SOUTH WALES CAVING CLUB
club ogofeydd deheudir cymru

NEWSLETTER
No. 109
1991

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CAVING CLUB

CLWB OGOFEYDD
DEHEUDIR CYMRU

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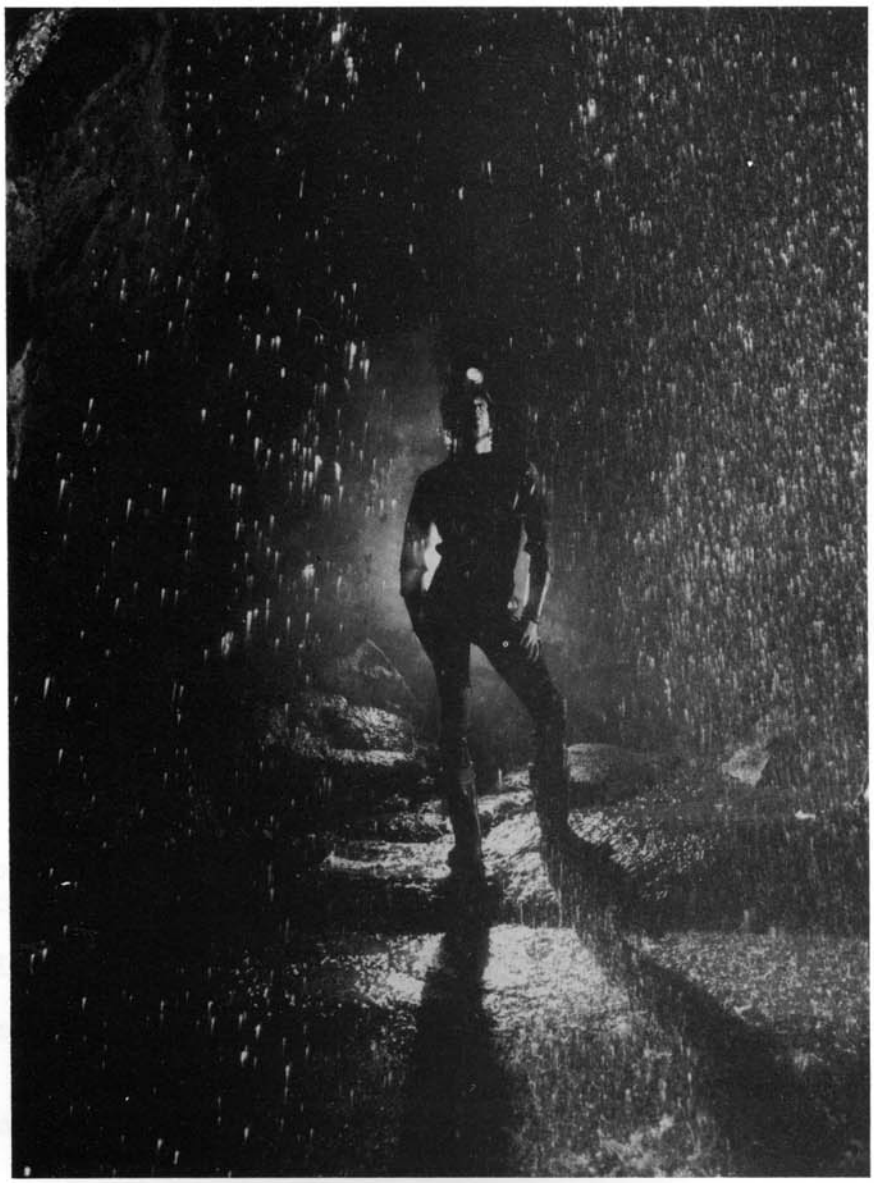
Front Cover Photo; Malcolm Herbert negotiating Helen's Horror in Cwm Dwr II, by Iain Miller. See full report starting on page 32.

Back Cover Photo; Eric Inson receives the keys to the new Rescue Land Rover from Simon Weston, patron of the West Brecon Cave Rescue Team Vehicle Fund. Picture by Western Mail.



Gary Nevitt at the Waterfall, Piccadilly.
Photo: Tony Baker

EDITORIAL

Here - at last - is the first edition of the Newsletter to appear since I was elected Editor at the last AGM. It's taken a while simply because, having taken over the job, I decided to buy a computer to do it with. Starting from a position of almost complete ignorance about computers, I was reliant on the help and advice of others to help me choose what to buy and, once I'd bought it, how to use it. Special thanks must go to Malcolm Herbert, Jopo and Ian Todd for their valuable assistance. I have mastered the thing at least to the extent that I've been able to put together this edition, and I'm learning all the time, so the next one will be a lot quicker, I promise! Anyway, apologies for the fact that you've had to wait so long to read this, and particularly to all the contributors who must have been wondering whether their work was ever going to be published.

On that subject, I've been very impressed - as I hope you will be - with the high standard of the material submitted, and I look forward to receiving some more stuff very soon. I'm aiming to put together my second effort soon into the New Year, so start writing. On page 63, I've put together some "Notes for Contributors", to give you a few guidelines about submitting articles. I'd very much like to broaden the scope of the Newsletter, so if you have an idea for something that you think might interest other members, don't be afraid to write it down. While reports on discoveries, foreign trips, and scientific work will always be the backbone of the content, they don't interest everyone, so it's over to you to hit me with some new ideas.

One of the things that soon became apparent when I took over the Editor's job was that everyone has their own ideas about what they want the Newsletter to be, how they want it to look, and so on. As Editor, I have my own ideas about it, but I'm always willing to listen - so I want your opinion about this first attempt. Talk to me at the club, give me a ring, or better still write it down and I might publish it. I can't promise to please all of the people all of the time, but hopefully by the time they've finished reading this one (all 64 pages of it!), some of the people might be pleased for some of the time.

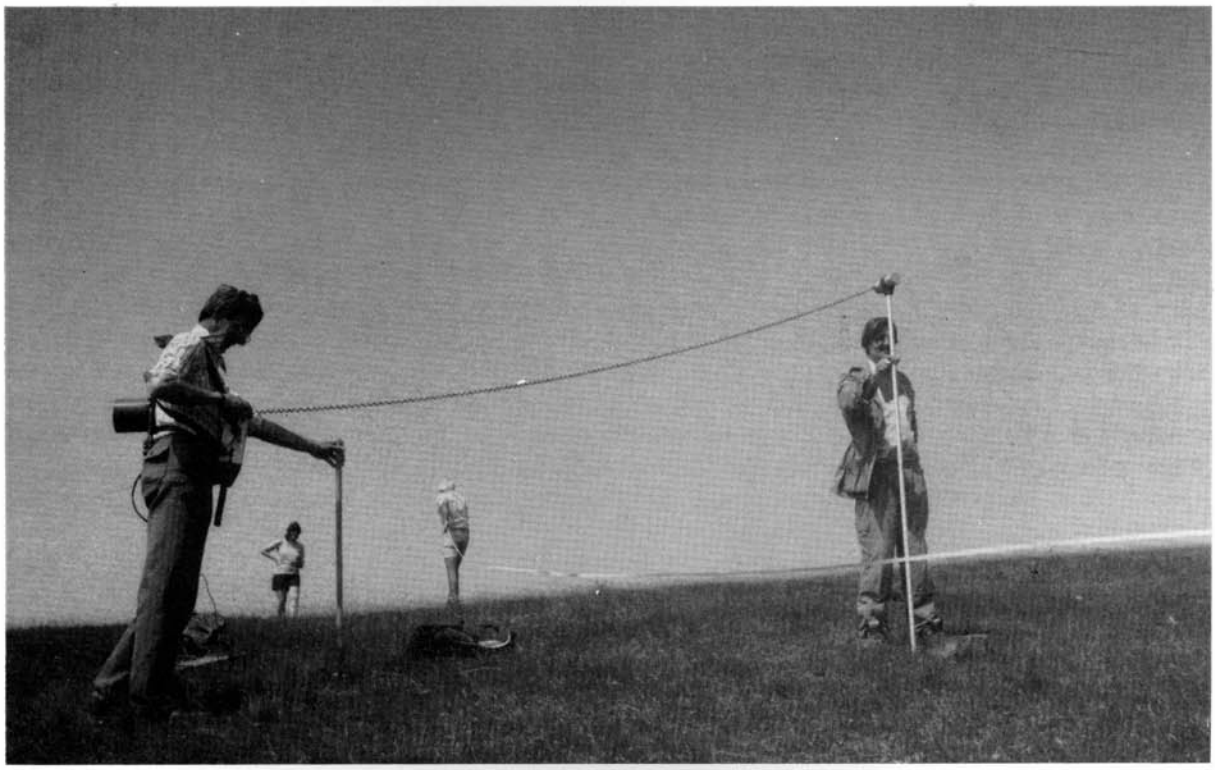
Tony Baker, November 1991.

PROJECT GREENSITES

Over the next 27 pages, there follows an update on the progress of the Greensites project, which started as a result of the one day Dan-yr-Ogof conference back in 1989. It all began when Clive Jones "ventured upon the very mildest of suggestions" that caves often lie just below the surface, where there may be no clear evidence of their presence, and that perhaps ways could be found of identifying such caves. Clive suggested five possible approaches to finding new caves in this way, namely through geophysics, biology, chemistry, morphology, or divining.

All of these methods have been tried, to a greater or lesser extent, and it is to the great credit of those involved with Greensites that they have been so diligent in writing up their results. As you will see over the following pages, a great deal of work has been done, and continues to be done, on this exciting, and potentially very productive project. Let's hope that a major discovery or two will soon reward all the time and effort.

For more information on the Greensites Project, and details of previous work, refer to SWCC Newsletters No.106 and No.108 (both 1990).



Greensites in action; Members of the British Geological Survey conducting an induced potential survey on the Ogof Ffynnon Ddu Nature Reserve.
Photo: Tony Baker

PROJECT GREENSITES

by Clive Jones

Three comments were made, by a variety of people, when we started Project Greensites. These were:

- This is the way to do it.
- It's unethical as we will make cave discovery too easy.
- Here are a few people trying to blind the masses with science.

The replies were:

- We hope that it is but it will take a little time.
- It will never be easy.
- Club members are a clever bunch and to blind them with science would be difficult. But we keep on trying.

Enthusiasm for the project has fluctuated and many of the helpers in the early stages lost interest when no instant cave discovery method emerged. This is understandable as not many people want to drive long distances to spend a weekend pushing buttons and taking readings off geophysical instruments – especially when they do not know if the data is going to be of any value.

Unfortunately this has to be done and there will be a lot of tedious work. If the button pushing and recording can be seen to be yielding worthwhile results, perhaps more enthusiasm can be generated for the next phase of the project.

The articles that follow report some of the more interesting findings. The plan is that the next phase be devised by club members who want to be involved. So if, after reading what we've done, you want to be more involved or have any ideas or just want to listen in please let me know. A planning, or drink and think session will be held some time soon to decide what to do next.

In the project's first phase we have looked at a range of geophysical methods. Of these resistivity seems to hold the most promise. Our ultimate aim is to find a method which scans a large area giving results in real time. It has been suggested that the ultimate in resistivity will be cavers wearing crampons as electrodes all connected to a backpack computer giving printouts of cross-sections. The quicker version would substitute mountain bikes with spiked wheels for the crampons. Whilst we wait for these developments we need to work on a light-weight low cost meter, a data logger and an improved loom and switching box.

A number of people can now use the equipment for resistivity and provided they can borrow a meter they will find the looms etc. in the laboratory at Penwyllt.

We would also ask the more mathematically inclined members to consider electrode configurations etc. There may be better layouts which enable us to cover the ground faster and more effectively.

We should also be thinking about some geobox where we can test resistivity equipment and theories. This is not a box of electronic wizardry, but a box of rock and soil equivalents on which the wizardry can be tested. This may already be available somewhere. If it is, someone in the club is bound to know.

The biological work has made a good start by confirming that certain plants are associated with cave-type draughts. More needs to be done on this aspect and the work extended to include soil bacteria.

Dowsing and the Pant Mawr experiments got off to a good start with several people trying the grid. A second grid near the club was not as popular proving that dowsers need a good walk before they twitch. The plan now is to try to dowse along every resistivity line to see if there is a correlation.

Staff at University College Aberystwyth have made an application to the National Environmental Reasearch Council for remote sensing flights to map the Northcrop limestone.

Equipment normally used to detect heat loss from buildings is being made available to search hillsides for draughts and temperature anomalies. This work would normally start when the cold weather returns. However, we have an unusual situation in the Swansea Valley with the fans in the Dan-yr-Ogof and Tunnel Cave creating cold draughts on mountain tops on hot days. With this equipment we should be able to see Tunnel Cave top entrance and other draughts.

We have made a modest start. There is a tremendous amount of new work to do, but we need people. There are a whole variety of activities with something to interest everyone. Whilst we have not found any real cave yet, things are sufficiently encouraging for us to believe that we are not far off. We need your involvement so please get in touch.

JURY STILL OUT IN DOWSING CASE

by Stuart France

The Greensites Project was proposed by Clive Jones at a symposium held in April 1989 to discuss the prospects for finding new caves in the Dan-yr-Ogof catchment. It has been observed that many large cave passages come close to the surface without any obvious indications, for example OFD2, Pwll Dwfn, and Lancaster Hole. The converse is also true: many large passages lie at considerable depth and beyond the reach of diggers, yet they are overlaid with dry vallies and large shakeholes such as behind Dan-yr-Ogof. Rather than dig at sinks, resurgences and shakeholes, perhaps we should be examining less obvious places, i.e. Greensites, using new techniques such as geophysics, botany and soil microbiology, chemistry, morphology, divining and other inspired methods.

