the



A typical group of helictites in Ogof Ffynnon Ddu I

direction of growth, and the result is the random twisted course of helictites.

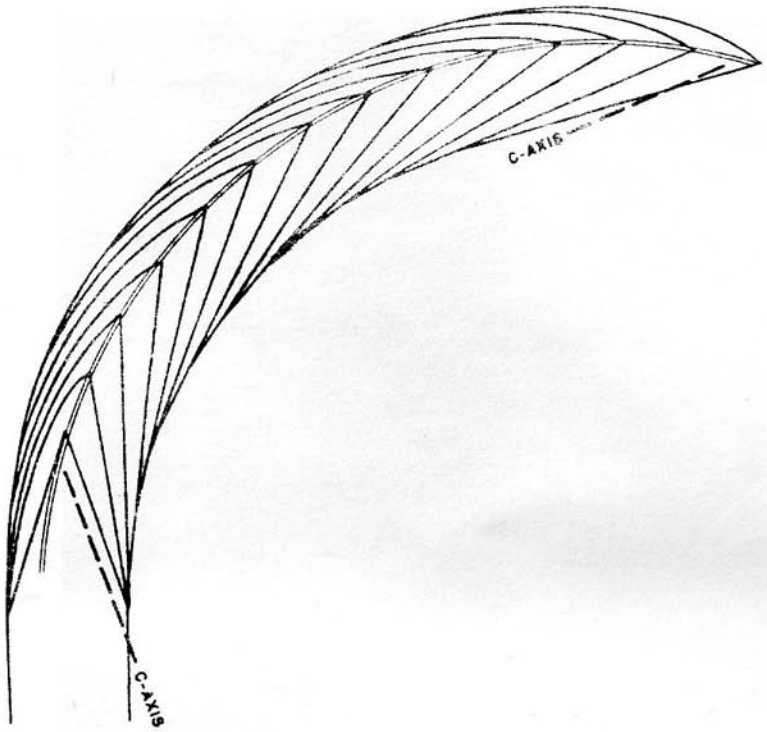
To put this into some sort of context, I will attempt a vastly simplified overview.

All matter is composed of atoms of different types - the "Elements". The way in which the elements combine with each other to form "Molecules" determines the "molecular structure" of the matter being studied.

"Minerals" are formed when a regularly repeating atomic pattern is present. The mineral "type" is determined by which atoms are present and the basic shape is determined by the manner in which the atoms are positioned, essentially due to different types of atomic bonding. A good example of the way this works is diamond and graphite, two polymorphs of carbon. These two minerals are entirely composed of the same element, but have quite different structures due to the organisation of the individual atoms. These differences determine the final crystal form and hardness (diamond the hardest known substance, graphite one of the softest).

Calcium Carbonate (CaCO3), is another example of a polymorphic substance, two of the most commonly existing forms being calcite and aragonite. The CaCO3 molecule is made up of one calcium atom, one carbon atom, and three oxygen atoms. Under favourable conditions these atoms may take on a definite geometrical arrangement and form crystals. Returning then to calcite, this crystallises out with symmetry of the Trigonal crystal system whilst aragonite belongs to the Orthorhombic system, two quite distinct structures. However, within any one crystal system a mineral may exhibit different crystal forms which are dependent upon the physical conditions at the time of crystallisation. Calcite commonly occurs in a number of different crystal forms which depend on a combination of prisms, rhombohedra and scalenohedra, for example as "Dog Tooth Spar", a form dominated by elongate scalenohedra, and "Nail Head Spar", in which prisms and rhombohedral faces dominate. Some characteristic crystal forms of calcite are shown in Figure 5 and details of the rhombohedral structure in Figure 6.

In many minerals, atoms which have similar properties may replace each other. For example, magnesium and iron have similar characters as do iron and manganese. Such substitutions are very common in nature and thereby may form other minerals within a family. The "Carbonates" group; Magnesite (MgCO3), Siderite (Fe2+CO3), Rhodochrosite (MnCO3), Smithsonite (ZnCO3), Dolomite



(CaMg(CO3)2) and Ankerite (Ca(Mg,Fe)(CO3)2) forms one such family. The X-ray fluorescence trace (Figure 4) shows the presence of certain elements, which essentially relates to the chemical composition. In this example it can be seen that calcium, iron, silicon, aluminium, potassium, chlorine, sulphur and titanium are present. In a single crystal of calcite there may be a certain number of calcium atoms substituted by other elements without substantially altering the crystal structure. It would be reasonable to assume that the waters from which the sample helictite precipitated contained minute amounts of these elements. Some elements have the ability to give a colour to a mineral and in this instance the reddish colour of the helictite is probably due to iron.

At this point, I must express my thanks to Clark Friend for his patient assistance during the preparation of this article and for triggering the next phase. On checking through one of my preliminary drafts and in relation to the sample helictite which I had submitted to the crystallography laboratory, he asked the question "how do you know that it was a helictite and not a straw?" This seemed a fair question and I puzzled over it for a while until hit by one of those "Eureka" moments. I remembered that I still had the original sample - somewhere. A brief search and there it was, still intact. I immediately studied it under a magnifying glass, something which I had never done before. The first thing that struck me was its sheer beauty as an object - not in terms of its general shape, but in its odd crystalline structure. I next took it to work and studied it under a microscope, trying to relate what I was seeing to the discoveries reported by Moore.

The first thing that I noticed was, as predicted by Moore, a tiny hole running right through the helictite. The edges of this hole, throughout its length, were irregular (something like a miniature cave passage) giving a feathery appearance.

The surface of the object was striated, looking something like the whorls and grooves on the side of my thumb. These turned out to be the edges of planes of crystals which looked remarkably like the face of a dry-stone wall built of long, thin blocks with arrowhead shaped ends. In some places this striated surface appeared to be covered in "scales" of crystal growth, whilst in others, large crystals had grown in projecting lumps. Half way along the helictite, one crystal had grown so large that it appeared to have burst out from the centre and deformed the shape in doing so. I hope that the accompanying photographs (see next page)will give some idea of this.

I tried to equate what I was seeing with Moore's theory of curvature. The central hole is certainly there, as are the

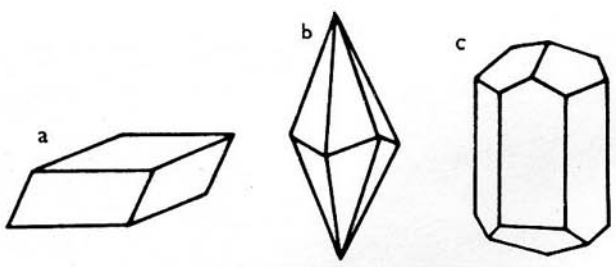
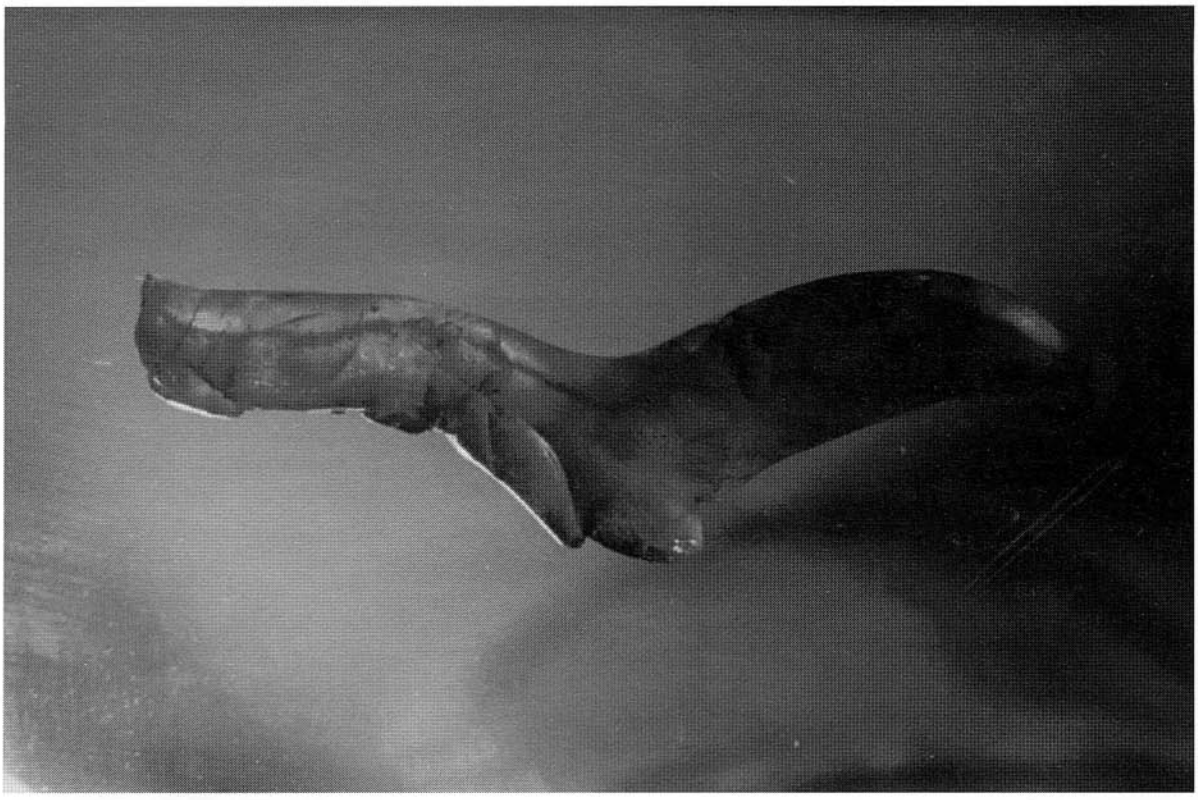
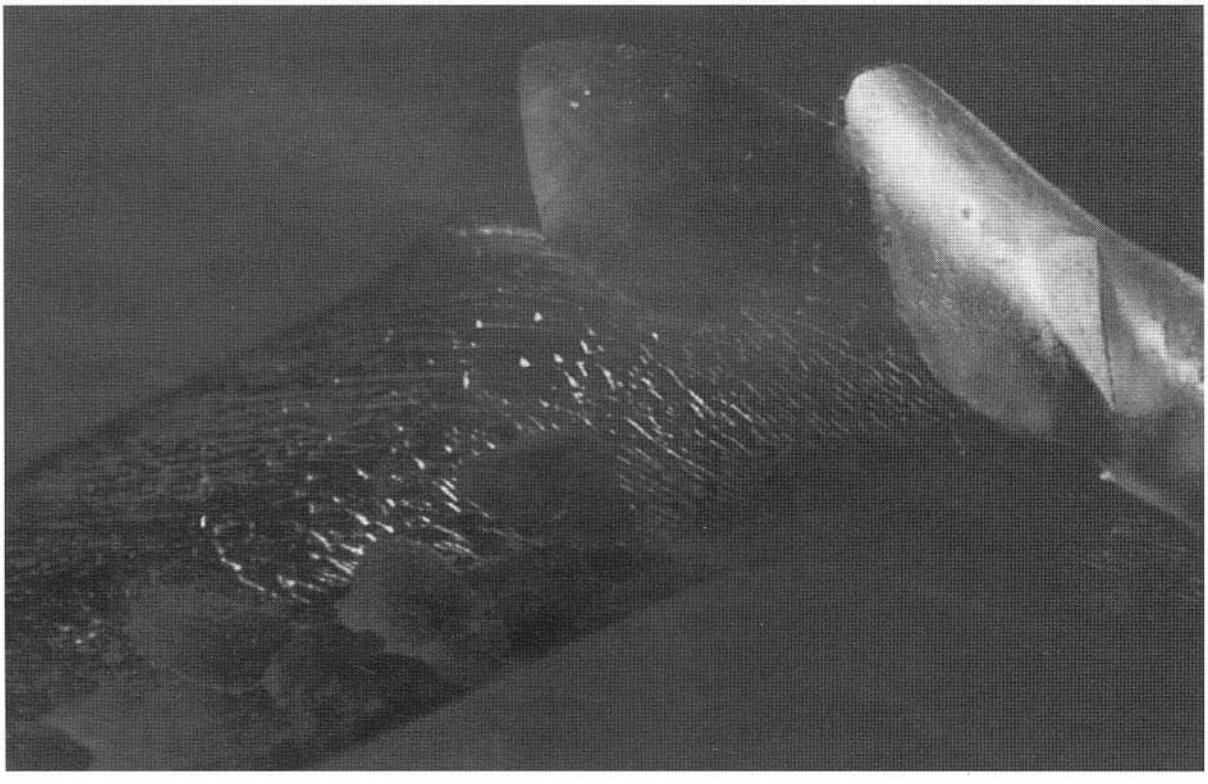


Figure 5: characteristic forms of calcite crystals.(a) Rhombohedron, (b) Scalenohedron, (c) Columnar



Backlit view of sample showing central hole



Close-up of sample showing surface features

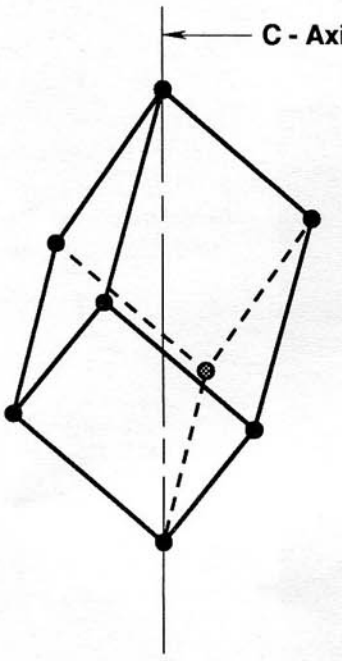


Figure 6: Details of Rhombohedral Structure

planes of crystals, although whether the c-axis is rotating around the hole or not I am not sure. That the planes are at an angle to the hole there is no doubt, but I could see no obvious evidence of wedges in the thickness of the planes although the planes certainly appear to conform to Moore's Figure 7 in shape. However, this sample is not strongly curved, compared to those in Moore's samples, so maybe that feature is missing.

It is worth noting that Moore's reference to a "Universal Stage", in the study of the eight thin sections, indicates that the crystal orientation was determined using a process involving the analysis of the specific effects which result from light being transmitted through the section; unfortunately I cannot equate the direction of the c-axis (shown as a dashed line) in Moore's Figures 8 and 9 with the recognised definition which, I am assured, is correctly shown in my Figure 6.

At this point I felt that there was a good possibility that Moore's theory was pretty close (and who the hell was I to question it!) and I began to ponder over some of the things which had always puzzled me, and what explanations there may be. For example, the timescale over which formations are created. A figure which I seem to remember from the past for stalactites was in the region of 3mm growth in 100 years but this was, of course, gravity assisted. I also believe that the interplanar spacing for calcite is of the order of one nanometre, which equals 10^{-9} metres or 10^{-6} millimetres or 0.000001mm. 3mm in 100 years is .03mm per year or the equivalent of 30,000 crystal units per year. This sub-microscopic atomic dance therefore continues over long periods; in the case of my 40mm long sample, at .03mm per year, 1300 years at least. During this period, or longer, helictites as different as my sample; or the tree-like structures and long horizontal sample in Pant Mawr, somehow managed to grow in shapes which are, at the same time, so diverse and yet, as in the case of the similarly curved (ex) "Fingers" in OFD I, can be so similar.

If the effect is purely due to hydrostatic pressure, could this remain constant over 1000 or more years? If they were being acted on by outside forces; for example, the "Coriolis Effect" due to the earth's rotation, or the "Coanda" effect of fluids following a preferred wall, or gravity, etc; surely over a long period they would all wind up roughly the same? On the other hand, if the forces were chaotic and random, surely nothing could follow a smooth curve over a period of 1000 years!

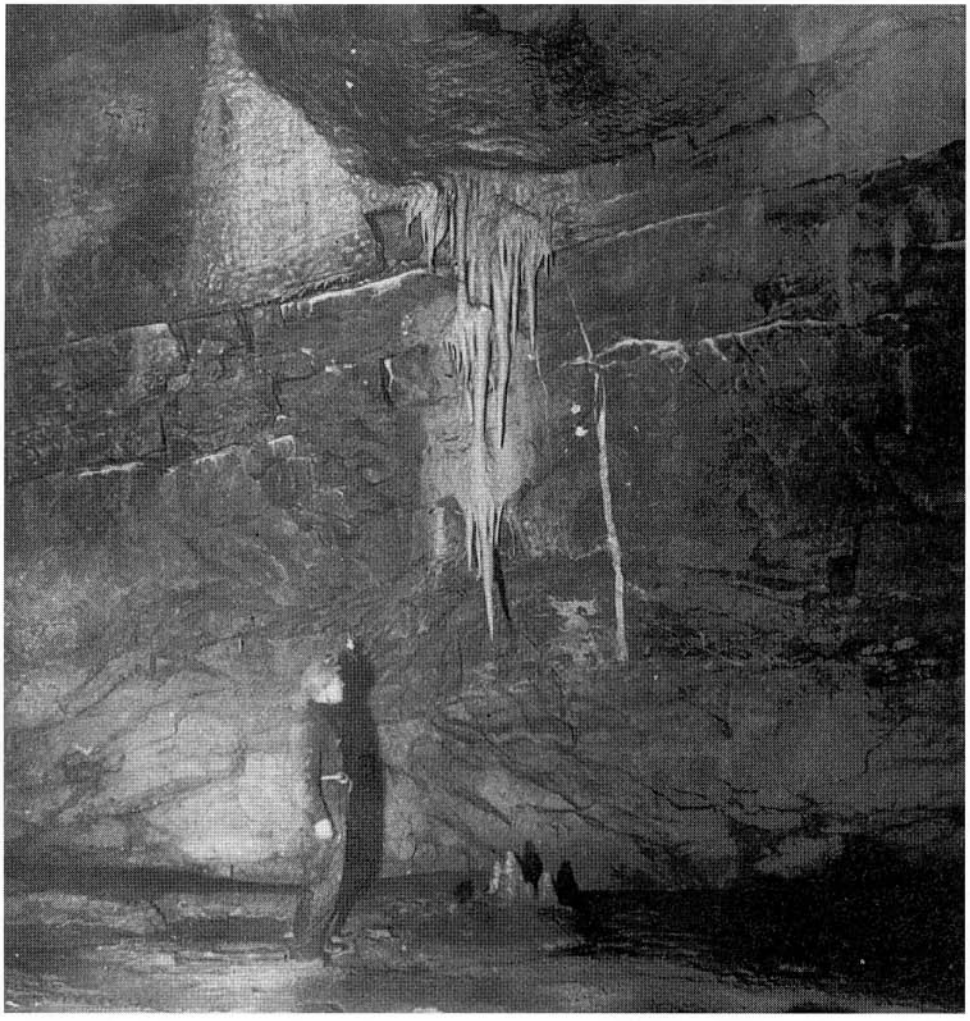
As a final exercise, before I missed publication deadline yet again, I subjected my sample to a further microscopic examination. The sample is now in two halves, due to a photographic accident, and the central hole could be studied in more detail. The "feathery" effect noted earlier turned out to be a definite corrugation in the wall of the hole and showed that the hole expanded and contracted on a regular basis. My guess is that this represents an annual change, either in the rate of flow (and therefore water level) or evaporation, or a combination of both. If this is the case, then the growth rate of the sample can be estimated. Using a 0.3mm diameter hypodermic needle for comparison, at a magnification of 25x, I estimate that the hole is 0.2mm diameter and the corrugations about one fifth of that. That would indicate a growth rate of .04mm per year and a lifetime of 1000 years for the sample: not a bad correlation. More importantly, the corrugations were not consistent in alignment; almost as though the growth after the hole had closed to its smallest diameter was randomly choosing which side became predominant during the next expansion period. Although this discovery is exciting to me, I still cannot believe that something as symmetrical as the "Fingers" can be the result of randomness. Obviously I still have more work to do.

So, there you have it. All sorted out as far back as 1954! Or was it?

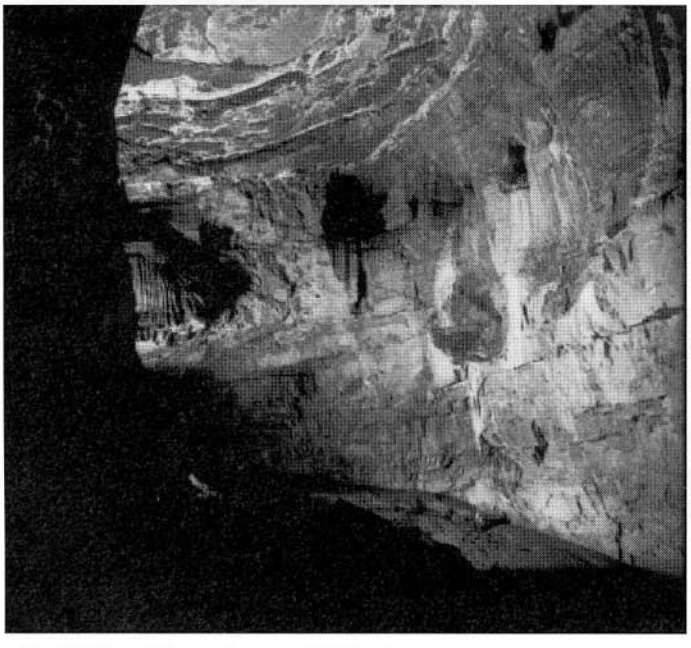
It may all be that simple; or that complicated; or even more of either. All I know is, after all these years - it's as clear as mud to me!

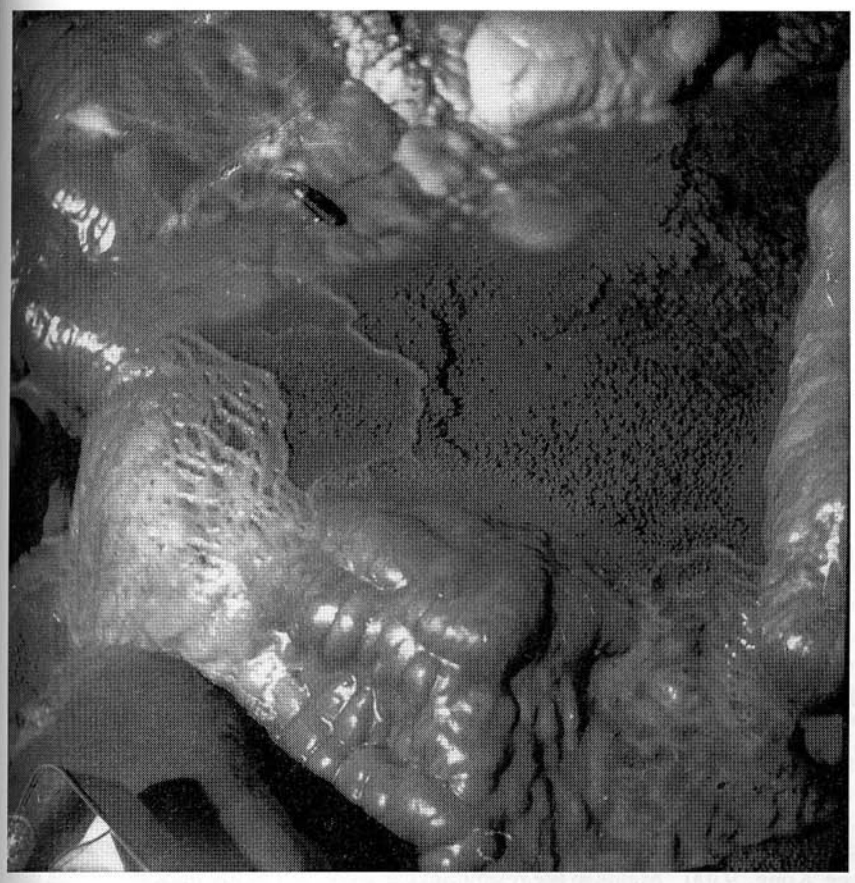
I hope that the Club is still breeding experts and that they too may be sufficiently intrigued to attempt to confirm or deny Moore's explanation; and, best of all, to share the secret with the rest of us - some time before the 100th Anniversary Publication!

Photographs of Tunnel Cave by Bill Clarke

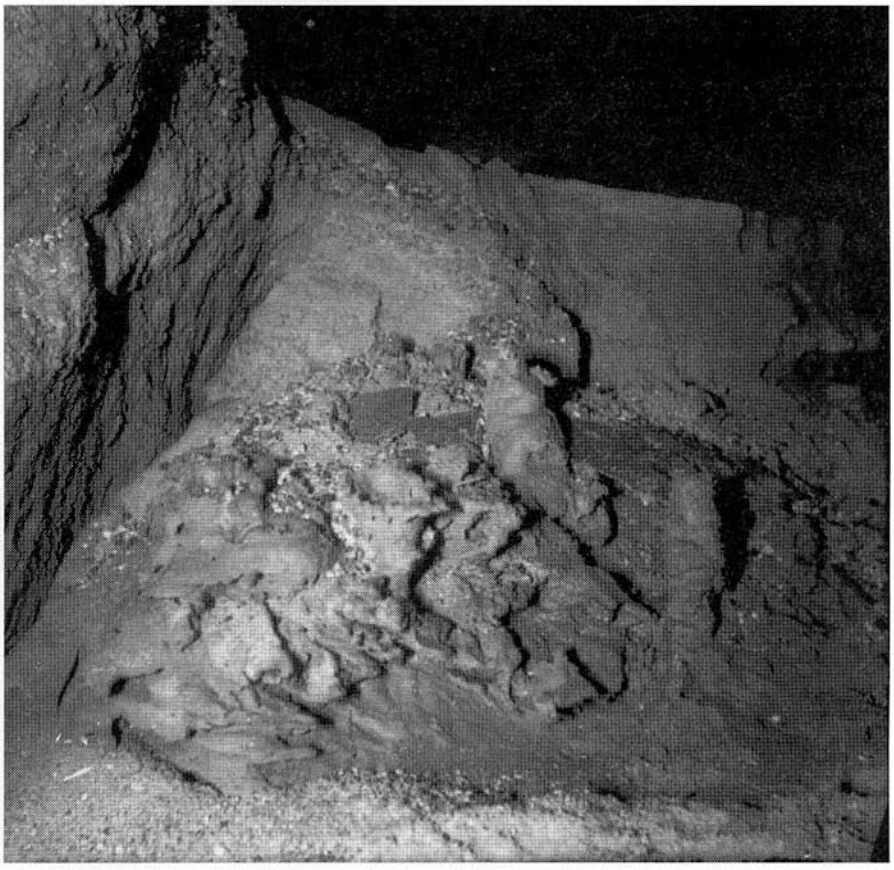


Three views of Davy Price's Hall. The picture bottom right is a self-portrait. All of the pictures on these two pages are from glass negatives.





Left: a rimstone pool.
Below: mud and stal formations.
Both of these features no longer exist.



Carmarthen to Hong Kong by Train

by Seaton Phillips

It was on a mountain top in Hong Kong that Penwyllt came into the conversation. I was staying at the Mount Davis Youth Hostel when the assistant warden noticed the address on my card. "We seem to be near neighbours" she said. I don't know which of us first mentioned Penwyllt, but we soon found that we had quite a lot to talk about, despite the fact that it is over twenty years since I left the club. Her name was Fiona Thorpe (still is, I believe). I hoped she was impressed that I had just arrived by train from Carmarthen.

This journey might well arouse some interest as an unusual way of reaching the now-fashionable caving areas of Mongolia and China, or at least stimulate ideas of getting away from the valley for a time. Anyway, let's go...

When I stood on the platform at Carmarthen station on September 17th 1995, I failed to see the sign saying "Hong Kong, 9300 miles" but it was there in my mind. It seemed quite a long way away.

However, London was not very far, nor was Brussels with the help of "Eurostar" and the Channel Tunnel. Then into Germany, a night at Cologne Youth Hostel and a day of city sights. Next evening came the first mild shock, the first taste of the East. When I stepped aboard the train for Moscow, I was immediately in Russia: Russian train, Russian staff and Russian companions. "*Auf Wiedersehen, Deutschland - Stravstvuyitye, Rossiya.*" 38 hours in the one train was expected, but not the triple-tiered bunks with my top one only just below the ceiling, and I didn't have a caving helmet. Luckily I was more or less prepared for the lack of food on the train, and stops were not long enough to risk getting out to buy any; but glasses of refreshing *chai* appeared on numerous occasions. There was, however, the one 90-minute stop for the extraordinary bogey-changing operation at the Poland-Belarus border at Brest. Russian railways have a five-foot gauge, just 3 inches wider than most of the rest of the world. Five feet might seem a more sensible round figure to them, but this little difference involves every train in complicated shunting manoeuvres, lifting each coach and running new bogies beneath; all carried out with the passengers still on board.

Anyway, Moscow did eventually arrive, and now I was in the Intourist "net". Thus far, I had booked my own ticket through British Rail (as I think it was still called then). Once in Moscow, I was to be wrapped up and tied into a trans-Siberian package, which included a night in a luxury hotel. I didn't mind that, and welcomed some good food for a change. As packages go, mine turned out to be ideally simple: a group of just three, the other two being Andreas and Erich, two young Austrian dairy farmers, one of whom spoke reasonable English. They introduced me to the Metro and Red Square, full of their three-day experience of Moscow, and next day was my compulsory tour of the Kremlin, GUM store, cathedrals and museums and finding, with great difficulty, a post office. Seeing as it rained for the whole day, this seemed quite a good way of passing the time. But I was not impressed by Moscow.

Then the Trans-Siberian train - for seven nights and six days. I was separated from Andreas and Erich and booked into a four-berth compartment with a Ukrainian couple. I managed to find out that they were bound for Ulna Use. I hoped they would be pleasant company: Ulna Use was four days away. They were indeed. Valentine and Michael had become Valya and Misha by the end - no English, but I did have an invaluable Russian phrasebook. Our potential mobile prison very soon became more of a home from home as the days went by. One felt that we could keep trundling along at our steady 50-55 miles per hour for ever. Meals in the restaurant car were part of my package, which were good despite what one reads about inedible or non-existent food, and made for three welcome fixed breaks each day. I was surprised at the lack of English voices. I met only one English couple, a few English-speaking Germans, two pleasant Swedish ladies and two American ladies, both farmers (one farmed Highland cattle, the other emus!). Being September, it was too early for a Siberian winter experience, which was perhaps a pity; in fact the weather was largely cloudy, often drizzly, but with some good sunrises and sunsets. The scenery was trees: mile after mile after mile of birch, larch and pine set back from the line, with the occasional, apparently lifeless, village of unpainted wooden houses. The chief scenic feature was Lake Baikal, the world's deepest lake which contains 30% of the world's fresh water. The train follows the shore for some 120 miles which made a pleasant change.

Moscow, 21/9/95: Seaton Phillips at the Byelorusskii Voksal (station), having just arrived from Cologne

Zabaikalsk on the Russia-Manchuria border, 27/9/95: the Trans-Siberian train is shunted off to the bogie-changing shed on the dual-gauge track

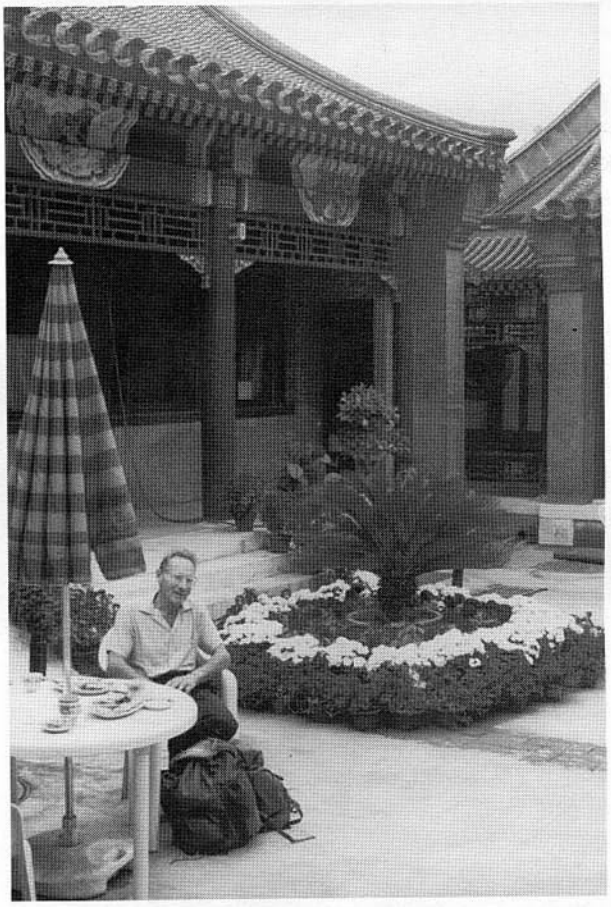
There are two routes from Moscow to Beijing: through Mongolia and through Manchuria, which diverge at Ulna Use on the fourth day of the journey. I had chosen Manchuria, chiefly because it is still an area of steam locomotives, always a pleasing sight to me. They were building new ones there until 1994, so we saw plenty. Mongolia would have had the added attraction of a new country and the desert to cross, but the drawback of an extra tedious border crossing. Our border crossing into China took 7 hours, from arriving at Zaibaikalsk in Russia to leaving Manzhouli in Manchuria; that had to include another bogey change to get us back to 4ft.8 ins again. And the Chinese army had to come on board to rip up the corridor floor and remove roof panels - we were all potential drug smugglers.

Then it was China: cheerful China. Why did China seem so much more inviting than Russia? Was it that there seemed to be far more life - villages full of people walking about, cycling, driving herds of pigs or goats, children going off to school, horses and tractors at work in the fields? Or was it just that the sun was shining a welcome?

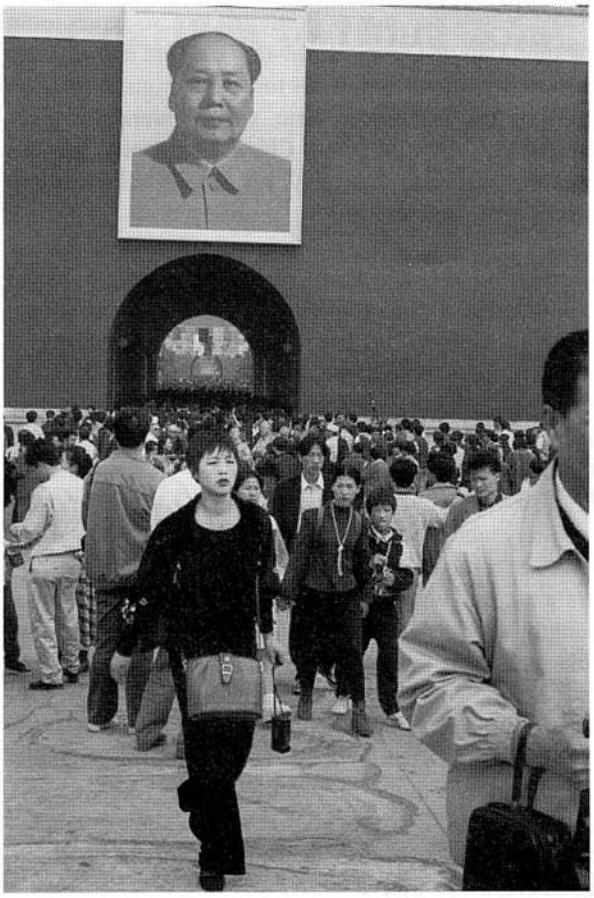
Now there were just 36 hours to get us to Beijing, where we arrived at 6.30 on the seventh morning. End of "package". I was on my own again, and I had to find my hotel "all at your own arrange", as my itinerary from the China Travel Service put it. I found I was almost dumb and illiterate. No-one spoke English, the only sign I could read said "McDonalds", everything and everyone was - well, Chinese. Time to start greeting them all with the impeccable *ni hao* that I had been practising. Somehow I found a tricycle rickshaw and showed the driver (rider?) the name of the Lu Song Yuan Hotel, and thither we wove our way through the teeming traffic. A curious place. Listed as the only youth hostel in China, it is in fact a small hotel with some dormitory accommodation as the only hostel feature. Hidden away in a narrow *hutong* (one of the network of back alleys), I would have had great difficulty in tracking it down on my own. All very friendly and, thankfully, it provided a delicious fried rice lunch from its restaurant on the side of an open courtyard where I could relax in the pleasant 70° sunshine.

Just three days for Beijing - hopeless. I didn't even attempt to get to the Great Wall nor many of the "must see" sights that delight the travel agents. I was much happier discovering my own way round (for the same reason that makes Porth yr Ogof so much more interesting than Dan-yr-Ogof). However, I did find my way into the Forbidden City, after being firmly forbidden from entering on the first day by the Tiananmen Gate, when I found it solidly blocked by a barely-moving jam of Chinese humanity. It was a national holiday weekend. Next day, I walked in unopposed at the other end, at the 8.30am opening time.

Next train: Beijing to Guangzhou (which I am trying to forget used to be Canton). 36 hours south through the middle of China, and Zhengzhou, Xinyang, Wuhan, Changsha and Hengyang. A luxurious and friendly train for me, as I had a 2nd class four-berth compartment all to myself, and was welcomed aboard by Lao Yin Yen, the charming young conductress (hostess seems a much better word) and now, I hope, my friend. All smiles and not a word of English. It was during the next day that I asked her name and she actually understood my Chinese, which pleased me greatly. In the evening she insisted on bringing me supper from the restaurant car, and we somehow managed to spend an hour or more in lengthy discussions on all sorts of topics. Never has a phrasebook seen such intensive use. I was enchanted by the unexpected soft intonations of her voice, so different from the rasping tones of the Chinese en masse. There are far too often far too many of them, but they can obviously be delightful individually. As far as I was aware I was the only non-Chinese on the train and, therefore, I suppose the only exotic item of interest for her. I presented her with a postcard showing Big Ben and a London bus, as she was interested in transport.



Beijing, 30/9/95: Seaton Phillips at the Lu Song Yuan Hotel ("youth hostel")



Beijing, 30/9/95:the Tian An Men Gate, where Chairman Mao still looks down on the masses trying to make their way into the Forbidden City

Next morning it was Guangzhou and "*Zaijian, Lao*", and a walk in the rain to the Kowloon-Canton railway station, then the Kowloon Express for the last three hours across the border into Hong Kong. Back now in an English-speaking world, it was almost like coming home again, except for the mad rush of buses, trams, cars and people. I had to find my way across the ferry to Hong Kong Island, and then out to its western end: another complete contrast as I walked up the six hundred feet to the top of Mount Davis. I didn't meet a soul as I followed the narrow winding road through thick woods of bamboo and ferns steaming in the hot, damp mist and on up to the hostel. Here at last I found a haven of peace and tranquillity, overlooking the harbour and the forest of tower blocks of the crazy town below. "A stunning view" as *The Lonely Planet Guide* puts it. It was now the 3rd of October, just sixteen days after I left Carmarthen.

English-speakers of many varieties to talk to including, of course, Fiona who was soon offering me a pile of *Descent* magazines for my enlightenment. In the next three days I learnt more about the South Wales caving scene than I had for several years in South Wales! But in the end I had to leave and continue my travels to Australia. That, perhaps, is another story.

A Few Boring Facts

Basic cost including all trains, Moscow hotel (full board), meals on Trans-Siberian train to Russian border (5 days): £750
Youth hostel accommodation, Cologne and Beijing (3 nights): £20
Food for ten days: £50
Visas for Russia and China: £60
Insurance: £60

2/10/95: Roast chicken and Lao Yin Yen at Xinyang

Trains to Moscow were booked by British Rail International. Trains from Moscow to Hong Kong by China Travel Service through Marco Polo of Bristol (independent travel advisers) who were very helpful. Hostels in Cologne and Hong Kong booked through YH International Network in London, Beijing "hostel" booked by letter.

The Trans-Siberian Handbook by Bryn Thomas (£10) is an essential item.

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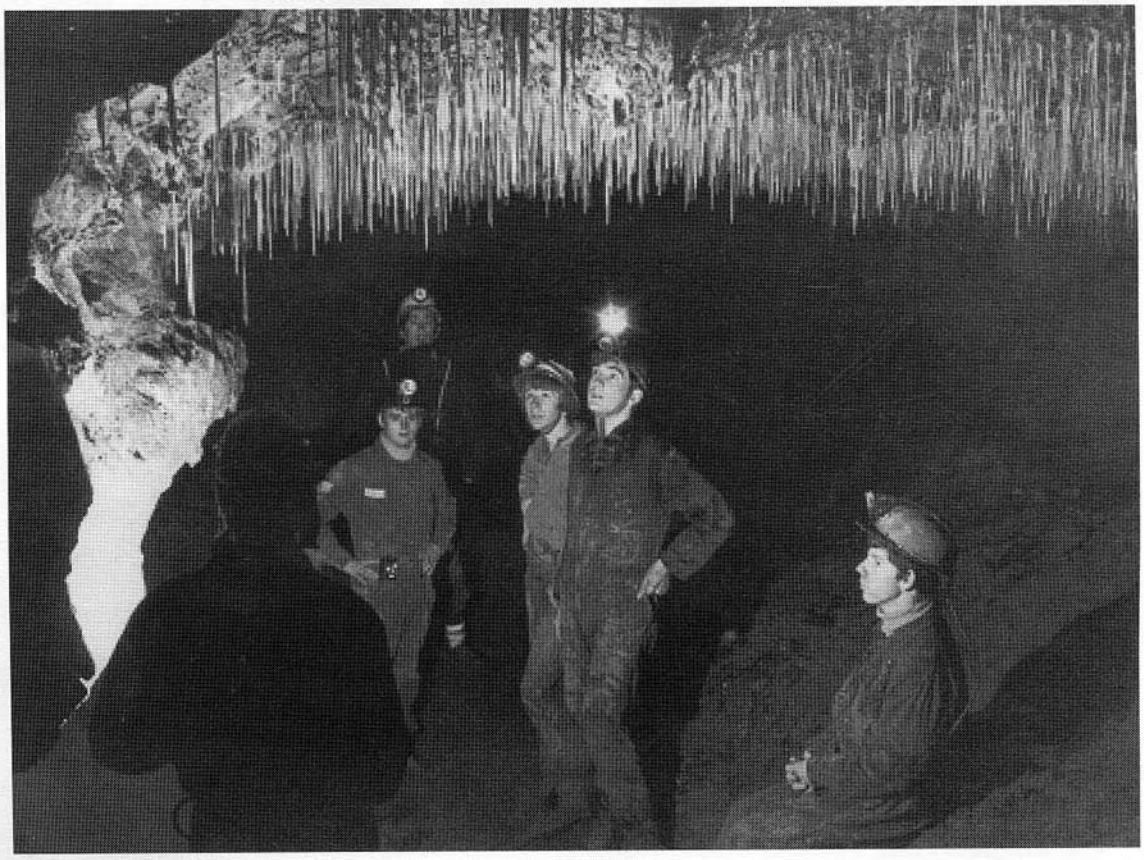
Editor's Note: *Readers who enjoyed Seaton's account of his travels might also like* Riding The Iron Rooster, *Paul Theroux's account of a similar journey (Hamish Hamilton 1988, available in a Penguin paperback, ISBN 0-14-011295-2)*

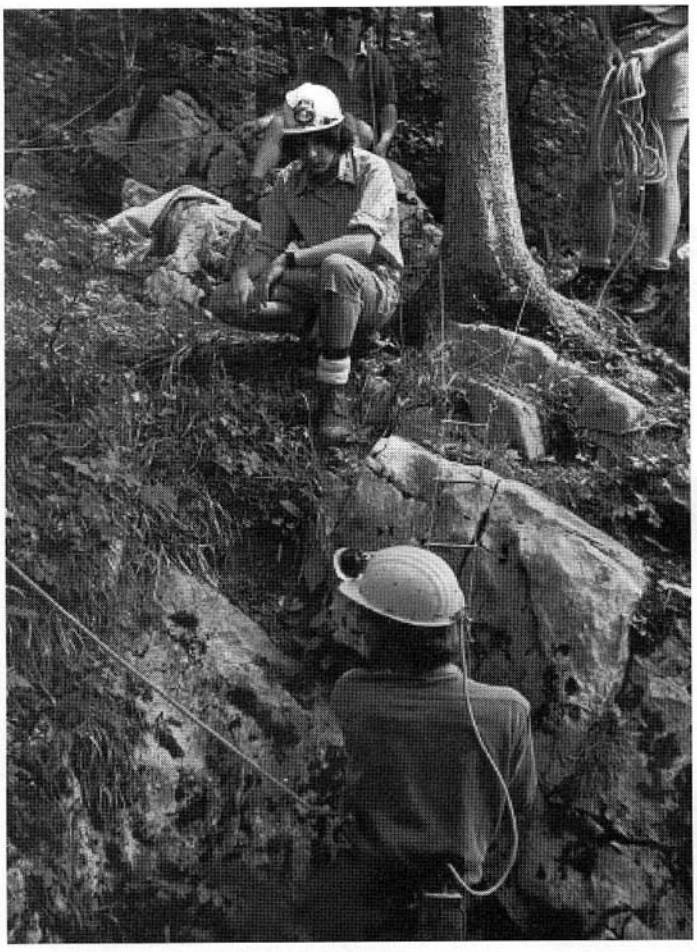
4/10/95:The view from Mount Davis Youth Hostel, Hong Kong.

Photographs by Gary Jones

Ogof Cil-yr-Ychen, 1968. Gary with light on.



Bob Radcliffe (on left) and Martyn Farr, Little Neath Sump, circa 1971



Yugoslavia, 1972. Dr. Gem Taylor, Fred Levett and Gary Jones prepare to descend an unexplored 60m pit

Penwyllt, circa 1975. L to R: Hywel Ball, Nerys Ball, Mike Ware, Pete Francis, Jopo, Pete Hall

Bob Radcliffe at the Mini Columns, circa 1969

Boating at Porth-yr-Ogof, 1973. Mike Ware, Martyn Farr, Gareth Davies, Margaret Thompson

Measurement of Cave Air Temperatures

by Mel Davies

The instrument used in these experiments is a digital direct-reading thermometer which has one sensitive element in the casing, and a second one in a probe on the end of a 3m long cable which can be lowered into potholes. Arthur's Pot is a 10m deep pothole with a constricted entrance on the Black Mountain at SN 7616 1811 (Oldham's *Caves of the North Outcrop*).

Date of measurement: 12 September 1994
Weather: Blustery showers with occasional traces of hail; at 1430 a gleam of sunshine appeared as the weather gradually improved.

ARTHUR'S POT

Depth of probe in pothole	Surface temp.	Temp.in pothole	Time of measurement
3.0m	48.4	53.6	14.13
2.5m	48.6	52.9	14.17
2.0m	48.4	52.2	14.20
1.0m	48.2	51.1	14.25
0.5m	49.5	50.9	14.30
0	51.6	51.3	14.35

Comment: This was a coldish day outside with a temperature of about 48.2 to 48.6. The air in the pothole was relatively warm especially at a depth of 3m (or more), and as the probe was drawn upwards so the temperature fell. Near the surface the probe recorded only 50.9. Note that there appears to be a slight difference between what the probe records and what the built-in thermometer in the casing records. Actually the temperature of 53.6 at the bottom of Arthur's Pot is a relatively high value; many caves are considerably colder than this, e.g. Agen Allwedd has been recorded as low as 44 degrees F.

OGOF PWLL SWND

This cave has a step at the entrance so the probe could only be lowered just over the step; in hot weather a cool draught blows out of the cave. Readings were taken in sunny weather on 12 September 1994 as follows:

Depth of probe in cave	Surface temp.	Temp.in cave	Time of measurement
1.5m	57.4	49.3	1455
"		49.1	1500
"	56.5	48.7	1502
"	56.3	48.2	1503
"	55.2	48.2	1505
"	54.5	48.6	1507
"	54.1	48.9	1509

Comment: The cave has a slightly variable temperature from 48.2 to 49.3. The reason for the variation has not been identified but it is probably due to a slight fluctuating draught with interchange of deep cave air and surface air.

DOLPHIN'S CAVE SHAFT

The shaft is situated in the same doline as the Dolphin's Cave entrance and is some 2m away to the west. At times it has a strong emergent draught. The probe was lowered into the shaft and readings recorded there and on the surface as shown:

Depth of probe in pothole	Surface temp.	Temp.in pothole	Time of measurement
3.0m	57.7	48.6	1520
2.0	56.3	48.6	1525
2.0 repeat	55.8	48.6	1530
1.5	55.4	48.6	1535
1.0	53.1	48.7	1540

DOLPHIN'S CAVE ENTRANCE

The probe was lowered as far as possible into the small cave entrance and the following readings obtained:

Depth of probe in cave	Surface temp.	Temp.in cave	Time of measurement
1.0m	53.2	50.0	1542
2.0	53.2	48.9	1545

As the afternoon progresses so it becomes colder on the surface and this is probably due more to the sun becoming obscured by cloud than rapid cooling due to the season. The cave temperatures are not affected by this surface change and the readings support the belief that the cave and pothole are connected not far down in the system.

Thirty Years in the Fault Aven Series

by Bob Hall

Background

Fault Aven itself is a huge, fault-directed void with a flat roof at the level of a shale band. It is connected to the First River Chamber by a comparatively narrow rift about 10m above stream level. Fault Aven Series lies to the east of the aven and connects to it at a number of levels. Access to the series is conventionally from the streamway via one of two passages just upstream of the First River Chamber.

The discovery and initial exploration of the Fault Aven Series is described by Mick Day in SWCC Newsletter No.59, pages 12 to 15 (1968).

When Paddy O'Reilly surveyed the series a few years later he published the comment: "At the very top of the aven a passage may be spotted at the far side much too far away to ever reach." (O'Reilly, O'Reilly and Fairbairn; Ogof Ffynnon Ddu; 1969) This passage lies on the west side of the aven and in actual fact is some 15m below the roof at that point. In any event Paddy's choice of words was a challenge to Mick. In the early seventies Mick, Pete Cardy, Jerry Woolf and myself pegged and bolted (using the crude techniques of the day) up the rather loose, overhanging wall to eventually gain access to this passage.

Subsequently work by a wide range of members established links between this area and the Birth Canal Series. (Ref. SWCC Newsletter No.103, pages 9 to 30, 1987). Also related to these discoveries is the work of Rob Parker and others in The Granary (Ref. SWCC Newsletter No. 98, pages 26 to 29, 1984).

The Early Seventies

Paddy's "challenge" was just the motivation we needed. But we still felt unwilling to tackle the climb until we were sure the "passage" was not just a shadow on the wall. In those days lighting was less satisfactory and the aven was certainly a big place. In an attempt to get a better view we set about exploring the higher parts of the aven. We soon found that the shale band gave us just the access we needed - rather like the area of the RAWL series between Roundabout Chamber and Starlight Chamber. In other words we could crawl in the shale band around the lip of the aven towards its apex. From this exposed eyrie it was possible to descend by ladder to a point just opposite the supposed passage and to confirm that it really did seem to "go".

This descent may be described in half a sentence but to me - at the sharp end of the ladder - it seemed quite an epic at the time. To the best of our information the "eyrie" was some 70m above the stream and the sense of exposure certainly opened my eyes if not quite any thing else! Just to make it worse the aven is on a slight hade and the ladder hung in contact with a very loose wall all the way down - this resulted in a constant stream of debris rattling around me.

This minor epic concluded, we were all set to tackle the climb. Now at that time the use of self-drilling (spit) anchors was pretty new and power tools still a very long way off. An ascent of this nature was best tackled using pitons ("pegs") and restricting the use of bolts to points where no peggable crack could be found.

Mick Day pegging, early 1973

The lead climber would hang or stand in "etriers" (short webbing ladders) and would retreat frequently by wire ladder for a rest at ground level. This wall, following the general hade, overhung in a series of small steps and it too was desperately loose. In fact we more than once encountered the "expanding flake" phenomenon whereby inserting the highest peg so wedged apart the rock below as to free the peg supporting the climber! Because of this type of uncertainty we developed a procedure of testing each new peg by clipping the ladder into it and getting someone at ground level to test it. This was fine - if you were aware that "ground level" was in fact a ledge some 40m above the stream! On one occasion, the image of which is etched in my memory, Cardy responded to the call from above to test the latest peg by grabbing the ladder and swinging out over the void! Only after he had released the ladder and set himself down did the rest of us breathe, and only after that did Cardy wake up to what he had just done.

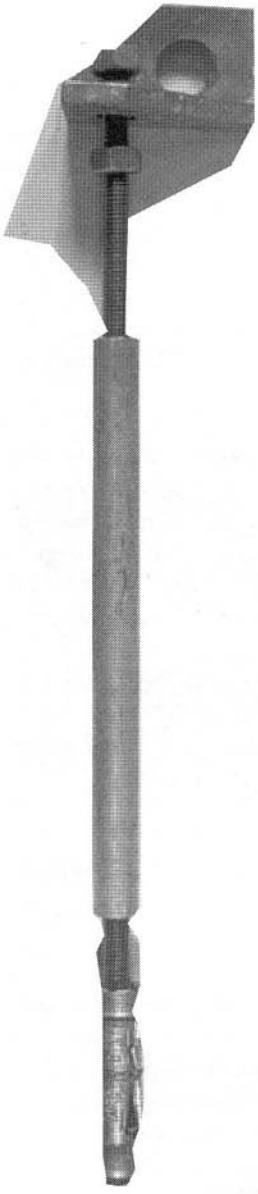
As chance would have it I was at the sharp end of the increasingly precarious climb when the lip of the passage finally came in reach. Standing as high in my etriers as I dare, and overcoming considerable rope drag I just succeeded in getting my centre of gravity over the edge. But that was it. I could go no further, and could in all probability only fall down! Cardy describes the next few seconds (minutes?) as the work of some demented, mechanical woodpecker. In fact I was inserting a "bong". A bong is not, as the nineties caver might suppose, a sex toy. A bong is a monster piton, about 5cm wide, and I was wildly hammering my bong into the only crack available. With this frantic hammering concluded I was secure enough to complete the move into the passage and fix the ladder for the others. Our exploration did not take long! The short series we had entered was more notable for its volume than its length. So much so that Mick, on writing it up in the log book, described its dimensions in "barrels". (Having, I think, crude oil rather than beer in mind!)

The chief interest in our find lay in two windows looking out over further drops. The first, a dark, wet, black affair was soon confirmed to be the Granary by the simple expedient of dropping sweet wrappers down it. The second was more of a mystery, a mystery that was not resolved until Colin Fairbairn pushed some climbs in the Birth Canal Series many years later and found the last link to connect Fault Aven Series with the Nether Rawl. At the end of our brief period of exploration we left a doubled Spunstron rope on the climb and the series lay fallow for fifteen years or so. (Although Rob Parker did in fact enter it briefly from the Granary in the course of his work there in 1983.)

A Welsh Record Pitch?

After our tentative partial descent from the apex of the aven in 1972 I had harboured the ambition to descend the whole aven from the highest point to the streamway. I supposed that this would be the longest single natural pitch in Wales.

In 1976, when Cardy returned from Ecuador, he was full of enthusiasm for the foolish methods that passed for SRT in those days. Now I was no stranger to abseiling and prussiking by all manner of improvised techniques so felt confident enough to give it a try. Also important was the fact that Pete had just obtained a lovely new rope that was allegedly long enough for the job. The final stimulus



One of the long bolts used to provide a safe belay in the shale band (see text).

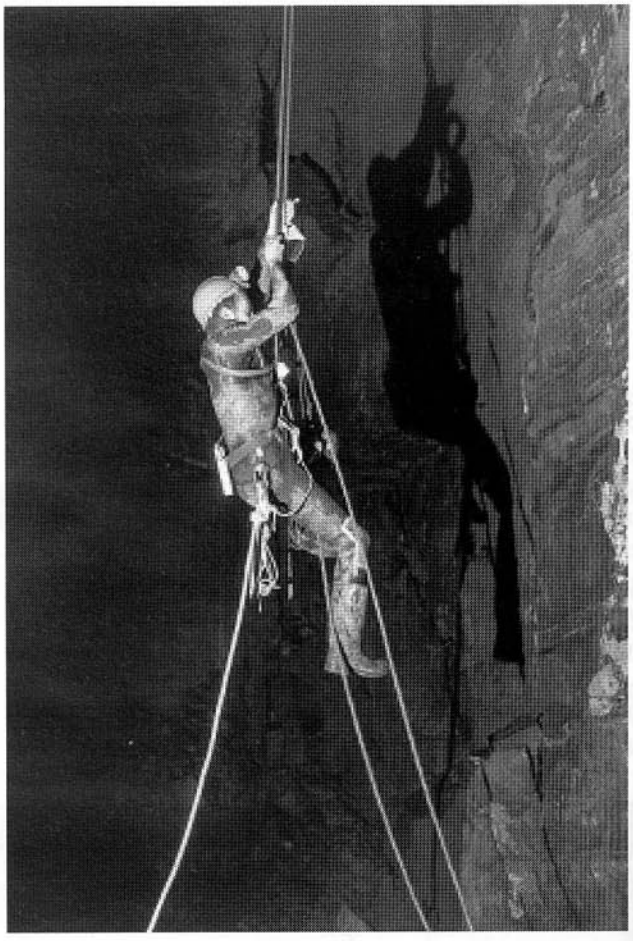
Opposite page: overall view of the pitch, with Bob on the rope. The flashgun on the top left is in the "shale band" Photo by Tony Baker

was the appearance at the club of a student (I think) who had some association with the Red Rose or some other famous club from the land of bottomless pits. This poor sap was induced to join us.

Hauling Cardy's pristine new rope we edged our way along the shale band for only the second time ever. Using the same natural threads that we had employed for the ladder we rigged a single rope.

Perhaps, as some concession to rope-rub considerations, we might have used the odd tackle sack or pullover but I can't be sure. Quite how I don't know but Pete and I somehow convinced our young companion (let's call him "Jim") that he was the best man to make the first descent. With hindsight it seems ludicrous since both Pete and I were much more familiar with the whole situation. Perhaps the sense that "big drops is the Northern boys' business" motivated us - or maybe just natural funk.

In any event "Jim" set off and as I might have predicted was soon being bombarded with stones as his rope came into contact with the sloping wall of the aven. (A situation with which contemporary explorers are also familiar - see below or just ask Tony Baker!) Jim persevered but soon announced that the rope was too short for him to continue. Now I can't remember for sure, almost twenty years later, but I'm fairly certain that poor Jim had been despatched to his doom with no more hardware than a simple "figure eight" descender. Certainly ascent would have been very difficult. Consequently Jim was left suspended in no more than a doubled tape sling for a harness until Pete and myself could make our way round to a ledge roughly level with him. This must have involved us in about



Bob ascending the "ancient hairy rope", photo by Stuart France

twenty minutes' fairly rapid caving! Somehow or other Jim was retrieved and soon afterwards Pete and I returned to the shale band to collect his rope. And here was our final lesson - the stream of debris falling around Jim had all but severed the rope some distance above him.

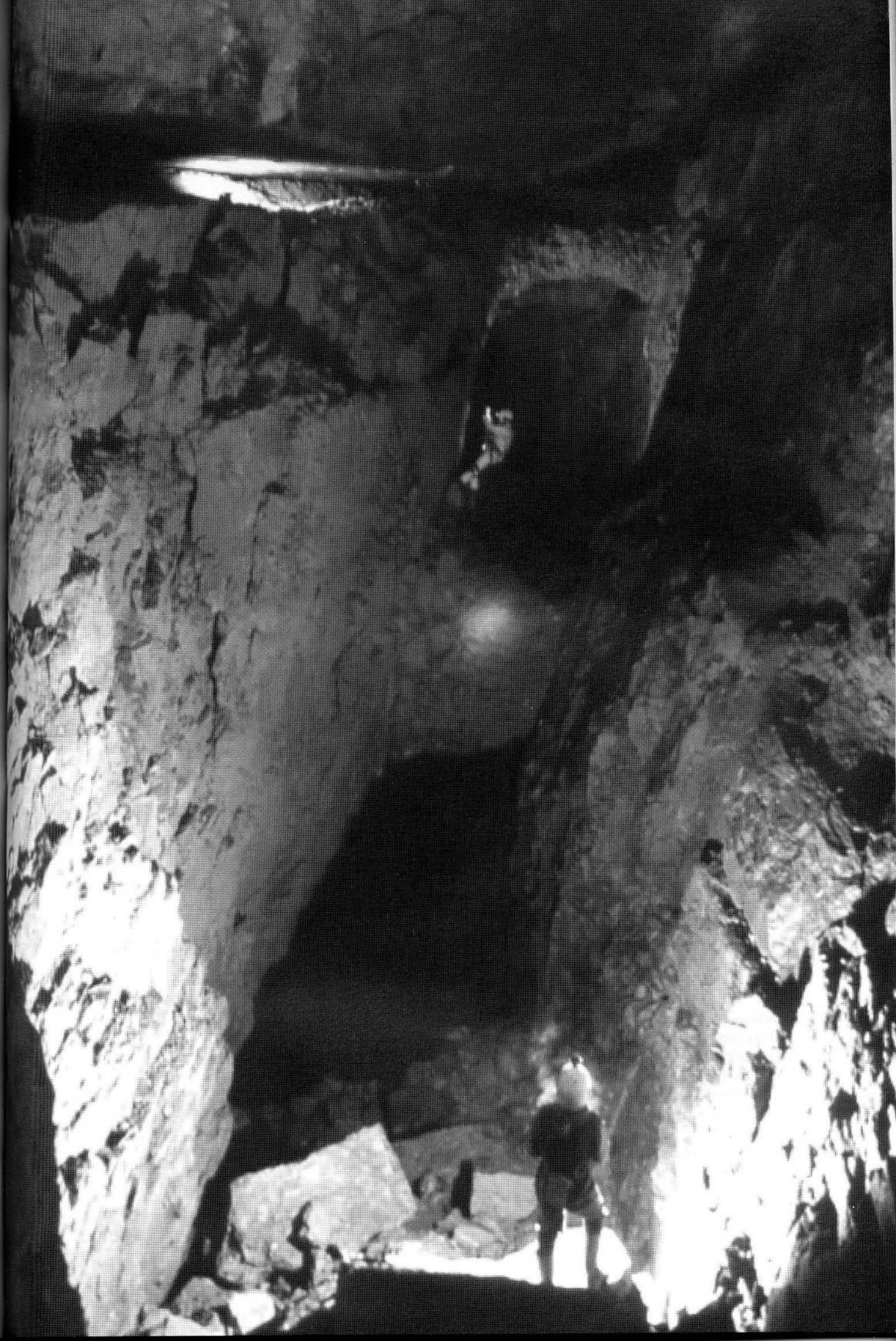
One way or another my ambition to claim Fault Aven as the deepest pitch in the Principality was on hold.

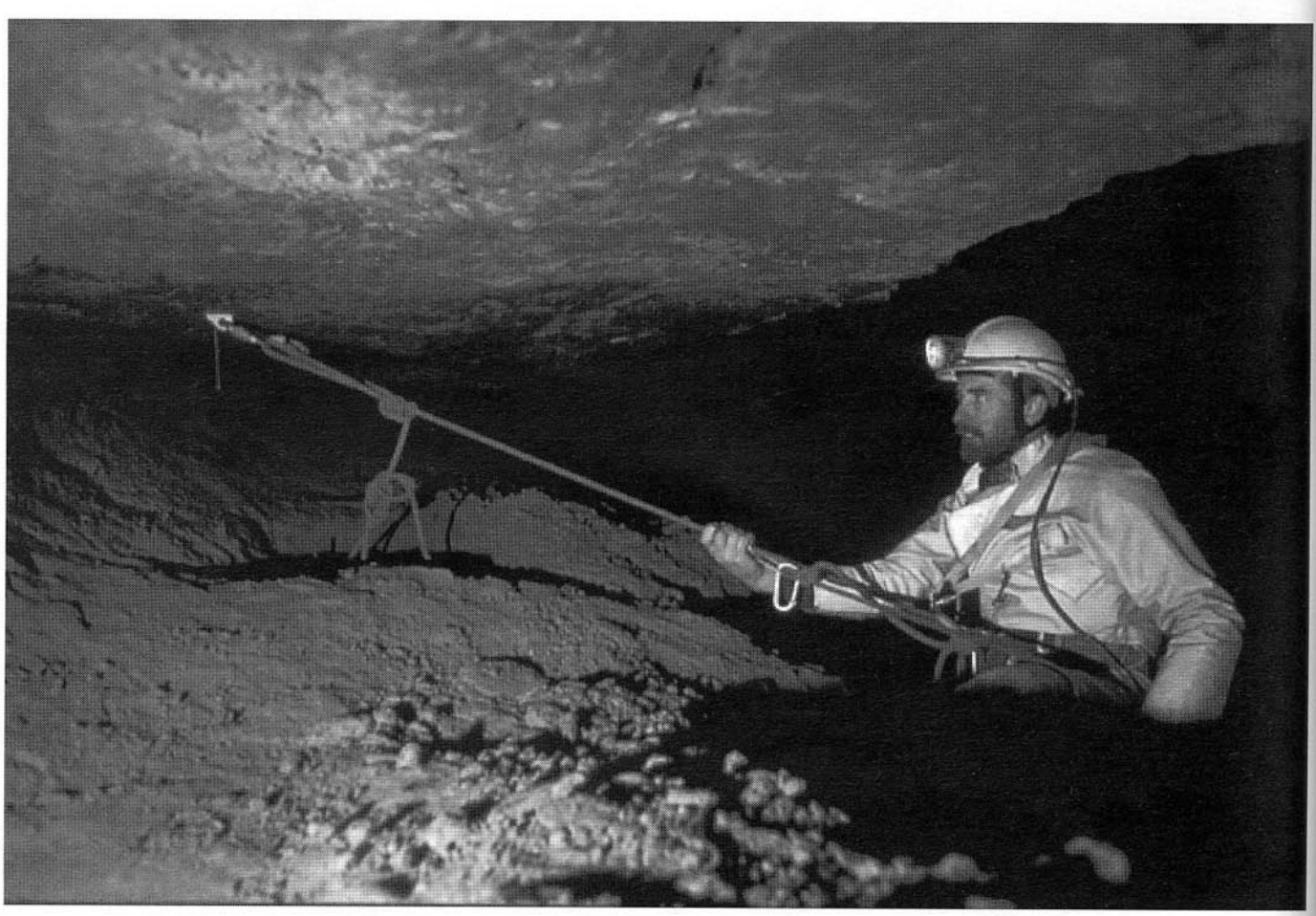
All Weather Access

A rescue incident occurred in the mid-1980s when a party from the Hades club were trapped in the Fault Aven Series by flood. This prompted Roddy McLaughlan and I to look at the possibility of "dry" access. The first step was to replace the old rope on our 1973 pitch. My rather fumbling prussik up this ancient hairy rope was captured on film by Stuart France. This ascent accomplished, we were able to go ahead and fix proper static ropes on this pitch, on the pitch down to the Birth Canal Extensions and on Colin Fairbairn's pitches. This entailed a series of trips with Roddy, Huw Thomas, John Harvey and others over the space of a year or more. It has since been possible to reach this area of the cave whatever the streamway conditions but this capability has yet to be put to serious use. Nevertheless it did rather rekindle my interest in the area.

Success at Last

Not long after completing the dry access project I heard that Iain Miller was keen to survey the aven properly. Clearly decent





Bob at the top of the pitch. Photo by Tony Baker

access to every level would be needed. At last - a motivating spur to get the old scheme off the ground.

Tony Baker and I revisited the dreaded shale band in late 1992 or early 1993. It was immediately obvious that "Jim's Route" was never going to be viable - the hang just had to be from the overhanging side of the aven. The problem was a sound belay. Everywhere we looked was flaking, crumbling shale. There was no way conventional spit anchors could be relied upon. To solve the problem I remembered the technique I'd used to secure the library shelves! This was to use Rawlshields on the ends of lengths of threaded rod in very deep holes. Thanks to Bosch technology this was now a technique usable underground. The photo on page 150 makes it clear.

The first anchors were fitted in the summer of '93. There then followed a long break whilst we all went to the Berger and other projects had priority. Almost a year later Tony and I made a partial descent on the available rope and it was not until the autumn of '94 that Paul Quill and I finally completed the descent, twenty-one years after I had conceived the project.

Our ropes remained in place for more than twelve months and I was loath to remove them until Tony had had a chance to complete what he had helped so much in bringing to fruition. Our first return trip was rained off and it was not until late in '95 that we finally stood at the bottom of the rope together. In the event Tony and Tim Clark made the ascent, de-rigging as they went.

This was a painfully slow affair and Annie Peskett and I were hard pressed to keep warm waiting! All the while we could hear Tony's increasingly desperate and exasperated cries to Tim. Tony was perched at an uncomfortable rebelay at the very focus of the funnel into which Tim, more or less inevitably, was dislodging stones. The spirit of "Jim" was at large for sure.

Postscript

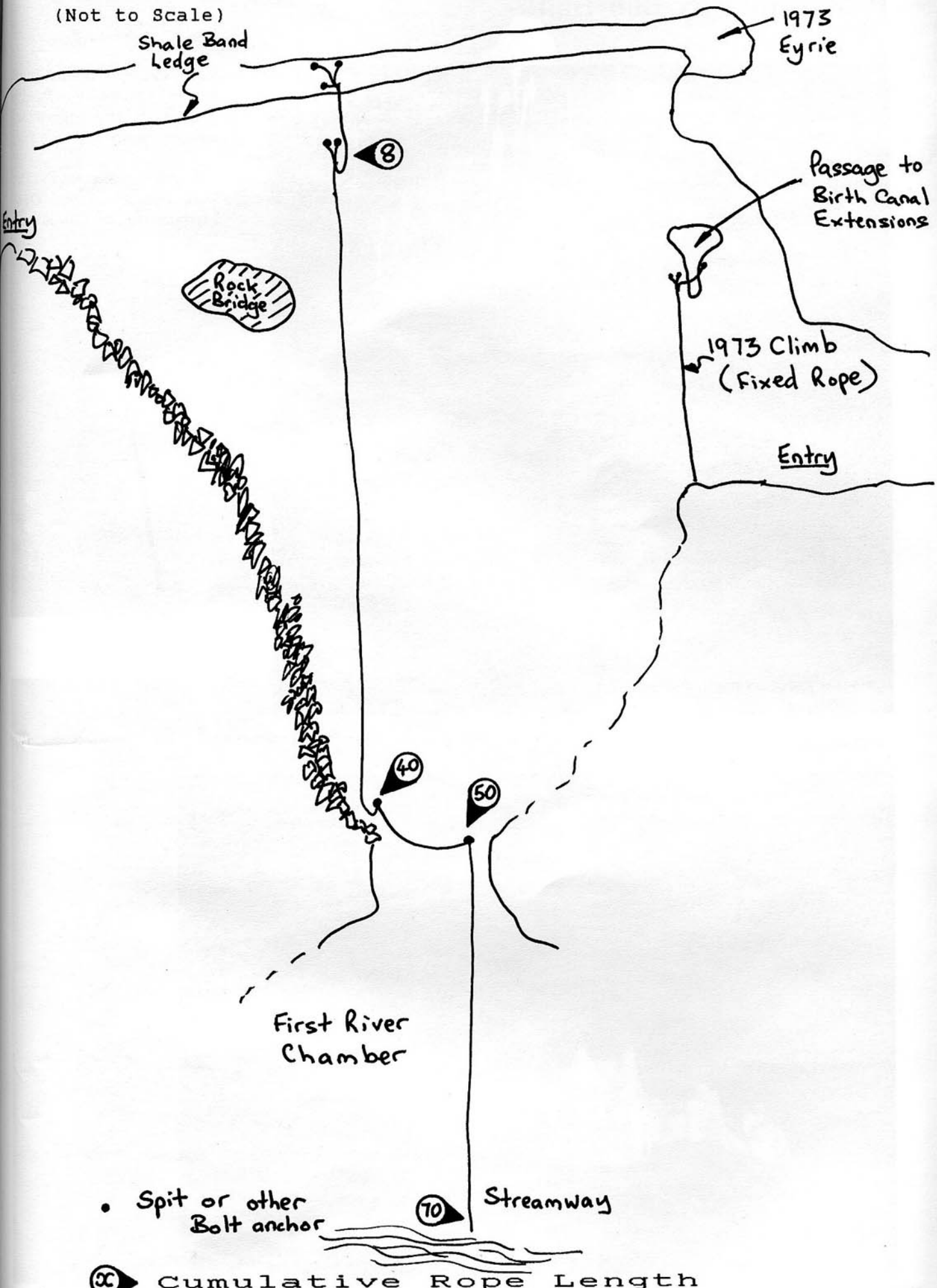
The key anchors remain in place and the descent is there for the making. A small team is a must and very great care needs to be taken with the loose rock. Not least because of the risk of damage to the rope above one.

The all-weather route also remains open but the ropes are not adopted fixed aids - they are a WBCRT facility and are not intended for general caving use.

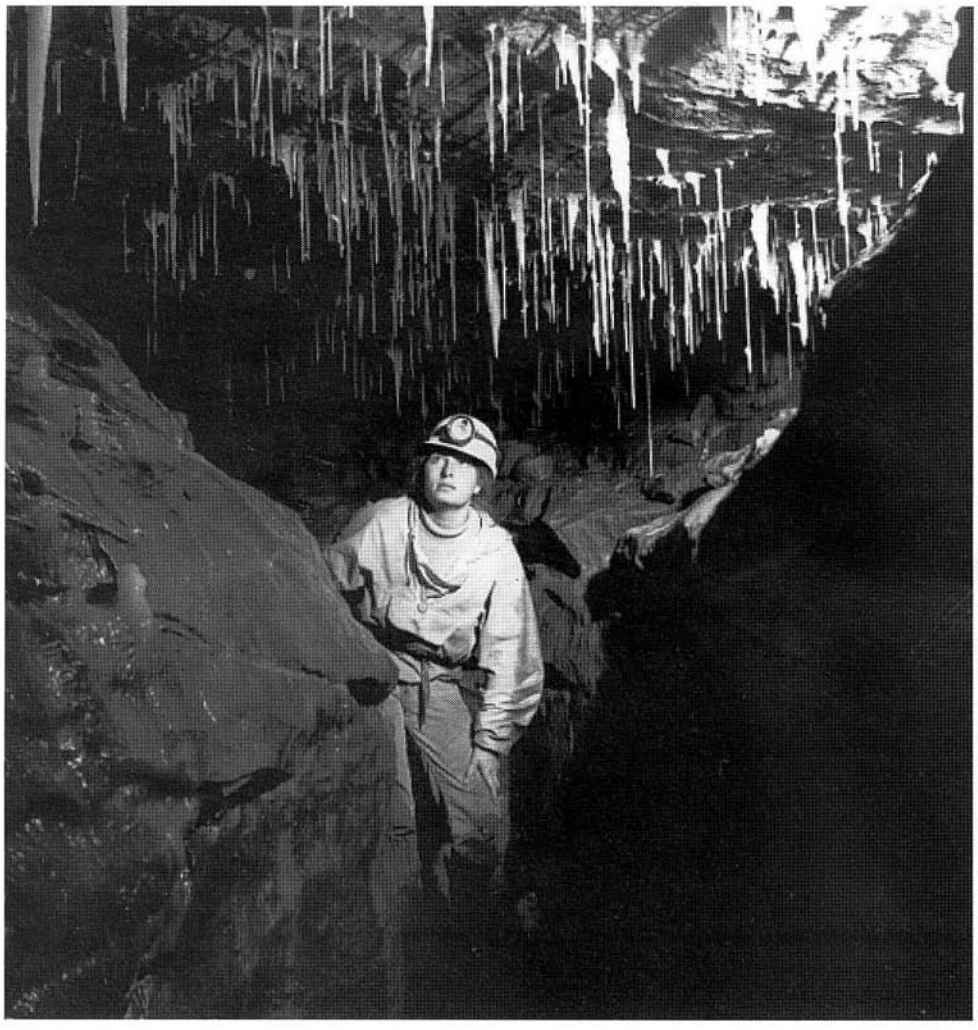
I still claim the big pitch as Wales' deepest although the Granary must be a close rival. Only an accurate survey will tell.