This article reports on an experiment to evaluate dowsing as a Greensites technique. It was conducted over the period August 1989 to June 1990 at Pant Mawr Pot near Penwyllt, Powys. This cave was chosen because it is massive, but uncomplicated, with a large river, albeit at a depth of about 70-100m. Part of the cave near SN889159 was radiolocated and 8 survey stations in the cave were tied into a square grid pegged out on the surface in lines 25m apart, labelled A-F 1-6 as shown in Figure 1. There is one huge shakehole near E1, many smaller ones, and also a public footpath crossing from near A5 to F5, as shown on Figure 2.

Dowsers were given a pre-printed form with a blank grid, and asked to sketch in and interpret the reactions they experienced and explain the method used. Neither the relation of the cave to the grid nor the results obtained from any other dowsers were disclosed. The grid lines were set parallel to surface features (rather than the cave passage) to avoid giving any information away.

Pant Mawr is 45 minutes walk from Penwyllt or the Nedd Fechan, and to walk all the grid lines is about a mile. The number of people participating was disappointingly small. Thanks to those people who helped in the surveying and dowsing for their time and interest in the project. In order not to embarrass anyone who may have come up with an odd result, the surveys are anonymous. No doubt those involved will recognize their handiwork, despite it being digitized.

The dowsers all used hazel twigs, bent metal rods or similar devices and all conducted their investigation on site. There was no dowsing with pendulums over maps and so forth back at home. Some were supremely confident of their results; others were left feeling unsure. Given that the large known cave passage is deep, there is plenty of limestone above in which other unknown passages may lie. However, ground resistivity measurements (a geophysical technique which will be reported in another article) suggest that there are no substantial cavities in the first 30m below the line A3-F3.

Dowsers H, J, C, and L produced strikingly similar results showing one or both of two parallel passages. Dowsers J and C also have the passage width about right for Pant Mawr. Their results, shown in Figures 3-7, all parallel to the grid lines, do not reflect the direction of the known cave or the dip of the limestone.

Dowser E, in Figure 8, gives a clear representation of a river passage on which the flow is also indicated. This is in the general area of the river part of cave, as is seen from the survey alongside. Dowser M marked the points shown in Figure 9 where disturbance was experienced. Many of these lie along the C1-C3 line over the known cave, and also around A3 where Dowser E indicated a river passage.

The results from Dowsers G and Y, Figures 10 and 11, are anomalous results which neither correspond to the known cave nor the plans from other dowsers. These two individuals said they were not confident about what they found, and one of them had problems due to the severe winter weather at the time. Dowser B returned an empty form and said he found nothing.

Dowser W has an intriguing result in Figure 12. He is the only person to have got the angle of the cave passage to the grid correct and the idea of two passages joining. The shaded area shows the width of his reaction, which he says is proportional to depth rather than passage size, and the centre line drawn shows the line of the passage. He thought that 100m depth was rather a lot to ask for his technique. The cave survey superimposed on his result shows that what he appears to have is a copy of B1-B3-D3-D1 enlarged to the size of the grid.

Finally, Figure 13 is my own result. Of course I knew the answer before I began. I have never felt any kind of dowsing reaction and the only way I can get metal rods to cross is by wearing woolen mitts to reduce the friction. Metal rods free to swing in biro tubes have been recommended to me. My result seems to demonstrate the importance of conducting blind experiments.

So what can one conclude? Some dowsers have produced similar results independently. What did they detect? Other dowsers have obtained a result with a resemblance to the known cave, but nowhere near accurate enough for dropping a shaft into one of the large cave passages or a borehole into the river.

However, I would not write off dowsing on the strength of these results, and my own inability to do it. Its proponents are very sincere people. Their reaction to what they somehow sense, which I have watched, is very strong although they cannot explain it. We should not deny the existence of what we cannot comprehend, quantify and dimension. The thirst for knowledge, adventure and creativity which has produced so many scientific discoveries is a very real force but not itself part of the physical world.

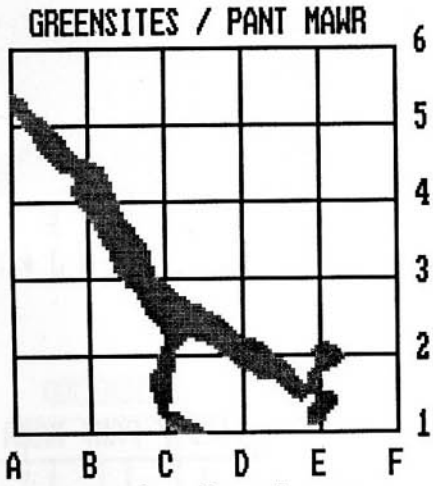


Figure 1. Cave Survey

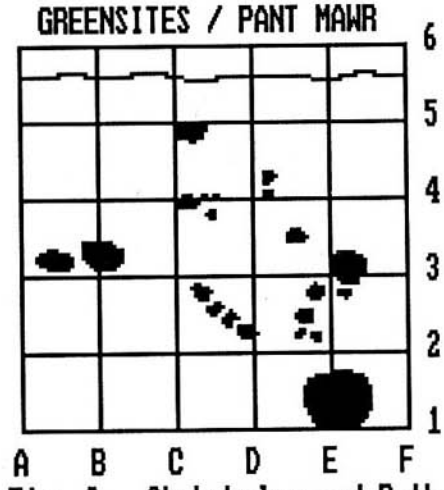


Fig. 2. Shakeholes and Path

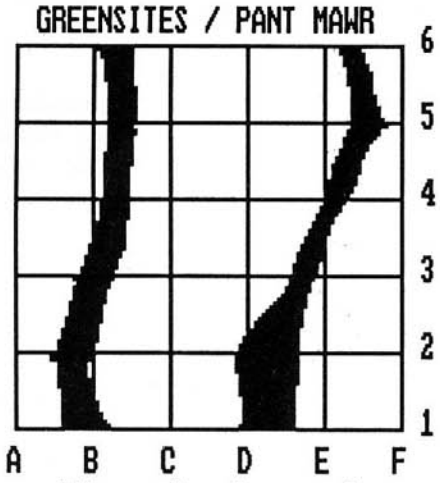


Figure 3. Dowser J

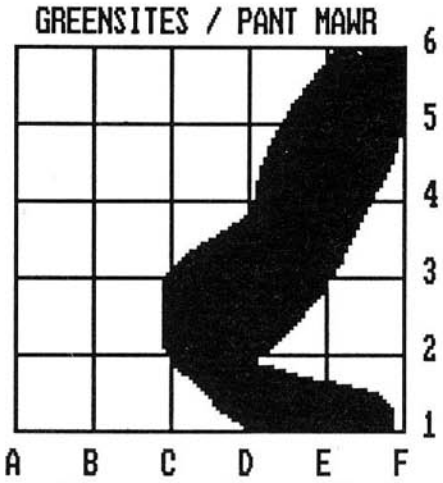


Figure 6. Dowser L

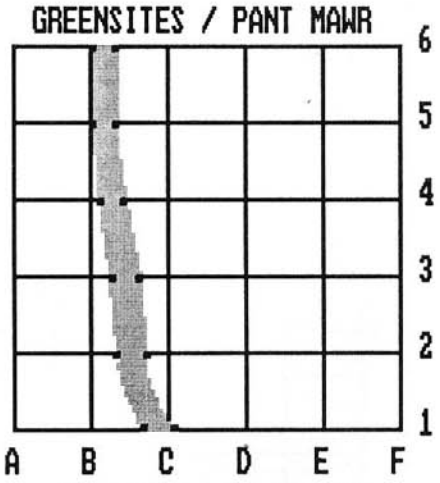


Figure 4. Dowser C

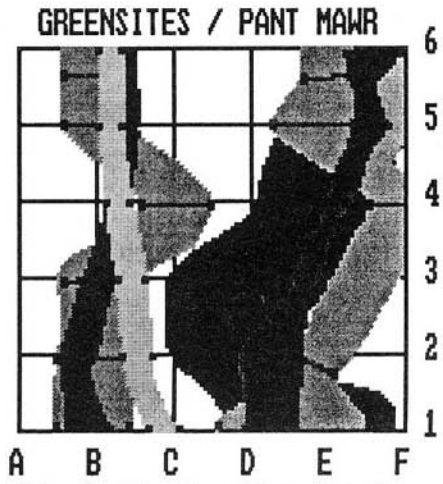


Figure 7. L + H + J + C

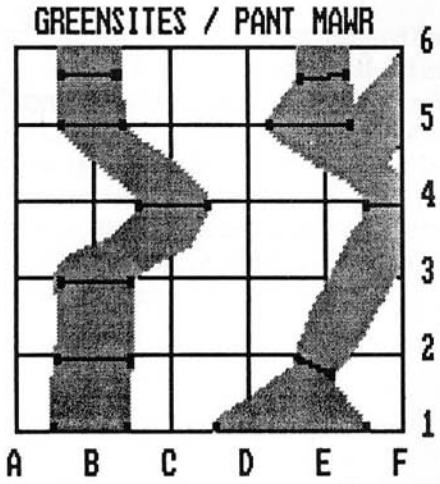


Figure 5. Dowser H

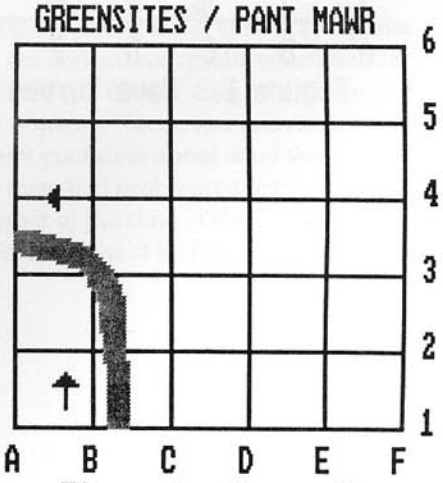


Figure 8. Dowser E

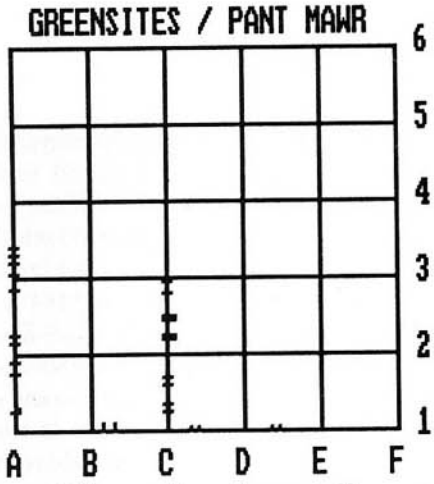


Figure 9. Dowser M

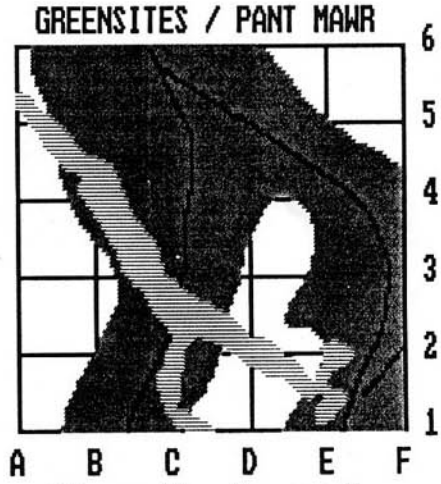


Figure 12. Dowser W

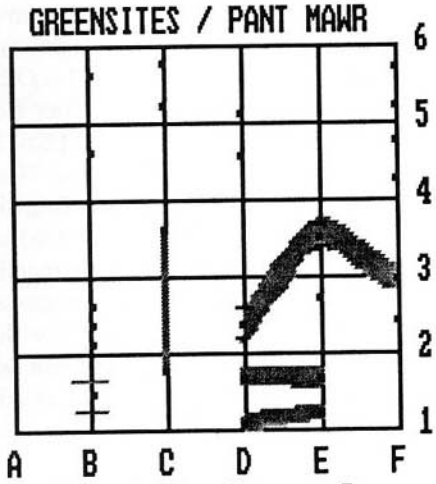


Figure 10. Dowser G

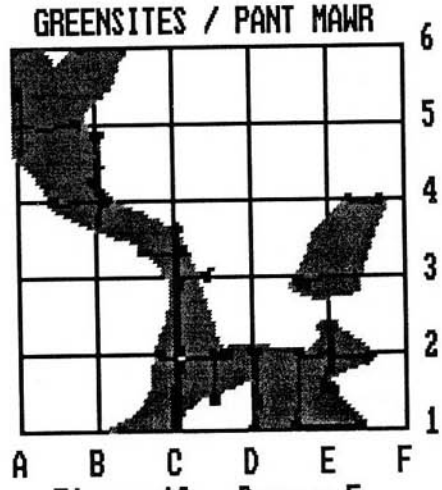


Figure 13. Dowser F

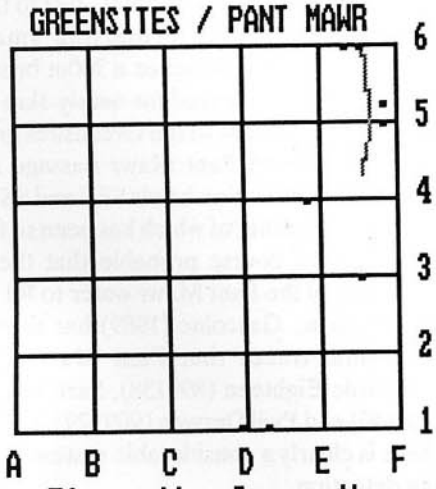


Figure 11. Dowser Y

DOWSING DAN YR OGOF & PANT MAWR

by John Wilcock

The suggested cave systems discussed in this article are the result of dowsing carried out in the Pant Mawr area in December 1989 and the Dan yr Ogof area in May 1990. Whatever opinion the reader has of dowsing, the results are at least interesting, and they stand as hypotheses until disproved.

DAN YR OGOF

The Dan yr Ogof system has been the subject of extensive exploration and study (Coase and Judson, 1977; Coase, 1989; Hall, 1990). It contains 14.4km of surveyed passage, and yet the known cave must be only a fraction of the total system. The first two dye traces to identify the major stream inflows were carried out in 1970 (Coase and Judson, 1977, p.306; Gascoine, 1989), Sink y Giedd in 36 hours, and the main sink from the peat bog Waun Fignen Felen in 24 hours.