FAULT AVEN : SECTION LOOKING WEST

(Not to Scale)

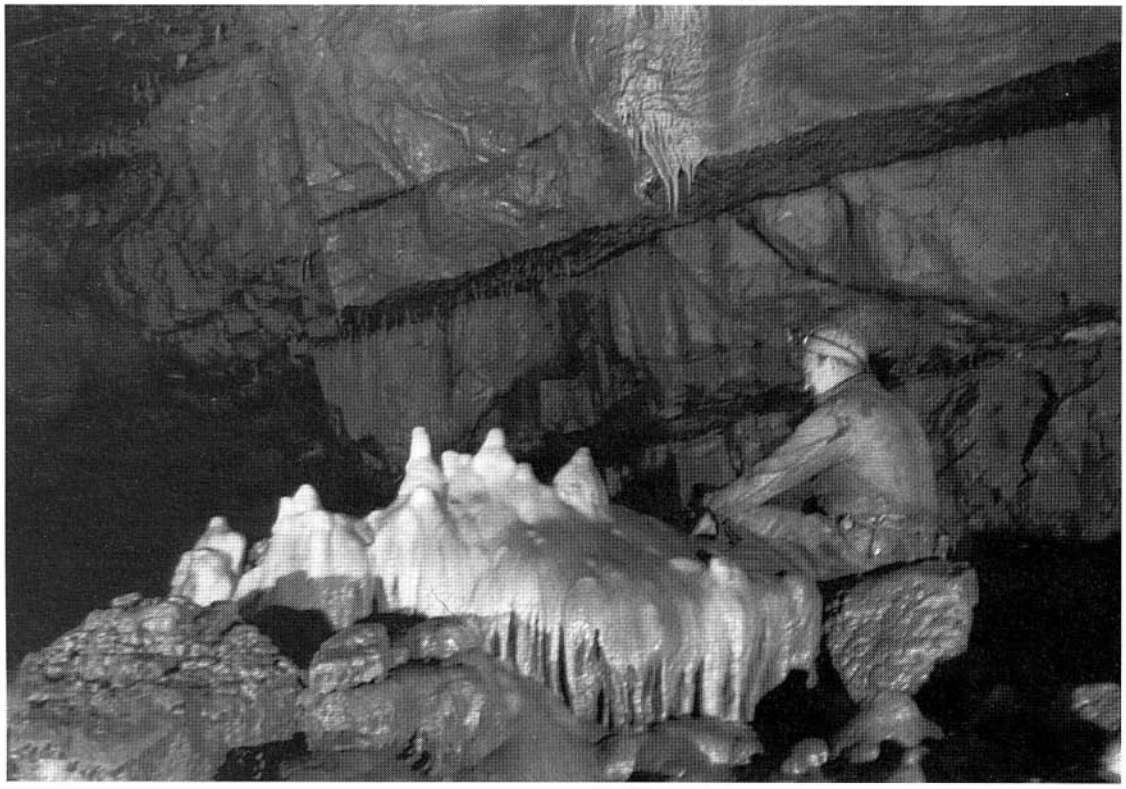


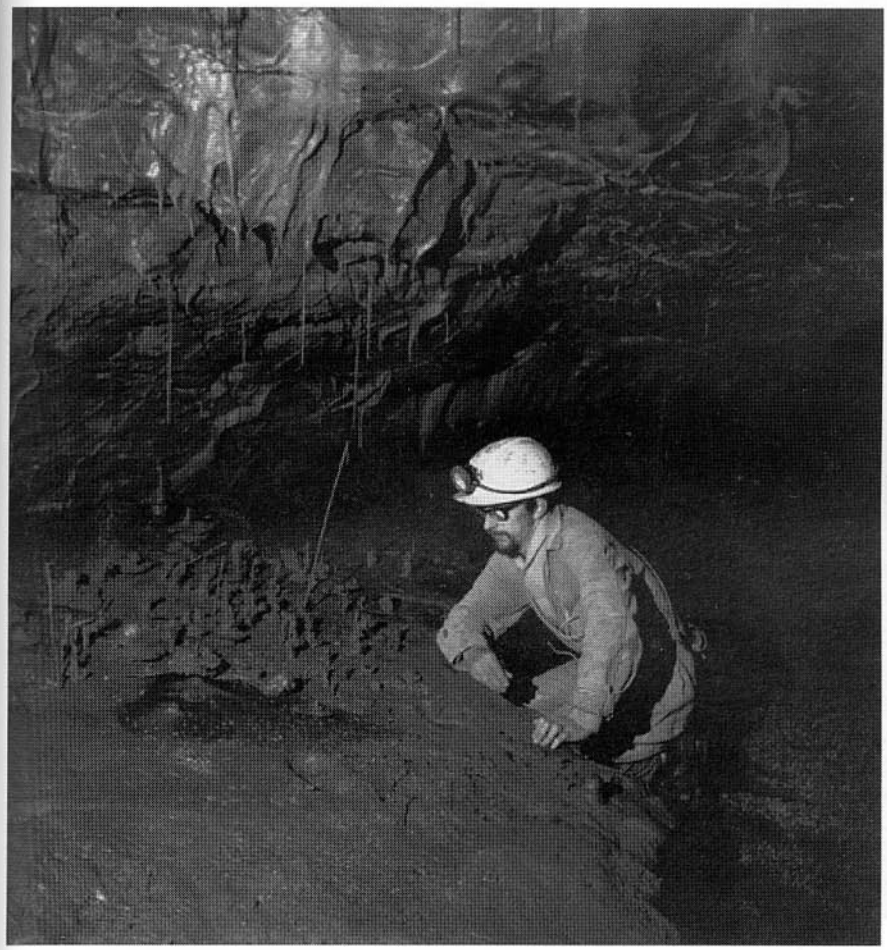
Photographs by Bob Hall



Left: Denise Samuel (now better known as Denise Knibbs) **in the Oxbow Series, circa 1970**

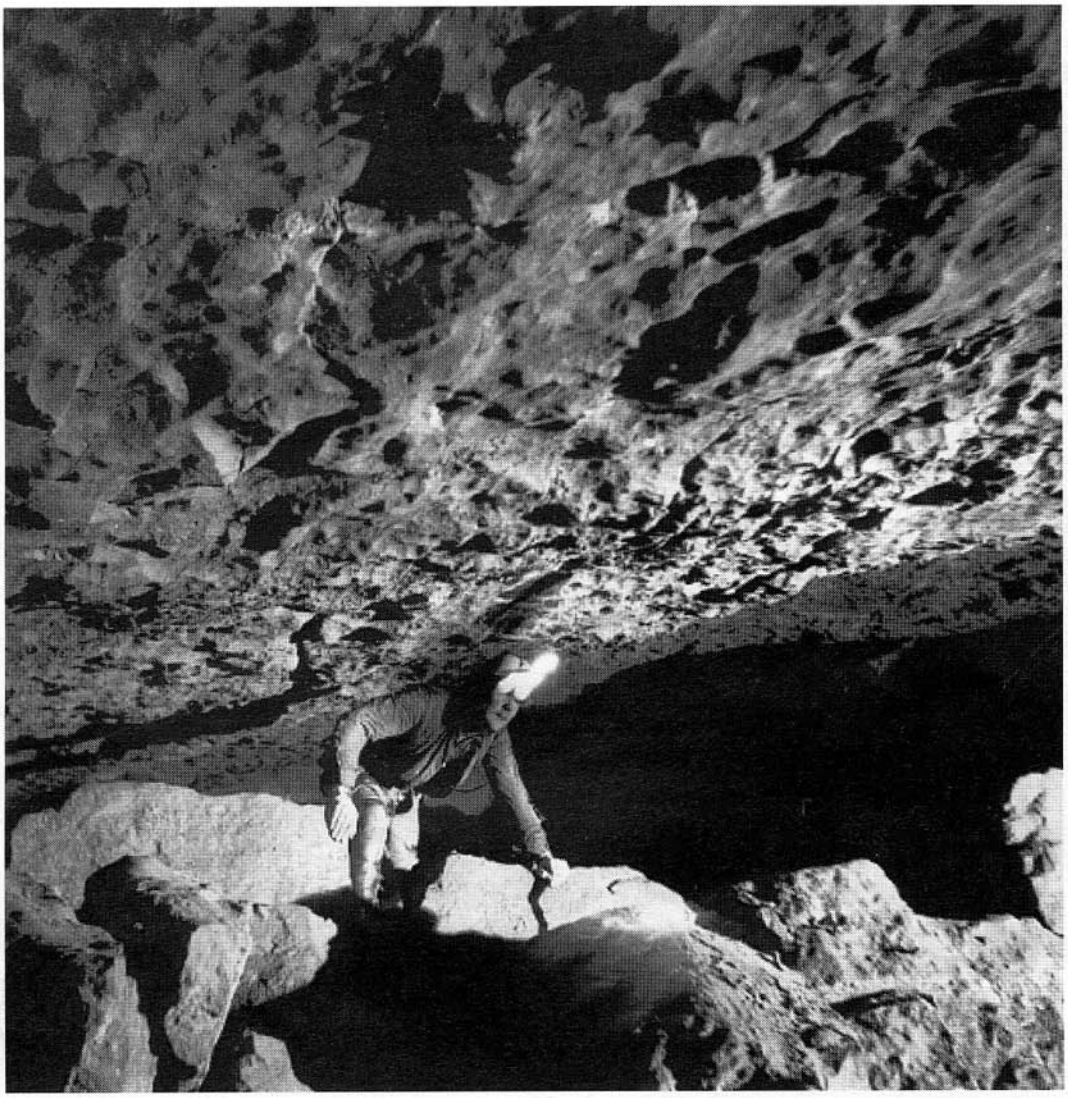
Below: Gwyn Saunders at The Wedding Cake in Ogof Ffynnon Ddu II, also around 1970





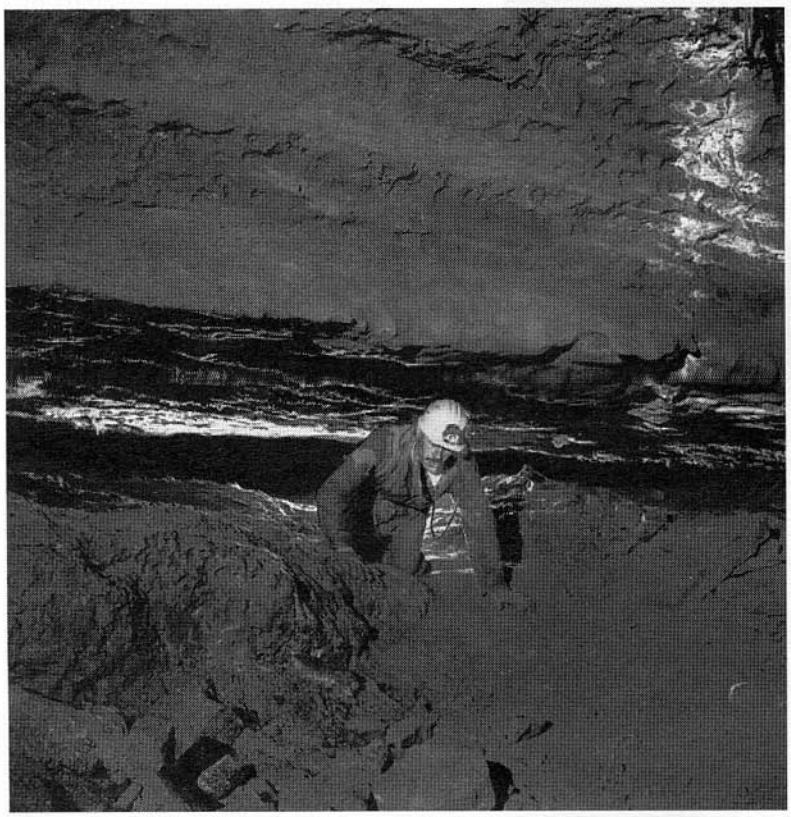
Above: Pant Mawr Pot

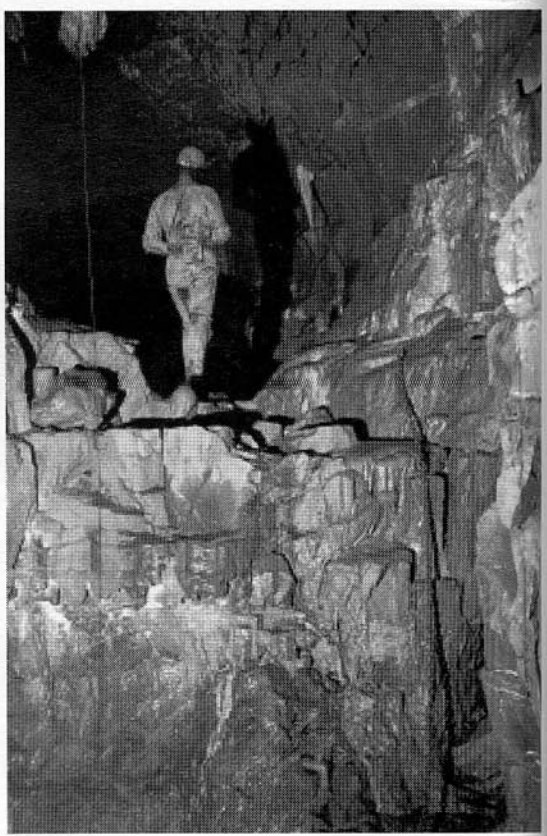
Left: Barry Mawson with mud flowers in Davy Price's Hall, Tunnel Cave. Both these pictures taken around 1970



Left, and bottom left: Shale Crawl in the Rawl Series

Bottom right: John Stephens at Idle Junction in the Waterfall Series, Ogof Ffynnon Ddu I, circa 1970





The Same Thing, Only More So

by ***Bill Little***

Editor's note: *Pat Hall found the article below reprinted in a Cave and Crag Club publication soon after Bill died, and sent it to me for inclusion here. Although written 45 years ago, the sentiments expressed are still relevant today.*

1951 is well on its way. In climbing and caving every year is a better year, so long as we do better things. Whether great or small, these are better for our approach to them and the way in which we attempt them. Motive too is important, but basically it is for pleasure that we strive in our activities; so whether we are upon mountains or in underground labyrinths it is much the same, the more we put in it the more we get out. Which means doing these activities seriously and wholeheartedly. Faced in this way 1951 should be a good year.

In climbing we seek to prove our technique and experiences of mountaineering.

The exploitation of fear and confidence, weakness and strength, endurance and the forces of nature, calls for responsibility, reliability and friendship. This must be cemented by judgment and tolerance.

In caving basically the same principles are involved but since they are less obvious they are inclined to be overlooked by many. Too often some people "have a look" in some cave or another without considering the mental and physical consequences. Their safety and their pleasure is usually deficient in the long run.

The climber with an urge to "engineer" some rock route with the ironmonger tackle can find satisfaction in the tendency underground, where the end justifies the means, without spoiling the pleasures of the "purist" rock climber. Conversely the caver can satisfy his desires on the crags by climbing unladdered pitches and knowing the indescribable feeling of standing on a summit. Though the summit may not be his ultimate goal, it is a milestone, for the attaining of this will have improved him mentally and physically. He will return to his caving that much better for it.

If anything is worth having (or doing) then it is also worth sharing. Caving and climbing are not diminished by this process but become the wider and deeper.

10/01/51

W.H. Little: 6th December 1919 - 26th December 1992.

Growing Old Gracefully
(or, How to Cave Forever)

by Dr. Alison Maddocks

...It is evident, from the structure of the body , that exercise is not less necessary than food for the preservation of health. - William Bacon, 1792.

INTRODUCTION

Some twelve years ago whilst lying on a hospital bed with acute sciatica and spondolithiasis (slipped disc) I made the mistake of asking the Consultant Orthopaedic Surgeon when I could start mountaineering and caving again. His reply was, in one short word, "Never", followed by "if you partake in those sorts of activities you will be back in here within twelve months with a cauda equina lesion" (slipped disc of the lower spine causing total paralysis). "Why can't you just learn to grow old gracefully?"

I chose to disregard his advice; perhaps I was in the fortunate position of having alternative opinions easily available and I set about following simple advice of another colleague who suggested that, the stronger and fitter your muscles are, the more they will protect your joints against injury. As the spine is one long series of joints this seemed quite sensible. I then looked at ways of achieving maximum fitness coupled with a fairly sedentary job i.e. a lot of driving and sitting around in clinics. I gradually learnt that physical fitness is not just the privilege of the young. That is enough anecdotal experience, what about hard facts?

DESIRED OBJECTIVE

To be able to enjoy what we do at 20 when we are 60, 70, 80.....

BACKGROUND INFORMATION

Fitness

It may be easier to understand the consequences of not being fit i.e. through physical inactivity. This leads to a progressive reduction in the capacity for physical exertion. Individuals find that with a period of prolonged inactivity they can exert themselves less or for a shorter time; a greater effort is required than previously and fatigue occurs more quickly. Inactivity leads to physiological changes which include poor cardiovascular function, weakness of muscles and reduced bone density (i.e. desperately unfit). When unfit people make brief efforts to exert themselves, they do so by using anaerobic energy stores and do not realise their endurance for such activity is limited (this false self perception contributes to the problems that unfit people have when they undertake sudden exercise). They are also more likely to sustain injuries such as torn ligaments and sprains after relatively minor falls. Fortunately the physiological and biochemical changes of being unfit are reversible and with a return to regular exercise an individual *of any age* can engage in activity longer and harder than previously.

Fatigue

Ageing decreases the capacity of energy generation in muscle. Physically untrained subjects become more dependent on anaerobic processes (i.e. not using oxygen) and are more susceptible to fatigue with increasing age. Simple regular aerobic training can counteract this. Fatigue also sets in when glycogen levels in muscle are depleted (this will happen to any individual after, for example, a long caving trip).

Exercise

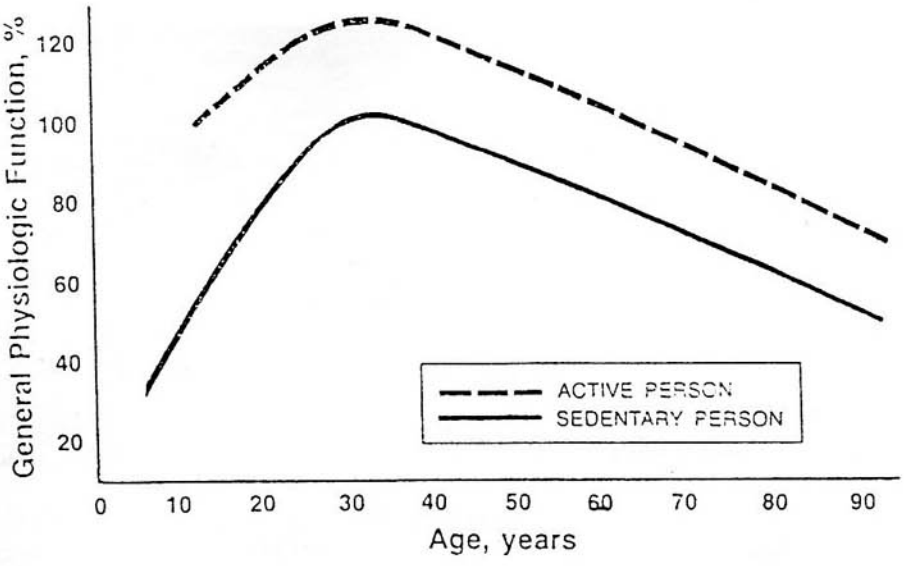
Aerobic exercise involves repeated contractions of large muscle groups at levels of energy expenditure less than about 60% in maximum capacity. This can be performed for prolonged periods on available oxygen supply. Walking, jogging, cycling, swimming are examples. An anaerobic metabolism occurs when intensive activity exceeds the availability of oxygen i.e sprinting, jumping, press-ups or lifting heavy items.

Measurement of Exercise

The maximal oxygen uptake, so-called VO_2 max is talked a lot about in texts on exercise. It is without doubt the best single measure of the overall functional capacity of an individual. This will be measured if you have an exercise work-out or fitness assessment in a sports centre. However, most outdoor types I know don't think much of sweaty gyms and won't get round to measuring their VO_2 max. You may also read about energy expenditure which is oxygen consumption or calorie consumption. An easier way is to use METS. One MET is your resting metabolic rate and any energy expenditure will be a multiple of this. Therefore driving a car expends 1.1 MET; walking up hill at 6km an hour would expend 7 METS; running at 9km an hour 8.5 METS and ski-touring 20 METS. (From bitter experience I can confirm that this is the most strenuous exercise I have ever undertaken). MET expenditure in caving would obviously vary on the speed you were caving, the type of passage; the temperature of the water; clothing and whether you are lugging somebody else's kit around but overall would be probably between 10 and 15 METS.

WHY EXERCISE AT ALL?

Earlier I mentioned the effects of a sedentary lifestyle and the danger in perhaps trying to go caving if you have no regular exercise i.e. are totally unfit. It is also helpful to exercise regularly so your caving trips are safer, you feel less tired and don't get the shakes any more. It is, as I have already hinted beneficial to grow old undertaking regular exercise. *Research clearly demonstrates that if an active lifestyle is continued into later years, a relatively high level of function is retained and vigorous activities can be*



Generalised curve to illustrate changes in physiological function with age

engaged in safely and successfully. Ageing is unfortunately, whether we like it or not, the only predictable thing in our life that we are going to do apart from dying.

The diagram above shows how various measures of bodily function improve rapidly during childhood to reach a maximum between ages 20 and 30. Thereafter, there is a gradual decline in functional capacity, with advancing years.

The good news is that an active person will maintain their physiological function at about 25% higher levels for each age category. So a 50 year-old active man or woman can have the same functional capability as a 20 year-old counterpart. Although all our body rots with age, not all bits rot at the same rate and this does vary between individuals. Brain cells die at a constant rate and liver and kidneys lose 40 - 50% of their function between the ages of 30 and 70 years. The bad news for women is they lose 30% of their bone mass by the age of 70 years while men of this age have lost only 15%.

Muscle Strength

Maximum strength is generally achieved between the ages of 20 and 30 and falls off after the age of 30 due to a reduction in muscle mass (there is actual loss of muscle fibres). Research shows clearly that older adults can increase muscular strength and endurance with regular overload strength type training.

Flexibility

You don't need an article in this journal to tell you that we become stiffer and more rigid as we age. However, appropriate exercises that move joints to their full range of motion can increase flexibility by as much as 20-50% in men and women of all ages. Prevailing clinical opinion is that normal ranges of motion for specific joints are necessary for pain-free movement. It is helpful for cavers to remain as flexible as possible. Also, physically active people of all ages move significantly faster than a corresponding age group that is less physically active.

Cardiovascular Function

Maximal oxygen consumption (mentioned above) and endurance performance show a steady decline in men and women after the age of 20. At the age of 65 aerobic endurance has decreased by about 35%. There is a progressive decline in the maximal heart rate which is expressed by the following relationship. (You may have seen this in exercise magazines.)

MAX HEART RATE (BEATS PER MINUTE)

=220 minus age in years - men
=226 minus age in years - women

Regular exercise does appear to retard this age-related decline of maximal heart rate. It also improves heart contractability, helps keep blood flow capacity to peripheral tissues and possibly prevents arteries narrowing.

The Americans have studied this in a big way and have produced tomes on the beneficial effects of exercise on the heart; prevention of coronary heart disease and identifying predictive factors for developing this. They even have a type of chart predictor called "Risko" which I will willingly discuss with individuals but for fear of making you all cardiac neurotics I have not reproduced it here!

In summary, regular exercise may not be the true fountain of youth, but researchers have found that regular physical activity not only retards the loss in functional capacity associated with ageing and disease, but can reverse the loss in function regardless of when in life a person becomes active i.e. it is never too late to start a fitness programme.

SPECIFIC TRAINING PROGRAMMES

From the above it is obviously apparent that personal fitness is highly individual; it will depend on many variables, some of which you will have no control over i.e. your sex and age. You cannot really do much about your genes either.

Cigarette smoking, a diet high in saturated fat and emotionally stressful situations are bad news. Moderate alcohol consumption does indeed have some beneficial effect but in large quantities alcohol is a cardio-toxin (i.e. poisons the heart); bowel irritant and will deplete your blood sugar levels. A throbbing head on a hard caving trip coupled with dehydration is distinctly unpleasant and dangerous. You will also need to ask yourself if you want to be the fittest person in the SWCC i.e. a) an Olympic athlete or b) fit enough to do long caving trips and not feel any ill effects or c) just stay fit enough to live to a ripe old age. Those who opt for the first category will need to embark on a rigorous twelve month training programme such as that used by triathletes. Any candidates for the Hawaii Iron Man can make a private appointment to see me.

For us lesser mortals who want to enjoy caving at weekends and mountain walking forever and assuming you already have a basic level of fitness, you will need to get out at least three times a week and develop or maintain your cardiovascular endurance. You can do this by formal circuit training or regular and constant aerobic exercise.

Activities such as high impact aerobics, jogging (at approx 10k/hour) or cycling fast in high gear are ideal. The objective during a session is to produce your required heart rate viz; 70-85% of your maximal heart rate (calculated from the previous formula). You should maintain this heart rate for a minimum of 20 minutes at least three times a week. If the time is less than this you will fail to stimulate the aerobic energy pathways sufficiently. If you are not doing a similar exercise programme you should start gradually and build up. Eight weeks of regular training will produce worthwhile and demonstrable biochemical adaptations of your muscle enabling you to sustain physical effort for longer and have less fatigue. You will need to persist in this regularly and possibly for longer the older you get. It does become easier and it is after all only three hours out of your life during the week. You will also find your resting pulse will slowly fall. Do not forget a good stretching programme before and after this activity.

Serious cavers will also want to include some weight training. The training described above is for general body fitness and in particular cardiovascular fitness. Weight training is more specific. Never personally having wanted to develop massive muscles and rippling thighs I would point people in the direction of supervised gyms and weight rooms to develop their own programmes.

SUMMARY

The above includes a very brief skim over some aspects of exercise physiology and trying to be fit. Caving is a unique sport, which does allow different individuals to carry it out at their own rate and within their own limitations. Most of us who go caving will always strive to do a harder trip one day and also to always have "something in reserve". The whole topic of sports physiology and sports medicine is a huge one and there are many areas I have not mentioned: exercising following injury, problems for women (i.e. pregnancy, menopause and osteoporosis) and specific illnesses.

Finally, why bother with all this? It would be much simpler to go and ask Peter Harvey how he keeps it up!

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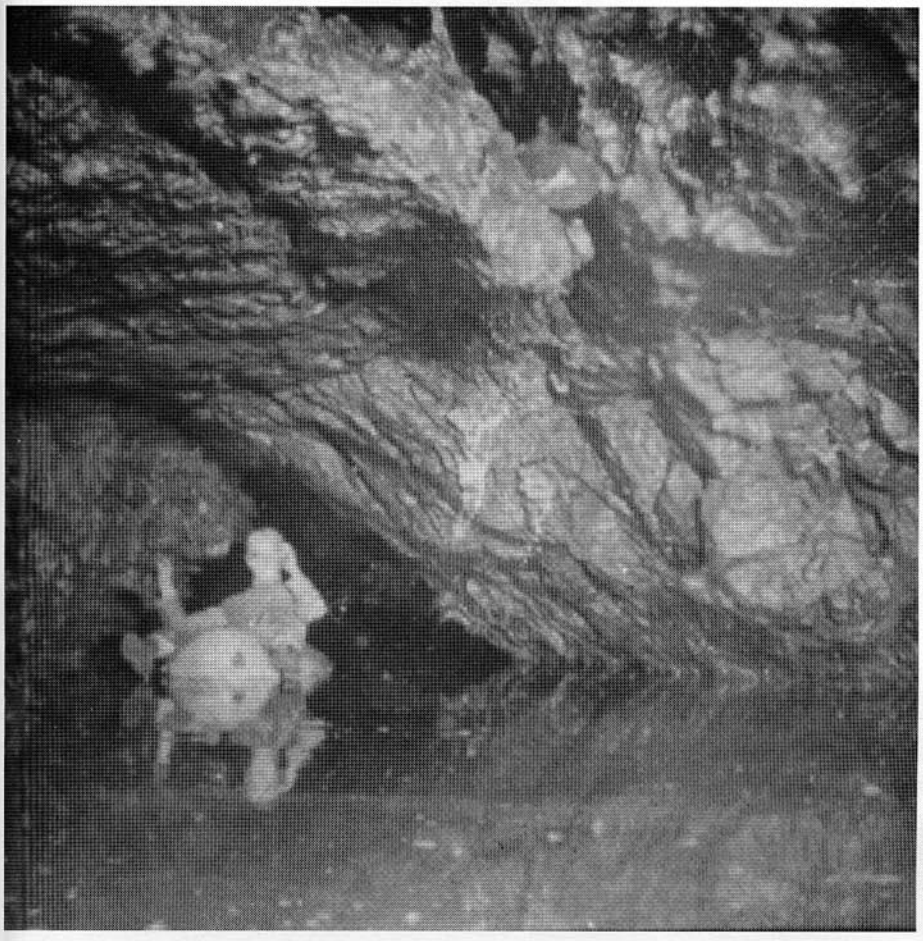
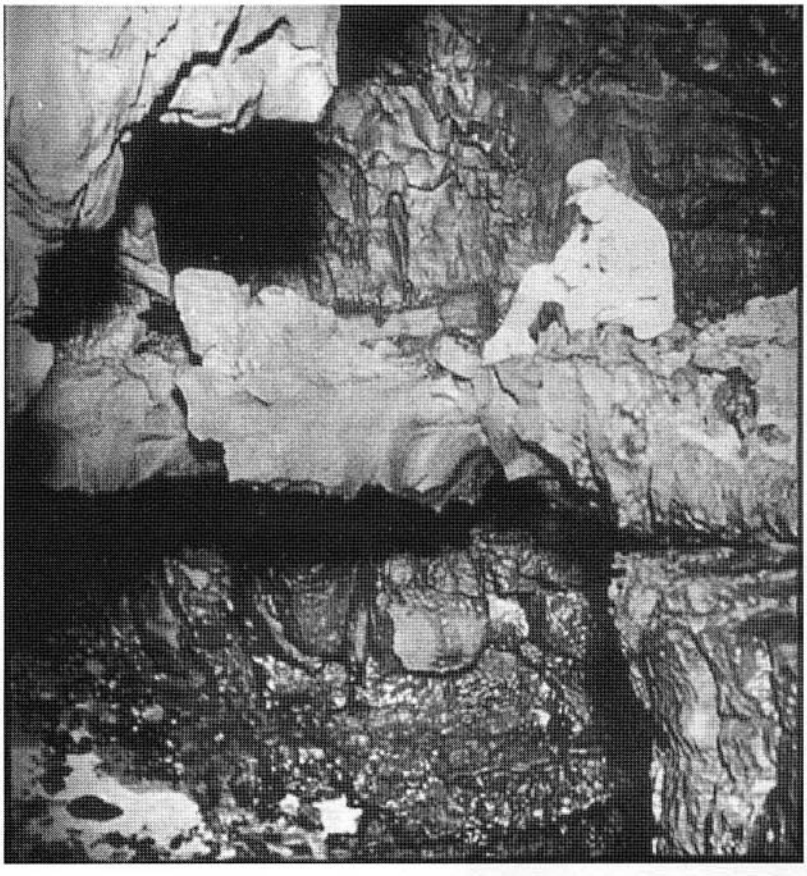
Photographs of Dan-yr-Ogof, from the Collection of Mrs. Joan Coase



Editor's note: *these photographs were the property of Gerard Platten, and on his death were passed to the late Alan Coase. I would like to thank his widow Joan, for lending them for the purposes of this publication.*

Left:The Lakes, 1937
Below: A 1937 meet



Above: the entrance, 1938
Left: Bridge Chamber, 1937

Dan-yr-Ogof, 1946?

101 Great Caving Trips, no. 8:

No Picnic At Ogof Craig-ar-Ffynnon

by Martin Hoff

(In which it is found that caving outside the Upper Swansea Valley can be hazardous to one's health...)

I'd been caving for a couple of years by then, and enjoyed a growing confidence in my own ability. Early in my caving career I'd been on one trip where a rescue had been necessary after someone I was with broke a leg, but otherwise I'd had none of those narrow escapes which build up your experience to the level where you know when you're pushing your luck. This was to be one of those trips.

Sunday 12 December 1993. I'd been in Twyn Tal-Draenen on the Saturday, and we'd spent the night at Penwyllt. It had rained most of the night, and fairly heavily, but I'd not paid too much attention. After all, this was largely a trip down a dry cave, not a stream passage cave like, say, Swildon's.

We gathered at the old lime kilns, Gary Vaughan and I from Penwyllt, Chris Payne (otherwise known as "Crispy), Tony Harris and his friend Marcus travelling up from Dorset. There was one other member of this happy band, best referred to pseudonymously as "A. N. Obhead", due to his negative score on the personality meter.

Another group was also going into the cave that day, and after letting them go on ahead we made our way through the gate and up into the excavated crawl section. Plenty of formations to look at, orange tape guiding the way and routefinding therefore hardly difficult. A small stream passage led to the first boulder choke where steel ladders and scaffolding stabilised the boulders. The way on was through what *Caves of South Wales* describes as "a crawl in a gravel-bottomed stream passage"; there was some water flowing down this, but only a trickle. No problem.

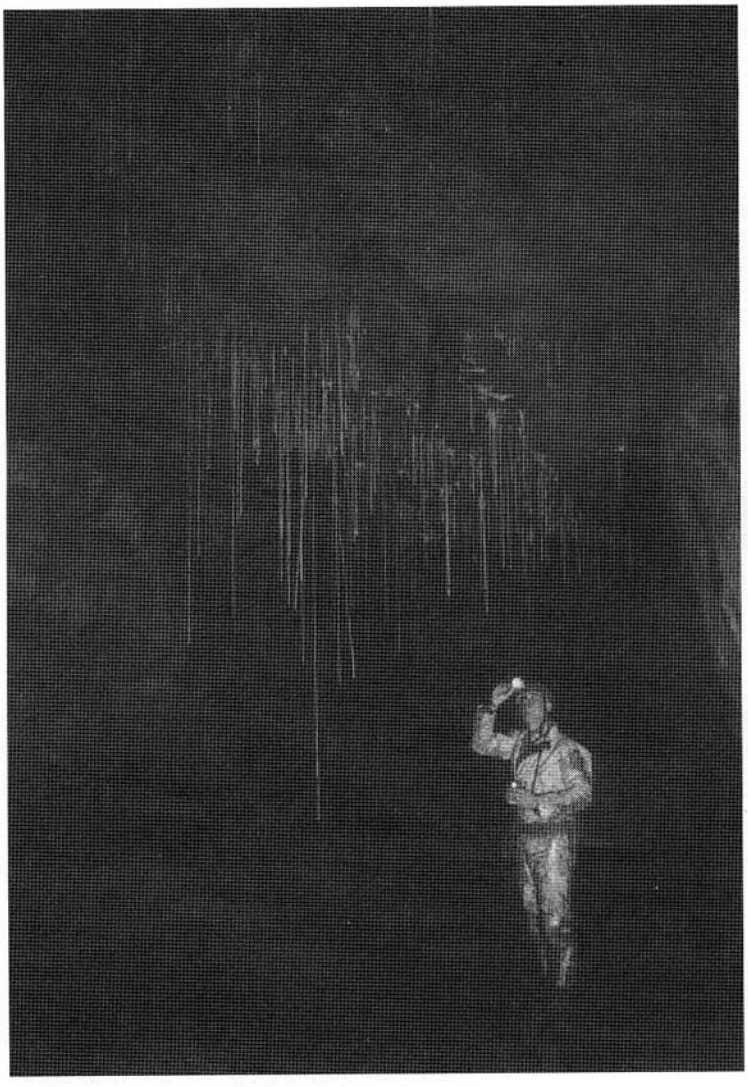
Up to the junction with North West Inlet, more flat-out crawling (this time over flowstone), and up into the second boulder choke. Gary and Crispy were used to caving together, Tony and Marcus frequently caved as a pair, and by default I was saddled with what was left. The delightful combination of horizontal and vertical moves involved in passing the second boulder choke allowed me to "accidentally" empty my wellies over Mr. Obhead, as we moved out into what my memory tells me were a lot of large passages with thick mud floors. In some places the only way to progress was to slide along on my knees in the parallel trenches other people's knees had worn.

With lots of formations to look at, a photo stop with Crispy allowed me to lose my shadow for a while. The pictures were hardly brilliant (are they ever?) but here they served a far greater purpose. We caught up with the others in the Hall of the Mountain King, a well-named and impressive chamber. I must have had some sense of my limitations as I didn't even bother to waste the film. We moved off down Hurricane Highway, almost 250m of crawling, to emerge in the Severn Tunnel, a lovely phreatic canyon with loads of selenite crystals in evidence. I was getting tired now. The rest of the cave blurred into fatigued stumbling, the wisdom of all that extra effort sweating away in my wetsuit now seemed marginal. Better than the prospect of putting back on the gear I'd soiled the day before, I'd thought. I couldn't have guessed how right this was to prove to be.

I turned round at the fourth boulder choke, quickly caught up by Tony, Marcus and the other bloke. I was definitely in no mood for listening to him now, and by the other end of Hurricane Highway I was barely treading water in the mass of salty liquid that seemed the limit of my universe. I flopped down to wait for Gary and Crispy who were a little way behind. They'd gone to look for the Promised Land, as many do. Peace, and a rest. Surely this was the Promised Land right here.

They arrived all too soon and we were off again. In the 500m of large muddy passage back to the second boulder choke, the three of us stopped by some lovely big gours for a welcome drink from Crispy's trusty flask, and more photos. As expected I could barely maintain Vaughan velocity by now, and after a few attempts at wrong turns I reached the choke just in time to see the soles of Chris's wellies disappearing between the boulders.

It felt different somehow. Water had begun to drip through and from its earlier silence the choke had become noisy. I was still concentrating enough to stop and catch my breath before climbing back down the aven to the flowstone-floored section, which was now surfaced with flowing water. A revitalising rush of water down my neck later, I started to realise something was seriously wrong. There was no sign of Gary and Chris, who I thought might have waited for me. As I progressed down the passage I realised that, in the last few hours, the water had risen. Water I remembered as being just over knee deep on the way in was now approaching nipple level. I rounded the next corner, following the water. "No, that's a sump. Must have come



Ogof Craig-ar-Ffynnon, by the author.

the wrong way." Oh dear, and similar phrases. Right, think!

I turned round and retraced my steps. I was talking to myself now, a conscious effort to rationalise my situation, to work my way logically through where I was. "OK, I recognise this junction. If that's not the way, this is the only other option." I lowered my face to the surface of the water streaming out of North West Inlet, and prepared myself to try to work my way up against its flow. In a flash it all clicked: "No, that was the way. Didn't I see orange tapes flowing into the sump? The same tapes I'd crawled up between on the way in? And now it's sumped."

The possible outcomes of what I'd just nearly attempted filled my mind. "Shit, that could have been the biggest mistake of my life." I took the time to be sure I didn't rush from one mistake to another. My super-abundant body heat was barely a memory. The first thing to do was to stop standing up to my waist in water.

I climbed on to a rock above the rushing water, settling down a bit. What about the others? I supposed I'd better go and examine the sump and see if there was any airspace. Kneeling down I shone my light across the barely-there surface, water filling my ears. I wanted to be absolutely certain before I committed myself to this.

I could see where the roof appeared to open up - there had been a distinct gap between the two crawls. I ran over it all again in my mind. Was I really right?

A figure appeared. Concerned at what was taking me so long, Tony had come back through the second part of the crawl. He shouted that I should come through, and merely lifting my weight off my knees meant that I was immediately washed through to where Tony stood. "Who's with you?" he shouted, struggling to be heard over the noise of the water. Gary? Chris? What had happened to them? Tony actually meant the other party that had come in before us, of whom there was no sign. He pointed out which side of the crawl to aim for - the passage was as good as sumped.

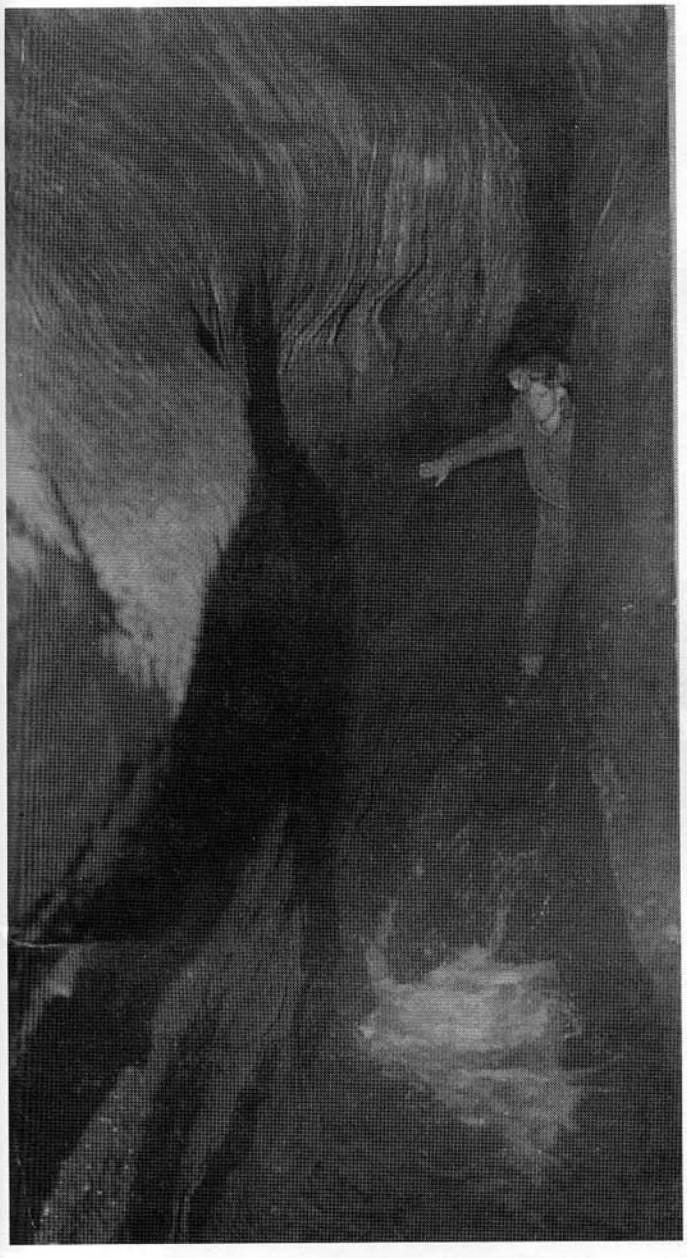
Deep breath, and once again the water sped me through. I stood up and looked at Gary, Chris and Marcus. The water draining off me was replaced with a welcome wave of relief.

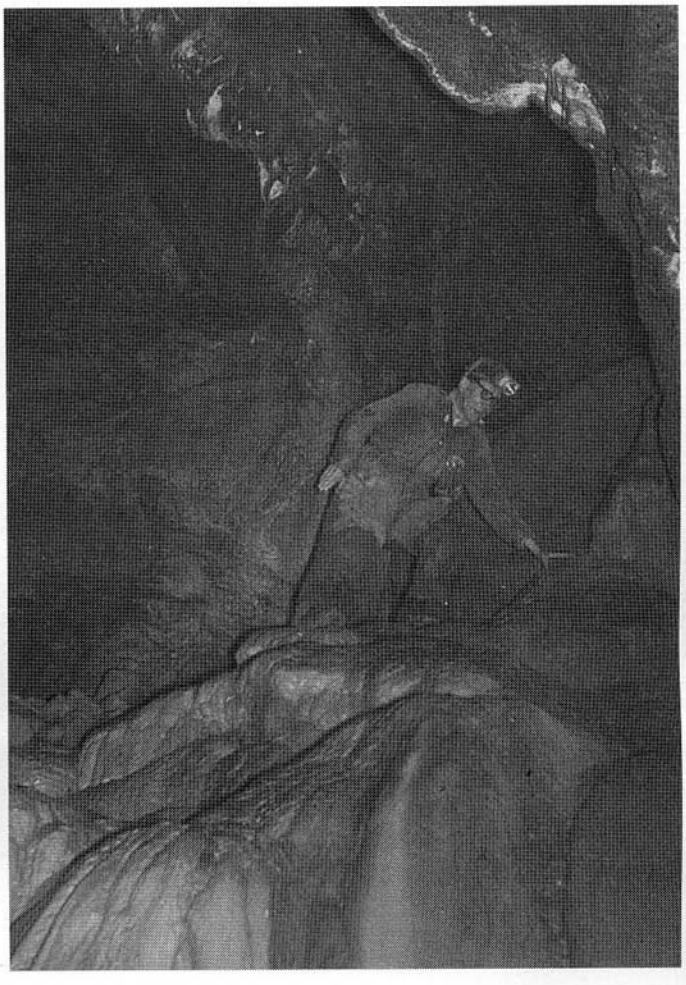
"We knew you'd be OK, you were the one with a wetsuit on," said Gary. "Hmmm..." I sort of answered. I spent the next couple of hours on an immense adrenalin high as we travelled back to Dorset. From the high vantage point a Transit van gives we could see just how much rain there had been from the standing water in the fields. And it was still raining, even now.

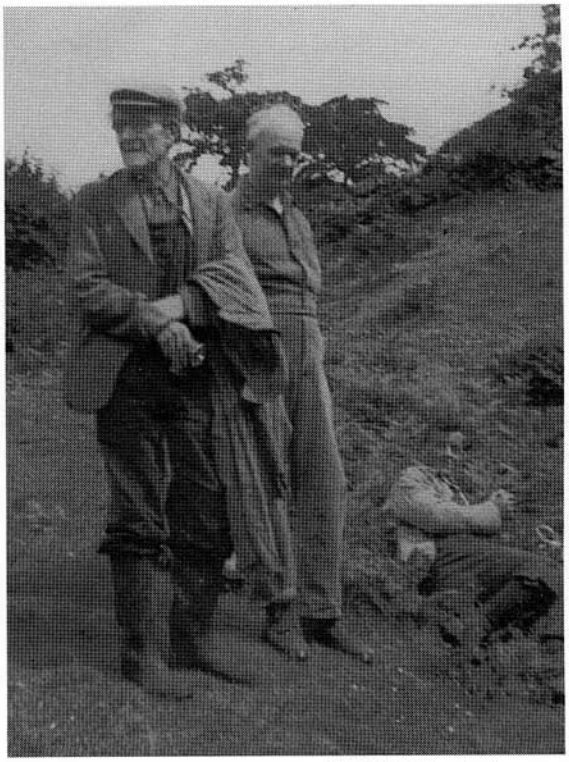
We talked about what had happened, occasionally adding further details as they occurred to us. The adrenalin was just levelling off when Gary dropped another little remark. When Tony had come back through to look for me, Gary had marked the water level. In the time Tony had taken to crawl back through, stand up and shout, wait for me to float down to him and dive back through, barely a full minute, the water had risen half an inch. The next part of the journey was made in silence.

N.B. "WARNING: THE CAVE IS LIABLE TO FLOOD. The stream passage near the entrance can flood to the roof in wet weather," says the guide book. Well it would, wouldn't it ?

Photographs from the Collection of Mr. John Barrows







Above: John Alexander in the Ogof Ffynnon Ddu streamway, around 1952

Top right: Dr. Edward Aslett descending Cascade Aven, Tunnel Cave. John thinks that this photo was taken one or two years after the discovery of most of Tunnel Cave in 1953

Bottom right: L to R - Cyril Powell, Charles Freeman, Peter Densham. 1949/50.

Top: Cyril Powell (on right) and Danny Lewis (who was John Barrows' best man) at Powell's Cave in 1926. Bottom: The bones found in Powell's Cave in 1926 (see SWCC Newsletter No.112, 1993, pages 23-27 for more details). Both these pictures by Llew. E. Morgan

Rock Falls

by Keith Ball and Clive Jones

If you're looking for a big opportunity, seek out a big problem.

Boulder chokes are part of a caver's life and we spend a great deal of time climbing over them, through them or trying to dig past them. Despite the great deal of time spent in these boulders we have not used much of it to obtain a better understanding of how they came to be. If we had been a little more observant then perhaps we would now know enough to have a reasoned digging strategy for each and every choke we tackle.

Some will argue that there are so many variables that no theory could do sufficient justice to the problem to be of any use to cavers. Push on regardless, following lead after lead through the pile, is by far a better policy. There is a lot to be said for this, especially when considering that the random shapes and distribution of boulders can easily create a negotiable route through almost anywhere in the pile.

However, just in case there is some cosmos in the chaos this note is our first attempt to interest people to be more observant and to then contribute to the thinking about boulder blockages. In any case it could be an alternative to discussions on religion, politics and sex in the pub of an evening

We are suggesting that as a first step that we take a lead from the biologists and attempt to classify boulder chokes. If then we are able to describe what we see terms of a classification it will give us some thing to look for when we are confronted by a shambles of shattered stone. Unless we have something to look for we will see nothing.

Our first attempt at classification is six levels, with most levels being a subset of the preceding level.

Level 1 STRATIGRAPHY

In our area cave passages are found mostly in one limestone formation: The Dowlais Limestone. Within this formation, which is about 100m thick, it is clear that there are zones within the succession which are more conducive to cave development. Primary phreatic tubes are located at a small number of horizons within the formation. As a result many cave passages are concentrated at certain heights within the Dowlais Limestone formation. However cave passages are not confined to these horizons since canyon development can result in downcutting of several tens of metres beneath the origins and collapse upwards can literally raise the roof. In practise most of the Dowlais Limestone somewhere has a cave passage in it.

So if we come to a boulder pile how do we approach the problem? Ideally we would be able to locate the passage that we are in, either by knowing the geology or by surveying its position in relation to reference horizons, the most convenient being marker beds near the bottom and at the top of the formation. The next problem might be to examine the boulder pile or choke and again, ideally by recognising the origins of the boulders, to give some idea of the likely height that we would need to penetrate if we went over the top.

Failing this option can we get some general idea of the position of the upper part of the boulder pile by noting the size and shape of the boulder and postulating in which beds they originated. This does not always follow. See fig 1.

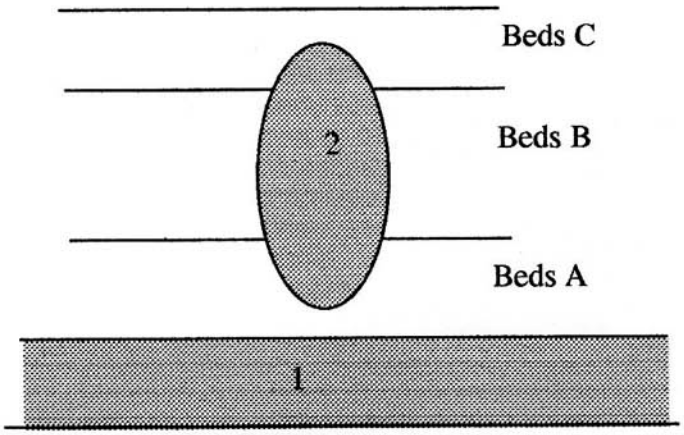
Today's cave surveyors are very professional and are backed up with powerful computer programmes. It will therefore be no big problem to relate all of the chokes in a surveyed cave to their geological horizons.

Level 2 GEOMETRY

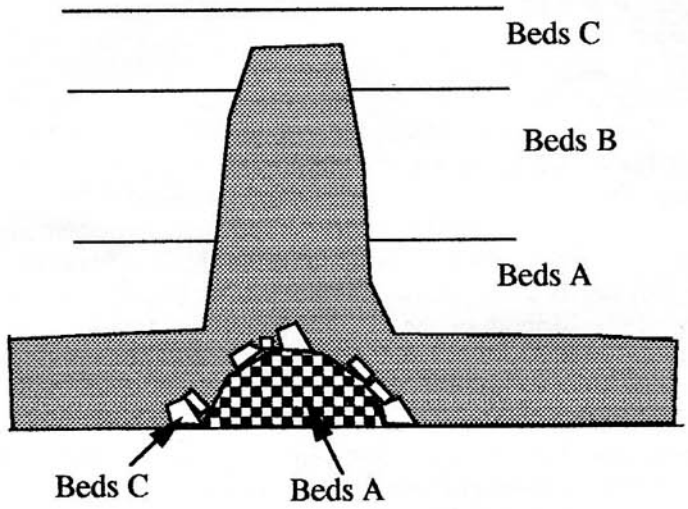
The shape of a passage will influence its structural stability and the tendency for rock falls to occur. There are three basic passage shapes: tube-like, canyon-like and rectangular.

Some cave surveys show cross-sections but there is a need for more. These should not be difficult to obtain when you consider the number of people who enjoy caving trips because they are caving trips and need no grand purpose to justify what they do. If once in a while some of them could be persuaded to make a few dimensioned sketches we would soon have the information needed.

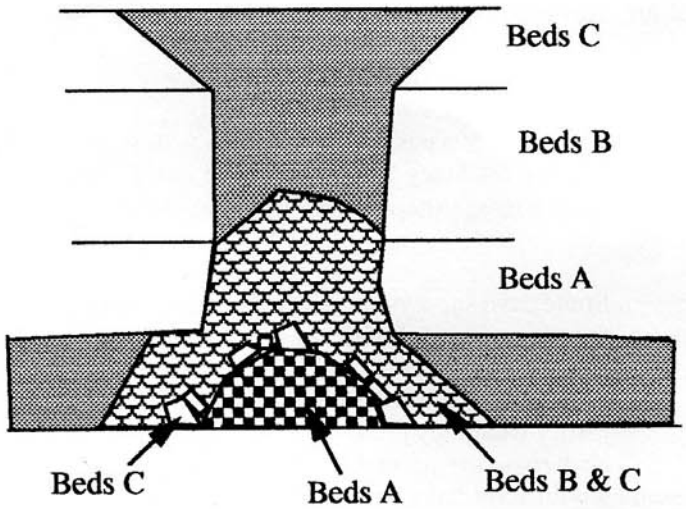
Rock blocks fall from cave walls and roofs. In both cases, as the boulders fall, voids occur within the pile and the boulder pile takes up more space than the sum of the individual boulders. In the extreme case the hole will cease to develop when it becomes filled with boulders and voids. See fig 2.



One cave passage passes over another.



Roof of passage 1 collapses and the boulder pile contains boulders from Bed A, and also Bed C caused by upward migration of Passage 2.



Passage 2 roof propagates upwards to a stable roof and contributes boulders of beds B and C to the boulder choke.

Suggested scenario for Boulder Chamber in Ogof Ffynnon Ddu 1.

FIGURE 1

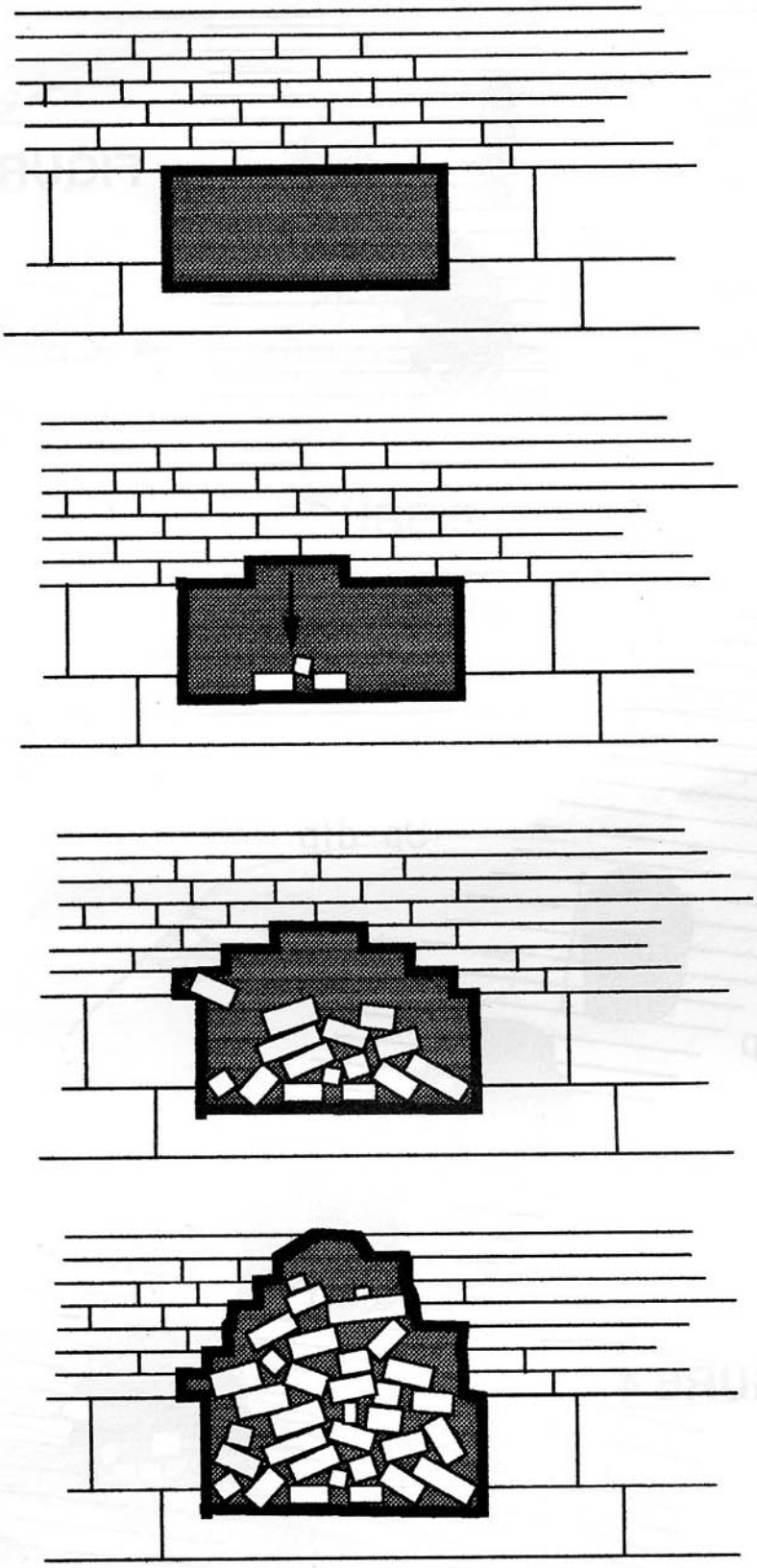


FIGURE 2

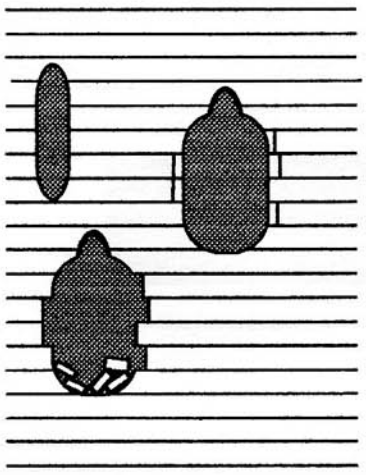


FIGURE 3

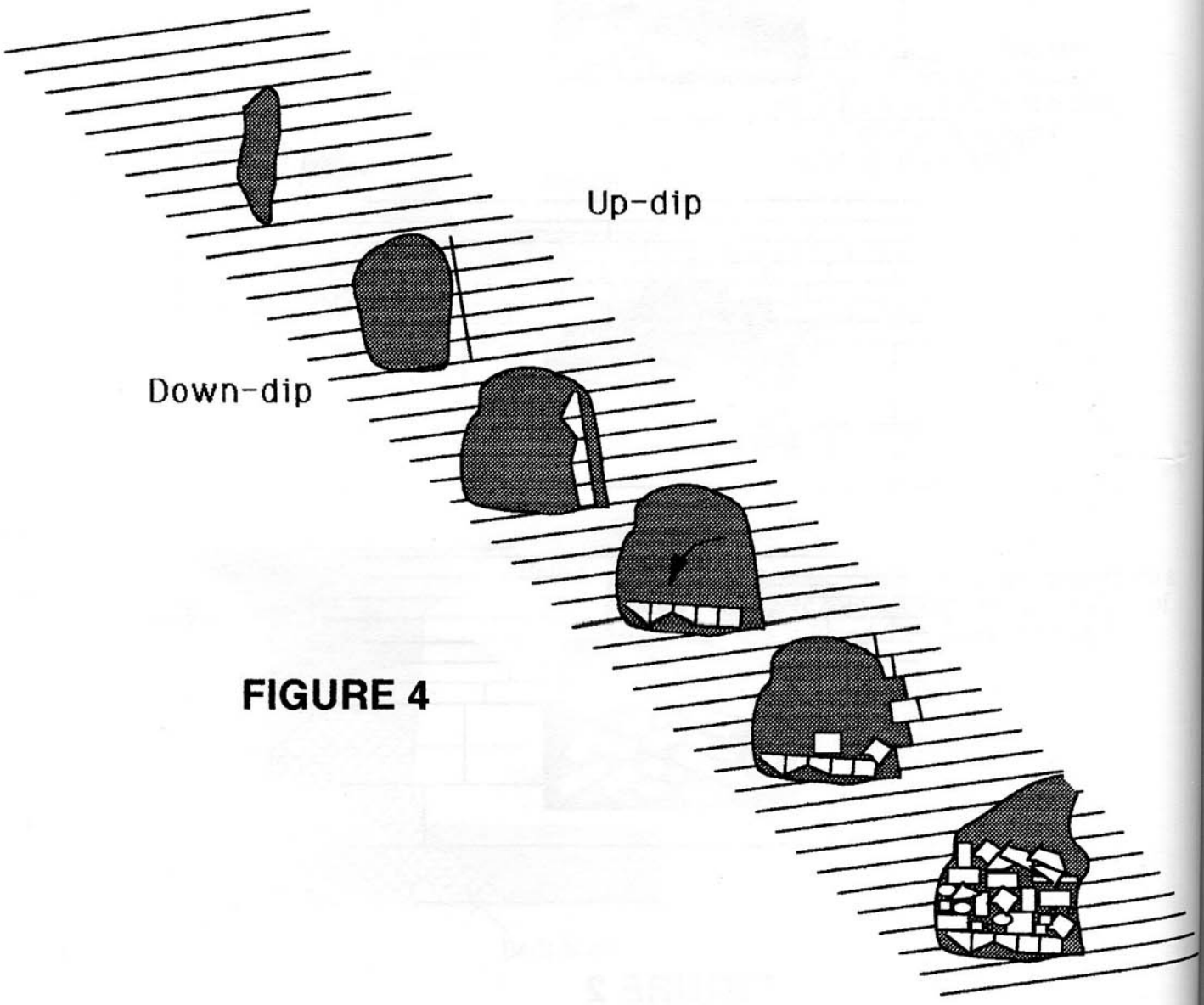


FIGURE 4

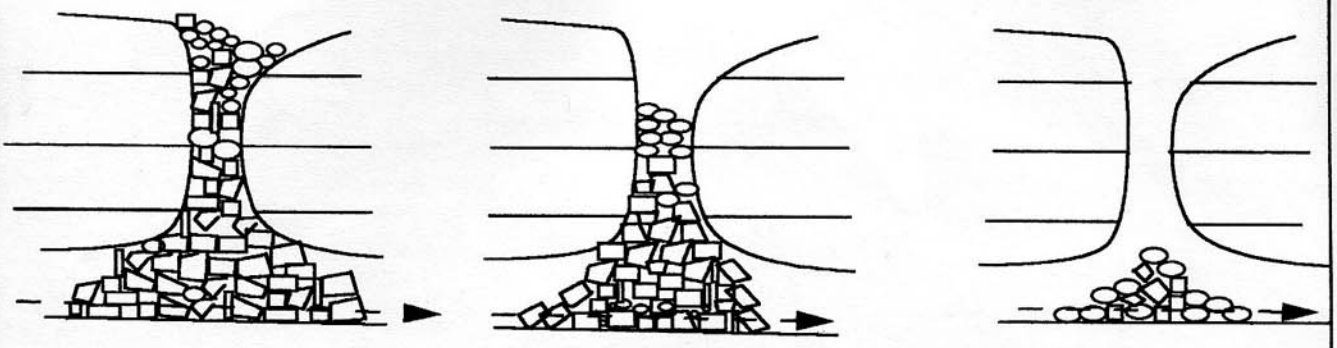


FIGURE 5

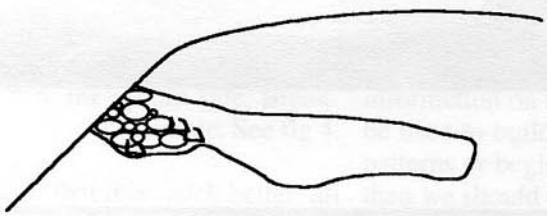
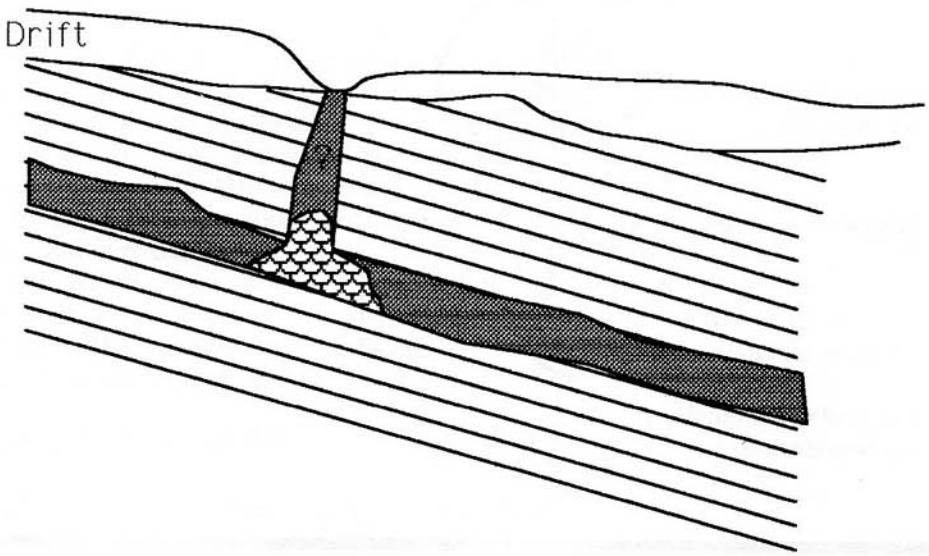
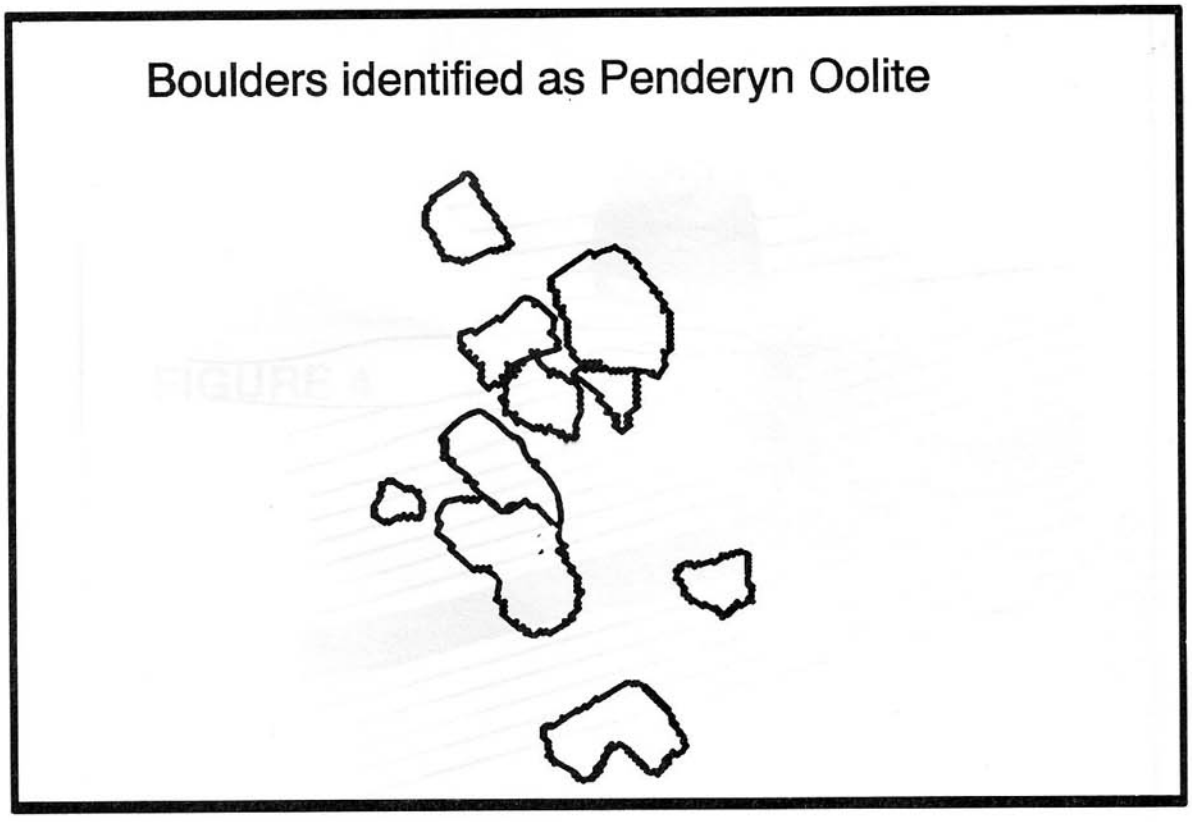


FIGURE 6





Photograph of Boulder Chamber, Ogof Ffynnon Ddu I by Graham Christian

Level 3 DIP OR STRIKE.

Passages generally are formed either along the strike or in the direction of the dip.

Dip Passages.
Observations indicate that in Ogof Ffynnon Ddu there is little or no collapse if the width of the passage is less than one metre wide. As the passage gets wider, then at three to five metres, walls tend to flake and breakdown occurs firstly from the walls. The breakdown is joint-controlled. Both walls tend to contribute boulders to the passage floor. Unless the passage is much wider than five metres the roof appears to be quite stable. This is because the solutional effects producing the passage tend to produce a roof arc that is mechanically stable.

Strike passages
If passages are aligned along the strike they quite clearly have one wall that is up-dip and another down-dip. Joints in the walls induce weakness and there is a tendency for walls to break down mostly from the up-dip side. Breakdown from the down-dip wall is often negligible. See fig 4.

The lesson from this of course is that it is much better, all other things being equal, to follow the down-dip wall, since that wall will be more regular than on the up-dip side. One might think that there are safety advantages in following the up-dip wall but this is only psychological. The loose boulders do not necessarily move away from the wall when they collapse and the wall itself may be unsafe. See fig. 4.

Level 4 WATER MODIFICATION.

Broken rocks, because of their larger surface-area-to-mass ratio, will erode faster than passage walls. As a result a boulder pile will be diminished by flowing water. If the base of a pile is in an active stream then the pile will be lowered. If the pile is being eroded by water flowing down through it then the erosion will be more general but the result will be the same, i.e. the lowering of the pile. It is possible that in the second case with free-flowing water trickling through the pile that erosion will be quicker due to increased aeration of the water. Alternatively the boulders become cemented with calcite. See fig 5.

Level 5 SURFACE CONNECTIONS.

Many boulder chokes result from a connection to the surface. These connections can either be a shaft, caused by roof collapse or aven development, or a blockage resulting from the infilling of a passage by glaciation or surface erosion. See fig 6.

The infilled types are often characterised by the presence of rounded boulders of rock types that are not found in the adjacent bed rock. The infill material is often poorly sorted, containing big boulders and a clay and silt fraction. These are usually derived from the glacial drift and thus include boulders from the Old Red Sandstone, and from the Basal Grit of the Millstone Grit series.

Level 6 PROXIMITY TO OTHER PASSAGES.

Passages one above the other create a weakness in the roof of the lower passage which can lead to a collapse. It is likely in Ogof Ffynnon Ddu that a significant number of the deeper chokes are caused by passages crossing other passages.

SO WHAT NEXT?

The observations we have made for this first attempt at a classification are fairly obvious and need to be improved. What is now needed is a systematic approach to recording information on boulder chokes. This information can then be used to build a better classification. If we can identify patterns or begin to understand the structure of any choke then we should be able to predict the position of the "way on".

Our plans to achieve this objective are;

1. To co-operate with cave surveyors to develop surveys showing the geological level of all cave passages.

2. To use this information to see if there are any patterns of boulder choke occurrences.

3. To produce a record sheet, that could be completed by anyone on a caving trip, and to use this information to classify the chokes.

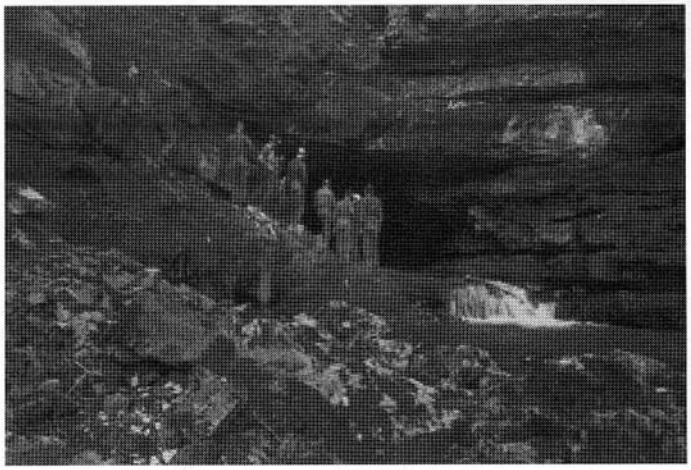
4. To make this information widely available on the internet and in club journals.

5. To develop a numerical model of chokes so that they can be created as a computer model.

We would be delighted to hear from any one who feels that they can comment on the above and become involved in any project.

Photographs from the SWCC Library

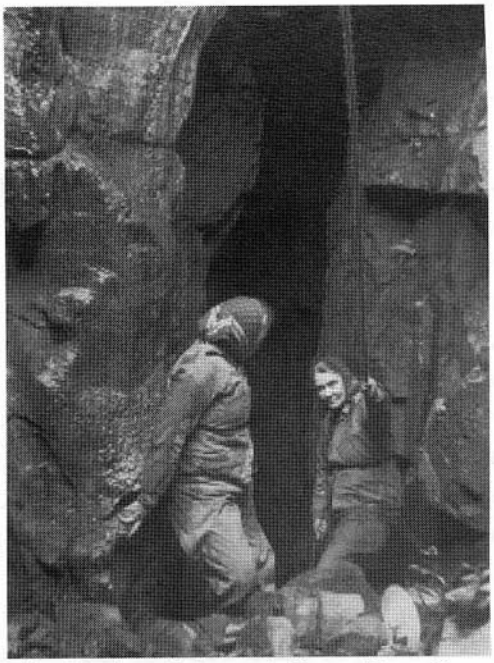
The photographs over the following pages are from a box in the library. In most cases the photographers concerned are not identified.



Three photographs from 1938.
Right and below: Pant Mawr.
Above: Dan-yr-Ogof.

Outside Y Grithig, circa 1951/2. L to R: David Hunt, John Alexander, Peter Harvey, Sylvia Barrows with Howie, Ruth Barrows, John Barrows, Bill Little.

Brigadier Glennie's (65th?) birthday party, Ancient Briton, 1940. Back row, L to R: Gwen Hill, John Davies, "Griff" Griffiths, Charles Freeman, Colin Hill, Marjorie Railton, Mary Hazelton. Front row: Mrs. John Davies, Mrs Griffiths from the Ancient Briton, Aubrey Glennie, Dr. and Mrs Ashford Price, Lewis Railton and Ricky the dog.



The Taylor sisters at Cwm Dwr Quarry Cave No.1

A Flint Find in Ogof Gofan, Castlemartin, Pembrokeshire

by Mel Davies

This cave, situated in a sheer sea cliff at SR 9581 9301, has only had infrequent visits since its discovery in 1966, but publications of finds from it have appeared many times over the years (ref.). Animal bones were found protruding from wet clay in the Bone Chamber (see plan), Neolithic pottery lay on the surface at "B" only 3m from the entrance, and a brief excavation by R A Kennedy, the County Archaeological Curator, revealed waste flint fragments in an alcove near "A" on the plan. During winter storms it was clear that wave tips and spray reached the entrance and it was feared that all the prehistoric deposits had been washed out.

On August 31st 1996 the Countryside Council for Wales organised an official visit by a geologist and a marine biologist to assess various caves on the coast, and it was my job to guide the visitors and describe the archaeology. Close examination of the rubble and pebbles on the floor of the entrance chamber revealed waste flint and the flake shown in the figure. This artefact has been chipped out from a prepared flint core using well-known techniques but it shows no evidence of use as a scraper. The find suggests that much more survives in the entrance passage than had been suspected. Fortunately a thin layer of stalagmite protects part of the floor, but further excavation is necessary before winter storms complete the process of destruction. This process of coastal erosion and washing out of cave deposits has been continuous since the eustatic recovery of sea level following the low levels of the last Ice Age, and much has already been lost from several of the known caves. We can never know what was contained in those caves which have been completely destroyed, nor can we guess at what is disappearing from those caves not yet discovered.