Further traces using lycopodium spores have been proved to Dan yr Ogof from Twyn Tal y Ddraenen, Carreg Lem and the Lost Valley Sink by Gascoine. A considerable amount of the passage from Waun Fignen Felen has been explored (the Great North Road). The very sharp change of direction of flow (120°) on meeting the main cave passages indicates that this passage is an invader which has been captured by the main system, which emerges from the Mazeways sump in the Cribarth Inlet.

Coase suggests that the unknown limb from Sink y Giedd enters from the north; the present paper suggests that, on the contrary, it enters from the south, having passed in a broad loop SSW from Sink y Giedd, then east to the Cribarth Disturbance, and finally north, a route of some 8km. This distance, using the rule of thumb of 5 hours per km of passage, would account for a delay of approximately 40 hours, which is consistent with observed tests. The proposed route is well outside the topographical area which has been surveyed by the other authors (e.g. Coase and Judson, 1977, p.246 and the enclosed plan "Geology, drainage and structure in the Dan yr Ogof catchment area").

With reference to the Figure opposite, it is proposed that Sink y Giedd (810178) is the confluence of several tributary systems, one from the Giedd low flow sink (812185) via Cig Sink (811182) with feeders from two sinks to the west of Waun Fignen Felen at 815184 and 819183; the second from Twyn Tal y Ddraenen (807191) via the Rusty Horseshoe Dig (807184); and the third from Twyn Tal y Ddraenen via Carreg Lem (805178). The route is then progressively SSW for 3.5km, considerably further than has been supposed previously, with a sharp turn to the east at 798146 in the viscinity of some prominent drumlins.

Fringing the northern border of the Giedd forest, the system then enters the Cribarth Disturbance, swinging progressively round to the north under the complex mountain of Cribarth, and approaching the known passages via some large shakeholes at 829151. Other points of note are the continuous feeder from the main sink of Waun Fignen Felen (826177) south to the known end of the Great North Road; the tributary feeder from Peat Bog Sink (824161) via the Loast Valley Sink (826156) into the Dan yr Ogof syncline; and the large reaction in the Pwll Dwfn area where few passages are known. Because of the extreme low flow conditions in May 1990, no reaction was obtained from the dry sinks at the western edge of Waun Fignen Felen.

PANT MAWR AREA

On a trip to carry out dowsing at the Greensites Project grid at Pant Mawr in December 1989 several additional reactions were obtained. The first is a large reaction around and to the east of Pwll Byfre. The second is a small reaction at 881169. Just to the east of the fence some promising small shakeholes at 885168 commence a 200m broad reaction heading SSE, traced for nearly 1km to 886160. Finally, adjacent to the Greensites grid and above the known Pant Mawr passage an increasingly broad reaction heads SSE and SSW in two branches, neither of which has been so far explored. It is of course probable that these mark the route of the Pant Mawr water to R1 in the Nedd Fechan. Gascoine (1989) has shown by lycoposium traces that Pant Mawr Pot (891162), Hole Eighteen (899138), Sarn Helen Sink (908140) and Pwll Derwen (909129) flow to R1. There is clearly a considerable system here awaiting detection.

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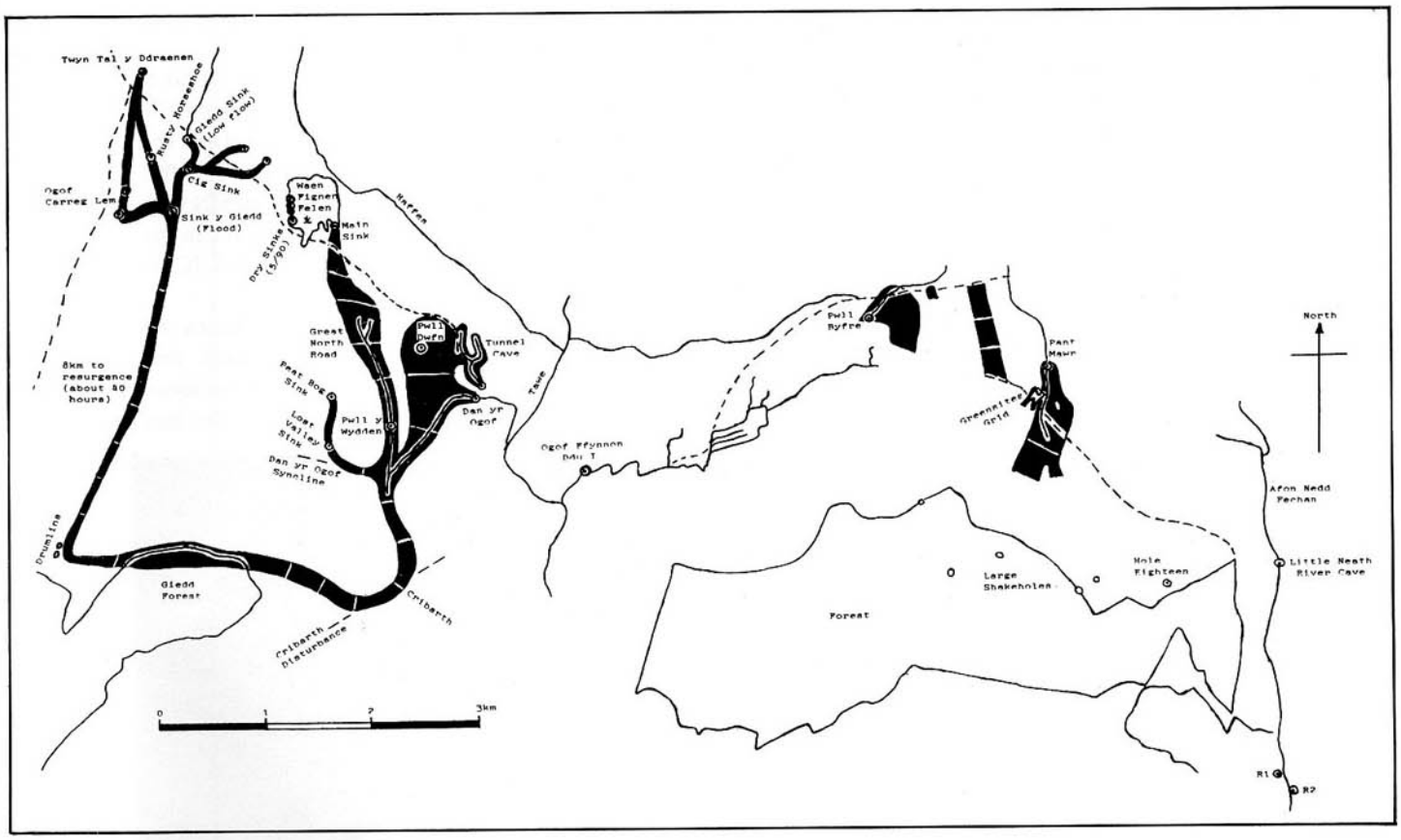


CAVE DETECTION BY AIR TEMPERATURE VARIATION

by Stuart France

'The wind was a torrent of darkness'
— Alfred Noyes

In the northern limestone outcrop of South Wales, top entrances to caves usually draught outwards in winter. The cave air temperature is typically 9C, and this can fall a few degrees as it meets cooler air outside. Many potential cave entrances are blocked in varying degrees by glacial drift. This will also cool the exiting cave air. The draught through any small gaps that may remain in the drift is not easy to feel, but the elevated air temperature is easy to measure with a digital thermometer.

Parts of significant caves like OFD2 and Pwll Dwfn lie at shallow depth, but there are no particularly obvious surface features. There must be many more caves like this. Pete Francis told me how he saw holes blowing plumes of tiny ice crystals ten feet into the air as he skied over the OFD Nature Reserve one bitterly cold, but bright winter day. The warm moist air from underground was frozen immediately at the surface to create the spectacular spray of ice crystals. I have seen Hot Air Mine sending clouds of steam 10 feet into the air on a cold winter day. These warm draughting holes vary from inches to yards across.

Cheap digital thermometers are available from electronics parts suppliers like Maplin. W.H.Smith sell the Maplin catalogues. These thermometers have an 0.1 degree resolution which is important; the accuracy does not matter since the measurements are relative. I used a Maplin LCD temperature module (part number FE33L) mounted in a small ABS plastic box. It runs for a year on a single AA size 1.5 volt battery. I use an external temperature probe (part number FE34M) on about 0.5m of cable. The complete instrument costs about £10.

There is no need to wait for extreme weather conditions to observe temperature variation effects. Simply look for warm draughting holes on a cold, calm winter's day in a promising area. Do not overlook rabbit sized holes on flat or featureless ground in favour of obvious sites like rock outcrops in big sinkholes.

Temperature sensing could also be applied to resurgences in river beds by looking at water temperature variation. It is possible that thermal imaging equipment, as held by Fire Brigades, could be used to scan large areas of moorland for warm draughts quickly. The 30m resolution Landsat infra-red data seems too coarse to be useful for finding warm draughts, but 5m data obtained from aircraft flights might just work. Infra-red and other remote sensing data can be combined with the Ordnance Survey digital elevation model to produce a cave probability map which is manipulated and searched by software.

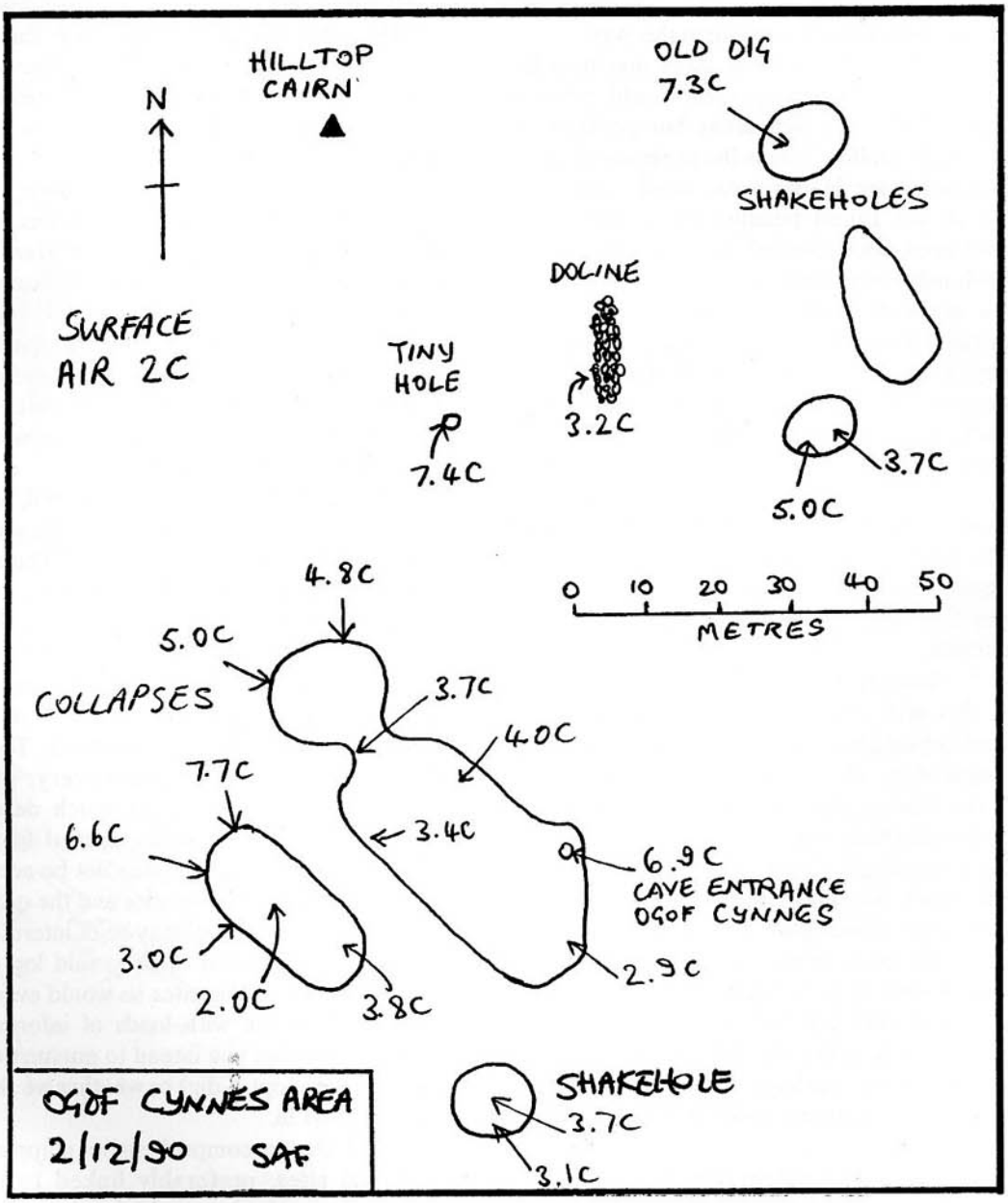
The Maplin temperature probe was tried at Ogof Cynnes (Warm Cave) in December 1990. It was a dry overcast day with little wind and the surface air temperature varied from 2.5 to 3.0C. The cave entrance was blowing out slightly with an air temperature of 6.9C. Other holes in the area varied in temperature from 2.0C to 7.7C, as shown on the plan opposite.

The very warm and sheltered holes all contained Hard Fern (Blechnum spicant). See the article on ferns by Debbie Stephens for more details. It is a species not found in the less

hospitable holes. Spiders also favour the smaller warm holes with moisture laden webs much in evidence.

Repeating these measurements during the colder snowy weather of January 1991 showed maximum blow hole temperatures of around 5.5C with surface air at about -2C. The highest temperature difference observed to date is 8.6C and this is about a half mile from Ogof Cynnes. These other holes on Mynnydd Llangynidr showing wide temperature variations and located well away from the few known caves merit further investigation.