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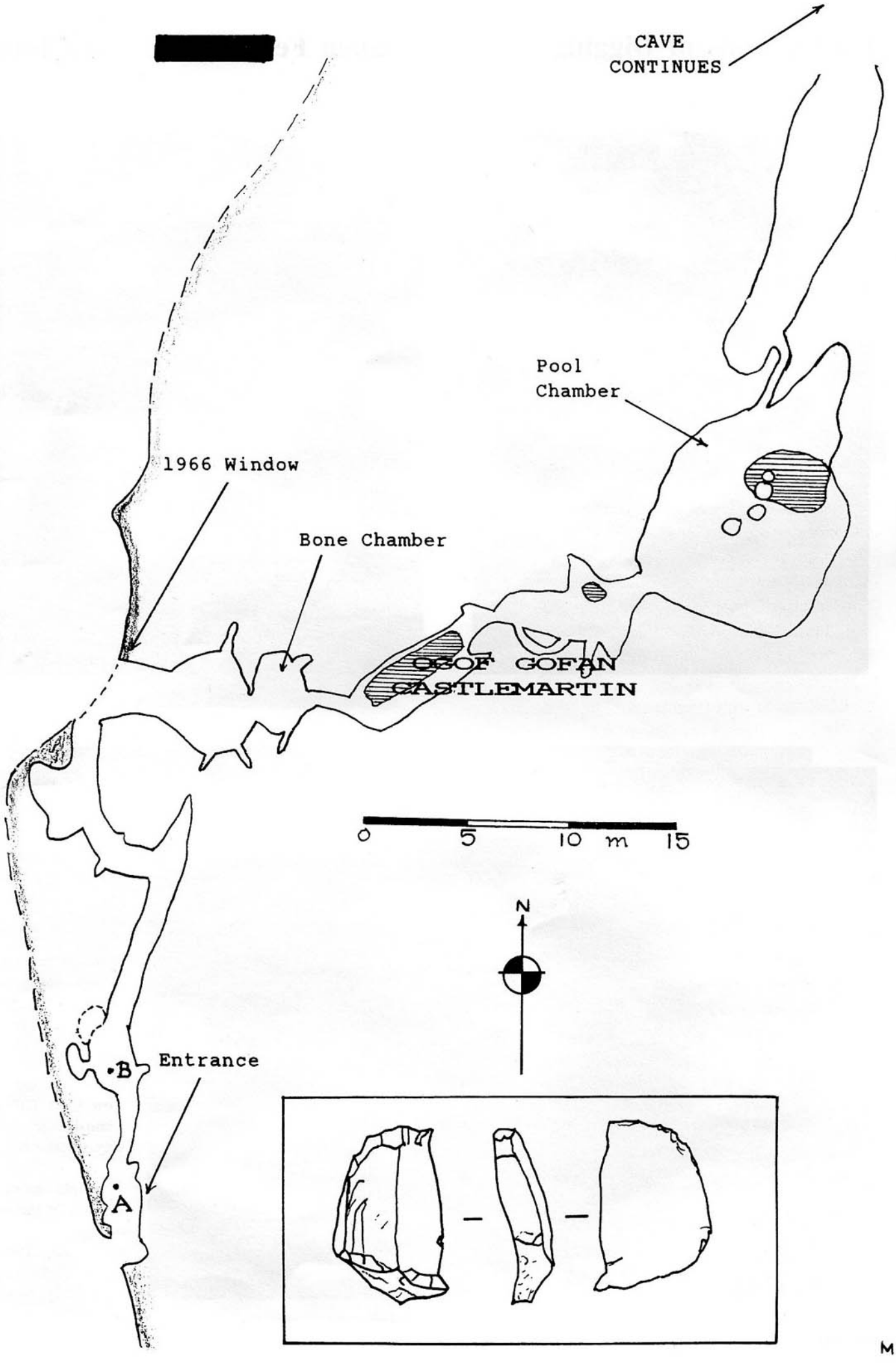
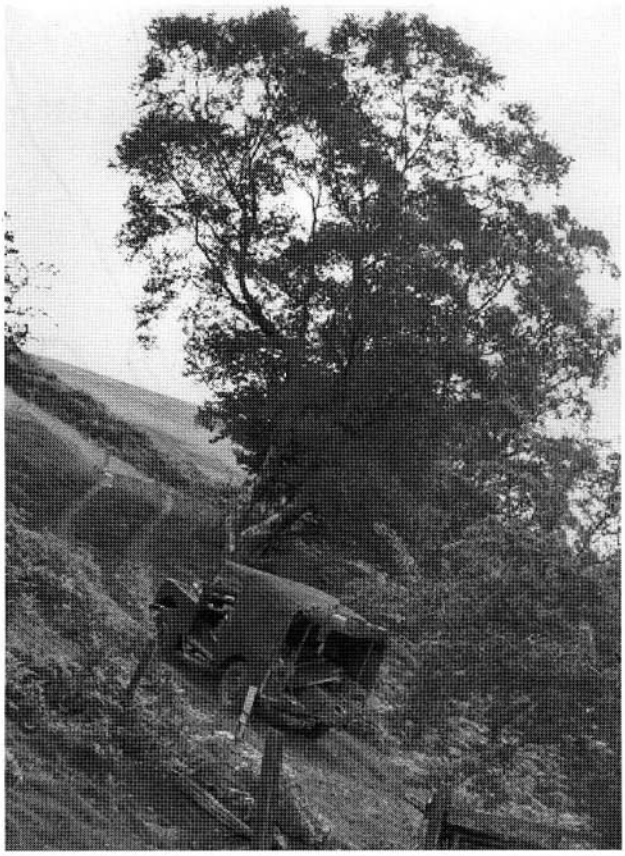

CAVE
CONTINUES
Pool
Chamber
1966 Window
Bone Chamber
OGOF GOFAN
CASTLEMARTIN
0 5 10 m 15
N
B
Entrance
A

MD

Photographs of Digging at Waen Fignen Felen, from Clive Jones

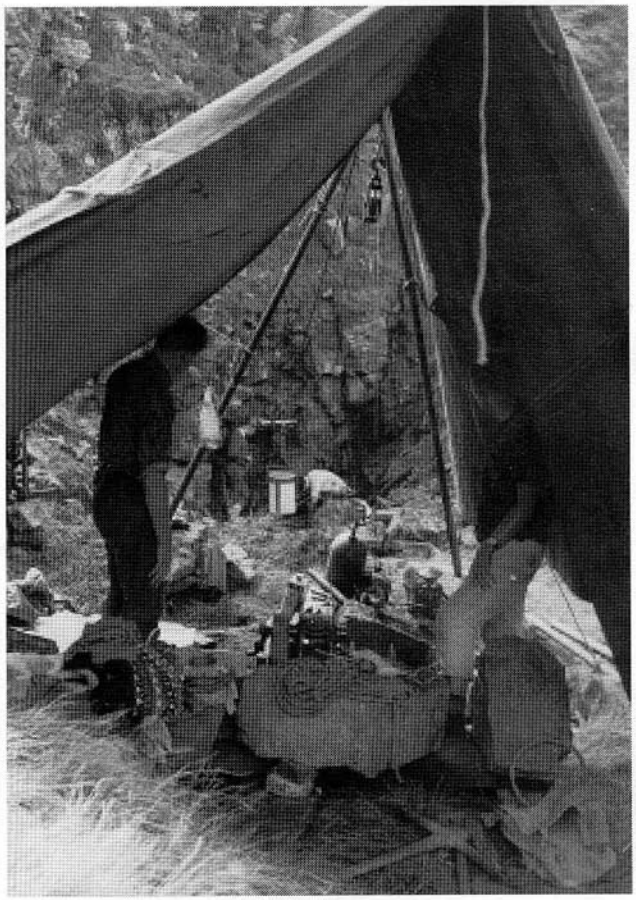


The dig at Waen Fignen Felen was started around the late 1940s, and was dug sporadically until the early 1950s. It was resurrected around 1960, and dug in earnest for some three years, during which time these photos were taken.

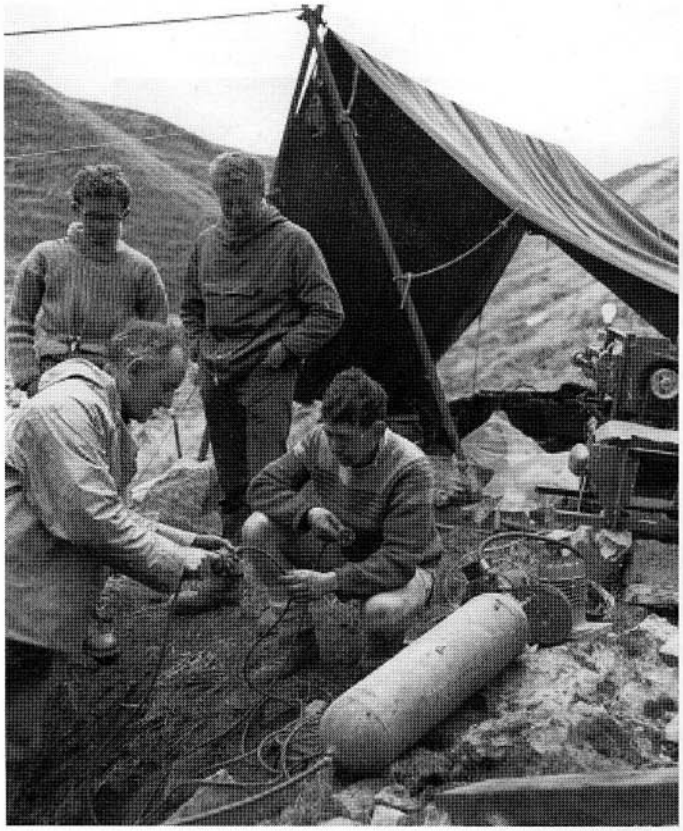
Top left: Clive's Land-Rover on its way up the hill.

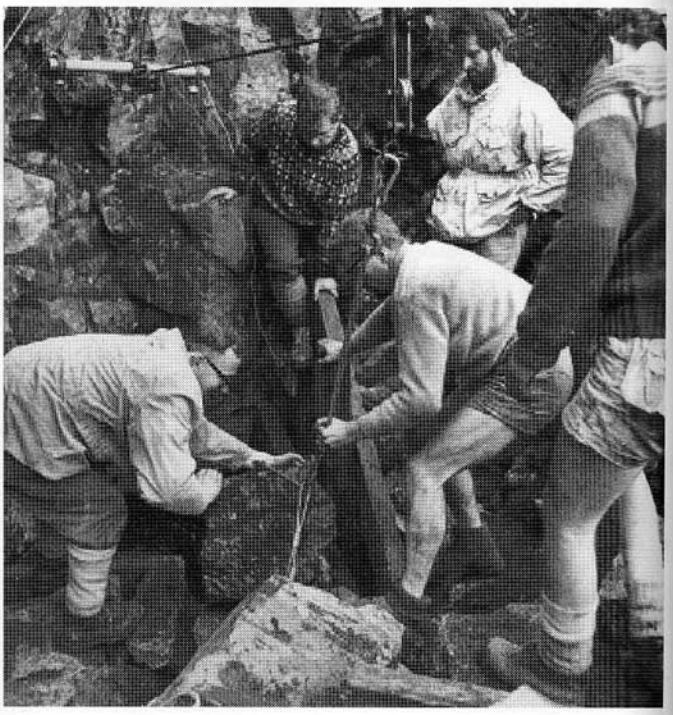
Top right: an overall view of the site.

Bottom: David Hunt (left) and Noel Dilly cutting timber

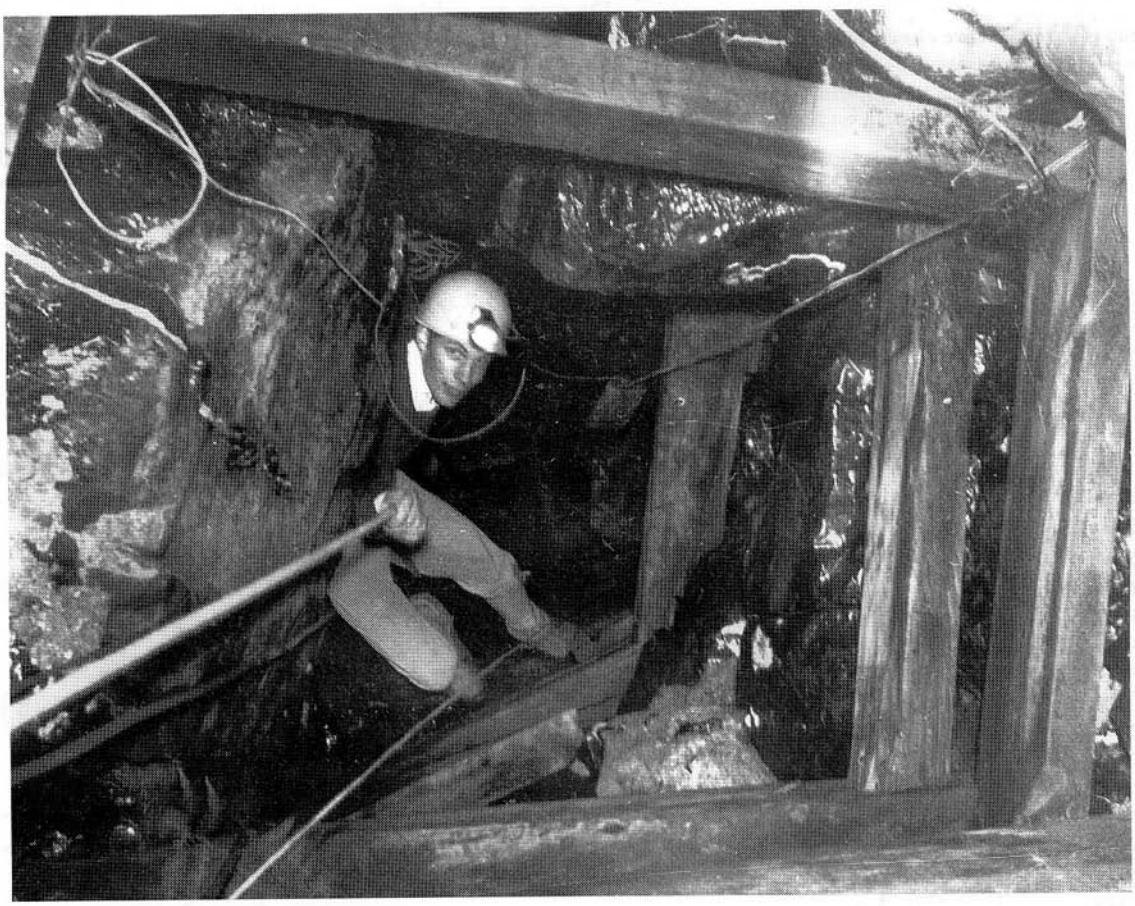


Left: the generator tent.
Above: John Harvey takes a break.
Below: on the left, the generator tent, on the right the carpenter's shop.





Top: the Waen Fignen Felen campsite. Bottom left: Clive Jones and John Harvey in discussion in front of the winch tent. Bottom right: hauling a boulder out: Noel Dilly on left, David Dilly at the back in the sweater, Terry Lloyd in the centre with his hand on the sling, John Harvey on the right.



Top: John Harvey with one of the power units used for running Kango hammers at the dig. In the background, Phil Matthews, ?, David Kemp. Bottom: Jerry Woolf in the shaft, photo by Bob Hall.

The Lava Caves of Lanzarote

by Keith Ball

Caves in volcanic rocks are mostly produced in lava flows. The fluid lava flows downhill from a vent, which is usually on the flanks of a volcanic cone. After a while the surface and sides cool and solidify. Depending upon various conditions, such as viscosity and speed of flow, the inner part may still be molten and, if the flow diminishes, either because the eruption stops or the flow is diverted nearer to the source, the molten inner part keeps flowing and empties the tube. The resultant cave is by its nature shallow and the roof frequently collapses. Sometimes later lava follows the same course and results in multi-storey caves. The structures are consequently complex and lava caves may be buried by later flows in which they may be better preserved or they may be invaded or partially invaded by later lava flows.

The Canaries are a string of volcanic islands off the coast of Africa. Lanzarote is one of them. The climate is pleasantly warm and dry. Lanzarote first rose above the waves about 10 million years ago and volcanism has continued to recent times. The last major eruptive event was the production of a widespread field of lava during six years from 1730, (see the map). This was emitted from at least thirty volcanic centres. The whole island is reputed to show evidence of over 300 volcanic edifices.

About three thousand years ago a large basalt eruptive event took place in the northern part of the island. A lava cave was produced which extends from near the volcano to at least 1.6km under the sea making a total length of about 6km. This is the main cave system known on the island and it supports two show caves .

The Jameos del Agua is the show cave closest to the coast. It has been extensively modified and developed tastefully with underground concert theatre, swimming pool, bar/restaurant and a rather fine museum. An interesting feature is a sea water pool/sump in which are found blind white crustacea. These have been variously described as crabs or lobsters. They are certainly blind and white and about one to two centimetres across. These normally inhabit the abyssal depths of the ocean but here are found close to the surface. The "sump" has been followed some 1.6km under the sea.

About a kilometre inland there is another show cave with reputedly 2km of passages. These again have been tastefully developed. Colours are present from mineral staining but of course there are none of the calcite stalactites of limestone caves. Frozen lava "icicles" make up for the deficiency. Clever use of lighting and one spectacular optical illusion makes the visit very worthwhile.

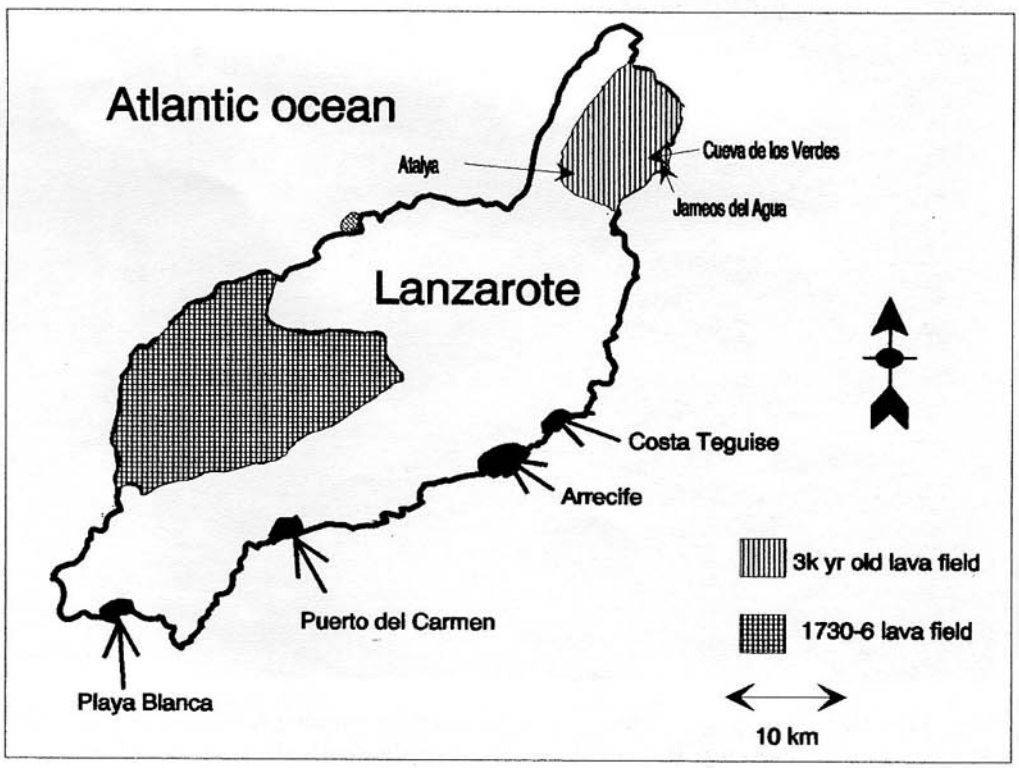
About one kilometre to the west along the same road another shakehole allows entry to a different "wild" part of the same tube. The shakehole is alongside a lay-by, but cavers should take care with parking since tour buses use the road and there is not much room for passing. If congested it is suggested that parking is made on a wider road at a T-junction, about another 1km to the west.

Near Atalya are two caves of archaeological interest.

We spent a little time investigating the newer lava field to the south. Here the lava has only the sparsest cover of lichens. We did not find any tunnels such as are obvious in the north, although there are sea caves that may connect. One interesting feature was that because the volcanoes are composed of basalt there is relatively little ash. We examined some superbly preserved former vents in the middle of shallow craters inside volcanic cones. The rock appeared to be very sound and stones rolled and rattled to an interesting depth in the vertical vents. Without tackle we declined to descend.

This southern area does seem a wide open field for exploration although care is needed. There is still some remnant volcanic activity with geysers and high heat flows close to the surface. There is even a restaurant where you can have your steaks grilled by lowering them into a hole in the volcanic ash. There is still a distinct smell of sulphur in places, so that any exploring parties would be wise to test the air in caves for noxious gases during exploration.

The caves are a delight to visit, being roomy and with few animals. Compared with lava caves elsewhere in the world, they do not have the overpowering stomach-churning stench of bat guano that is found in some lava caves in Kenya, nor do they suffer from the presence of other wildlife ranging from cattle ticks at the smaller end through to leopards. Compared to lava caves in Iceland with their "speleo-glaciers" they are of course much warmer.



Current Projects

As the year of the club's 50th anniversary draws to a close, enthusiasm for digging has rarely been higher. Every weekend there are teams at one or more of the current projects. The Ffynnon Ddu, Dan-yr-Ogof, Llygad Llwchwr and Ffrwd Las catchments all have at least one dig on them, and they are almost all being pushed hard by regular teams of dedicated volunteers, while others are applying technology to try and cut out the guesswork and/or the donkey-work.

It can only be a matter of time before someone gets lucky, and it's about time too. Over the last decade or more it has been the diggers in other parts of South Wales who have had all the luck: first in Daren Cilau, followed by Carno Adit, and more recently in Ogof Draenan. Now it's our turn, surely.

So, who are the current hot favourites? Which is the club's premier dig? And who is flogging a dead horse? The next 27 pages are your chance to find out...

Ogof Gwynt yr Eira

by Pete Francis

A raw, cold Sunday at Penwyllt. No-one about, the clouds hanging low over Fan Hir. The wind depressing all enthusiasm. The thought of hanging about up there with only a few armchair cavers too much to bear. The thought of an early return home equally depressing. A sudden inspiration: "Why not go home via Herbert's Quarry? Instead of walking a long way from the road" - the wind precluded that - "let's look around the area near the road."

We'd always ignored that, rushing past it for Pwll Swnd and the emptiness beyond. Arriving there, the wind seemed colder than at Penwyllt with snow flurries in the air - *Gwynt yr Eira*. A large, obvious sink beside the road was quickly looked at. Bare limestone above it to the north but a thick layer of peat leading down to it. Sweet wrappers and old tin cans amongst frost-shattered rock at the bottom.

A quick scratch around. "No, there's too much peat here, this would be a long-term project." How right we were.

Across the road another depression fed by a small steam coming from an ice-encrusted pool. Was there a slight draught coming from between two rocks? We pulled some free and so Herbert's Quarry digging began for us. It was 14th April 1985.

Word got round: "There's a new dig at Herbert's." People shied away. "Too far away," they said. "It's not in the Swansea Valley - involves driving." People continued enthusiastically digging the rabbit holes near the club.

But there were a band of younger volunteers, people who knew no better and some who should have: Steve Jones, Simon Calvin, Fiona Thomson, Kev Davies, Jenny Peat, Ann and Andy Bell, Gareth (Gags) Jones, John Lister, Jopo and Hywel Jopling, Jon Kitchin, Hamish Osborn, John Cliff, Steve West, Ian Peabody, Nig Rogers and others who could be persuaded, and gradually progress was made.

An inclined crawl first, then a cramped chamber with unstable walls. Down then, as there seemed nowhere else to go and, after a short distance, a keyhole opening up to one side drew large crowds. They sunbathed outside, caving gear at their sides, eager to share in the thrill of exploration; energy overflowing enough to swat the occasional midge that settled on their drooping eyelids.

Below, we broke through. A small chamber, boulder-floored - we lost the crowbar immediately. An aven parallel to it with hanging death above, enticing but going the wrong way, up not down. A crawl leading off but into a suicidal choke. We took counsel, called all the digging team down. There was no easy way on but we stayed there an hour, just to make the sunbathers above sweat a little.

Tourist "trips" started. A few of us, feeling a bit disgusted by it all, wandered away over the road, pulled a few boulders out from the peaty sink. So the dig there began. Just as it was looking a little interesting "Loony" Jim Thompson brought a couple of tons of wall down from the cliff face above - "Didn't like that. Good laugh though"- and wandered off again.

A setback of a couple of days but we'd started digging and so carried on. Peat fill with angular boulders to tear at nails but progress was good and soon, excitedly, water-worn shaft walls were evident. Some shoring and cutting back of the peat was done, a sloping ramp took shape. It got to the bucket stage and a regular team developed. Excitement grew as the shaft deepened, growing wider if anything, the dig became a regular weekend activity. After all, although far from the club, it was right next to the road and there were ice creams in the summer from the van down the way.

Then disaster struck. The shaft bottomed out and only a thin bedding plane crack led away. Enthusiasm waned, another time-consuming project that led to nothing. Only fools would carry on. But while the rest of us gave up a few still pursued their dream: Ian Alderman, Vaughan Clark, Steve and Helen Richardson, Toby Dryden, Richard Roberts and Les Walsh still went up there, chiselling their way onwards, no explosives around, not enough interest.

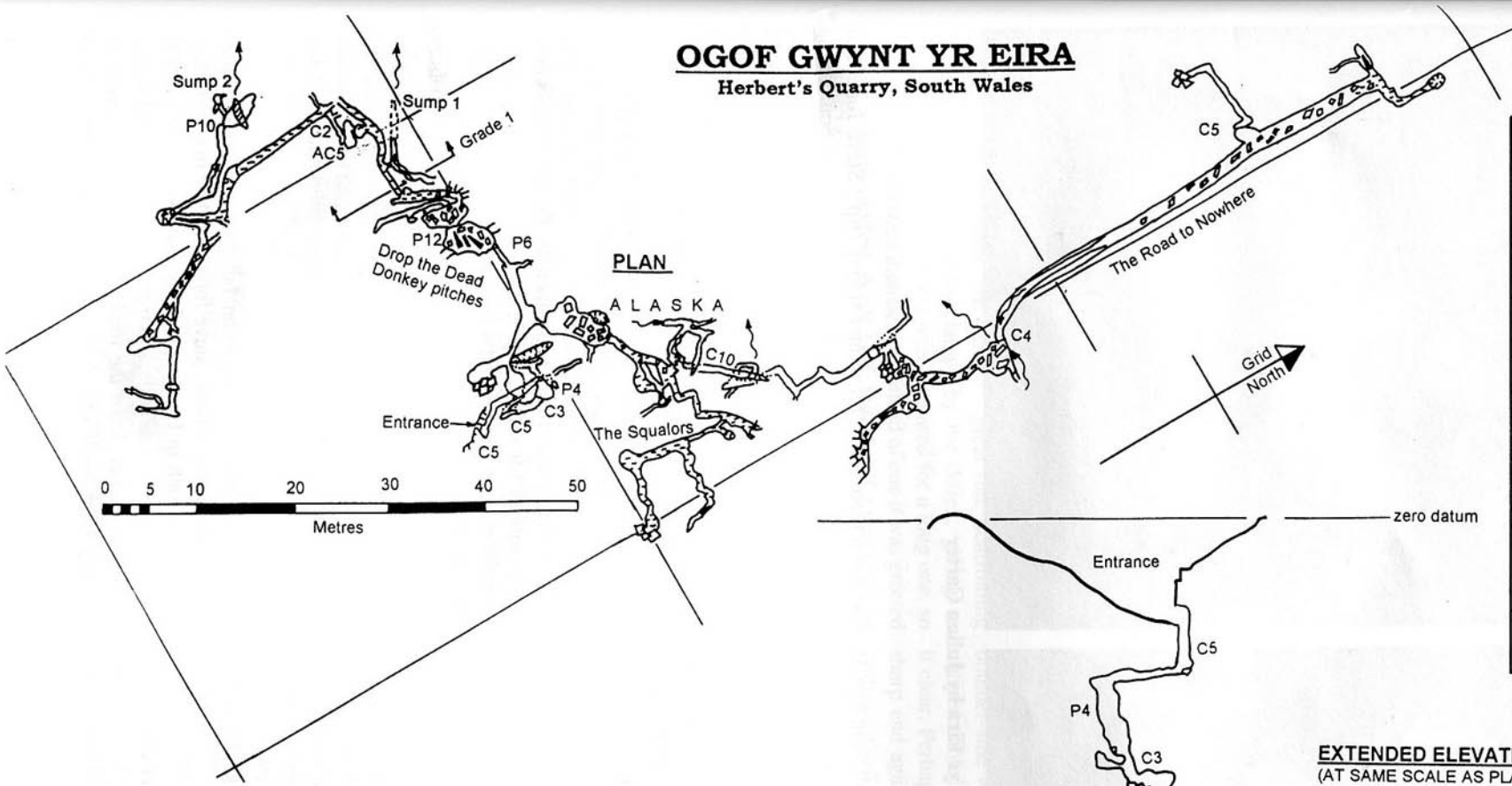
"You really should come up Herbert's again, we've made a lot of progress," Ian remarked to me one day, and having nothing better to do I reluctantly agreed. When I saw what they'd done I couldn't believe my eyes. "Yes, progress is a bit slow. You have to lie down dip and chisel away by hand". Ian made the understatement of the decade. Guilt, and a nagging suspicion that he'd been right all along to continue digging, forced me to join him and soon others followed. Inspired by what Ian and his small crew had achieved digging gained pace again. Soon, not only were there weekend digs but midweek ones as well with new cavers from Trinity College, Carmarthen and Gower joining the team.

Another mud-filled shaft was encountered and now a larger team had to be recruited, with diggers, two bucket-hauling teams and a "draggers" team needed for the crawl. A short delay to timber the top of the second pitch and make it "safe", then progress was swift.

One Wednesday night, crowbarring away at the bottom, suddenly a boulder dropped and there was blackness - a chamber beyond. I felt terrible! It was Ian who had made all this possible and now that a breakthrough had come he was two hundred miles away. Without his unshakeable belief and enormous work excavating the crawl none of this would have been possible and now, like

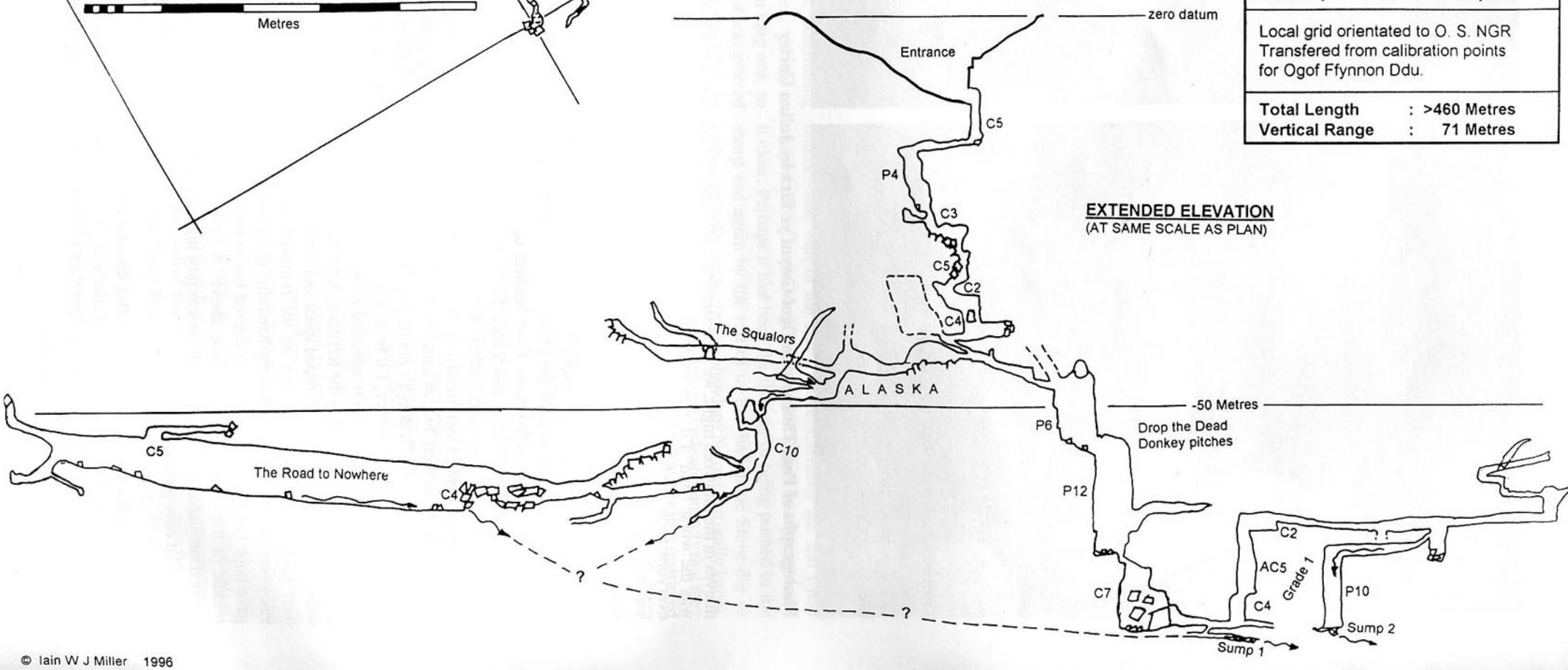
OGOF GWYNT YR EIRA

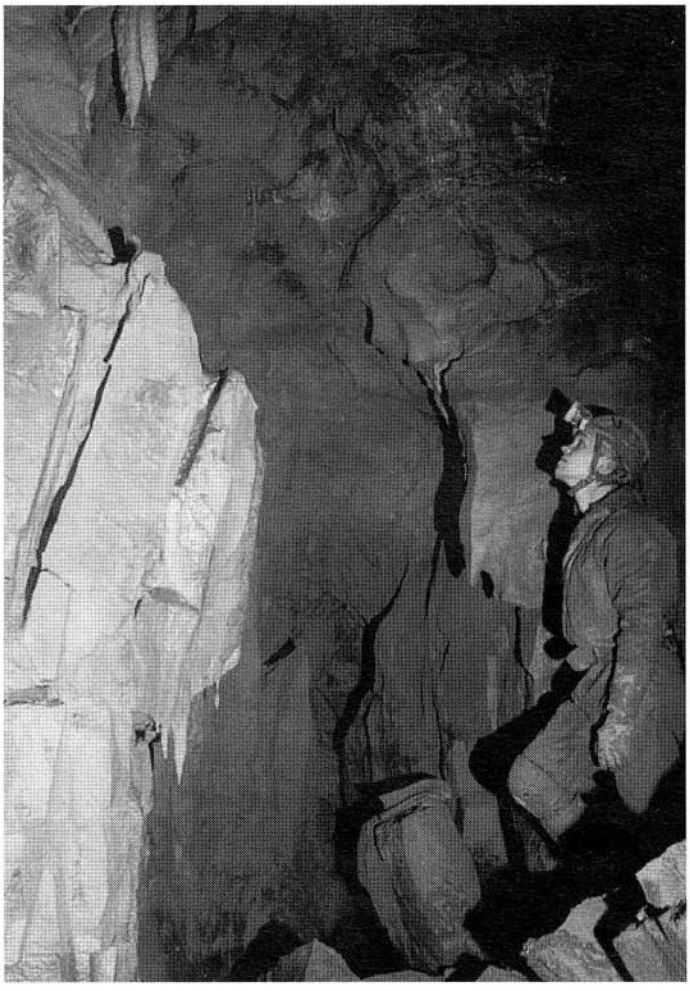
Herbert's Quarry, South Wales

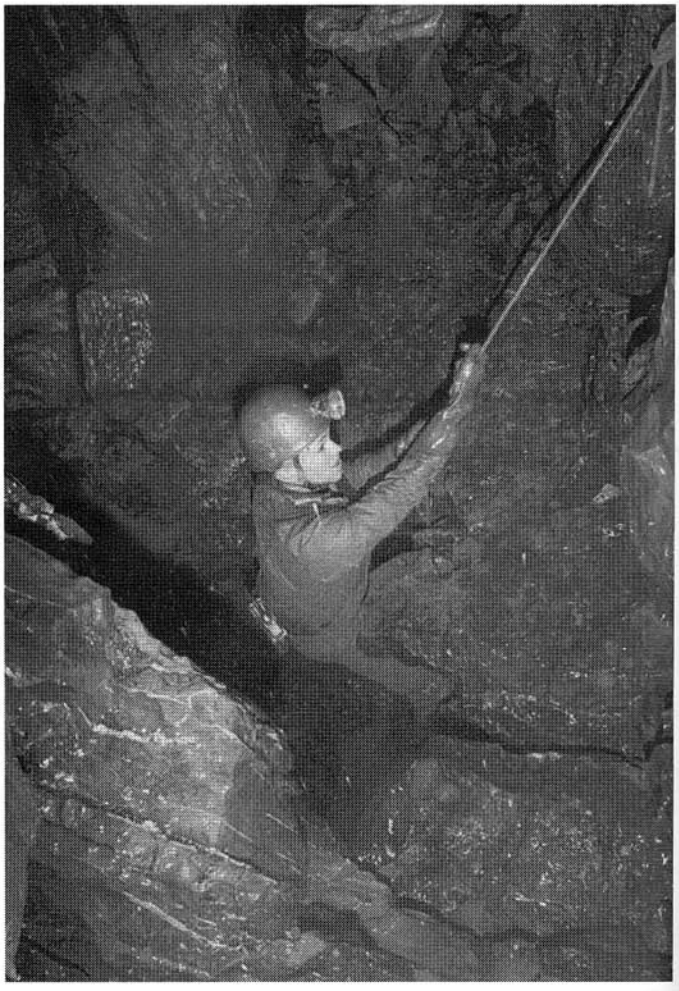


Also Known As :	Herbert's Quarry Dig, Ian Alderman's Dig, or "Dead Horse Dig" ?
LOCATION : NGR SN 732 185	
BCRA GRADE 5c unless specified	
Surveyed by	I Miller, T Dryden, G Vaughan, P Francis, B Clipstone, & Others.
Center line plotted by I Miller using SURVEX v0.62.	
Drawn by I Miller.	July 1996
Local grid orientated to O. S. NGR Transfered from calibration points for Ogof Ffynnon Ddu.	
Total Length : **Vertical Range** :	**>460 Metres** **71 Metres**

EXTENDED ELEVATION
(AT SAME SCALE AS PLAN)







Photographs of Paul Thornton in Ogof Gwynt yr Eira by Julian Carter

thieves in the midweek night, we were stealing it all from him. It was the worst "find" I'd ever made. It was impossible to hold everyone back, we had to see what was there. But an agreement was made that after a short recce, if it "went", we'd wait until the weekend to begin exploring in earnest.

A shattered chamber emerged to one side of the pitch bottom with a further hole directly beneath the pitch. A slightly suspect roof and steeply sloping slab-strewn floor leading down to holes through boulders to the left and a rock-filled slot to the right. Thank God it hadn't gone any further. With trepidation I phoned Ian that night, fearing a lost friendship. He sounded disappointed at not having been there but, as usual, belittled his own feelings and role in the affair. "It doesn't matter who breaks through, as long as we have. Don't worry, I'll be down this weekend." The breakthrough excitement soon subsided as no obvious way on emerged. Digging started in the left-hand hole but we couldn't stabilise the boulders in the cramped space and had to abandon it, later backfilling the entire area as we removed spoil from elsewhere. Work started on the right-hand slot. Its two solid walls gave hope but after three metres it curved out to end up in the middle of the boulders of the slope above. A protracted dig seemed inevitable again but enthusiasm was now high; hadn't we already hit cave passage?

Midweek digging once more resumed. But disaster once more struck and this time in a far more spectacular way. A good team was assembled and I'd even taken my eight-year-old brother-in-law down there for a "bit of an exciting trip". Steve Jones and Simon Calvin were at the bottom of the slot, passing boulders up to the rest of us who chained them back to the packing space above. We'd already had to use some timber but it was a rudimentary affair, aimed more at spurring the diggers on to more confident effort than anything else, as we all felt a big black space could be only feet away below our own feet.

Suddenly everything moved. It was like sitting on a giant egg-timer whose grains had suddenly turned liquid, and a mad scramble to stay on top started. Steve and Simon shot out of the slot, remarkably unharmed, and joined the fleeing fearless crew in their squirm for safety. My brother-in-law, unaware of the proximity of our doom, looked at me wide-eyed as I shot past him - was all caving like this?

When pulse rates slowed a few pale-faced diggers assessed the situation. All the rock we'd removed from the bottom of the slot and placed neatly on the boulder scree above had simply reshuffled itself around and was now, once more, filling our hard won dig. It was plainly suicidal to go on.

Things change, the world moves on. Ian went away to Blackpool to do a photography course, Steve Jones finished in Carmarthen and went to teach in London, and my marriage broke up. The enthusiasm to continue collapsed from fear. Railway Dig started half a mile further down the road with the Minerva crew, in decidedly safer conditions. And so the dig slept for three years

until Ian bounded back after completing his course. "I really think we should have another look at Herbert's", he said enthusiastically, "work out a new strategy." I groaned inwardly.

Both of us agreed that if the slot was to be tackled again it had to be done correctly - a proper engineering job. The trouble was that, with it entering the boulder choke halfway down, any scaffolding put in place would be inherently unstable as it would be "floating" in the middle of the boulders and would move as they moved. "This is beyond us," I seem to remember saying, "what we need is a real engineer, a mining engineer." John Harvey appeared through the doorway. John had a lot going for him, he was a very well-qualified mining engineer, had taken to trusting me after a few seasons winter mountaineering in Scotland and, most importantly, had never been down the dig. Unfortunately he had heard all the stories about it. I think his final comment was something like: "From the sound of it, it seems to be the last place on earth I want to go to, but I suppose I'd better, before you lot kill yourselves." Dig on!

With the typical lateral thinking of an engineer, John solved the "floating" scaffolding problem as any seafarer would with a floating craft; he moored it by steel cable to the rock walls above. Two cables, one threaded through the choke itself, the other through the slot, tensioned the scaffolding to keep it rigid despite any movement in the choke. We could dig safely again.