In summary, the temperature probe is quick, easy and cheap although its use is season dependent. It seems to have much to offer in the search for new caves without waiting for snow. Other observations such as flora and fauna can assist. There is also scope for high technology distance observations.



IDIOT'S GUIDE TO FERN-SPOTTING

by Debbie Stephens

Much has been said so far about the possibility of finding new cave in places indicated by certain botanical species. In the original seminar, Ray Woods suggested several species which may be useful in this way.

Ray has indicated that there may be a few reasons why some species would grow in particularly cave-rich areas but perhaps the simplest to follow here is the presence of plants normally rare in the area, small colonies of which are found because of a particularly sheltered spot. Shakeholes, cracks etc. are obviously more sheltered than open hillside so we are concerned with species which are peculiarly sensitive to the cold, and which would appear to need the warming effect of cave air to prevent dangerously cold conditions. The most useful of these plants would appear to be some ferns.

A "biowalk" was led by Ray and we experienced first hand the difficulty of identifying one fern from another. Much discussion ensued, and I describe to you here just five fern species which appear to be of interest.

Lady Fern (Athyrium filix-femina)

A mid-green crowned fern with doubly-pinnate fronds and scaly stem to half the length of the whole. Bomb-proof identification is the comma shaped sori, or spores, on the underside of the fronds. Not to be confused with the misleadingly named Male Fern (Dryopteris felix-mas), they are different species, not male and female of the same. We found Male Fern to be much more common, growing in larger clumps with large circular sori, covered with a kidney-shaped flap. When seen together, the Lady Fern is noticeably lighter, more delicate and feathery, perhaps indicating its lower tolerance to extreme cold. It may die in the Autumn.

Hayscented Buckler Fern (Dryopteris aemula)

Fronds are 15-60cm long with concave segments, curled upwards at the tips. Long, dark-based stems covered in red-brown scales. Sori in two rows and pale brown, this fern has the scent of new-mown hay when crushed.

Brittle Bladder Fern (Cystopteris fragilis)

One of the two species at OFD Top Entrance, a lovely fern with fronds 6-36cm long, the stem being dark and brittle for half the length. Sori are in two rows on the underside of each pinnule and are sometimes (early in the year) covered in a swollen bladder-shaped flap. Delicate and distinctive, dies in Autumn.

Hart's Tongue (Asplenium scolopendrium)

The other species at OFD Top Entrance, Hart's Tongue has a very distinctive shape, grows well in shade. Fronds are 10-60cm long, undivided and tapering to a point from a heart shaped base. Likes wetter locations.

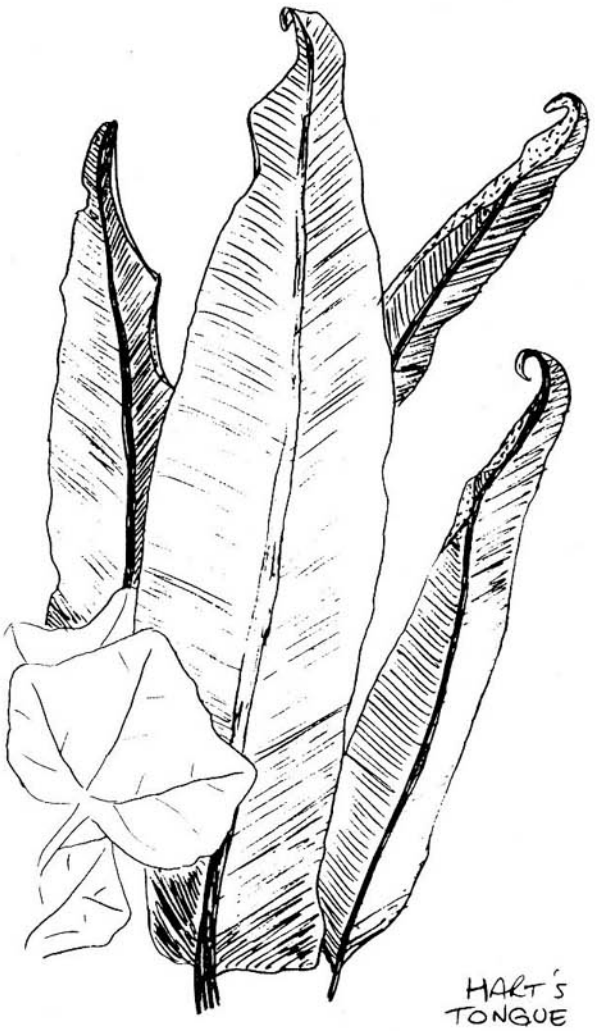
Hard Fern (Blechnum spicant)

Like Hart's Tongue, leaves grow direct from frond with no intermediate stems. Hard Fern has two kinds of fronds which may cause you to think there are two plants – don't be fooled! Sterile fronds are 10-40cm long, making a rosette flat on the ground and are evergreen. Fertile fronds die back in winter but are 15-75cm high standing erect. These are narrower and look not unlike a fish backbone.

All this identification is all very well, but if a sensible log is to be kept of possible dig sites, we need to know exactly where they are! Therefore, almost more important than accurate species recognition is accurate grid referencing. This is not easy! When walking across a featureless hillside or bog, you will need to keep an eye on compass bearing and distance from a mapped feature (or you might triangulate). To help Rent-a-dig refind your discovery, please describe the location in as much detail as possible, particularly noting special features. "Shakehole" at this point may not be accurate enough. Note also the species and the quantity of it – even tiny colonies may be of interest.

I have volunteered to keep said log of all botanically interesting sites so would everyone please furnish me with loads of information including whether you intend to pursue the dig yourselves (Adopt-a-dig) or whether we should send the boys in.

I feel that a comprehensive mapping of botanical sites, preferably linked to other discovery methods, could lead us to the "Caverns measureless" that we are seeking.

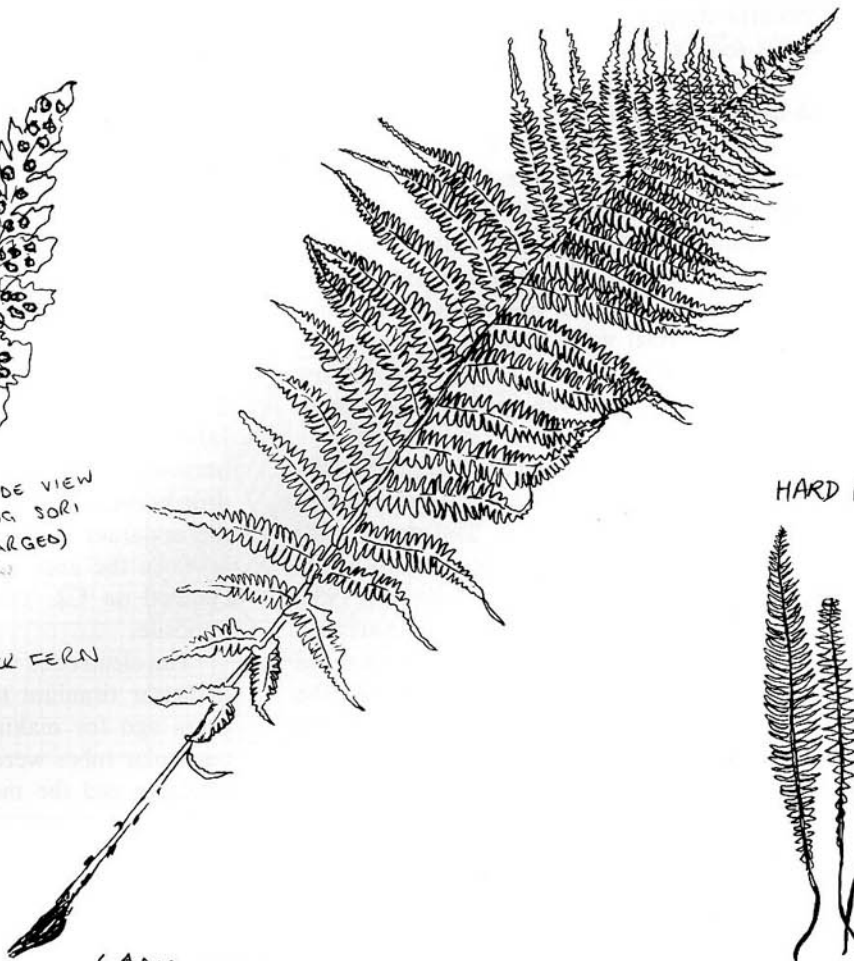


HART'S TONGUE

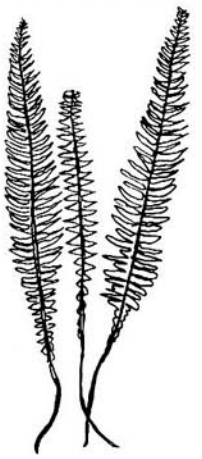
Hay-scented Buckler Fern

UNDERSIDE VIEW SHOWING SORI (ENLARGED)

BRITTLE BLADDER FERN



LADY FERN



HARD FERN

D.S.
1991

COMPUTER GRAPHICS AND EARTH RESISTIVITY

by Stuart France

We are all familiar with recent advances in medical diagnosis made possible by computers which convert raw data from body scanners into meaningful pictures. Complex numerical analysis is easily accomplished in software, and pictorial results in the form of computer graphics are easily understood.

Inexpensive personal computers now have the memory and speed of huge commercial mainframe machines of twenty years ago. The software development environment today is now much more sophisticated and supportive.

Earth resistivity is one of a number of promising geophysical methods which may assist in cave discovery. This article present a new efficient approach to both gathering resisitivity data in the field and processing the results back at base. High resistance anomalies, such as caves, are identified by software and the results displayed as pictures in vertical cross-section.

A SHORT HISTORY

The seminal work by Wenner on earth resistivity, as a geophysical technique, was published as early as 1916. Variations such as the Schlumberger electrode configuration have advantages over the Wenner method, but the underlying principle of operation is the same. The commercial value resistivity is mainly in detecting ore bodies, appearing as low resistance anomalies: the opposite situation to finding caves.

The technique has been applied successfully to cave finding, with numerous papers published by Palmer from 1938-1959. The operational problems of shifting electrodes around in the field was addressed by Eve and Keys in 1954, who proposed the Single Electrode configuration. This is a misnomer since it relies on 4 electrodes like all the other methods: the difference is that only 1 electrode has to be moved per measurement.

Bristow at Pengelly Cave Research Centre proposed a graphical method to analyse data from single electrode surveys in 1966. This was a manual process using compasses, pencil and paper, to plot readings which deviated from the normal. The technique was used with some success in various Devon limestone areas. There has been little interest since then in applying resistivity to finding caves. However, the US Immigration and Customs Services are reputedly experts in applying resistivity to locate tunnels dug into the USA from Mexico for illicit purposes!

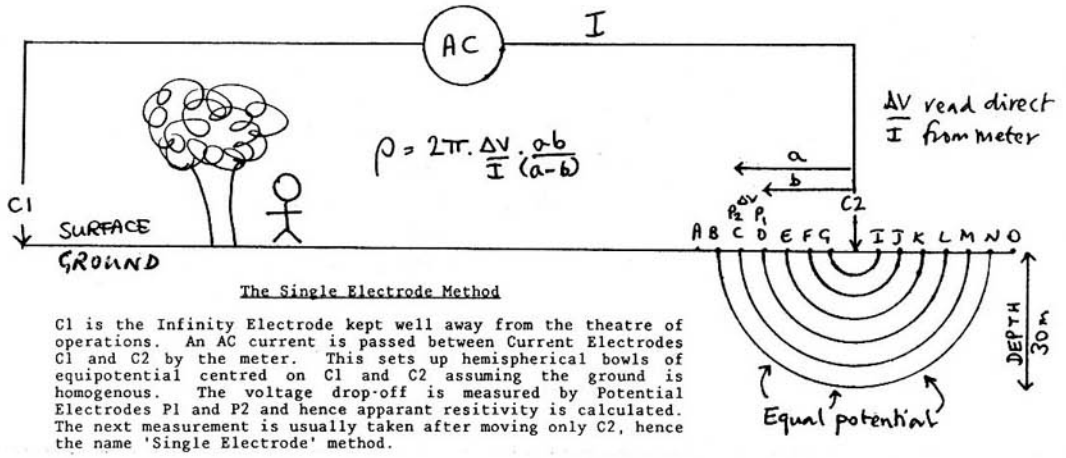
INSTRUMENTATION

We have had the use of two instruments kindly loaned by Cardiff University. The first is a hand-cranked Earth Resistance Meter made by Megger, with bakelite case and other period features. The second is a modern Atlas Copco ABEM 300 Terrameter with microprocessor driven digital display etc. The calibration of the instruments is not the same, but the computer graphics produced for sections for which we have dual data are remarkably consistent.

Both meters use 4 electrodes called C1, C2, P1, P2 which are placed into the ground along a straight line. C1 and C2 are current electrodes and pass an AC current through the ground. Close to C1 and C2, this electric field distributes itself as concentric hemispheres of equal voltage beneath ground level, the ground being a high impedance material. Midway between C1 and C2 the hemispheres will interact and distort. When all measurements are taken close to one current electrode (i.e. well away from the middle area) a hemispherical pattern can be assumed.

Voltage difference measurements are made by the potential electrodes P1 and P2 at some distance from C2. We always have C1 well away from C2/P1/P2 grouping and refer to it as the Infinity Electrode. Since the current flowing between C1 and C2 is known, as is the voltage drop between P1 and P2, the meter can calculate the apparant resistivity of the slice of ground between the arcs of radius C2-P1 and C2-P2 centred on C2. This arrangement is shown opposite.