Now digging "the choke" became an ongoing project. A regular crew of four formed - Ian, John, Paul Quill and myself. We socialised as we dug. "Men's talk", waiting for boulders to come up. Club scandal, "birds" we fancied - great fun. Scaffolding disappeared down the hole, clamps by the dozen, giving us noticeable gains each trip. We were prepared for a long one, so when two walls showed themselves instead of one it was greeted with enthusiasm and fear. A rift, O.K.,but what if it was too tight to follow? At least we could anchor the scaffolding to the bottom. Then a way off to the right. An awkward crawl, made worse by the proximity of hanging boulders above and an awkward boulder to slide over (I cracked a rib on it a few weeks later). But another hole down.

I can't remember who went in first, clearing boulders as he went. They crashed into emptiness below. We all followed quickly. A double pot and an awkward four-metre climb, subsequently made easier by a spoil mound. Double Pot Chamber. At first no way on, then, after a short dig, a crawl off. One wall solid, the other ominously built of grit and small boulders. A smaller chamber beyond. Up left first, over blocks, a squeeze, then more hands and knees passage. But another choke stopped us, looking decidedly mobile. Back to the crawl and a hole in the floor. I somehow eased down - though had to be dug out later. A three-metre drop to a further small chamber. A trickle of water leading down a constricted rift, closing down round a left-hand corner. A pool glimpsed at, out of reach, and a draught. We'd found our home for the next eighteen months.

"Oh, you bastards! I'm at the front again!"
"Come on Steve, stop whinging, get on with it. You know it's your turn."
"But it was my turn last week and the week before! Oh God, it's cold!" Giggles behind, as we waited for Steve to immerse himself in the water and get going. The digging had taken on a regular routine; outmanoeuvre Steve -or some other guest digger, there were a few of those - on the way down to the end, so that he was the one in the front. Then, remove spoil from the previous bang. Drill shotholes, place charges, fire and retreat. Two hours at a time were all we could manage before the toxic fumes drove us out. The Twyn Tal-Draenen Boys took to mocking us: "Dead Horse Dig" seemed set to become enshrined in the annals of club history. Each week the same, dragging bucket after bucket back then pushing with your feet on the back of the driller - usually John Harvey - to steady him. Then a thankful wait as he placed charges and a slow retreat. Each time going back to find nothing had really changed, only a few inches gained. Eighteen months with only feet to show for it. Time after time we'd discussed it and agreed that what we really wanted was a compressor to get some really long shot holes drilled.

Eventually John was persuaded to bring the Gloucester CRO compressor over. The air hoses went in remarkably quickly, the long mining drill posed no greater problem. It was easy digging, sitting on the surface, listening to the contented purr of the machine. John Harvey and John Lister emerged an hour later, caked in grey dust, ageing them still further but with big grins on their faces. The compressor had done all we wanted. Blasted roof fragments dumped in the pool below meant a reasonably dry passage to the small chamber beyond. But the water trickled out from it down a minute bedding plane. A mud-covered roof tube, inaccessible above but no easy way on - yet another long, unpleasant dig the only prospect.

Perhaps that was why Steve started poking about in the grit boulder-side wall of the crawl above. Certainly Ian and I had noticed a hole in it the week before and Rhys had nearly excavated it clear. Perhaps it had been the thought of being pushed to the sharp end again by the rest of us that had made Steve dig so enthusiastically, with so much abandon? No one can really know, but he (and Rhys and Ian) certainly proved subsequently that they had lost none of their ability to move backwards in a restricted space at great speed. As a result only their pride was hurt when the whole wall collapsed down on where they had been lying, leaving a worried Toby, sitting comfortably in Double Pots chamber to inquire: "Are you all right?" They were, needing only an hour's healthy exercise to physically prove it to him.

Undeterred, the next weekend we were back at the collapse. A short dig and we were surprisingly through into a steeply down-dip phreatic tube with a forty-foot blind aven above. A mud-filled passage at its end, but at its lowest elbow an interesting crack. Dave Checkley had been at the club that weekend demonstrating the new-fangled "Hilti Bullets". We quickly procured some and soon a body-sized hole was manufactured. Boulders beyond, but with a little strenuous heaving they moved forwards and tantalising booming noises followed, echoing on and on. The next couple of trips proved most frustrating as we strained and heaved to move the last few boulders to gain access. With each boulder moved more could be seen hanging menacingly, immediately above. Steve outmanoeuvred me and I found myself out in front, all alone. A twenty-five foot pitch right on a fault to a dangerously sloping ramp, full of moving debris to another lip and a forty foot pitch beyond. They had to be named "Drop the Dead Donkey Pitches"!

Bolt holes drilled, Ian and the rest followed. We sent him down,

listening in the tangible silence for his ongoing description: "There's a crawl leading off. Hang on, I'll take a look." Then, much fainter, "It's another twenty-five foot rift. I've free-climbed it. I can hear water ahead. It's a streamway. For God's sake, come on down!" We quickly followed him. A muddy passage leading to the streamway which was smaller than we'd hoped. Upstream, a hundred feet of passage ending in the fault again, with water pouring through thin cracks. Downstream, a sump! The way out seemed long. We'd thought we had cracked it, entered the master streamway, but it would have to wait.

The next trip saw us portering bottles for Gavin. A squalid kit-up followed by a squalid dive. A sump so small he had to enter it backwards. Round a few corners until it became too small, all at a depth of no more than a metre. An even longer trip back up the pitches. But when we got to their top Iain Miller and Toby were jubilant: "Bugger you lot, I've always told you surveying was worth while - we've found a new way on!"

An alcove we'd started to backfill with digging debris was taking a cold draught and with a little effort had revealed walking passage beyond - Alaska Series. It had to be called that, the draught was so cold. A quick root around - half a dozen leads noted - then back to the hard business of bottle-carrying back to the surface and a jubilant night at the pub.

Steve West and I were the only two to see "The Squalors" in its pristine, beautiful state. Five minutes later Ian had turned it thixotropic and we wallowed in it for a week or two, digging its body-sucking end out. Whilst Rhys and Ian persevered to find a branching passage and a hundred foot more, Steve and I escaped to pull boulders out of somewhere else. Toby'd made an excuse about having to be away after a downwardly mobile wall had missed crushing him by a hair's breadth the previous week. We twisted and turned a monster block until it finally teetered away revealing a small, free-climbable pitch. Upstream, a short stretch of passage, downstream an impenetrable rift. Rhys, trained on three years of student diet, managed to get through but no one else could. He reported being within inches of what he thought was another pitch but couldn't get to see over the edge. We decided to join him and two banging trips later Steve, Paul Thornton, Tony Donovan, his mate Mark and I found ourselves at the top of another forty-foot, water-clean shaft - and it was free-climbable!

"Oh God, Ian, I've done it again!" I thought, feebly trying to hold the newcomers back. But they were off and we had to follow. This time the passages were really walking-size with a lofty rift at the far end. Layers of coarse-grained sediment hung in benches from walls and it ended in a magnificent banded sand cliff. Four hundred feet, all in one go! The next few weeks saw all "interesting" leads looked at. Paul being entombed, with Tony doing his Samson act of holding all the offending boulders up, despite one of them having severed his light cable. "Lucky I'm small, or I might have got hurt" was Paul's only comment. We knew we were onto a good thing as converted Twyn Tal-Draenen diggers joined us. "Bloody Hell, it's changed a bit since I was last here," Pat was heard to say.

But word had got around to others. "What's this about you putting a gate on it?" We hadn't but now people were trying to dictate to us what we could and couldn't do there, even though they'd never been down. Eleven years of apathy and now "local" cavers were demanding their say. It put our backs up. We installed a gate, to prove our point, though, as yet, it isn't locked. The survey was completed but when projected onto the computer screen it was obvious that the Alaska Series was only an inlet, with all passages trending upwards. Where now to dig?

"Remember the passage just before the streamway? Wasn't there an elbow just before the end of it - full of mud? It might be worth a poke around there." We went to look, and soon digging revealed a phreatic tube leading on. A few weeks' work and we suddenly broke through into airspace at the foot of a forty-foot aven, the draught following us through. We ignored the aven, burrowing on. The mud became worse and worse. Every move you made entrapped you in it. Even lifting an elbow required huge effort. Bucket dragging became a nightmare. The outward climb, weighed down with pounds of extra mud, a test of sheer survival. Iain Miller and Toby said they'd bolt up the aven. We carried on digging below. Iain and Toby said they'd bolt up the aven. We went away skiing. Iain and Toby said they'd bolt up the aven. We started digging again. Iain and Toby said... we got fed up with waiting, bought an etrier and, after placing six bolts and a bit of free-climbing, were up. Iain and Toby were really annoyed with themselves. Perhaps they needn't have been: after a roomy chamber, a climb up led to yet another thixotropic crawl. Two hundred feet of passage beyond, all trending upward with yet another forty-foot, blind pot halfway along - another inlet series!

And so an impasse is yet again reached, and we, like headless chickens, must run round again. But remember, in the land of the underworld, the headless chicken reigns supreme, as it, and only it, can still run round, albeit in ever-decreasing circles. And we now have a cave - not a dig - fourteen hundred feet of passage, two hundred and fifty feet of depth and a streamway. And, although we can't follow it yet, we know where it comes out - Llygad Llwchwr. Five miles away and seven hundred and fifty feet lower down - and counting.

Ogof Carig Cadno/Stuart France's Dig/Chas's Dig

by Chas Jay

To the best of my knowledge this dig was started by Stuart France some years ago. With Stuart's consent I continued digging in a rather desultory fashion - with a number of different helpers - while eulogising on its potential to almost anyone I could get to listen (in the hope that they would take it on as I didn't then have the time). Fortunately, this year Bob Radcliffe indicated his interest in the site, and with Twigs having finished at college things got moving and there are now a number of enthusiastic diggers.

The original entrance was via a very narrow slot making access difficult. Past the entrance there was a short crawlable section but the passage soon became half-filled with mud and required digging. Digging was confined to the right-hand wall with the spoil being packed against the left-hand wall. Digging continued in this manner until the first bend was reached, where the passage dipped down sharply and became completely filled with mud.

At this point it became clear that spoil would have to be removed to the surface, and this meant that the entrance would have to be enlarged. Simon kindly obliged with the necessary bang and later Pat Hall and friend (who were walking by) were press-ganged by Twigs and myself into assisting with clearing the broken rocks.

With easy access, digging continued down and round the bend but with very little progress being made until the work began in earnest this year.

The passage turned right and went down for about four feet before the roof flattened out again. Digging continued for five or six yards with the passage going slightly to the left and with a very small air space, through which a draught could sometimes be felt, soon appearing. The spoil comprised three main layers: a top and bottom layer of smooth mud without stones and a middle layer of calcited mud. There was a very small covering of peat on the top.

Initially, in digging this part of the passage, there was a problem with flooding which necessitated bailing but Andy Dobson found a small rift on the side which he persuaded to allow the majority of the water to escape, albeit very slowly.

At the end of this passage the nature of the soil changed and boulders now appeared, one of which required banging: this was carried out using both SLB and a "Simon Special" (the SLB was successful in breaking a very large boulder into about four pieces but these were still too large to take out). Having removed the large boulder the roof started to rise and what appears to be a small chamber, filled with mud and rocks but with a small air space over the top, has been reached. This chamber has been dug a short way into but, at the moment, there is no obvious way on. Two suggestions have been made. The first is to dig in towards the centre of the chamber, taking a slice a foot deep all round, and the second is to follow the right-hand wall.

The dig is to be continued into the winter, with anticipation of an early breakthrough as it seems logical (?) that the boulder fill in the chamber must come from a rift or roof collapse which cannot be far away. The major problem with this dig is the difficulty of removing the spoil, which requires an absolute minimum of five diggers, with six or seven preferred.

Early diggers include, among others: Stuart France, Bob Hall, Allan Richardson, Twigs, Simon Amatt, Paul Quill and Dai Bancroft. More recent volunteers include Gary Jones, Dave and Andy Dobson, Geoff Amabilino, Bob Radcliffe, Graham Christian, Chris Grimmett, Andrew "Roger" Gardener, and others. Would those not mentioned please accept my apologies, as I'm writing this without access to the logbook.

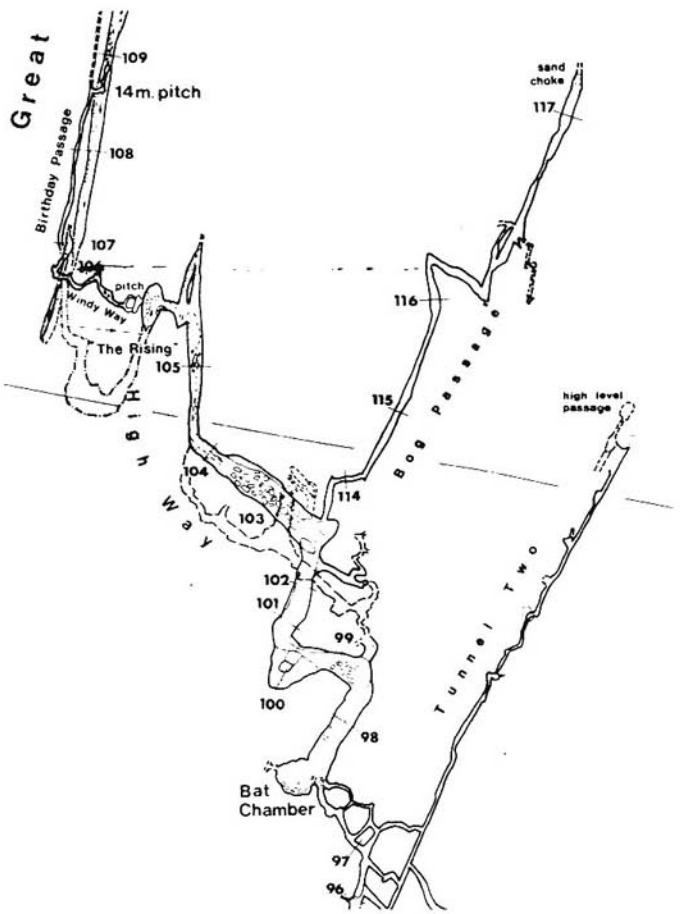
Stop Press: the source of the blockage in the phreatic tube, from which the mud has been removed, has now been reached. This, as expected, is a rift filled - unfortunately - with boulders. Although no effort has yet been made to push into the rift, the fill looks unstable so there is a problem in crossing it safely and finding the continuation of the phreatic tube. The face of the dig is in a small chamber and is quite wide. There is water trickling down in the centre leaving it clear of mud (and extra-loose). On the left is a hard wall with the boulders still stuck together. On the right there seems to be a small rift going off but, again, with an unstable-looking roof. We expect to push the left-hand side first, with engineering works as necessary. (October 1996.)

Bog Passage, Dan-yr-Ogof

by Tony Baker

To my mind, Dan-yr-Ogof is one of the finest caves anywhere. So, when after several years of tourist trips and learning my way around all the obscure bits of Ogof Ffynnon Ddu the inevitable happened and I was bitten by the digging bug, it was finding "the rest" of Dan-yr-Ogof that interested me most. Spurred on by the one-day conference on the prospects for extending DYO in 1989, myself and others started the dig at Twyn Tal Draenan that continues to this day (see elsewhere in this publication).

I like to spend both days of my precious weekends away doing something constructive but Tal Draenan is hard work, and after a day up there on a Saturday something a touch less energetic was required as Sunday entertainment. In Dan-yr-Ogof one doesn't have to stray far from the beaten track to find things that look worth digging, and I'd always been intrigued by a place I'd seen on the survey which headed straight for a big blank area, the end of which was labelled "sand choke". A quick look on a pottering-around trip confirmed that all that was needed was a bucket and spade, and the Bog Passage project was started.



On my first visit, I dug on my own while my companions went on a tourist trip, but soon afterwards Pat Hall joined me on a trip and his enthusiasm was fired, too. When we started, the work involved digging sand out of a low crawl that was full to the roof. One of us dug while the other hauled the full bucket out. Fill six buckets, then swap places. After a couple of trips, the roof took an upward turn and our hopes were high: the layout of the previous section of passage had led us to believe that we were only digging through a short sand-filled section and that once the roof went up we'd burst out into virgin passage. Trouble was, the roof kept going up, still through the sand. And up. In fact, it became a wall rather than a roof. We ended up digging vertically upwards, a pastime which we soon realised was dodgier than Dodgy's first album. Sand got in eyes, ears, nose, mouth and lots of other places besides. Occasionally slabs of sand would detach themselves from above the digger, hitting the floor with a resounding "*whoomph*" that sounded impressive from the bucket-hauling end of operations but was guaranteed to scare the man at the sharp end s**tless. And still we went up.

Every metre or so, we had to cut a ledge so that it was possible to climb up and down the otherwise-vertical sand aven we'd created. By the time we were four metres from the deck, the whole operation was decidedly precarious. Whenever the sand started coming down by itself, the digger had no option but to jump down from his perch, sand cascading down past his ears and his heart racing! At least the pile of sand that had accumulated at the bottom gave a safe landing.

Looking back (and I'm sure Pat would agree) we were mad to stand on a tiny ledge hacking down sand from directly above us, but it did seem rather safer than it may sound, since the sand was tightly compacted and layers of clay bound a lot of it together. My spine did shiver, though, when I saw an episode of *999* on TV where a reconstruction was shown of an incident involving a small boy being trapped under a collapsing sand dune he was digging in!

Fortunately, at the point where to continue seemed foolhardy, we found a solid roof to follow. Digging horizontally was a lot safer, and a rope was installed which made getting up and down from the digging face a lot easier.

And that's the current state of play. Progress is slow, but the dig is good fun and many a Sunday afternoon has been spent hauling buckets and discussing goings-on at Penwyllt. At least a digging trip to Bog Passage involves a couple of hours' sporting caving just getting there and back.

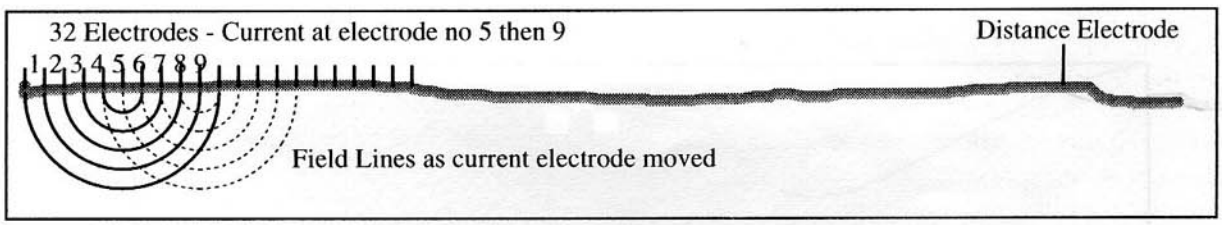
Thanks to everyone who has accompanied Pat and I at various times. Those I can remember are: Rhys Williams (who's made several visits), Alan Braybrooke, Clark Friend, Bob Hall, Idris Williams, Gary Nevitt, Simon Lacey, and Rhiannon Cardwell. Sorry if I've omitted your name from this list.

The Greensites Resistivity Project

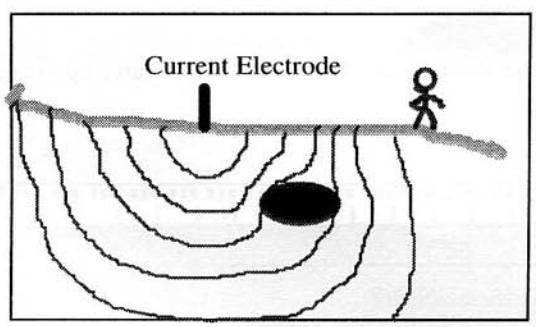
by Neil Weymouth

The recent interest in earth resistivity in the SWCC was started in 1990 by Stuart France who took a commercial resistivity meter and attached it to the ground using 16 electrodes and a manual switch box. The measurements made were so encouraging that it was decided to build an integrated meter and automatic switch, to be controlled by a portable PC and drive 32 electrodes. This was designed and built in 1992 by Neil Weymouth and Dave Edwards. Also a computer program was written to control the equipment and process the results to produce an image depicting a vertical slice through the ground.

Earth resistivity as a means of cave detection works in the following way. If you put two electrodes into the ground and attach a battery between them, a small current will flow through the ground from one electrode to the other. The highest current will be along the line directly between the electrodes, but it will also spread out horizontally and vertically to flow through all of the ground in the area of interest. The shape of the current field can be calculated for homogenous ground and gives theoretical voltage readings on the surface. If the readings actually measured on the surface differ from the theoretical this indicates the presence of a geological feature. Several configurations of electrodes are used commercially but are more suitable for detection of beds rather than cavities. The configuration we use was taken from a paper by C Bristow and is the Single Electrode configuration. The two current electrodes are placed a large distance apart and readings taken in the region close to one electrode where the field lines are roughly spherical.

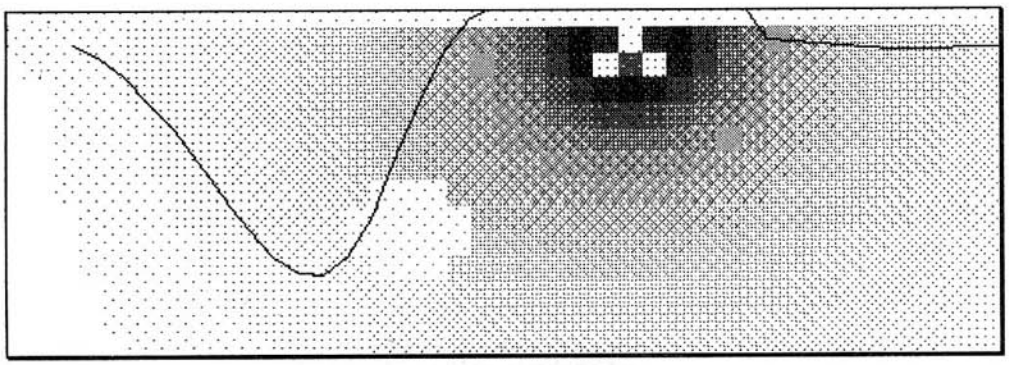


The 32 electrodes are laid out 3m apart and connected to the meter by two 16-core cables, each cable has tap points at 3m intervals. Current is applied to each electrode in turn while the voltage is measured between all the others. As the current electrode moves along the line a pattern of overlapping arcs is created for a particular slice of ground. The pattern of arcs is then processed by the computer into a vertical section of the ground below the electrode array.

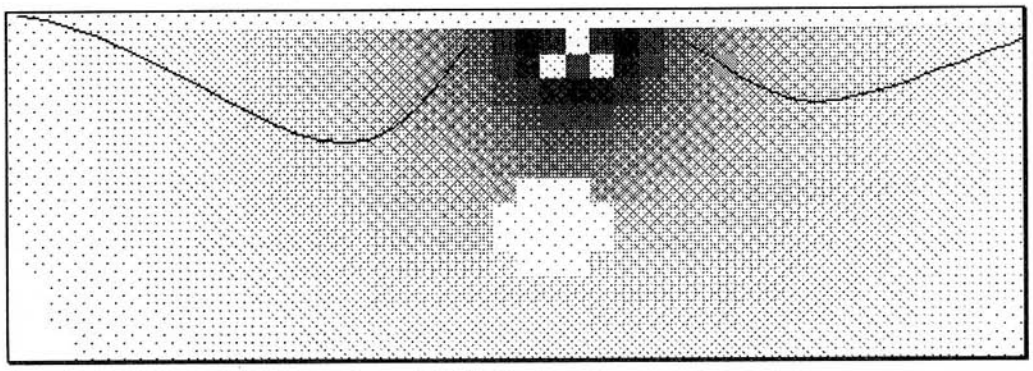


The diagram shows the field lines which are equally spaced on the LHS of the electrode but are distorted by the cavity on the RHS of the electrode.

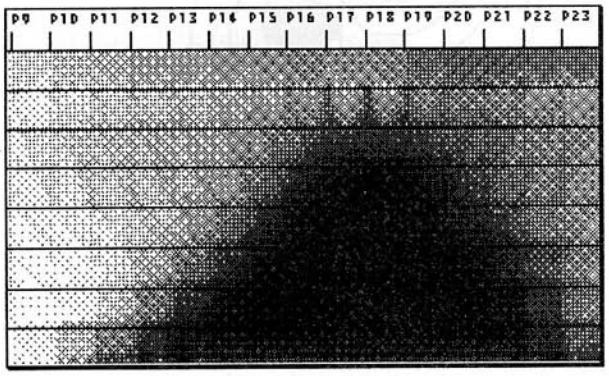
The distortion caused by the cavity follows the potential arcs up to the surface rather than appearing directly above the cavity. To investigate this a computer simulation of the ground was written with the ability to insert cavities as shown below. The shading indicates equal potentials and the line the variation from the theoretical voltage at the ground surface.



The diagram shows that the effect of the cavity on the surface is displaced to the left following the arcs to the surface and the peak is smeared across the arcs intersecting the cavity and neighboring arcs.

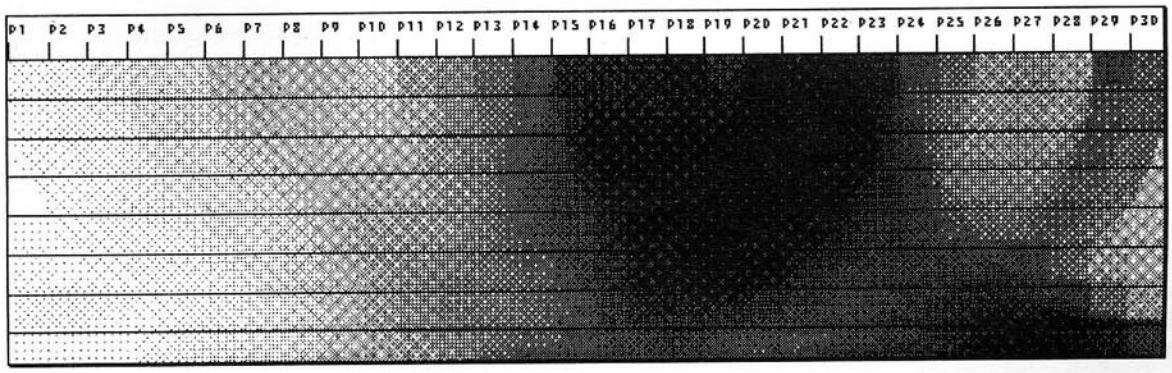


When the cavity is below the electrode the effect on the surface follows the arcs up to either side of the electrode.

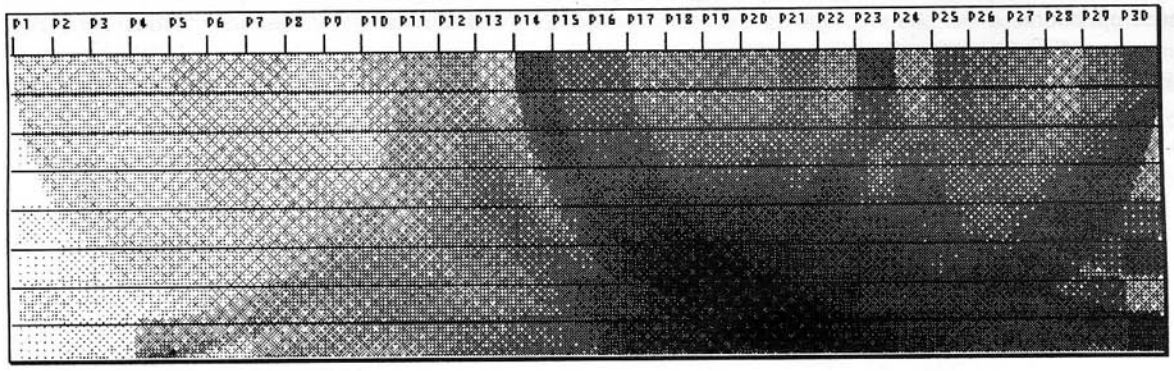


The results from the simulation can be fed into the imaging software used on real field readings and produce the image above. This shows that the position and top of the cavity may be accurately defined but the bottom is less distinct.

In the period since the equipment was constructed many scans have been done over known cave and "greensites". The following scans are over known caves.



This scan was taken above Ogof Ffynnon Ddu top entrance and accurately shows the main passage.



This scan was taken over the main chamber in Dan-y-Rhedyn and shows the entrance pitch leading down to the chamber.

This method of resistivity scanning should clearly detect passages up to a depth of twice their diameter i.e. a 5m diameter passage could be detected at a depth of 10m. Although theoretically smaller passages or greater depths can be scanned the images would be unreliable due to thickness of surface drift, peat depressions, shattered limestone etc.

As yet no new cave has been found using this method. In several areas we have scans that clearly show what we believe to be passages running close to the surface. However the technique will not show the small features like avens coming to the surface which would allow us access to the caverns below.

Was Sir Isaac Wrong?

by Clive Jones

The tortoise makes slow progress by sticking its neck out but it gets there in the end.

It sounded like a caver's dream. Methods ancient and modern being used to detect unknown caves and then a bloody great drilling rig to probe into the cavity followed by full penetration by the hard men. Sadly the dream was a dry dream, with neither drill rod nor hard man achieving the desired climax.

But let us begin at the beginning. The Greensites Project was originated to devise ways and means of detecting close to the surface parts of unknown caves. It would, like Sunday opening, revolutionise caving. There are many approaches that we could have taken and these included gravimetric, seismic, ground penetrating radar and resistivity. Expert opinion was that gravimetric was without doubt the most accurate followed by the radar and then resistivity. We chose to concentrate on resisivity for the following reasons;

1. Some work had already been done by Bristow in 1966 to detect caves.

2. The equipment was reasonably inexpensive, certainly cheaper than most other geophysical instruments, and it could be designed and built by club members.

3. The equipment was very portable and capable of being used by inexperienced operators.

It started like all good things with lots of ideas and enthusiasm. But this type of investigation requires lots of time to design equipment, write software and to test and develop ideas in the field. In typical club fashion all of these skills were forthcomming. The parts came together in the form of the clubs resistivity equipment. Stuart France, Hugh Thomas, Neil Weymouth, Dave Edwards, Brian Clipstone and several others were the backroom boys. The field workers were too numerous to mention by name. All of this was made possible by support from Richard Preece of the Countryside Council for Wales.

Interest waned when no immediate results, that is no big discoveries, were made. We had problems with procedures but these were overcome by new designs and a user-friendly kit emerged. To cut a long story down to size the situation by the spring of '96 was as follows:

We were confident that we could detect known cave.

When operating over green sites we could detect resistivity anomalies, but could not differentiate between cave, fault, enlarged joint or fractured rock.

We had two sets of software, one devised by Neil Weymouth and the other, based on a finite element analysis approach, developed by Rob Davies at Oxford University. Both gave similar results from our field work data.

We had decided to concentrate on one site, the area just over the stile behind the club in the nature reserve. We had already dug a 3m hole on site which had not been a hit. This we now know was due to a misinterpretation of resistivity results. I have done my penance but understand that there is more to come from the diggers involved.

We had been able to utilise expert help on the site and both gravity and ground radar results showed a major anomaly, most likely to be cave, close to but not coincident with the resistivity anomaly.

These results coincided with what an eminent club dowser had found. However for reasons of scientific respectability we ask you to keep this information confidential.

The gravimetric equipment was based on the theories of one Sir Isaac Newton who in about 1670 was struck on the head by an apple and in what must have been a dazed condition came up with the notion of gravity. This was acclaimed as concept of fundamental importance on which most of today's scientific thinking is based. So it must be right. Without it there would be neither space travel nor any activity requiring an up and down motion. We have a lot to thank him for.

A plan was made to drill a number of holes on the site, which need be no deeper than 20 to 30 ft in depth to confirm the gravimetic results and to give us a better understanding of the resistivity pictures. The radar results had indicated an anomaly confiming the resirtivity results as well as confiming the gravimetric conclusions. Gary Evans and I, after careful consideration of the radar pictures, agreed on the location of the first hole to confirm the resistivity work. Once the drill had penetrated the cave the idea was to lower a camera and when we had located the shape and form of the cavity to plan a dig into it. All of this was brought forward to coincide with Clwb 50 week.

So on the Friday preceding the Club week a drilling rig appeared and after a few minor unplanned difficulties (the caterpillar track came off and we had to move a farm gate) it was positioned over Sir Isaac's point. Twenty minutes later and 60ft down we were still going strong and the noble knight was probably rotating in his resting place. Seven holes later we had not found the spaces indicated by the resistivity work For some reason interest of the few who had already turned up for the week's activities waned.

Some final shots were tried with the rig, these were near the gravity points and on a position where early resistivity work had shown an anomaly The first hole hit a 1-metre space three metres down, a second hole hit a similar cavity but only about half a meter in size. A third hole hit nothing, no big deal. Some of us retired to lick our wounds and to see if there was any way by which we could contact the now not-so-noble knight to ask for advice.

With a fresh dawn comes new hope and this appeared in the shape of the offspring of the Cardys and Joplings who decided to dig for victory and reach the space that the drill had tickled. Using the

The drilling rig on the hill behind the club. Photo by Gary Evans

club toothpick and aided by club explosives experts they pushed their way through frost-shattered and then through solid rock. A Hilti drill was then used to speed up progress to the big time. This turned out to be no more than a joint in the rock. Some joints can be fun, so I'm told, but this one was no joke, the drill had only skimmed it. A couple of inches the other way and there would have been no dig.

The Good Lord - or was it the Devil - looks after his own. Just below the joint there was a phreatic tube, a small one but better than nothing. The tube was filled with clay and the second hole had hit it. Like people possessed the digging team clawed their way along it until it was unreasonable to pursue it any further.

Now was the time to consolidate. We are digging on a National Nature Reserve and as people who profess to care more for the environment than does the average man we have to practice what we preach. The site was cleaned up. In particular the cave mud and sand was removed as, for some reason which I do not understand , nothing grows on it. A temporary lid was made and we stopped to sit and think.

Sir Isaac's agent was contacted. He checked his sums and did not shift his position. State-of-the-art ground penetrating radar was brought in from Sweden and this came up with the same results as the previous radar work.

Oh Hell, what do we do now? Digging out the clay or sand from the tube is like trying to screw custard to a crocodile, it's not on. We have no option but to push things further. If we do not then much of what has gone before and has been based on Sir Isaac Newton's work will be cast into doubt. Did Neil Armstrong land on the moon? I shudder to think of the consequences. Could this be the end of science as we used to know it?

We have no option, we have to continue to a definite conclusion, a state of limbo is no state to be in. So after much deliberation, three pints, we decided to blast a tunnel over and along side the phreatic tube and make a bee line for the gravity anomaly but a little to the left or a little to the right of the bore hole. The first blast confirmed the temporary nature of the lid but as fortune favours those who are prepared it landed back from whence it came. We have now modified our procedures.

If we can get the support we need we can make rapid progress. If we hit space then we can resolve a lot of problems but in any case we will consider with care all that we have learned in recent weeks and open our deliberations to serious and wide debate in the club. We must also encourage debate on some of the ethical points that have been raised during this episode. These range from the rights and wrongs of using drilling and science to find new cave to our responsibilities to leave as little surface evidence of our digging activities as possible.

This report has been written using current political thinking, known as B.S.E. If something goes wrong Blame Someone Else (Sir Isaac?).

A Game of Two Halves: Ogof Twyn Tal Draenan, 1992-6

by Tony Baker

Every Saturday morning, up and down the country, small but loyal groups of like-minded individuals don scarves and woolly hats, and set off on pilgrimages. Their destinations: theatres of dreams, places where they have experienced elation, despair and all points between. Week after week they come back to endure or enjoy these extremes of emotion, in hopeful expectation of the day when it will all be worth it...

I last wrote about Ogof Twyn Tal Draenan in Newsletter no.110, in 1992. Since then, we've found a lot more cave - most of it in one hit, early in 1993, but we have yet to find the miles of passage that (hopefully) lie between the sink and Dan-yr-Ogof.

At the time of that last article, the limit of exploration was a sump. Gareth Hardman subsequently attempted to dive this, and after two separate attempts concluded that it didn't go. The only "dry" digging site had also been abandoned and we were faced with the prospect of having to find something else to do with our Saturdays. Stevie West and I went in on a last-ditch attempt to find a lead, and while he was scratching around in the bottom of the unpromising rift next to the sump, I chimneyed up and was delighted to find a draught whistling up through a slot. It might have been heading towards the surface, but at least it was something to go at.

A week later I was back, this time with Ian Middleton. I pulled some rocks out from the slot and was convinced I could get through it, but after ten minutes of sweating and struggling I was stuck. Ian was still at the bottom of the rift looking at something else, but now I needed help. "Ian, can you, er, come up here? I think I need some, er, moral support here." He made the awkward climb up the rift and helped me extricate myself, before pointing out that if I hadn't been in such a hurry I could have pulled out a couple more boulders and the slot would have been easily passable. After a couple of minutes with a crowbar, he was off up a sloping rift along with the draught. As I followed him, I noticed a chocolate wrapper on the floor of the passage: "Ian, I think someone's been here before us!" It turned out, however, that the wrapper had fallen out from his oversuit, and Boost Passage was christened.

Over the Moon, Brian.

From then on, finding new passage was an almost weekly experience. At the end of each trip, just when we thought we'd explored all there was, a new lead would appear and there'd be something to go back to next time. This went on until February 1993. Ian Alderman (yes, that Ian Alderman - he couldn't, at that time, find anyone else to go and help him flog his dead horse up at Herbert's Quarry) and I spent a couple of hours struggling to remove a particularly truculent boulder from a slot. We didn't succeed, but just as our watches ticked past the hour when we had to leave or risk walking off the hill in darkness, we managed to move it just enough to allow us to squeeze past. We entered a small chamber, at the far end of which a passage led off, the way on blocked only by a pile of rocks which I reckoned would take half an hour to shift. Here, again, was something to go back to next week.

When Saturday Comes

On to the following week, the date of a party at the club to remember Bill Little. Ian Alderman, for some reason, wasn't interested in coming back - he was obviously finding a real dig too much of a challenge, and he hasn't been back since. The team consisted of the regular three; Ian Middleton, Paul Quill and myself, plus Hywel Davies, on his first weekend back at the club after a year playing Australian Rules down under. Quill, as was customary, wasn't able to get through to the sharp end, and so was occupied in enlarging a squeeze with a lump hammer. The boulders at the end took around half the time I'd estimated to remove, and we were through into a small chamber with, disappointingly, no obvious way on. However, it didn't take Ian long to discover that the calcite bank that barred further progress was formed over a sandbank, and after a few minutes' work with a crowbar, he wriggled along a low rift. The passage then turned left down a tight squeeze, which I didn't like the look of as I stuck my head into it, especially since my helmet jammed.

"It's alright - it doesn't go, so don't come through" called Ian from the chamber he and Hywel had reached. Then, after a few more minutes: "Hywel's dug a way through! Come on through the squeeze."

Fever Pitch

I took a deep breath and forced my way through, knowing that, tight as it was going downhill, it was going to be a real bitch to get back up. Exploration fever expunged such thoughts from my mind. What followed was the best trip we've ever had in the cave: 50 metres or more of new passage, including a chamber 10m long and 5m wide, two shafts down, an impressive water-worn rift and more leads to follow up than we could shake a muddy crowbar at. We really felt that we were getting somewhere at last and excitement was running high, especially since the cave was trending downwards at last; the furthest point being, at our estimate, at least 15m deeper than where we'd started from. We spent more than two hours exploring all this, and were already resigned to walking off the hill in the dark by the time we decided to head out. Paul Quill must have been wondering where we'd got to.