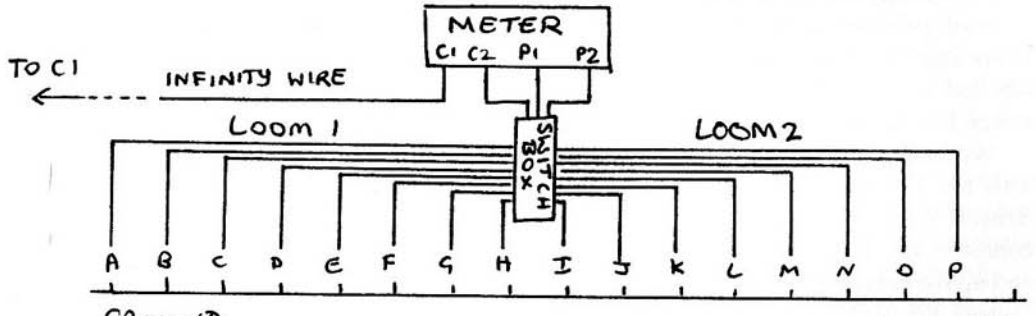
The electrodes used are 300mm long 12mm diameter titanium tubes, no doubt acquired years ago for making caving ladders. These particular tubes were used because they were available and the metal is strong yet light to



The Single Electrode Method

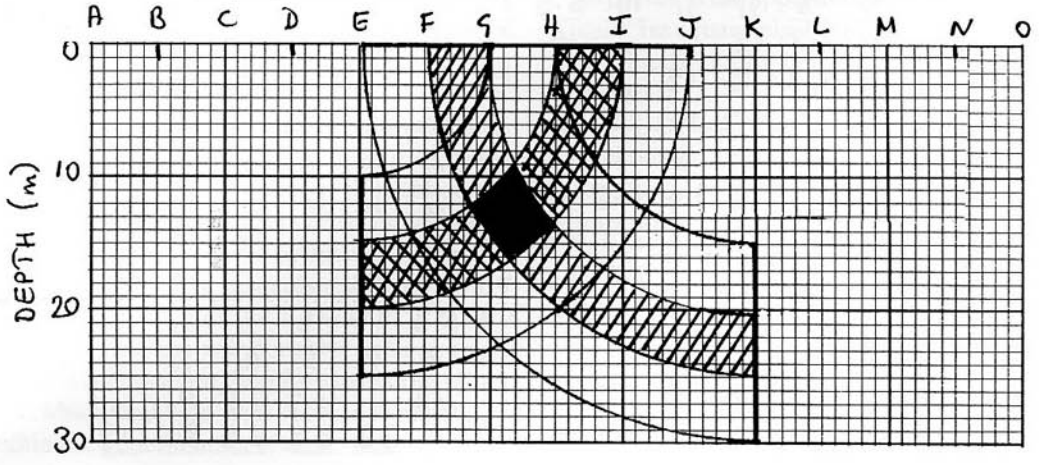
C1 is the Infinity Electrode kept well away from the theatre of operations. An AC current is passed between Current Electrodes C1 and C2 by the meter. This sets up hemispherical bowls of equipotential centred on C1 and C2 assuming the ground is homogenous. The voltage drop-off is measured by Potential Electrodes P1 and P2 and hence apparant resitivity is calculated. The next measurement is usually taken after moving only C2, hence the name 'Single Electrode' method.

WIRING ARRANGEMENT WITH LOOMS AND SWITCH BOX



BRISTOW CURVES

Here is a 70m wide by 30m deep cross-section. With electrodes A-O spaced at 5m intervals there are 110 possible curves each with its own apparant resistivity value. Suppose that the curves defined by [C2=K,P1=F,P2=G] and [C2=E,P1=H,P2=I] shown cross-hatched have high resistivity readings compared with the neighbouring curves shown plain. The implication is that a cavity may lie at the intersection of the curves shown in solid colour.



carry. The rods are placed about 200mm into the ground if possible.

We have improved the efficiency of the Single Electrode method by using wiring looms and a control box so that a whole section can be scanned in small steps with the operator sitting in one position. This means that all the electrodes are placed and hooked up in advance. Any of these can be selected for use as C2/P1/P2 by rotary switches on the control box.

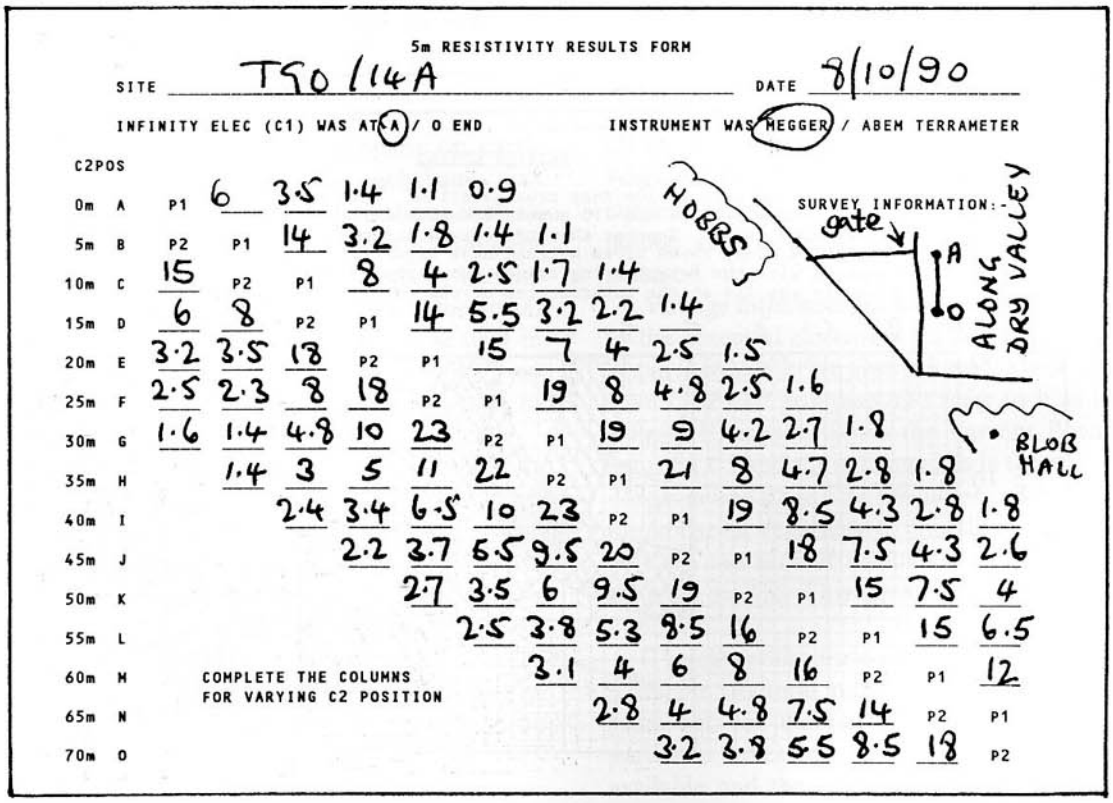
Most of our experiments have been over 70m long sections divided into 5m steps. This requires 15 electrodes to be placed, plus the infinity electrode typically 200m away. All possible slices of 5m thickness to a maximum radius of 30m into the ground are examined. In other words P1/P2 are always 5m apart and never more than 30m from C2. This gives a total of 110 measurements per section and quite a lot of redundancy due to overlapping slices which in turn permits a statistical approach to analysing the data. The 15 electrodes are labelled A, B, C etc. for identification on the switch box and also in the results.

We have a pre-printed form for 5m scans. This has 14 columns which correspond to 14 Bristow style experiments per 70m scan. We complete the form working alternately down and up the columns from left to right across the page. This normally involves only one rotary switch adjustment per reading on the meter. A completed form for an actual experiment near Twll Gwynt Oer is shown below.

It takes about one hour to peg out, wire up and take the readings for a 70m section with 5m electrode spacing. It is helpful to have 2 or 3 people to assist in moving the looms from one section to the next. During experiments one person can record while another operates the switch box and meter, the third person has a beer. So allowing for a walk to carry the equipment into and out from the test site, obtaining 4 or 5 sections per day is a realistic target.

We have data for about 80 sections in the Swansea Valley, that is over 5km of cross-sections to 30m depth, mainly near OFD. This represents 2 or 3 man-months of effort in the field work in this area alone. We have also tried some experiments using 2m or 3m electrode spacing to get finer resolution, but most are 5m since we aimed to find walking size cave passages, not grovels. Where we have data at different resolutions over the same ground, the graphical results are consistent.

A huge amount time and effort has been invested by a small team consisting of Stuart France, Clive Jones, Huw Thomas, Neil and


5m RESISTIVITY RESULTS FORM

SITE T90 114A DATE 8/10/90

INFINITY ELEC (C1) WAS AT (A) / O END INSTRUMENT WAS (MEGGER) / ABEM TERRAMETER

C2POS														
0m	A	P1	6	3.5	1.4	1.1	0.9							
5m	B	P2	P1	14	3.2	1.8	1.4	1.1						
10m	C	15	P2	P1	8	4	2.5	1.7	1.4					
15m	D	6	8	P2	P1	14	5.5	3.2	2.2	1.4				
20m	E	3.2	3.5	18	P2	P1	15	7	4	2.5	1.5			
25m	F	2.5	2.3	8	18	P2	P1	19	8	4.8	2.5	1.6		
30m	G	1.6	1.4	4.8	10	23	P2	P1	19	9	4.2	2.7	1.8	
35m	H		1.4	3	5	11	22	P2	P1	21	8	4.7	2.8	1.8
40m	I			2.4	3.4	6.5	10	23	P2	P1	19	8.5	4.3	2.8	1.8
45m	J				2.2	3.7	6.5	9.5	20	P2	P1	18	7.5	4.3	2.6
50m	K					2.7	3.5	6	9.5	19	P2	P1	15	7.5	4
55m	L						2.5	3.8	5.3	8.5	16	P2	P1	15	6.5
60m	M							3.1	4	6	8	16	P2	P1	12
65m	N								2.8	4	4.8	7.5	14	P2	P1
70m	O									3.2	3.8	5.5	8.5	18	P2

COMPLETE THE COLUMNS FOR VARYING C2 POSITION

Debbie Weymouth, with help from many others. Huw Thomas made the switch box and looms from wire kindly donated by Stuart Kirby.

COMPUTER ANALYSIS

Imagine a vertical cross-section through the ground 70m long by 30m deep divided into a grid of 1m squares called pixels. This concept is central to understanding the computer analysis. The software draws 70x30m cross-sections and the analysis unit is the 1m square pixel.

For each field measurement, the software draws the relevant arc on to a 70x30 grid held in memory and updates the corresponding pixel data for each 1m square that is overlapped by that arc. There are several numeric items recorded for each pixel, such as average resistivity. When all 110 field measurements for a particular section have been examined, it is possible to make futher calculations such as identifying pixels which have a far higher resistivity than the norm.

By using a colour or grey scale to represent average resistivity and other metrics, these grids can be drawn on the screen or output on paper. It is immediately obvious to the eye where the high resisitivity pixel groupings are, and by implication the likely locations of caves in limestone areas.

The software also produces a histogram showing the number of readings, from the total of 110, which fall within each 100 ohm*m wide resistivity band. This is overlaid with a graph of average resistivity versus depth. The program performs one pass through the data to determine the spread of raw resistivity values and to set a cavity threshold, which we call T, mid-way along this scale. This feature enables the program to calibrate itself according to the spread of the field results to take account of recent weather, ground drainage, and instrument variations.

It is also possible to adjust T manually after seeing the first set of pictures produced by the program. T determines the level of resistance above which any measurement is considered to be indicative of a cavity. By setting T very low the program will consider almost every measurement to indicate a cavity: if T is very high, the program will consider nothing to be cavity. It is important therefore to choose values of T which highlight high resistance anomalies within the general mass of data.

Overleaf are results from our most interesting site down dip from Twll Gwynt Oer (sections TGO14, TGO14A and TGO14B). This is just inside the OFD Nature Reserve and covers the series of small shakeholes in a dry valley going down from the 5-bar gate towards the Blob Hall end of Cwm Dwr Quarry. At the top of each result is the combined histogram and graph: the '+' signs are the graph part showing that average resistivity increases with depth; the solid bars are the histogram part showing a significant number of readings well above the mean.

TGO14 and TGO14A are repeat experiments (with a slight shift in the A-O electrode positions) done on different days with different instruments and different weather. The histograms show that the raw data varies numerically a great deal, yet the consistency of the graphic results shown below each histogram is truly remarkable. On the next page is the result for section TGO14B which is at right angles to TGO14 with the J electrode over the same spot in both sections.

The grey scale on the cross-sections is such that high resistance (i.e. high probability of a cave) is shown in black, with lower probabilities shown in dark grey, light grey and white. There are 4 cross-sectional pictures for each result. The top left picture labelled 'Data' shows the coverage of the data: in each case shown here it is 70m wide by 30m in depth. This is also where the program version, date processed, filename and value of T are displayed.

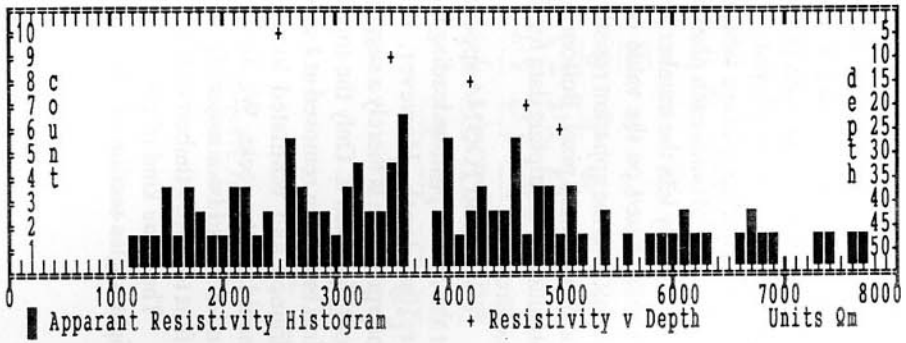
The top right picture labelled 'Hits' shows the number of times each pixel has been scored as in a cavity less the number of times it scores as solid, based on the value of T. Bottom left 'AppRes' is the apparant resistivity averaged for each 1m square pixel. Bottom right 'Product' is obtained by multipling data for the previous two pictures.

TGO14 and TGO14A appear to show a shaft at about the J position leading into a large cavity at 10m depth. However, this convenient interpretation is merely a suggestion as we have yet to get into it. Only the top 2m of grass and drift have been removed at J showing a dry, well drained and ventilated location with yellow mould on the rocks. We have not hit bedrock and it would be a major dig requiring a lot of effort to place a timbered shaft through the drift.

The same kind of picture is obtained in the right angles section of TGO14B. This suggests

RESIST V12 Run 11/5/91 12:16

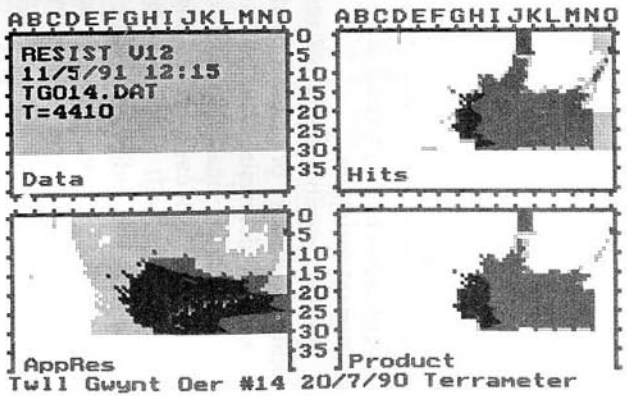
Filename : TGO14.DAT
Data is : Twll Gwynt Oer #14 20/7/90 Terrameter



Max. Resistivity = 7650
Mean Resistivity = 3800
Min. Resistivity = 1170

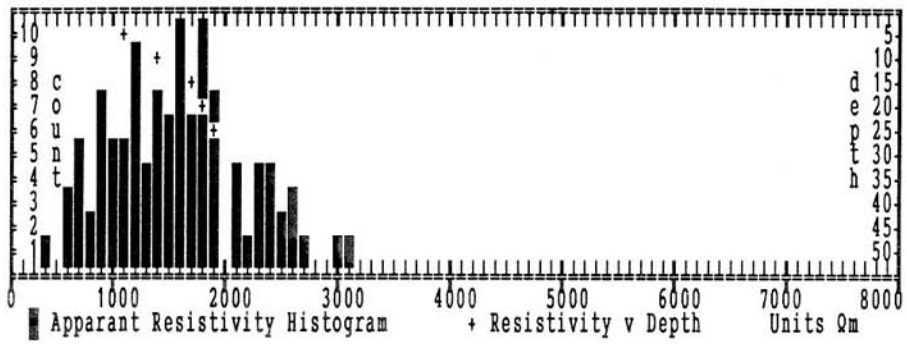
Datasets = 110
Off scale = 0
Threshold = 4410

Level 1 = 3520
Level 2 = 4680
Level 3 = 5840



RESIST V12 Run 11/5/91 12:24

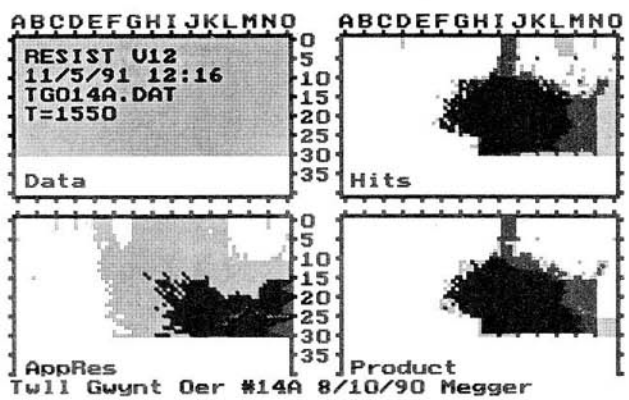
Filename : TGO14A.DAT
Data is : Twll Gwynt Oer #14A 8/10/90 Megger



Max. Resistivity = 3020
Mean Resistivity = 1490
Min. Resistivity = 380

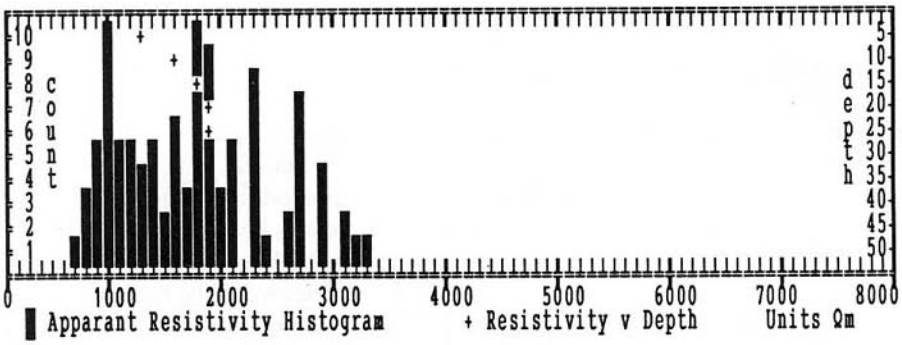
Datasets = 110
Off scale = 0
Threshold = 1550

Level 1 = 1460
Level 2 = 1980
Level 3 = 2500



RESIST V12 Run 12/11/90 20:06

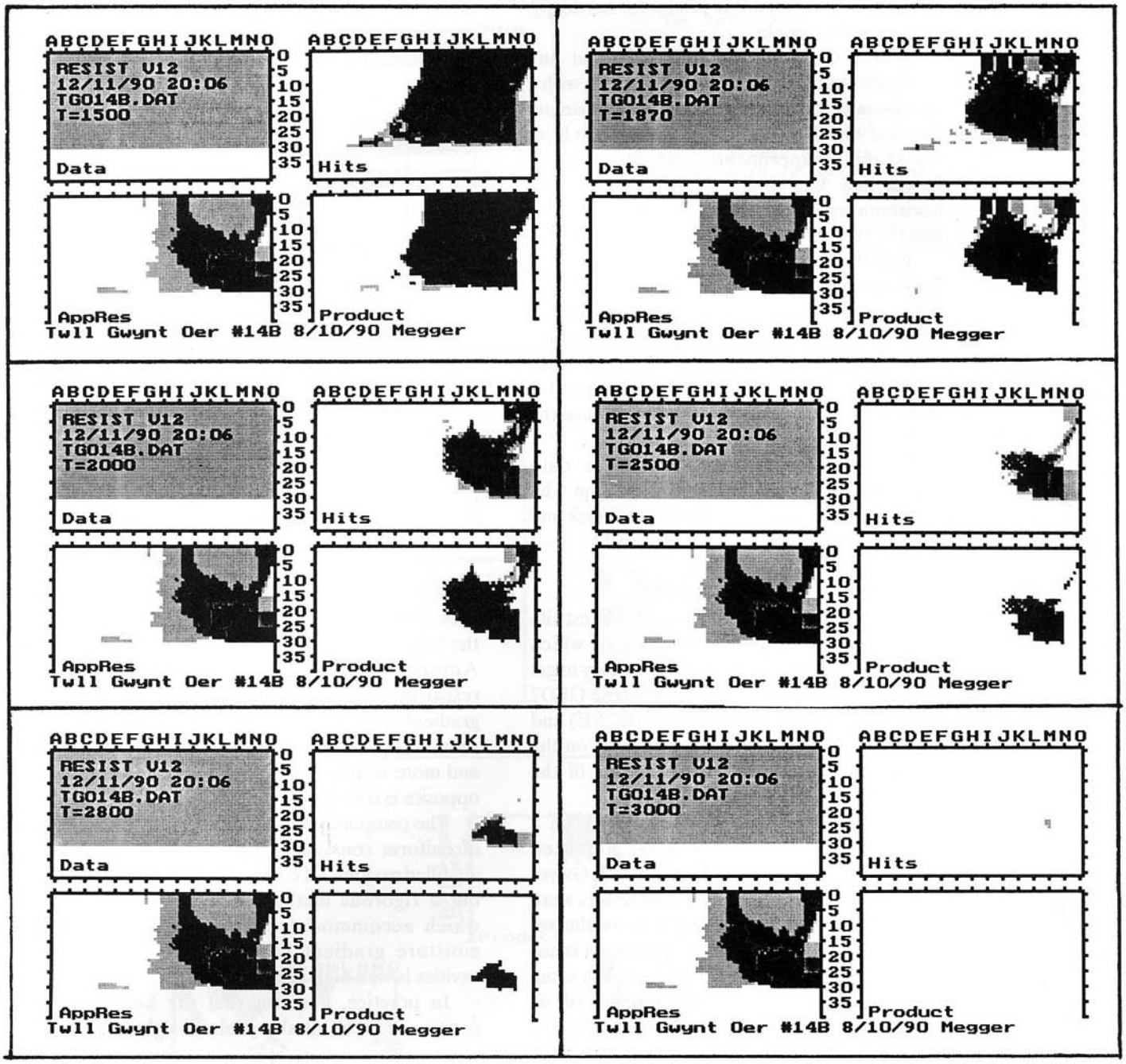
Filename : TG014B.DAT
Data is : Twll Gwynt Oer #14B 8/10/90 Megger



Max. Resistivity = 3200
Mean Resistivity = 1650
Min. Resistivity = 690

Datasets = 110
Off scale = 0
Threshold = 1870

Level 1 = 1720
Level 2 = 2150
Level 3 = 2580



that the cavity is a chamber and not a narrow rift. There are 6 cross-sections shown for TGO14B which illustrates the effect of varying T manually from 1500 to 3000 ohm*m. Clearly one could invent other schemes for jiggling numbers to produce pictures, known as a heuristic approach by the artificial intelligence trade.

THE SOFTWARE

The computer program described here is about 800 lines of Turbo Pascal version 4 and it runs on an IBM-PC compatible with CGA monitor. It can output the graphics screens to an HP Laserjet II compatible printer for hardcopy, as used in this article.

It was designed to handle data at any electrode spacing in multiples of 1 metre, with a maximum section length of 70m and maximum depth of 40m. However, most of our data is from 5m spacing experiments, with 70m section length and 30m depth. For this reason the horizontal spacing is marked A-O in 5m steps and the vertical scale is in 5m steps.

Neil Weymouth has also developed another Turbo Pascal program independently based on the Bristow graphical method without seeing the source code of mine. The graphical results obtained are similar but not carbon copies. This is a reflection of different heuristic strategies for evaluating what is and is not a cavity, since the underlying geometry is the same.

Both these programs and all the data available to date are available to anyone who wants a copy. A 1.4MB 3.5 inch DOS disk and return postage would be appreciated.

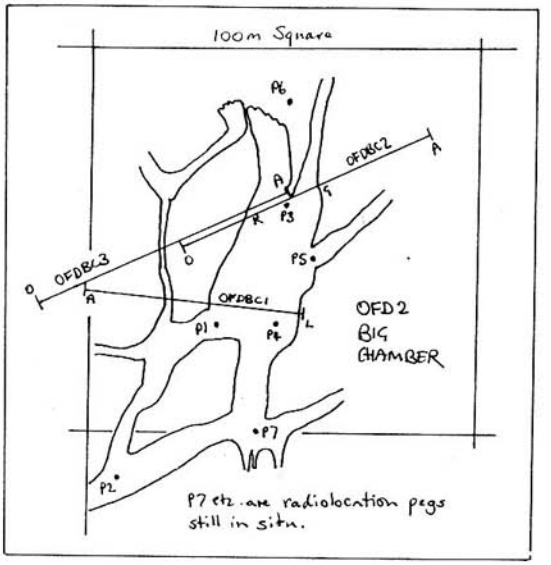
RESULTS OVER KNOWN CAVE

Greensites identified the need for a test site for evaluating various techniques of which resistivity is one. This place should be easy to get to and over a big cavity. We selected the OFD2 Big Chamber Near The Entrance (BCNE) and radiolocated it placing numbered pegs on the surface marking the departure points of the various passages leading off.

We have tried resistivity scans there on a number of occasions, but it has not been subjected to the onslaught that the Twll Gwynt Oer area has received. The initial results were promising, but later results were inconclusive. The area is not ideal for resistivity since it is not flat, nor of uniform drift thickness, it has some exposed limestone clints, and a possible rift or fissure where the obvious path crosses. This is the path going up and left from the OFD2 entrance as viewed looking towards the entrance gate.

Seismic, electromagnetic, dowsing and other methods also failed to produce good, consistent results here. We need a new test site over more suitable ground, perhaps the Northern Lights series would be better.

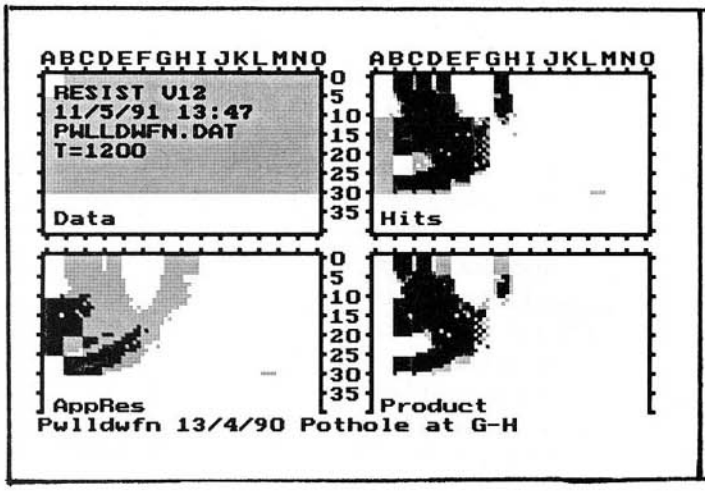
We used the BCNE site to make some overlapping sections to determine if there are end effects. We found that the pictures for section ends are consistent with section middles, as are results obtained on different days from different instruments. We have also mirrored sections, shifting the infinity electrode to the opposite end and this has no effect on the results either.