Extra Time

Ian was first back to the squeeze, and after several minutes of struggling it started to dawn on us that we may have scored an own goal. Every attempt Ian made to push himself through just wedged a different part of his body in the rift, the problem being that it was narrow at the bottom and only slightly wider at the top and he just couldn't force himself far enough up into this section. Every time he stopped struggling to recover slightly he was panting hard, and we could hear his heart thumping. We were

already much later than we'd intended, and a potentially awkward situation was developing. In the end, it became apparent that Ian wasn't likely to get through like this, so Hywel had a go and managed to slide through, aided not only by his slender build but by his longer legs, which made it easier for him to keep his body high in the slot. A sigh of relief; at least one of us was out, although I still kept thinking of the implications of causing a call-out on the night of a party at Penwyllt. I then tried the squeeze, and found by using Ian as a fulcrum, I could keep my body high in the slot as Hywel had done. It took me several minutes, but eventually I succeeded, with a gasp of relief. Now we just had to extricate Ian; playing a blinder, Hywel gamely volunteered to go back through and act as support from behind as Ian had done for me. It worked, and Hywel again managed to pass the squeeze unaided. It had taken us almost an hour to get all three of us through, and the squeeze was later christened The Bill Little Memorial Squeeze. As we left the cave another hour later, muddy, bruised and exhausted, we realised we'd had a very narrow escape.

As a precaution against a major discovery, we were in the habit of putting a ticket on the destination board at Penwyllt with a return time of 8.00pm, even though we were usually back by 6.00, by when it was dark. The policy was vindicated on this occasion: it was 7.45pm as we drove into the car park. My girlfriend Sue was in tears, having arrived at the club at 6.00 expecting me to be there and become increasingly distressed as time went on, imagining all the fates that could have befallen me. This had precipitated some concern, and the Land-Rover was out of the garage with the engine running.

Bring on the Substitutes

After this escapade, we decided that the Bill Little Squeeze had to be enlarged before we could continue the exploration, and for this we needed someone who could make the necessary noises. Several weeks passed as we were let down by one individual after another, but in the end Paul Taylor was coaxed over from the Forest of Dean and he did the deed. He came over on a later occasion, too, when he and Steve Tomalin helped us to make progress through a dodgy choke at the bottom of one of the shafts (later called Platypus Choke, after Paul Quill's comment that if any of the rocks in it fell on you, they'd crush a certain part of the male anatomy "flatter than a duck-billed platypus's tail").

Halfway through the afternoon, across the nation, the entertainment reaches a brief pause. Time for a hot drink, and a chance to discuss tactics. By now, a picture is forming of the likely outcome of this afternoon's efforts, but there is still plenty of time for it all to change...

Sick as a Parrot, Brian

All this was three years ago. Since then, we have found virtually nothing in the way of significant new passage, and Martin Hoff has become a member of the regular team. Hopefully these two facts are unrelated. We managed to waste a lot of time pursuing red herrings, after giving up the most obvious way on as being much too difficult. Inevitably, nothing else went and we're now back beyond Platypus Choke, following a narrow rift that is exceptionally awkward to dig, eats crowbars, and leaves the digger with a liberal coating of sticky mud. ("This place is shittier

than Shitty the Shitehawk's shittiest shit-coloured shirt" - Pat Hall, 1995.) Oh, and you have to go through "The Slurry Bath" to get to it. To get the spoil out, a bucket has to be dragged back through The Slurry Bath, through Platypus Choke, the contents tipped into another bucket, which is then hauled 3m up a climb and dragged into a chamber (Mrs. Miggins' Coffee Shop) to be emptied. This passing game needs a total of four people, at least three of whom get very cold very quickly while waiting to perform their part of the operation. On the plus side, sometimes if it's been raining a lot in the preceding week you can hear a trickle of water away in the distance, and one or two of us have sometimes thought that we felt an air movement that wasn't our own breath, but here opinion is divided.

Sing When You're Winning, You Only...

Predictably, our recent lack of progress has led to jibes from other teams' supporters. A unit of measurement, the T.D. (Tal-Draenan) has been devised, equal to two metres - our progress in the last twelve months. Equally predictably, some of those making such jibes are those whose faces were once seen regularly at Tal Draenan and who have transferred their attentions to the team that has had a run of good results. Goalhangers to a man, sooner or later they'll be back.

Quarter to five. The sun is setting as they leave, listening eagerly to transistor radios for news from elsewhere. Sometimes their step has an optimistic spring in it, their hearts gladdened by a successful afternoon. At other times their eyes are downcast, subdued voices analysing what went wrong. In any case, they'll be back next time, their expectations raised once more as they dream of that day - maybe not next month, maybe not next year, maybe not for for several years - when all the bad times can be forgotten, when the ultimate prize will be theirs...

The Boys Done Good

The team would like to thank all their loyal supporters, most notably:

Iain Miller, ably assisted by Clark Friend, for their magnificent efforts on the surveying. "They covered every inch of the park out there,Ron..."

John Lister and John Harvey, for coaching and encouragement in areas of expertise that have allowed the team to make good progress over the season. Also John Lister, Clive Jones and Eric Inson for providing match balls on a regular basis.

All those who've been to a game - there are lots who have played only the once but hardy souls who have come back for more include: Steve West, Pat Hall, Paul Taylor, Sue Mabbett (Sue's score so far: Visits to Tal Draenan 4, Herbert's 0).

Man of the Match on numerous occasions: the indefatigable Paul Quill, once a stalwart of the back four but sadly seems to attend away fixtures most Saturdays now.

SuperSub: Hywel Davies, whose most recent visit yielded such a good result. *Please* come back again soon, Hywel.

The Race for the Title

As far as we're concerned, the Premiership is still there for the taking. With the experience gained in Europe over the last few seasons (away victories at Gouffre Berger, PSM and Dent de Crolles) this team is confident it can go all the way. Critics may point to the lack of results since Martin Hoff joined the squad, but his run of poor form is nothing compared to Andy Cole's and look at what *his* team achieved last season.

Some of the Crowd are on the Pitch...

Never forget: at the end of February '96 Newcastle United were twelve points clear and the bookies stopped taking bets on them. Kevin Keegan ended up with egg on his face at the end of the season, so if you're part of a team whose manager ended one career in Southampton and moved north for another, watch out - Martin Hoff may turn out to be more Alan Shearer than Jason Lee after all...

Post-Match Interview

Sharp-eyed readers may have noticed that in Newsletter no. 110 this project was still being referred to as "Ogof Twyn Tal Ddraenan", but that in this article as well as recent log book entries it is called "Ogof Twyn Tal Draenan". The change follows Hywel Davies' assertion that the former was wrong, despite the fact I originally took the spelling from the OS map where the "Tal Ddraenan" form is used to label the sink. While compiling this article, I asked Hywel to provide a definitive explanation, and here is his reply:

"*Twyn* is a hillock, knoll. *Tal* is tall, high or lofty. *Draenan* is thorn.

"So there you have it, '*Twyn tal draenan*' is 'high thorn hill', or something of the sort.

"The 'D' versus 'Dd' (pronounced as 'th' as in English 'the') needs some explanation. In Welsh, if words begin with certain letters, then the beginning of that word changes if the word is preceded by one of a fixed list of other words. Thus *draenan* becomes *ddraenan* according to the rule called 'soft mutation'. However, *tal* is not one of the words that invokes the change, thus '*tal draenan*' is correct. If you referred to 'the thorn', you would have '*y ddraenan*', as this rule is invoked for a feminine noun (*draenan*) following *y*.

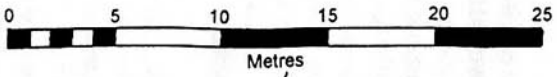
"I thought '*tal ddraenan*' was wrong when I first saw it and especially when I tried to say it, but I double-checked with my father who confirmed it. He is a totally fluent Welsh speaker, studied Welsh at university, taught Welsh for 30-odd years and doesn't get this kind of thing wrong."

So there you are. Grateful thanks to Hywel and to his father, and apologies to Welsh readers for the fact that I got it wrong in the previous article and several log book entries: I blame the Ordnance Survey. If you look at the map on the wall of the small common room (a 1981 edition of the 1:25000 series) the sink is clearly labelled as "Twyn Tal Ddraenan". Someone has clearly pointed out their mistake to them, however, since on later editions of the map it has become "Twyn Tal y Ddraenan".

Stop Press: a visit on 19 October found a roof collapse had occurred beyond the Slurry Bath, and an hour was spent clearing this before we could deal with a boulder that was all that lay between us and some long-awaited new passage.By the time you read this, the cave just might be rather longer...

OGOF TWYN TAL DRAENEN

South Wales



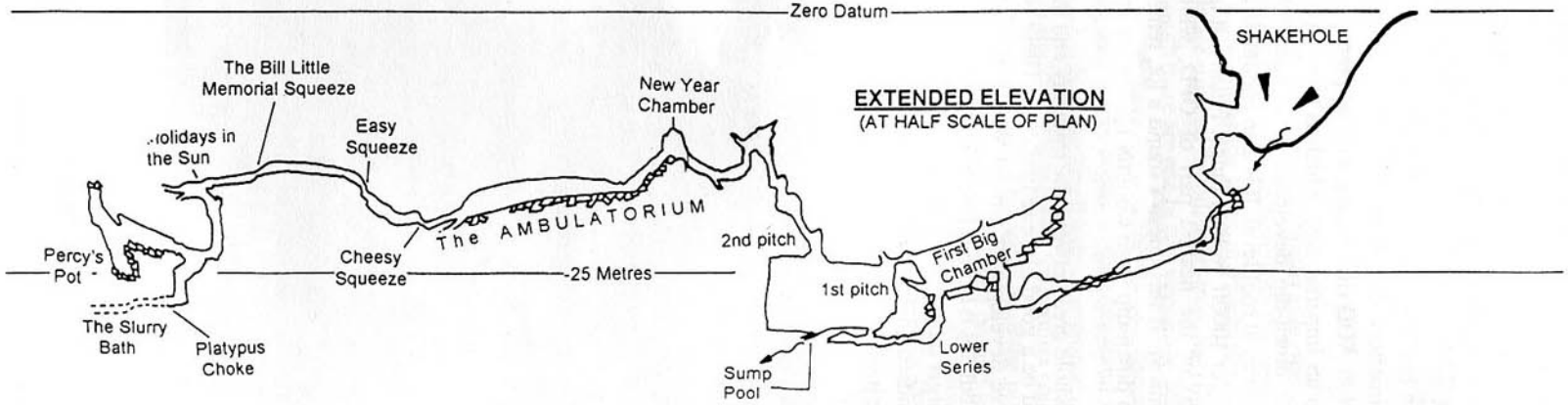
GRID NORTH

PLAN

LOCATION : NGR SN 807 191
BCRA GRADE 5c unless specified
Surveyed by I Miller, T Baker, H Davies, C Friend, M Hoff, I Middleton, & M Herbert.
Center line plotted by I Miller using SURVEX v0.62.
Drawn by I Miller. August 1996
Local grid orientated to O. S. NGR Transfered from calibration points for Ogof Ffynnon Ddu.
Surveyed Length : >195 Metres **Vertical Range : 23 Metres**

EXTENDED ELEVATION

(AT HALF SCALE OF PLAN)



Babysitters' Dig

by Sam Moore

The Dig

It wasn't always called Babysitters' Dig! Originally, it was called Pwll y Pal y Wal, which described what and where it was but did not exactly have a "ring" to it. At an early stage, some wag observed that the people then digging it all had small children and could only dig on alternate days. The name stuck.

The dig is situated at NGR SN 87008.46 16558.16, near the highest point of the fence and wall that separates the OFD Reserve from Cnewr Estate land. The potential for cave here is very good. It is in the "right beds", just below the Honeycomb Sandstone. The limestone dips nicely towards the OFD III streamway. It is at 1640ft AOD (in keeping with its premier position and status, this is an Imperial dig), which is more than enough to allow a simple down-dip development to come out in the OFD III streamway at roof level. It is also enough to allow a through trip with over 1000ft vertical range. Finally, it is over 600m up-dip (north) of the nearest part of OFD, which is the OFD III streamway. If this doesn't sound a lot, remember that it is only 500m down-dip from Column Hall to the streamway.

The whole area between the tramway and the reserve boundary would be a good place to find cave. There is plenty of evidence of cave development around Weighbridge Quarry, nearest the gate, but this is a little close to known parts of OFD. Surprisingly, the larger quarry a little further along the tramway has nothing at all. Indeed, there is very little to get interested in until close to the Byfre itself.

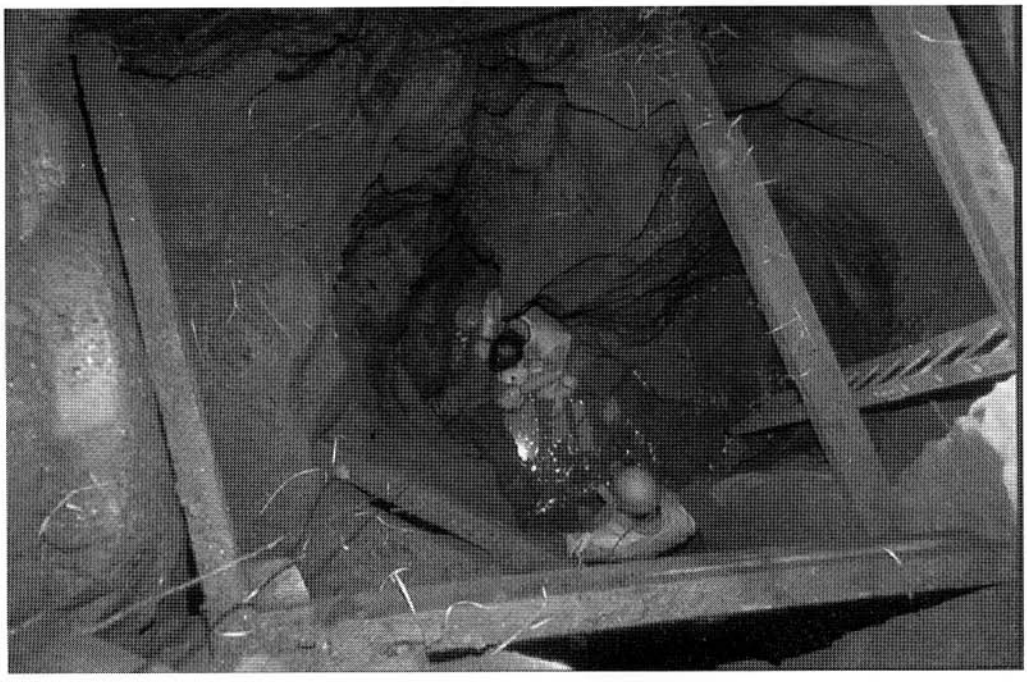
History

Early in 1992, I was looking at the area again, with Clark Friend and Allan Richardson. We came across what appeared to be a little water-worn scoop in a small outcrop. A tiny hole appeared, with the eye of faith, to be draughting in slightly. We scrabbled away in the traditional manner and soon uncovered what we thought could be the roof of a passage dipping into the hill away from us. At this point, I had to leave. 'Phoning Alan that evening, I was relieved to hear that I hadn't missed anything. We were all three convinced that we were digging something rather like Top Entrance and that a breakthrough was imminent. We should have known better.

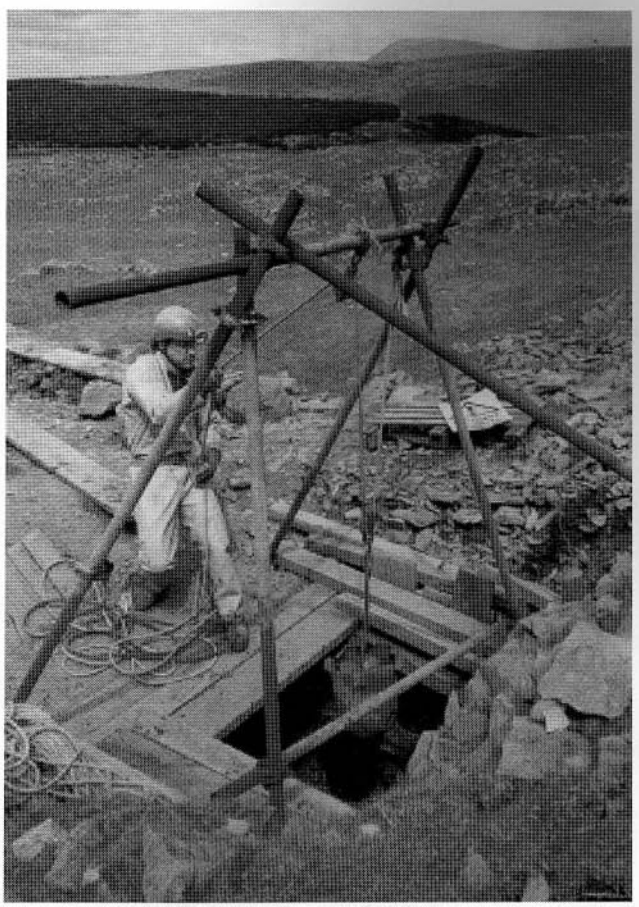
By the end of May 1992, the dig was a timbered shaft about 15ft deep, with a D-shaped cross section. The back (south) wall was a solid semi-circle of rock. The front face was the straight bar of the D, about 4ft across. The fill was clay and boulders. We couldn't be entirely sure whether we were digging down the side of a shaft, the wall of an unroofed passage or simply against a fossil cliff face.

In January 1993 we were down to about 20ft with no change in the cross section. Facing out, towards the fill, we could see that the back wall projected further out to both the left and right. Since digging was constricted, we decided to enlarge the shaft right down from the surface, using the newly-found sections of wall to support the timbers. This gave us a deeper D-section which was now about 3ft from front to back and 5ft across. Since we were moving more fill, we installed a surface platform and tripod. By the middle of Easter week (April), the dig was 25ft deep and a fixed iron ladder had been installed. By the end of the week, it was a foot deeper and we had found a solid floor. On closer inspection, this turned out to be only across the original scoop and the fill continued downwards in front of this. Unfortunately, there wasn't enough room to work in front of the existing timbered face.

After a pause to regroup, we started to drive an adit forwards into the fill, with a view to creating enough room to continue downwards. Not surprisingly, every time we went back we found that more fill had run in through the roof of this adit. We left the dig



View down the shaft, by Chris Grimmett



Clark hauls another bucketful out. Photo by Tony Baker

over winter. When we resumed, a lot more material had come down, always from behind the shaft timbering line. We cleared it all and found what we thought was a solid front (north) wall at the beginning of May 1994. There appeared to be a passage going off to the left. By the end of May, so much additional material had been washed through that this back wall could be seen through the timbering almost all the way down. All that was left was large boulders, supported on the timbers. Although these had not moved, they were clearly under load and we decided that it would be easier and safer to clear the shaft completely from the surface.

By July 1994, the dig headgear looked as it now does, with a tetrapod replacing the tripod for additional stability when landing large rocks. The shaft was 20ft deep with solid walls all round. An unroofed, filled passage about 3ft across went off to the left (west), looking out. By the August holiday, we had rediscovered the solid floor, now only a small ledge in the context of the enlarged shaft, and had continued a couple of feet further down. However, water ponded in the bottom between visits. We observed that it was always at a constant level and hence must drain somewhere. At the beginning of October we started to work into the west passage, stempling across to provide roof support. We soon lost the right hand wall, but the left wall continued solid and we used it to anchor one end of the roof timbers, supporting the other end on timber legs.

By the start of 1995, the adit was around 8ft long, with proper working dimensions of 4-5ft high and 3-4ft wide. We had reached what looked to be a left-hand bend, although this later turned out to be just the curve of another aven which we were entering. By May, we had found the far wall of the aven, which was fortunately only about 5ft across. The whole of the roof was a single jammed boulder, now well reinforced. By the end of the year, we had cleared all the aven and found no obvious way on. There was a very small choked rift to the left, which looked to be closing down. The rest of the walls were solid, except on the right, which was calcited fill. The options were to explore into this fill or to carry on downwards. Enthusiasm waned until early in 1996.

Current Position

That brings us to the present. A couple of exploratory trips in March and April have confirmed that there is no obvious way on from the aven at the end of the adit. It also appears that the disappearing right-hand wall in the adit does not go very far away and is perhaps no more than a foot or two behind the timbering legs, although some extra work would be needed to confirm this for certain. Water still ponds in the bottom of the shaft, but sinks shortly inside the adit, where the water level is lower. We have now gone back to the original shaft and are carrying on downwards, deepening the floor at the start of the adit at the same time in an attempt to improve drainage. Watch this space!

Description

Looking at the dig from the platform (north) side, the shaft is roughly clover-leaf shaped in cross section, with the central lobe pointing away and representing the scoop in which the first shaft was sunk. The walls are solid all round, apart from the rift going off to the right, although there are one or two very large detached but in-situ blocks which have been timbered as a precaution. Access is via a fixed iron ladder bolted to the right-hand side of the back wall, which lands on the small ledge mentioned earlier. At present, the main shaft continues down for another couple of feet, but will no doubt get deeper. The depth from the platform to the ledge is about 24ft and from the original ground level to the ledge is about 28ft. The shaft is approximately 8ft across both its north-south and east-west axes, slightly deeper than it is wide.

At the bottom, a timbered adit goes off in a rift passage. The adit is roughly 5ft high and 4ft wide and runs on a bearing of 240° magnetic for 9ft before entering an aven, which is about 5ft in diameter and offset to the left. At the start, both walls of the adit are solid, but the right hand wall is soon lost as described above.

Casting modesty aside, this is an impressive dig. The proprietor of one of the leading contenders for the premiership has recently admitted that, visually and volumetrically at least, Babysitters' is hard to beat. A rough calculation suggests that we've pulled out something in excess of 50 cubic metres of fill, say 80 - 100 tonnes since it has generally been fairly well compacted. Depending on your viewpoint, this is now either a monument to man's folly or a model of the way a surface dig should be conducted. Either way, we're enjoying ourselves. Why not come and join us?

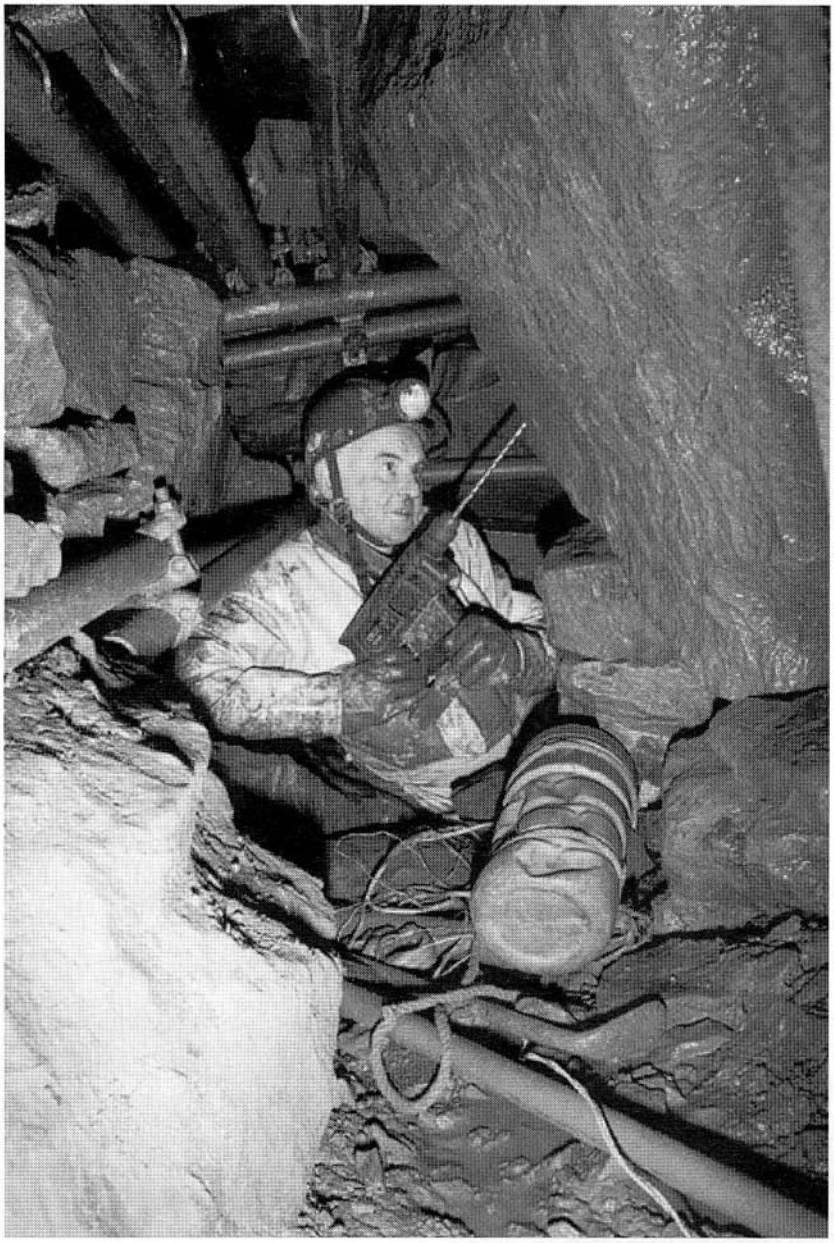
Acknowledgements

Tony Baker, for eventually twisting my arm enough to write this and for taking the photographs, along with Chris Grimmett.

Everybody who has dug at Babysitters'. It has always been very much a team effort, even if the composition of the team has varied. It is not really fair to single out individuals, but I would just like to pick on Simon Amatt, who nags me almost as much as I nag him and has the advantage of owning a heavy digging gear transporter.

Steel Drum Update

by Clive Jones



Clive Jones at work in Steel Drum. Photo by Julian Carter

Since the last report on Steel Drum we have battered, blasted, bolted between beautifully balanced boulders bottoming beneath bedrocked big bulging blocks. We are now at least 100 feet beneath *terra firma* and into Terror Firmer, we hope.

The place is a place of rare fascination - a joy for ever. Who could ask for more: a dig that goes on and on and as yet goes nowhere. No problems of access, no committees of the same people pontificating on who does what with which and to whom. If only all of life could be a never-ending hole.

As you will recall from the last report the first shaft, Boulder Shaft, takes us almost out of sight of daylight and leads to the dogleg. This deviation provides the tourist with a change from the drystone scaffolded scenery of the first shaft but not for long, it soon leads into Tombstone Shaft. This masterpiece of combined Stone- and Iron-Age engineering has as its centrepiece the tombstone. Below this monument the shaft goes on down and down.

All good things must come to an end and this second shaft came to a dilemma. There seemed to be a "way on" by going into the boulders and leaving the solid wall of Tombstone Shaft. This is what we did, we exchanged the solid security of our second shaft and ventured into the hanging gardens, not of Babylon but of Armageddon.

This was to be our final battle but who is to say when the battle is over. Who cares when you are enjoying the fight? A scaffolded safe way now leads through the boulders to a shaft of ten feet, again a safe place.

Our team seems to have evaporated. Except for the occasional visit from Simon and Mike, and now and again help from Gary Evans and Ben Dragon and guest visits from curious members of the original gang, the team is down to Tony Donovan and myself.

We are now in spaces in the solid rock but where is the way on? Every time we think that there is no hope a new chink of darkness appears to entice us to probe just a little deeper. We are now looking for Adam's navel.

For more on the Steel Drum project, see Movers and Shakers *in SWCC Newsletter no.117, 1996, pp 2-4.*

Somewhere Under The Black Mountain

by Nig Rogers

It's all there. Waiting. In the dark. We haven't found it yet. No-one has. Perhaps they never will. But we know it's there. We weren't always sure. But now we know. Make no mistake, it is there. Somewhere. Somewhere under the Black Mountain.

1975.

Beginning to tire of constant tourist trips, a quick inspection of the map was enough to pique my interest. "Carreg Yr Ogof" - must be a cave somewhere. A nightmare bus journey from Cardiff to Swansea and on to Upper Cwmtwrch saw Nelson and I walking up the Twrch valley with huge packs. Pitching camp opposite Ffrydiau Twrch, a mishap with the stove combined with a craving for the pub meant that we never actually reached our intended destination. We did see it in the distance though, from above Pwll Swnd - white limestone glinting in the sunlight contrasting with the gritstone grey ridge of Garreg Las to its south. Next time, maybe.

1978.

Packing a crowbar to take on your honeymoon may seem unusual to some people but fortunately for me Mary seemed to accept it as perfectly normal. Living in Lancashire, we only had four days to spare so South Wales was a good place to go. Approaching from Llanddeusant this time, an hour's walk got us up to the trig point and we managed to reach the twin cairns of Garreg Las beyond before the mist descended. Getting back down in twenty yards visibility became the priority so the crowbar did not actually get put to use. I had seen enough to know I'd be coming back - lots of limestone, lots of water sinking, loads of places to dig. The seed was sown.

1980.

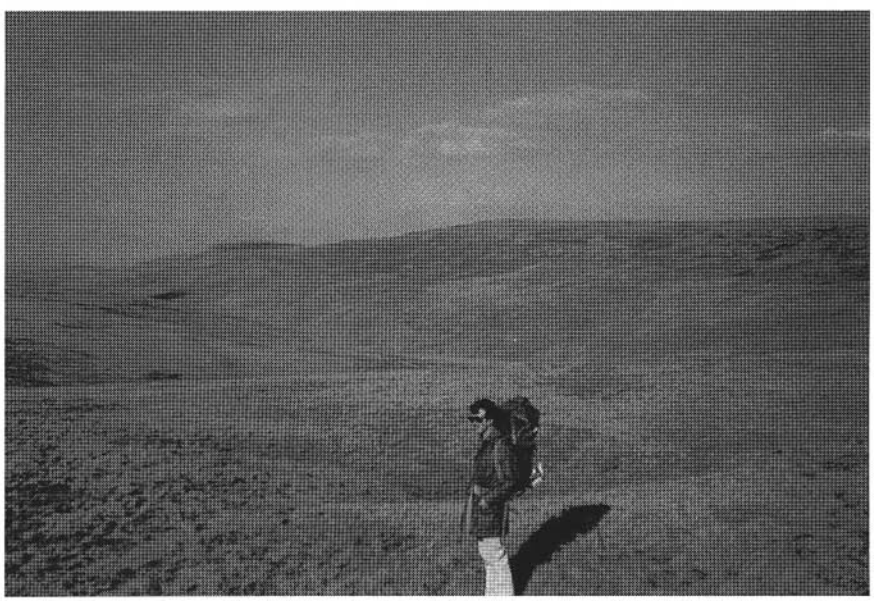
Now living on the doorstep with plenty of time to spare and plenty of motivation to inspire me, it should have been easy to get some serious digging done. The onset of a particularly hard winter made things rather more difficult. We decided to look at the obvious sinks first, beginning with the easternmost one. After securing a large loose boulder to a crowbar jammed in the snow, Nelson was able to squeeze over it into 2m or so of sharp, tight passage developed in shale before being stopped by an acute bend. Reversing this manoeuvre was problematical, at one stage looking decidedly doubtful, hence the name - White Death Sink. We'd come back in the spring.

1981.

With the discovery of Ogof Diwedd Yr Enfys under our belts we were keener than ever; the hunger was upon us in those days. Liam Kealy, with his friends from Hereford Caving Club, had blasted White Death Sink into submission, discovering 20m of pretty awful passage. We didn't mind, we didn't yell "Pirate!", we just accepted that they were better than us. At least we could turn our attention elsewhere. How about the main western sink, north of the hill itself? Liam, Gareth Jones and numerous others joined in over the course of the summer. It was just as well that we had a cheap, seemingly endless supply of explosive because we managed to consume vast quantities of the stuff. All to no avail! Despite a consistently strong draught, constant slumping of the sides meant that we were forced to concede defeat until a JCB could be airlifted in.

1982.

Having failed at both active sinks, we spent some time checking the known fossil caves higher up. Liam and I were friends then, before his own lack of success allowed the bitterness to creep in. Close to Ogof Y Gigfran, we found a hole which had been cleverly concealed beneath some limestone slabs, most likely the work of some long-dead farmer concerned about the welfare of his sheep. Shepherd's Hole dropped down a 4m pitch into 13m



Dai Hopkins on the long walk in from Herbert's Quarry. Carreg Yr Ogof in the far distance, partly in shadow. Photo by Nig Rogers

of well-decorated passage, chokes at either end. Exciting at the time but ultimately disappointing - a familiar tale so far as exploring caves on the Black Mountain is concerned.

1983.

The summer sun enticed us back and yet more bang was wasted at the western sink. Fed up of this, I had a look at the cave which gives the hill its name. Situated north of the trig point, this consisted of 25m of reasonable passage, pretty in places, ending in a calcited choke. As we had loads of bang I thought I might as well use some of it here rather than vaporise another boulder at the sink. A couple of solo trips as summer turned to autumn, then I was joined by Mike Hopkins and Martin Hicks. A loud echo beyond the choke promised much and on our second trip together, Bonfire Night, we broke through. Alas, a mere 8m further on we were stopped by the most unexpected obstacle of all. We had been prepared for more chokes but not for a beautifully clear, blue sump pool - not this high up, at around 580m altitude, a good 270m above the potential rising! It had to be a perched sump, possibly caused by some localised blockage, and hopefully would be short and shallow. Nelson's first and only cave-dive three weeks later proved this not to be the case. The sump was short, but only because it was completely blocked with mud after less than 10m. Surprisingly, it was anything but shallow, dipping steeply down to around 7m depth. Visibility was zero on the return and diving on base-fed line proved to be a somewhat unpleasant experience. Time to look elsewhere.

1984.

Having experienced some, albeit limited, success with one calcited choke we decided to try another. Carreg Yr Ogof Slot, a 6m deep vertical rift, lies 70m south-east of the trig point. At the bottom of the entrance pitch the main passage heads south but ends in a horrendously loose choke. An earlier bang here had merely succeeded in making it even more unstable. Going in the opposite direction, to the north, the passage was totally blocked by nice solid calcite - a much safer proposition. Calcite, although relatively soft, is difficult to blow up without drilling shotholes. We didn't know this at the time but we soon found out. It was to be several trips before Paul Tarrant and I got through to the continuation beyond. Once again disappointment was our reward. We had been encouraged by the dual spur of a good echo and the sound of a stream. The former came from a small blind chamber whilst the latter, only present in time of high water, sank in the floor. Never mind, at least we had learned how not to go about banging calcited chokes.

Determined to check out all the possibilities on the hill, we went back to the only sink we had not already examined. This is a flood sink in a deep shakehole to the east of the main track, south-west of White Death Sink. The entrance at the base of a small cliff had reportedly been opened up several years previously by Hereford Caving Club but they had soon given up. Once I went there I realised why. The whole place was decidedly dangerous - at times it was hard to tell whether it was the walls or the floor which were moving. Unfortunately, it was also distinctly promising. Two follow-up trips, first with Paul then with Steve West, saw some fair progress made down a desperate boulder funnel but common sense prevailed and we gave up too. None of us liked the place and there didn't seem much point carrying on when we clearly weren't enjoying ourselves.

1985 - 1988.

Our lack of major success had led to a predictable dwindling in interest and support reached virtually non-existent levels as people drifted away. A bad back meant that I wasn't really up to carrying a large rucsac for such distances any more. Oh, I still went up there for the occasional walk but the load was kept to a bare minimum and I tried to resist the temptation of pulling too many rocks out of too many shakeholes. The only problem with walking in a limestone area such as the Black Mountain is that you can't help wondering what may lie beneath your feet.

Once my back improved I was eager to make up for lost time and get some real caving done so Dan-yr-Ogof and Ogof Ffynnon Ddu became the focus of my attention for a while.

Apart from one half-hearted visit to the western sink, when Mary had to do most of the digging because I couldn't bend down properly, no serious work took place at all. The thought was still there though, at the back of my mind; it was only a matter of time.

1989.

August warmth to help me on, I made the long haul up the hill, 'sac heavy and biting. The hunger was still there, if anything sharpened by the enforced lay-off. Still not fully fit, I was determined to take things gently - an inspection of Ogof y Gigfran would do for starters. After deciding that the draught in the cave was probably surface-related, I wandered round to the main sink. Rather than carry on where the water actually sank (the site of our previous awesome expenditure of bang), Mary and I had started digging the grassy bank above. I continued here and was soon encouraged by cool air percolating upwards through the soil. I left it until I could return with an entrenching tool and longer bar.

Just over a week later a good session saw real progress being made to a point where a second person was required. Mark Ace, flush with the optimism of youth, accompanied me three days later and we managed to penetrate 3m between boulders. We even had a drink in the Copper to celebrate! Another three days passed and I was accompanied by two other keen youngsters, Gareth Davies and Huw Lewis. A further metre gained and yet another celebratory drink afterwards, this time in the Pontaber. A breakthrough looked imminent and we hadn't even used any bang! I decided to take some along next time.

Four days on, Martin Laverty, Anthony Roberts and Kevin from Seven Sisters joined Gareth and myself. We each carried a full set of caving gear in anticipation but I wasn't really all that optimistic, being certain that we would have to blow something up at some stage. As Lav and Anthony (otherwise known as "the human shovel") hadn't been there before we let them get kitted up first and begin digging. I went for a walk and came back within forty minutes to be informed that Lav had moved a rock out of the floor and was now attempting a tight upwards squeeze with space beyond. I had reached this point on the previous trip but had not really fancied it - it was awkward and committing and the boulders above looked dubious to say the least. Perhaps I had done too good a job convincing myself that we couldn't possibly find anything without banging but I didn't give Lav much chance of getting through. How wrong I was!

Now, I've never really subscribed to the "let's explore everything together as a team" school of cave exploration - if you want to

The team outside the entrance prior to the second breakthrough, 1st October 1989. L to R: Martin Hicks, Martin Laverty (back), Mark Ace (front), Nig Rogers, Chris Smith, Paul Tarrant, Mike Hopkins. Photo by Brian Hopkins.

Nig Rogers in stream passage. Photo by Martin Hicks

Gareth Jones (foreground) and Martin Laverty surveying the entrance passage. Photo by Martin Hicks

walk down virgin passage holding hands with your mates that's fine with me; bond away to your heart's content. Personally, I prefer to take each situation as it arises - it isn't always possible to have everyone who has been involved in a particular project at each and every breakthrough point. I would never expect anyone to hold back from pushing a lead just because I wasn't present, likewise you won't hear me whinge if I'm too fat to get through something and someone else comes along and does so. If it's there and you're there and it's open you go for it, simple as that. Sure, you don't use somebody else's tools or clear their spoil but, other than that, if it's wide open it's fair game. Lav obviously felt the same because once past the squeeze he was off and away. Shouting elicited no response so we assumed he was either into something decent or had fallen down a pit and killed himself. I wasn't in the least concerned that he was exploring whatever there was on his own but I did feel that he was needlessly putting himself out on a limb as he had no spare light and did not even know whether anyone else could pass the squeeze. Such is exploration fever. As Anthony was the only other one in caving gear, I said he might as well have a try himself. After a brief struggle he was through, shouting back that he was in a large ongoing passage with the stream entering low down on the left. I told him not to bother waiting for us but to go after Lav.