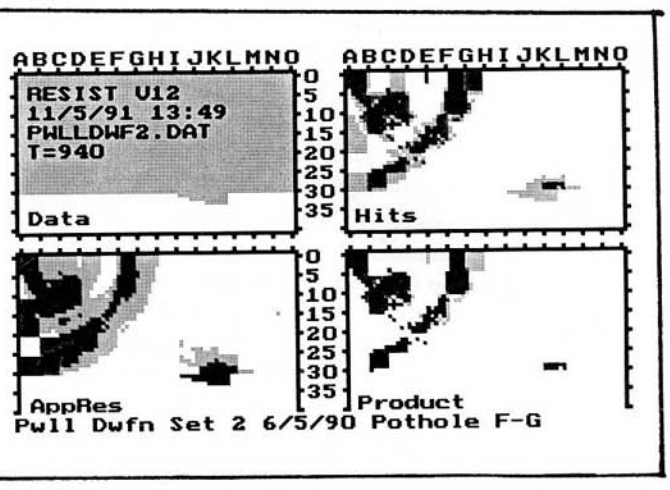
The weather seems to be a major factor. We have seen average resistivity values rise during the long dry summer of 1990 and fall again as Autumn arrived. From plots of average resistivity against depth we have observed the gradient invert as the water table has fallen. In summer the peat, soil and glacial drift is drier and more resistive than the layers beneath: the opposite is true in winter.

The computer model assumes the ground is of uniform consistency with irregular shaped air-filled cavities. Of course this is too simplistic, but a rigorous mathematical interpretation which accommodates stratification and a moisture gradient coupled with irregular cavities is well nigh impossible.

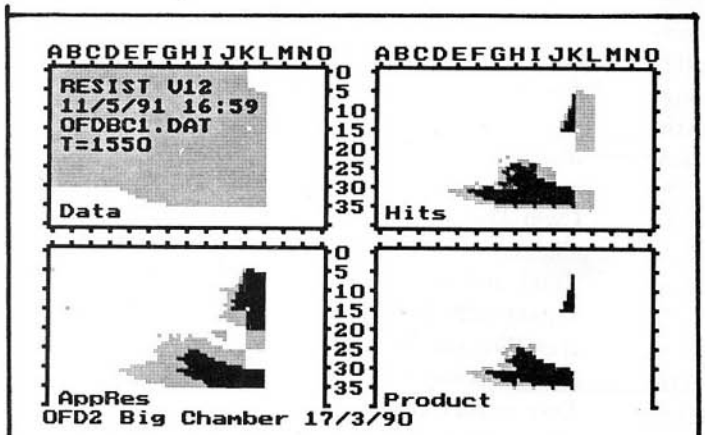
In practice, it seems that the horizontal position of BCNE is always about right and the



Pwlldwfn 13/4/90 Pothole at G-H



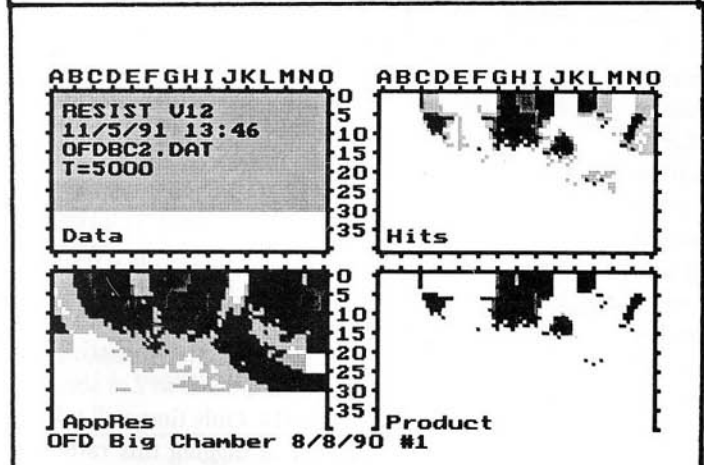
Pwll Dwfn Set 2 6/5/90 Pothole F-G



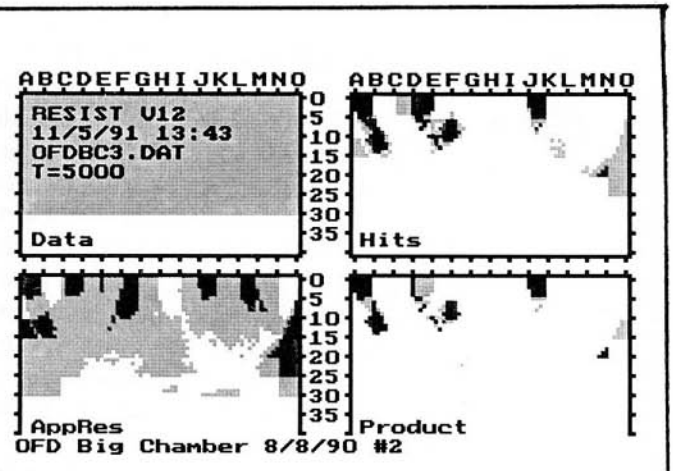
OFD2 Big Chamber 17/3/90

The Pwll Dwfn results above show the entrance shaft clearly at G-H and F-G. B-D could be a fault or the effect of the dry clints or another cave passage.

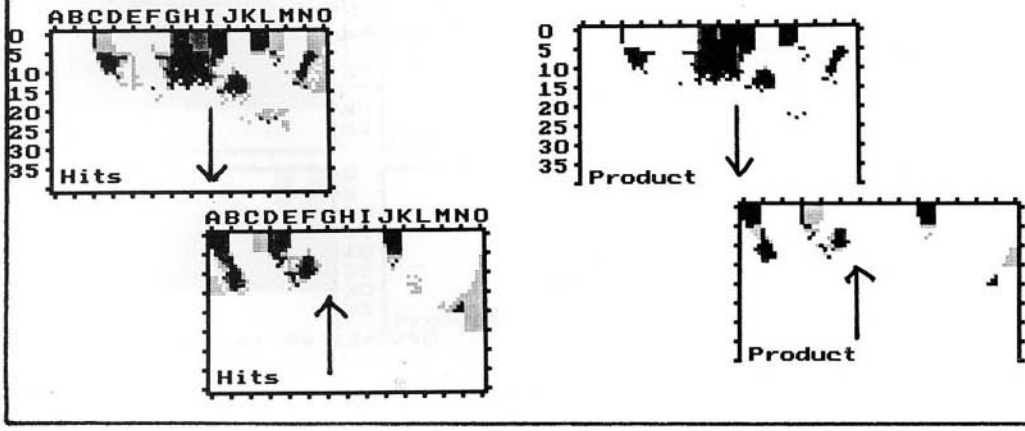
OFDBC1, left, is the original convincing result obtained over the middle of the Big Chamber. OFDBC2-3 below are overlapping sections which follow the path. These are less conclusive, but the anomaly at G-J in OFDBC2 is in the correct place but at the wrong depth. The overlap of I-O in OFDBC2 with A-G in OFDBC3 is clear in the Hits and Product pictures.



OFD Big Chamber 8/8/90 #1



OFD Big Chamber 8/8/90 #2



depth calculation varies according to the weather. The image moves nearer the surface in summer. This is thought to be a diffraction effect on the voltage hemispheres.

We have also examined Pwll Dwfn (PD) and Twll Gwynt Oer (TGO) entrances as tests over known caves, rather simpler caves than the maze of passages in OFD2. Both of these produce images of the entrance shafts. In the case of PD there is another high resistance anomaly of greater significance than the PD shaft itself some 20m East of the entrance. However, the drift cover also runs out on to clints at that point.

The TGO entrance shaft shows quite clearly in section TGO1 with the known cave some 10m down below G-H, but a much larger passage appeared at a depth of 25m, some 20m from the entrance and towards Hobbs quarry. This new discovery, has been followed up and down dip in the TGO field and on into the OFD Reserve. It appears consistently from section to section and mapping it became our major preoccupation in the summer of 1990.

Sections TGO1 to TGO7 go down the field. Sections TGO5 and TGO5A were done over the same spot a month apart and with different instruments and the results are consistent.

INTERPRETING THE RESULTS

It should be obvious that 110 numbers based on 15 electrodes arranged in a straight line is quite insufficient data on which to infer reliable passage cross-sections on a 70x35m grid with a total of 2450 1m square elements. There are too many variables and interpretations and complex effects like overburden, moisture gradient and so on. However, what is plain is that in the cases we have examined when a cave is present, the results always show some kind of anomaly, and the graphical result approximates to the correct shape and position.

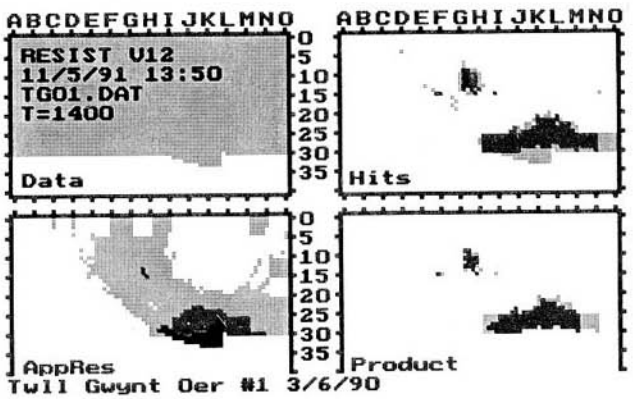
This does not mean that every anomaly is an open cave passage since narrow fissues, low bedding planes, shale bands, impossible boulder chokes and so forth will affect the picture. But with a negative resistivity result, it is unlikely that open cave passage of any significant size is present. We have dramatic results showing what appear to be entranceless caves, only open at present to question.

Spurious effects caused by narrow rifts and open jointing can be eliminated by performing several experiments at various angles and positions near a site of interest. Greater confidence can be placed in consistent results obtained from a series of sections, such as below Twll Gwynt Oer where a cave passage is the likely explanation.

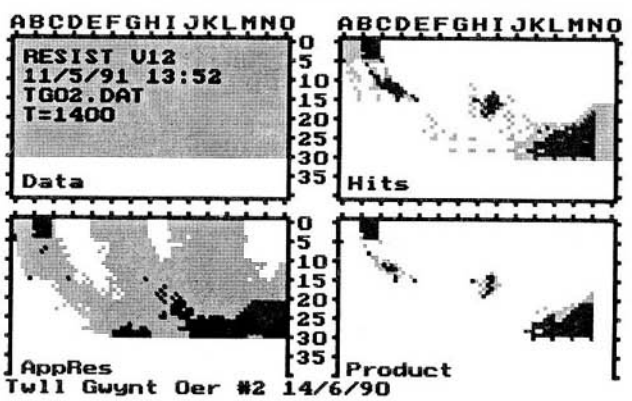
THE OFD RESISTIVITY SERIES

We have called the new discoveries which run from near Cwm Dwr and Gents Dig up in the direction of Twll Gwynt Oer, the OFD Resistivity Series. We have taken a large number of sections to track this series which we suspect is more to do with old fossil passages beyond the Cwm Dwr Jama and the Upstream Boulder Choke, than with TGO itself. We know that TGO and Blob Hall water issues from the Upstream Boulder Choke in Cwm Dwr travelling via the new Cwm Dwr 2 streamway. The resistivity results at TGO14 near the Cwm Dwr corner of the OFD Reserve are highly significant in this respect. We have also had a number of completely negative results where we have lost the big passages to one side or the other from the expected route down dip, such as at TGO20 near the stile on the path from the SWCC HQ into the OFD Reserve.

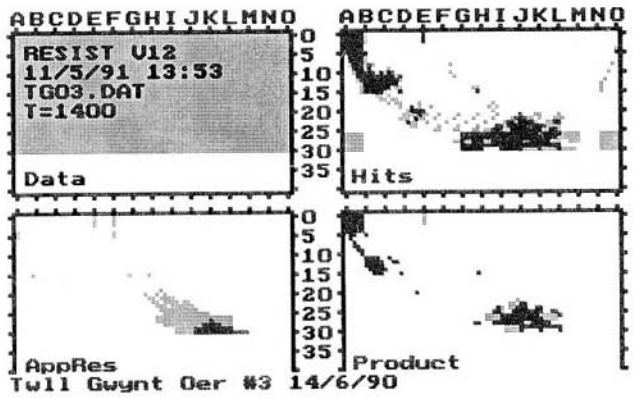
The surface survey overleaf shows the relation of surface features to our resistivity scans. These sections are numbered TGO1 to TGO32. The results will be placed in the SWCC library in due course together with other supporting documents, program listings and so forth. Perhaps an entrance to the Resistivity Series will be discovered via Cwm Dwr 2 or some place other than at TGO14. Only time will tell. It is hoped that interest in digging this rather convenient area will be fired by the knowledge that it is not a big blank nothingness, but full of interesting geophysical anomalies as well as tantalising cave fragments.