Gareth and I were in no hurry getting changed - might as well make the excitement last. Kev had decided that he was too big for the tight bit and set to building a double drystone wall on the surface. Talking each other through the squeeze, we entered the new cave - it was every bit as impressive as Anthony had described. Remember, this was before Carno, before Draenen, before I knew what it is like to discover passages that seem as though they are never going to end. I had found plenty of new stuff in the past but this was special; it was what I had spent the last nine years searching for. Although he hadn't been caving that long, Gareth had done more than his fair share of digging with me (usually in pretty miserable places) and it was good that he was here to share this. Apart from anything else, it was genuinely pleasant passage. The recurrent boulder breakdown was more than offset by plenty of calcite. Most important of all, we had the stream - where would it take us? The answer came soon enough when we met Lav and Anthony on their way back from what was to prove an insurmountable obstacle, at least for now - a huge boulder choke. Lav was content to head for daylight but the rest of us decided to have a good look for any possible continuation. Finally settling for a solid right-hand wall, we penetrated a fair distance into the choke before eventually calling it a day. Going out seemed a lot shorter than it had coming in (doesn't it always?) but we were well satisfied. Without a

doubt this was a significant find - old, fossil passage heading due south, steadily down-dip, re-invaded by an active stream. Ogof Y Garimpeiros - the name a tribute to the discoverers, true independent prospectors all. Surely, the 100m or so that we had found today was a mere taste of greater things to come.

Gareth and Anthony, both on leave from the Army, were keen to make a return trip while they had the chance so we persuaded Huw Lewis to come along four days later. Five hours digging, during which Anthony lived up to his nickname, saw us make sound progress to a point where we could hear the stream beneath us. The bad news was that at long last it looked as if we would have to resort to bang.

Returning after a fortnight's holiday in Jersey, I was joined by the strong team of Hicks, Jones and Laverty. The eldest, more portly member had to go naked under his oversuit in order to pass the squeeze but once inside a lot was achieved. The cave was surveyed, photographs were taken, shotholes were drilled and a charge was fired.

The following week a record number of cavers made the trek up the hill. Our numbers were soon reduced, however. One look at the shoring convinced Chris Smith that he wasn't really cut out for pushing trips and Mark Ace, who had been a bit fed up at missing out on the original breakthrough, soon became even more fed up when his (borrowed) lamp failed. Up at the sharp end, the spoil was cleared and Martin Hicks was sent in front. He duly regained the stream and dug his way along a wet bedding plane before reaching a dry oxbow. This in turn led to a large shattered chamber where he decided to come back for the rest of us. Mike Hopkins and I were none too impressed by Martin's concept of "digging-out" when it came to the wet bedding and we spent a considerable time enlarging it. By the time Lav and Paul Tarrant came through it was "Pan-Galactic Highway" sized - at least so far as flat-out bedding plane crawls go! Paul played his "I'm a married man with responsibilities" card before reaching the final chamber and sat on safety's side of a suspicious-looking boulder wedged in the roof. So, out of the seven people who entered the cave only four made it to the end. The others didn't really miss anything as there was no apparent way on.

The stream disappeared low down to the left just before the chamber so we laid a charge on some boulders higher up on the left-hand wall in an attempt to get back to it. We had extended the cave, but not in the manner which we had hoped and it looked as if a lot of work was going to be needed to get any further.

1990 - 1995.

You never really lose the hunger, it comes back from time to time, but you can satisfy it, abate it for a while. Once you know what is possible, proving it doesn't seem so important any more; the urgency is lost.

Six years, a mere handful of trips, no new passage. People came, people went, no-one felt inspired enough to really persevere. Pete Francis, prior to the onset of paranoia, before the imaginary wolves appeared, was as naturally keen as anyone else to see the new cave for himself. We had some fun, having to tie boulders together with a rope as we had no shoring, before firing another charge.

Les Welsh and Nigel "Cyclops" Ashcroft lent a hand, Cyclops being the only person to get any further along the stream until being stopped by a rock pillar blocking the way ahead. Hammer in hand, he wisely decided (at the last moment) not to risk hitting it, laying a charge instead. His choice was vindicated the following day when Hicks and Lav returned to find that the pillar was indeed gone but what had been the roof above the stream was now resting on the floor.

The entrance, doubtful from the start, duly collapsed and I spent a spring day reopening it. Before we had chance to have a trip into the cave it collapsed again. Someone (we still don't know who) did us a favour by digging a second entrance higher up - it would have been nice if they could have covered it over as well.

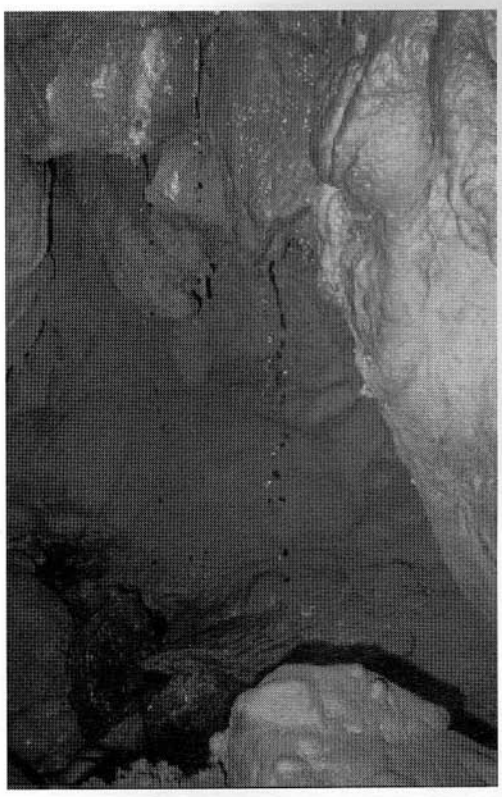
Using the new entrance, we began digging downwards from the far end of the final chamber. An inauspicious beginning, a misfire (due to a possible break in the wire and/or dirty contacts) resulted in a Jeff Bain mutiny and Geoff Snaith and myself deciding to fulfil our plans of going to Mama's in Pontardawe rather than spend all evening underground. Two days and one heavy hangover later I went back on my own, not really the way I had intended spending my birthday, sniffing the air just in case. I needn't have worried - everything was as we had left it. The contacts were absolutely filthy but a fresh wire was laid in any case and all was fine again.

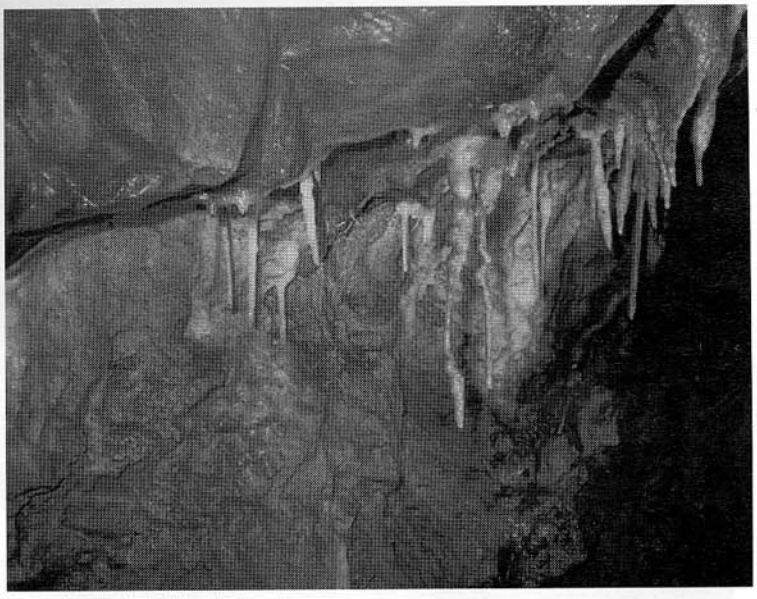
Mark Withers returned to caving after a twelve-month absence and soon wished he'd stayed away. My idea of a quick look down the Slot prior to a trip into Garimpeiros turned into a near-disaster when Mark couldn't get out. Sorry, Mark - I'd honestly forgotten how difficult a climb it is with only a handline. Apologies also to Mary, who had the unenviable task of walking down to the car, driving to Brynamman and back, then walking all the way up again with a ladder!

Jon Evans, temporarily home from the Antarctic, was recruited to help carry the gear when Mark finally saw the inside of the cave a month later. Another bang, but painfully slow progress.

Jeff, who had not enjoyed his previous trip, opted to stay on the surface (a solidly-frozen surface, I might add) as Mark and I braved the winter chill. His decision to go to sleep in a poly bag for several hours caused some considerable amusement - and a little concern - and we were surprised to find that he was still alive when we got out. So was the passing farmer who had got off his tractor to enquire as to his well-being! This was the most productive trip for some time because as well as further digging we performed a highly satisfactory water-tracing test. Dye placed in the stream at the final choke emerged at Ffrwd Las, the first lot of bags (95 hours) proving positive.

Despite this good result, the enthusiasm to carry on was sadly lacking and it was twenty months before I could motivate myself to return. Far easier to go over to Draenen where there was a virtual guarantee of new passage every trip. In the meantime, John Parker had visited the cave and had expressed an interest in digging there. I sent him a copy of the survey and told him to dig where and when he pleased - a marked contrast to his attitude towards other people digging in any of "his" caves. Consequently, Dai Hopkins and I were surprised that nothing had been done when we finally returned - the spoil from the last charge





Two pictures of formations in Ogof Y Garimpeiros, by Richard Hankinson.

remained to be cleared. Holes were opening up below and it looked well worth carrying on. The same day, we checked out the flood sink (never going back!) and White Death Sink (going back in summer with a drill). I had succeeded in extending the latter site by 3m earlier in the week and Dai was able to get around the right-angled bend which had stopped me for another metre or so until it became too tight even for him.

All we needed now was an influx of new blood and we could get moving again.

1996.

Perfect dye-testing weather, a falling flood, so we decided to try and pin the flowthrough time down to the nearest 24 hours. The previous trace had proved faster than expected but there was always a chance it got through even quicker. Only one way to find out. Richard Hankinson and Mark Walters, keen diggers from Mid-Wales, had come on the scene and they volunteered to dye the stream while I bagged the resurgence. Sean Harries, a local canoeist, offered to change over one lot of bags which meant that I only had to make the return walk of six miles for three days out of four. Upon placing the first bags I was very hopeful - I had never seen Ffrwd Las so high. As things turned out my optimism was well-placed. I could have saved myself two days walking - the first set of bags were positive. Less than 24 hours - a phenomenal result! Better get digging again.

Three more trips to date and things look better than ever. In addition to the end dig, a second dig has been started on the left, above the dropped bedding which almost proved to be Cyclops' end. A shattered chamber was entered after one bang and although what was thought to be an outlet proved to be an inlet, work continues. The provision of good shoring has improved morale and the ever-present draught is a good omen. Neither site will go overnight but either could pay dividends in the long term. The promise remains.

Today

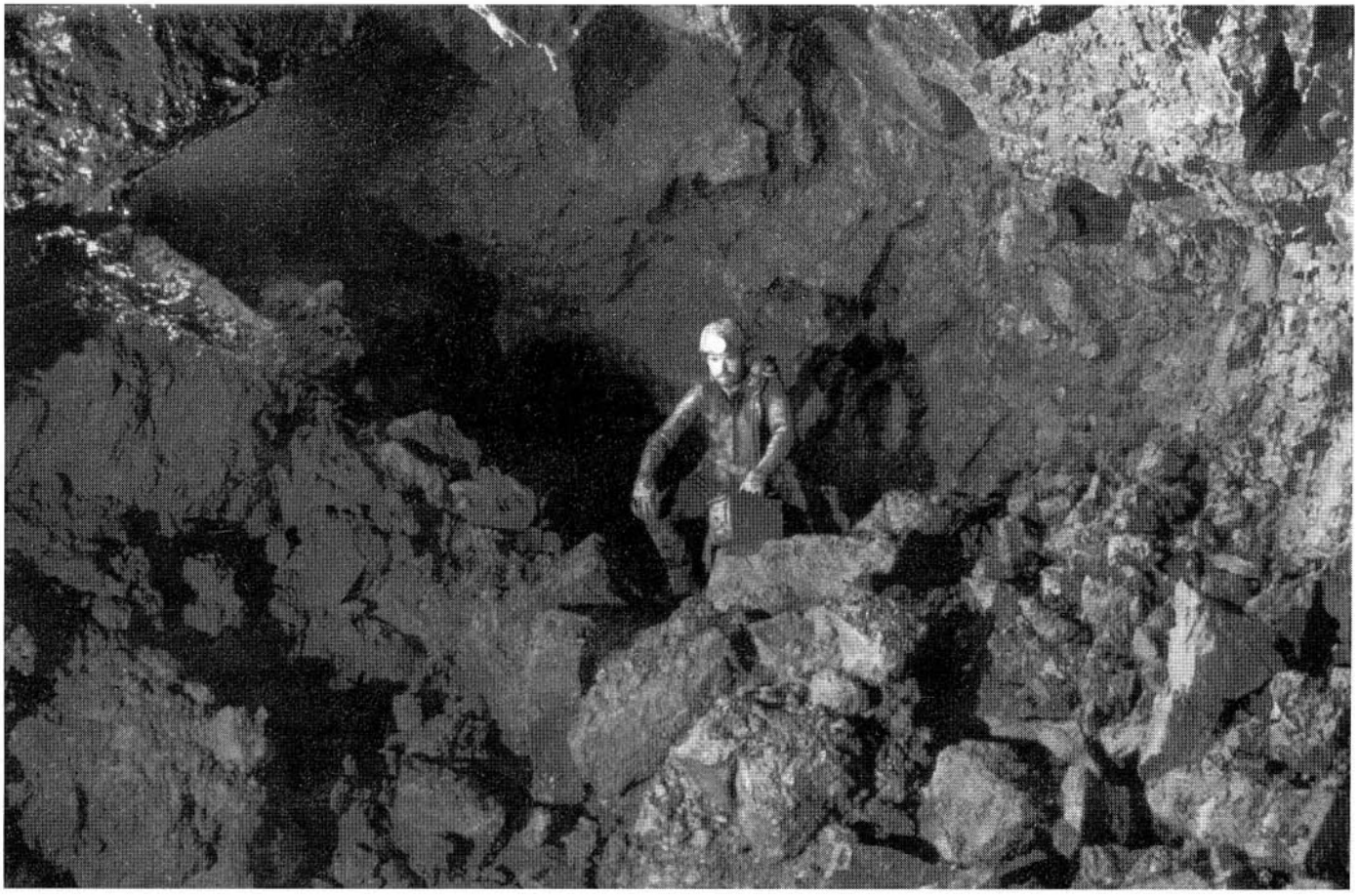
The weather's fine and I decide to take the scenic route from Herbert's Quarry via Garreg Las, one of my favourite walks. I've got the drill to carry but even allowing for numerous rest stops I should make Carreg Yr Ogof within a couple of hours. My objective is a surface dig in a prime position. First begun several years ago, I abandoned it after only one bang. With the acquisition of a mega-long drill bit and the advent of the "Cordtex-in-a-shothole" technique, what was then considered impossible now looks perfectly feasible. This will be my fourth visit in as many weeks.

Walking over, I think back to when I first came here all those years ago. Back to when it was just another place. Now it is my home, where I have chosen to spend my time. I come here a lot but never tire of it. Some days are better than others but every day gives me something in return. The mountain changes with the seasons, as do my moods. Funny, I never thought I would stay so long - now I doubt I'll ever leave. One day, I may well walk this way for the last time. One day, I may be able to put it all behind me. One day, but not yet.

Upon reaching the dig, I take my time getting changed, wondering what the last charge has accomplished. Bar in hand, I climb down the narrow rift. The base is blocked with debris but rocks were dropping further down the last time I was here. Bracing myself against the rock walls, I prod the floor tentatively - it moves. More prodding, then the boulders start to fall, echoes rising from whatever lies beneath. I feel it stir deep within me, steadily growing, back again. It's hard to lose the hunger, once it has taken hold. I hope I never do.

Yes, it's all there. Somewhere.

A sad footnote: Jeff Bain took his own life on 12 July 1996. He will be missed by those who caved with him.



Nig Rogers in high-level boulder chambers. Photo by Martin Hicks

CARREG YR OGOF

Geology and structure.

As the name implies, this outcrop of limestone has always been known to contain at least one cave. At 585m this is the highest and most northerly exposure of the North Crop, with a very high rainfall reflecting these factors. The whole block of limestone has dropped, and effectively been pushed northwards, between two parallel N - S faults.

The resurgence for this substantial catchment area of several square miles (including the grit outcrop which also seems to drain underground) was in doubt for many years but Jones (1972) postulated a link to Ffrwd Las, a major rising on the other side of the Twrch. This was put to the test by a fluorescein/activated charcoal dye-test (Jones, 1973) and found to go through, later confirmed by Bill Gascoine using lycopodium spores. This tracing was all done from the easternmost of the two active sinks, situated on the southern edge of a small bog, Waun Bwdel. Water here sinks directly into the Lower Limestone Shales which, at only 5m, are the thinnest beds of the North Crop (George, 1974, p.95).

The westerly sink, to the north of the main limestone mass, has always looked more attractive with a wet weather stream flowing underground from the Old Red Sandstone.

Brief description of Ogof Y Garimpeiros.

The new entrance bypasses the original tight upwards squeeze and enters a rapidly descending passage with a fissured roof through a choke at its northern end, the stream flowing beneath the boulder floor. At a narrowing of the passage trending 150°, the dip can be seen to be about 30° on the west and 60° on the east roof. Halfway down the cave, a meander with a dangerous roof takes some of the stream, the other half running over an eroded shale bed that is like a thin seam of coal.

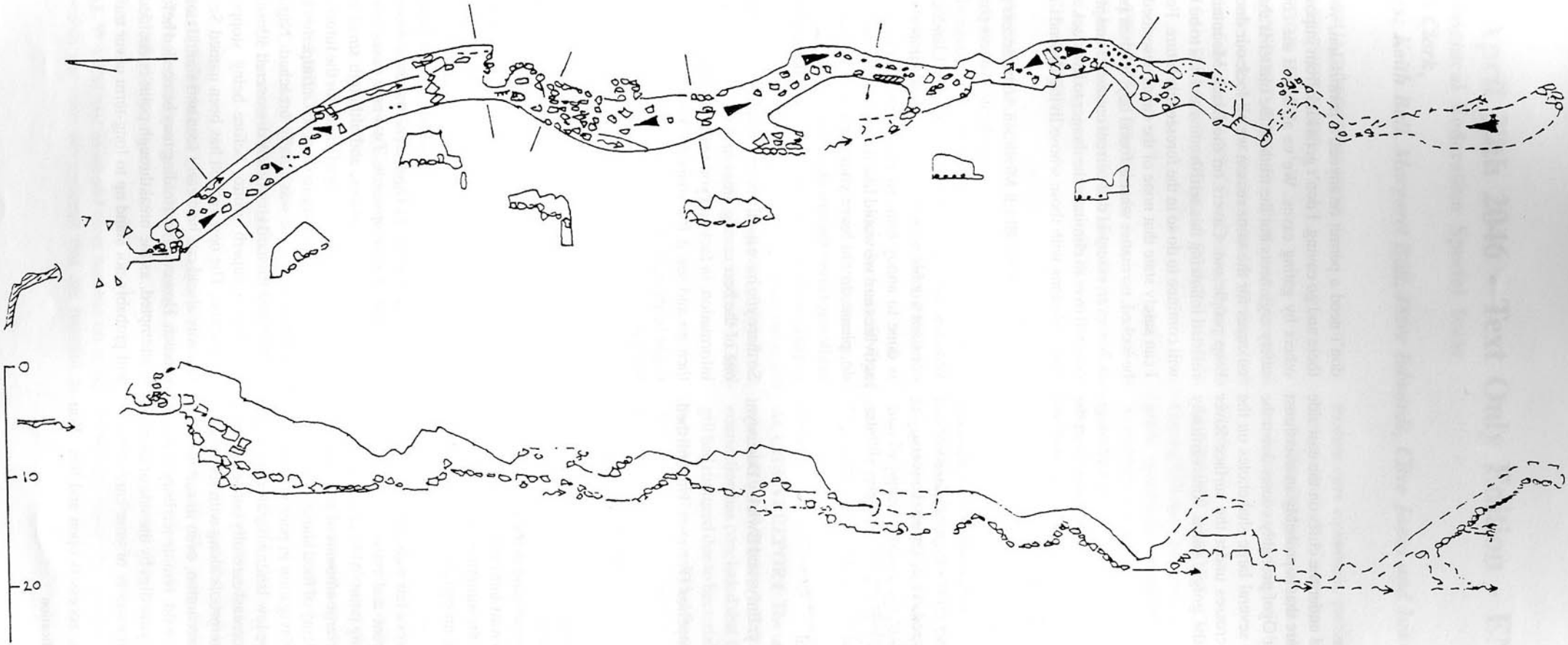
The stream continues on the Lower Limestone Shales through boulders, whereas the passage continues through muddy boulder chokes at a higher level. Two upwards-trending passages end in chokes but the stream continues at low level into narrow impenetrable fissures.

Thus the whole cave trends almost due south for 130m, apparently formed by collapse into the actively eroded stream passage directly on the Lower Limestone Shales. The difference in dip between the two sides of the passage suggests that it has been formed in a tear fault, almost certainly a branch of the N - S Twrch Fechan Fault a few hundred metres to the east.

Hydrology.

The resurgence at Ffrwd Las is 5.5km horizontally and 250m vertically away. The exceptionally fast flowthrough time of less than 24 hours (Rogers, 1996) indicates that much of this separation may well consist of open cave passage.

Two other sources of the Ffrwd are known, namely Ogof Diwedd yr Enfys and Bwlch y Ddeuwynt stream sink (Rogers, 1991). The latter gave a particularly strong result.



Ogof Y Garimpeiros

Surveyed by M. Laverty, G. Jones, M. Hicks
Drawn by M. Laverty

The East Twrch Master Cave.
This is almost certainly situated under the cliffs on the east side of the Twrch, a complex structure that is probably an overthrust fault. The water from Carreg Yr Ogof probably comes down the Twrch Fechan Fault (there are several large shakeholes on the way, some taking water) and crosses under the surface River Twrch at the northern end of the gorge, some 90m vertically above the level of the rising.

The future.
The end of the existing cave draughts strongly and the hydrological evidence suggests a rapid junction with the water from the eastern sink, with a probable enlargement of passage size and further massive potential all the way towards the rising.

References
George, T. Neville (1974), *Lower Carboniferous Rocks in Wales: II The Rocks in South Wales.* In *The Upper Palaeozoic and Post-Palaeozoic rocks of Wales*, ed. T. R. Owen. University of Wales Press, Cardiff.

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Rogers, N. (1996) Ogof y Garimpeiros Dye-tests. Unpublished.

ACCESS AND ADVICE
I have deliberately omitted the Grid References of all the caves mentioned but careful reading of the text along with the judicious use of an Ordnance Survey map should suffice if a visit is planned. A more detailed listing can be found in Tony Oldham's *Caves of Carmarthenshire* but inaccuracies abound in the current edition. Anyone interested is advised to wait until the new edition next year, by which time it is hoped the situation will be resolved - assuming I get around to writing an update in time!

Any trip to Carreg yr Ogof involves a fair walk, the precise length and difficulty (in terms of ascent and roughness of ground) depending on the choice of starting point. Although the caves are short, the long approach carrying large amounts of gear makes for quite an arduous day out. Take plenty of food and drink and don't overestimate your own ability. Navigation in poor visibility can be extremely difficult as there are few landmarks away from the main tracks. Check the weather forecast carefully but be prepared for sudden changes - a set of waterproofs along with some spare thermals in your bag is a wise precaution, even in summer. All in all, if you don't feel happy in wild, remote territory it would be better to stay away - stick with your digs by the side of the road where you can easily retreat to the safety of your car.

Regarding the caves themselves, access is open and free. You don't need a permit or anyone's permission, you just walk up there and go caving. I don't get a kick from imposing my will on others by gating caves. We've all heard the conservation and safety arguments but the truth of the matter is that gates are put on caves for the same reason we all lock our doors at night - to keep people out. Cavers on the Black Mountain have always resisted following this selfish ethos and it is to be hoped that they will continue to do so in the foreseeable future. For my own part, I can safely state that none of the caves described here will ever be locked, no matter what is found beyond their present limits. It is, however, essential that current entrances and any new digs are covered over to eliminate the danger to livestock and to maintain good relations with those whose living depends on grazing.

Unusually for the Black Mountain, some access problems have arisen in the past due to inconsiderate walkers parking their cars in the wrong place and obstructing the passage of working farm vehicles. The farmer at Gellygron, near Llanddeusant, has had constant trouble with this and it is vitally important that nothing is done to annoy him. At the moment he is supportive of our activities and we would like it to remain this way. Whatever you do, please do not leave your car at the obvious spot where the bridleway leaves the lane close to his farm. There are other places to park, as close to the hill - they just take a while to find.

So there you have it - all the information you require to experience one of the best caving areas in South Wales. More than enough information, in fact - all you really need to do is look at the map, then go and see it for yourself. You never know, the next dig might be the right dig - the one that really does go. Who can tell? With the correct attitude, it could be yours for the taking. All I would say is respect what you find, both above and below ground. Approach with open mind and open heart and the rewards could flow your way. On the other hand, if all you want is to find new cave passage to boost your own ego, to shout about in the pub or at the hut, to get one over on other cavers, then it may be best to go elsewhere. You won't find much anyway, so you may as well leave Carreg Yr Ogof to those who will.

Stop Press: During a fine summer, twelve further visits were made to the Carreg Yr Ogof area, in a three-month period from the middle of June onwards. Two new caves have been found, both in strategic positions, and although small at present they could have considerable significance for the future. Work has also continued at the end dig in Ogof Y Garimpeiros and on Sunday 6 October the choke was finally breached. Nig Rogers, Mark Withers and Richard Hankinson discovered 30m of fine passage, including a superb grotto, before being stopped by another obstruction. The new section has been named Seven Years On. The way ahead can be clearly seen and should not take too long to reach. However, scaffolding may be needed before more work is attempted, as the breakthrough point is decidedly dodgy and will probably not stand up to long-term caver traffic.

Dissent April 20th 2046 - Text Only Edition - ENGLISH

Welsh Ecumenical Federation Special Issue

Editor: Tim Clark

Contributors: Keith Ball, Margaret Ball, Dave Edwards, Clive Jones and Ian Todd.

WELSH LANGUAGE EDITION HERE
MANDARIN EDITION HERE
POLISH EDITION HERE

WALES TRANSPORT BAN: The Bishop of Brecon has banned all wheeled vehicles from the South Wales Heritage Park for the duration of the summer. SWCC has arranged for regular blimph flights from Bristol Balloon Terminal. BLIMPH SCHEDULE HERE

CONSERVATION BAN: The current conservation ban on entry to Ogof Fynnon Ddu will be lifted in May. However, access willbe limited to working parties only. SIGN UP HERE - AMER-ECASH ACCEPTED

VIRTUSOAP STAR MAKES BREAKTHROUGH: Myfanwy Deng, star of Pobl y Cwm and other virtusoaps, accompanies breakthrough team into Dan yr Ogof 5 via drone fed sensory link. INTERVIEW WTH MYFANWY - BREAKTHROUGH FOOTAGE PRESENTED IN FULL DOLBY SENSORY FIDELITY

NEW CONVENT HISTORODOC: The Convent of Ogof Gwynt yr Eira has just released the first part of there interactive historodoc on the last 25 years of caving in South Wales. SIMSENS EXTRACT. They are now compiling a further historodoc on caving at the turn of the century and are interested in hearing from cavers alive or in storage who may have holos, simcarts or memories that they are willing to contribute. CONTRIBUTIONS

SWCC AGM: The SWCC committee has ruled that all participants at this years AGM must be living. Votes will not be accepted by personality constructs, automata or the dead. Full rescucitation and hibernation facilities will be available in Abercrave for the duration of the AGM. AGM AGENDA - CRYOSTORAGE ARRANGEMENTS.

MAEN MAWR REPAIRS: The scaffolding and steel drum in Maen Mawr entrance shaft has been replaced by bio-deposited steel. The original structure was recorded holographically by the National Museum of Wales before macro scale enginebact was introduced to deposit a reinforcing skeleton. The shaft is presently hermetically sealed to prevent leakage of enginebact into surrounding soil.

ALCOHOL BAN LIFTED FOR CENTENARY: Negotiations with the Church Council for Wales has succeeded in lifting the alcohol ban for the duration of SWCC centenary week.

Ecology

ECO-CAVER PUBLIC MEETING: There will be a meeting in Brynamman Cathedral Centre to discuss the impact of tweed oversuits on the cave environment.

BACTERIAL WARNING: More and more bacteria are being discovered within the cave environment that are harmful to modern cave equipment, particulary equipment utilising active nano-technology. Cavers are reminded that although modern monofibres and oversuits are self cleaning regular treatment with anti-bacterial agents may still be needed.

North

ACCIDENT REPORT: CRG report that the near-fatality in Gaping Gill this Christmas was caused by the use of an industrial grade monofibre spinnerette. The safety fields on industrial monofibres are not sufficient to prevent incision into flesh and bone. The caver involved in the accident has nearly regrown both legs, but cavers are warned only to use caving monofibres for vertical caving.

Offworld

MARTIAN LAVA TUBE EXTENSIONS: Gamma tube in the martian southern hemisphere has now reached a length of 150km, with some pitches in excess of 5km. Recently the jub band, yip bong, have been providing a musical background to the exploration by piping there music down the expedition monofibres via satellite relay. GAMMA TUBE HOLOSTILLS - JUB BOUND SOUNDS WITH YIP BONG

Diving

ACCIDENT REPORT: The inquest into the death of a boy scout who was found floating within the Agen Allwedd - Daren Cilau connection has concluded that the permbrane within his artificial gill had ruptured due to bacterial action. Further testing within the two systems has concluded that two species of bacteria are present that show particular affinity for the cavities found within membrane gill structures. Divers are advised to apply an antibacterial agent to their gills before diving in the Llangattock area.

Gear Review

DCG CAVE HELMET IV: This is the first caving helmet to integrate an omni-directional bioluminescent light with a front mounted super intensity LED array. It is a superb helmet ideal for all types of caving from the big pitches to narrow crawls. There are no cables or protuberces mounted upon the helmet to get snagged and the integral power source has a 5 year life span. Clips are provided for easy mounting of a head up display and computer for those cavers who have difficulty route finding. The helmet is provided with a complete set of nanotech for the helmet fabric and lighting structures and can be grown in under two hours in a normal household nanopot.

PCP OVERSUIT: This is an all in one oversuit with integral boots. By incorporating the latest developments in smart materials it totally eliminates the need for the traditional cavers undersuit and wet suit. The suits lining is thermally reactive and is guaranteed to keep you warm and dry whilst sitting around or toiling up pitches. The exterior shell of the suit is surface reactive to provide the ideal amount of friction or abrasion protection whilst still remaining flexible.

A Vision of the Future?

Minutes of the 2046 AGM Held at the Tesco's Superstore and Conference Centre, Ynys Wen.

As only one of the two club members not on the Committee was present, the meeting was declared inquorate. The Chairman and his solicitor conferred with the President and his solicitor and it was decided that, since all 200 members of the Committee were present, business could proceed with all decisions pending and subject to a postal vote.

Minutes of the 2045 AGM and Proposal to Take Them as Scanned

The solicitor for the Public Relations Officer proposed that, as these minutes were likely to be contentious, the Smart Cards should be wiped and all minutes deleted. The solicitor for the Government Coordination Officer strongly disagreed, claiming that the contents fell under the Freedom of Information Act and must not be tampered with. The matter was accidentally resolved when the Disco and Party Officer adjusted the level of the background music to the extent that the ensuing increase in magnetic field wiped the cards anyway. It was agreed that this solution was within the spirit of the Constitution.

Matters Arising

Since all records had been erased, there were no Matters Arising.

Officers' Reports

On the advice of solicitors, officers declined to report on the grounds that they may incriminate themselves.

Election of Officers

Only one, new, "Elected for Life" Officer was required, to replace the Formation Cleaning Officer. The Chairman, with special permission from his solicitor, outlined the tragic demise of the previous incumbent who had been skewered by the "Trident" when the Araldite bond finally gave way. He paid tribute to the untiring efforts of the deceased, commenting that he had often watched his labours on the Longer Common Room video. Since the single, non-Committee Member present was the only active caver, the meeting unanimously voted him into the vacant position. His objection, that "week-long trips into Twyn Tal-Draenen left little time for conservation" was accepted, but it was agreed that he could fulfil his allotted function on Christmas Day.

Appointment of Auditors

Whilst it was accepted that thirty accountants had had great difficulty in agreeing which version of the club finances showed a true picture of the funds, it was agreed to maintain the status quo. In time-honoured tradition, each Treasurer emptied his cash box onto the table and the Chairman counted the total. £16,428.32 was allotted for the next round, £6.27 reserved for the Roof Fund, and £38,000,000 reserved for a possible claim by the widow of the Formation Cleaning Officer.

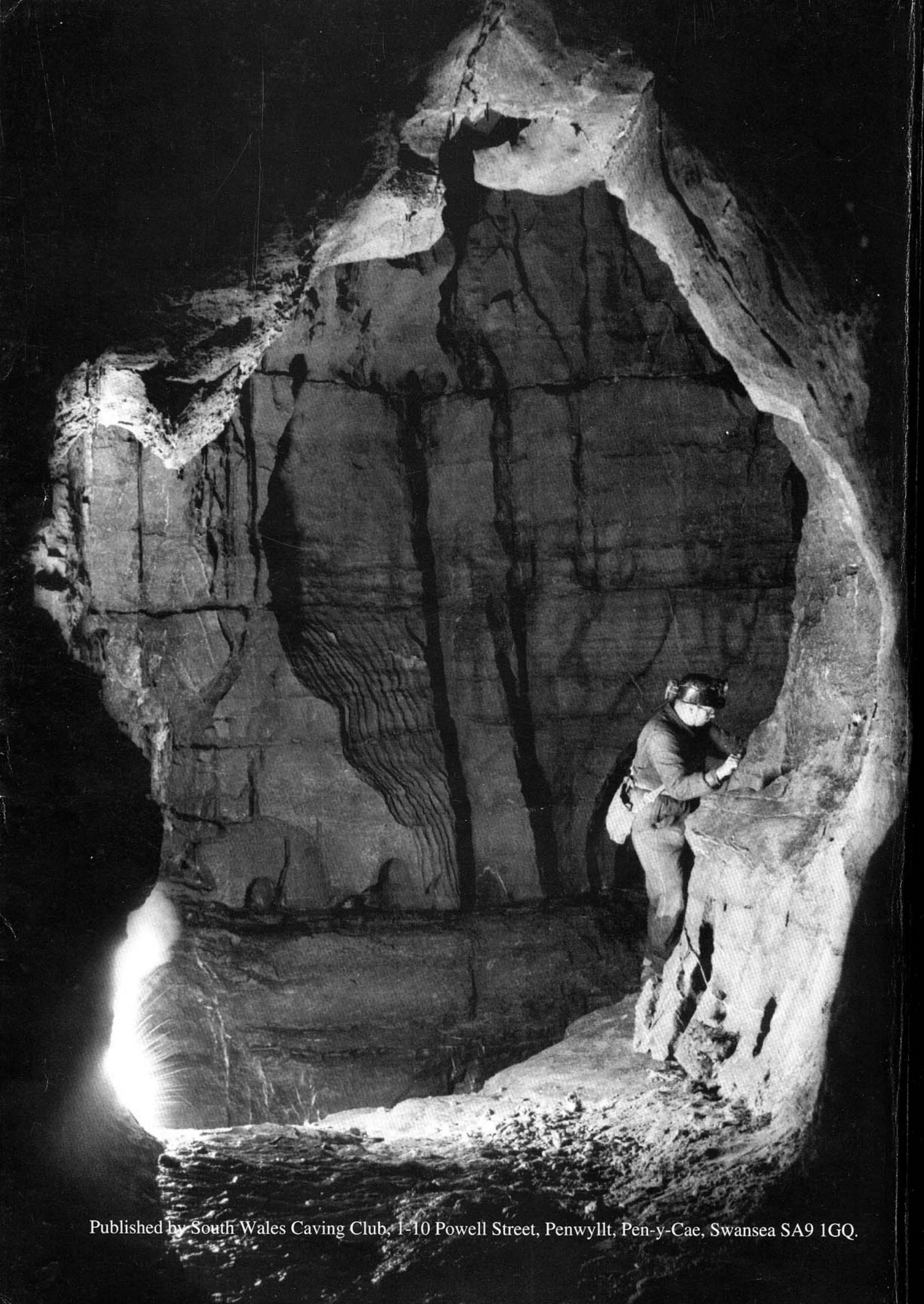
Any Other Business

The Chief Whip complained of being unable to find any Duty Officers. It was pointed out that, since most of the Committee were in the Longer Common Room most weekends, this was not a serious problem. The Hut Sheet Maintenance Officer said that he was having trouble collecting visitors' fees as they kept disappearing underground. It was suggested that he modified his sleeping habits and be up during the day. The Washing-Up Officer complained that the dish mops bequeathed by the Soup Dragons Memorial Fund were worn out and no longer removed the grease and scrambled egg. The Cottage Warden promised to find some old string and repair them. He also pointed out that pine needles were a cheaper alternative. The Cottage Cleaning Officer proposed that the time had come to extend the Longer Common Room upstairs so that members could be moved while he Hoovered downstairs. It was pointed out that this would reduce the daytime sleeping accommodation and cause considerable hardship for the members who had travelled so far to sleep there. A proposal to install a ducted vacuum system was also rejected. The Columns (Access and Lift Control) Officer warned that a Health and Safety Executive inspection of the Columns Lift was imminent. He was advised to rescue the hoist wire from Steel Drum Dig and replace the tatty piece of string currently being used to raise and lower the cage. The Medical Officer expressed concern over the number of cases of bedsores currently being treated. It was felt that the combined increase in Bar Opening and Disco Music Hours would probably alleviate this problem. The Car Park (Direction and Control) Officer complained of vandalism to the parking meters. On a query from the Childrens' Welfare Officer as to whether this might be a case of childish pranks, the Parking Officer felt that the card slots were too high for children to post used prophylactics. The Beer (Supply and Distribution) Officer asked if it was fair that he was required to pay for four parking bays whilst unloading the tanker. It was pointed out that this was a caving club and that his deliveries inconvenienced at least four members who may well be in the middle of a game of *Doom*. The Car Pit Safety Officer asked if the lid could be made lighter so that he could get out from time to time. This was rejected on safety grounds but it was agreed that a small perspex window could be fitted so that he could see to read a book. Heating for the pit was included in next year's budget. The Quarry (Landfill Monitoring) Officer reported that sales of scrap washing machine motors were still sufficient to ensure the waiving of subscriptions for a further year but warned that the supply of methane gas to the cottage was falling due to the decrease in vegetable waste being dumped. The Sheep Control Officer felt that this was due to an increase in the number of vegetarians, resulting from the continuing tendency of sheep to glow in the dark. At this point the Chairman brought the discussions to an end, pointing out that it was nearly morning and time to go to bed.

Time and Date of the Next AGM

After considerable discussions lasting a further three and a half hours, it was decided to postpone this decision until the one absent member could be contacted to solicit his views. An EGM would be called to announce the decision.

Dave Edwards



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