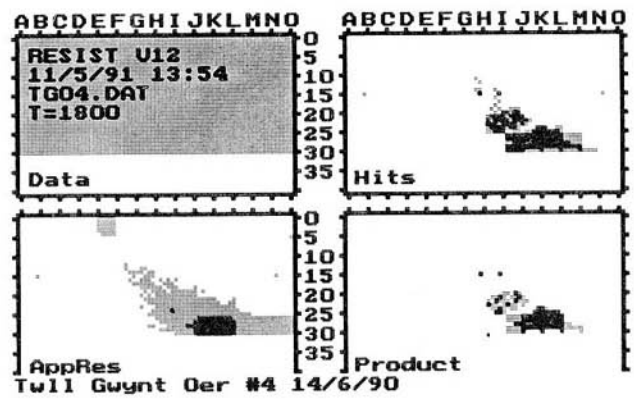
Twll Gwynt Oer #1 3/6/90



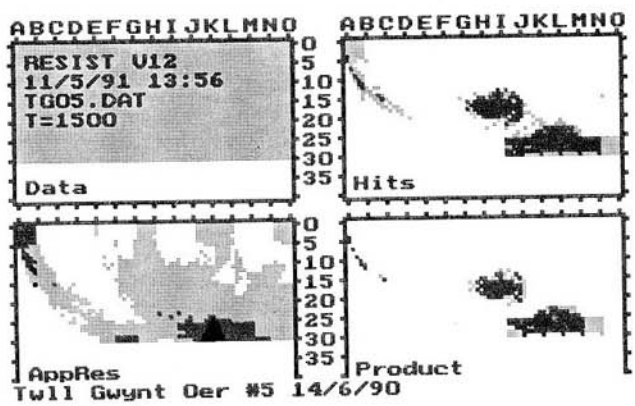
Twll Gwynt Oer #2 14/6/90



Twll Gwynt Oer #3 14/6/90



Twll Gwynt Oer #4 14/6/90



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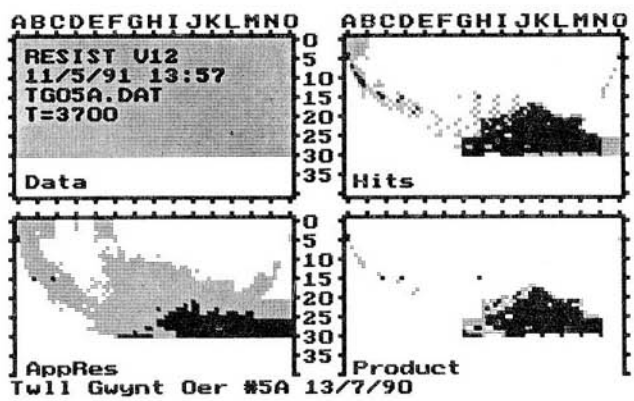
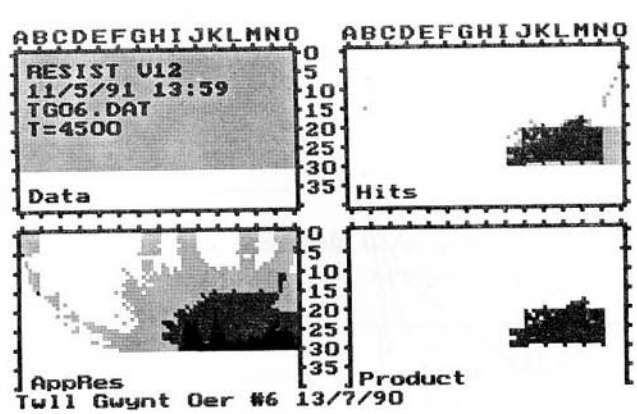


Twll Gwynt Oer #5A 13/7/90



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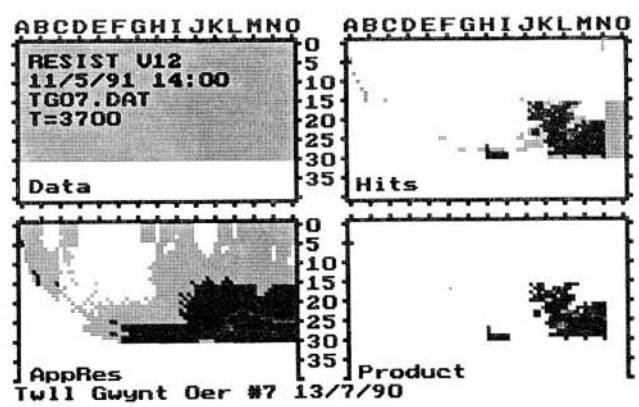

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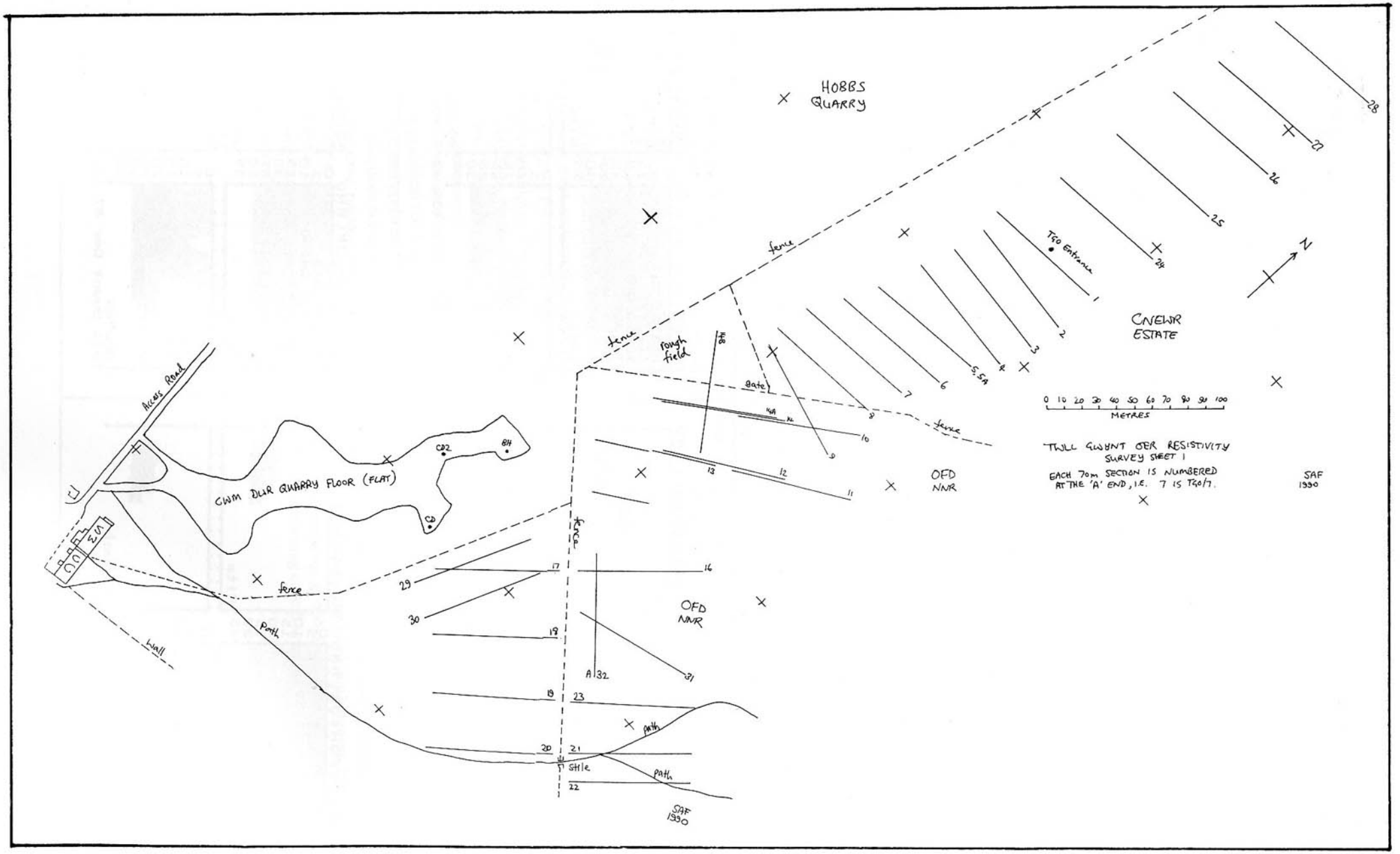


Twll Gwynt Oer Resistivity Survey

RADIOLOCATING BETWEEN CAVES

By Stuart France

The compass and tape surveys of the three main Mynnydd Llangattock cave systems, Agen Allwedd, Daren Cilau and Craig a'Fynnon, show that the gaps are now quite small. Other places of interest include the Craig y Castell digs on the Llangattock/Beaufort road which may join Agen Allwedd near Sand Caverns, Ogof Pen Eryr and other digs in the nearby old Daren quarries which could provide alternative ways into Ogof Daren Cilau and Ogof Craig a'Ffynnon.

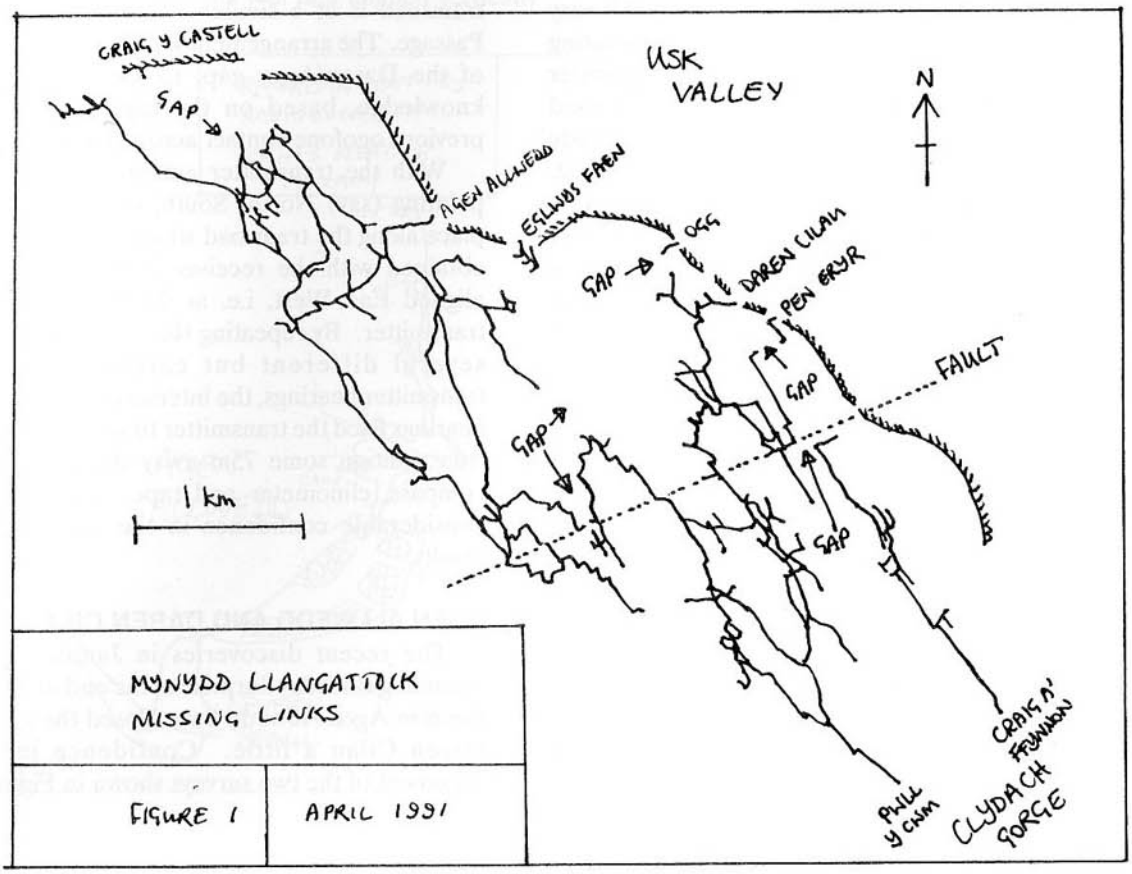
One can speculate about the various challenging caving expeditions which the links would make possible: Agen Allwedd to Craig a'Ffynnon (via Daren Cilau), Craig y Castell to Pen Eryr (via Aggy and Daren), Aggy to Daren through trips, etc.

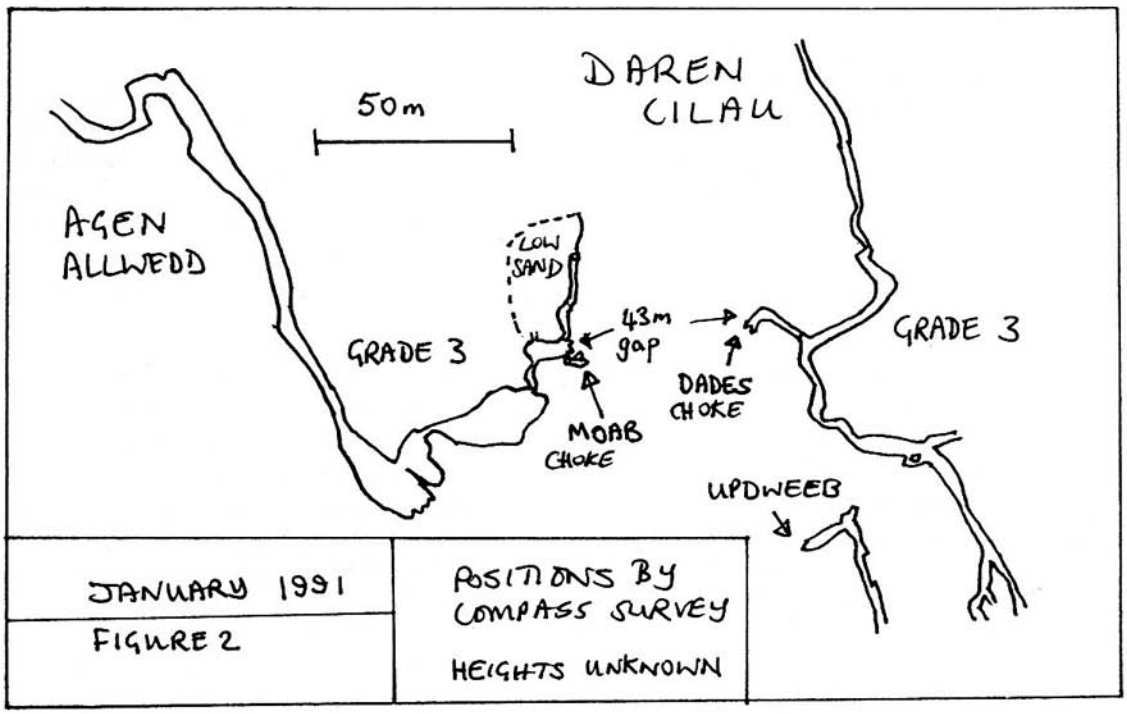
Figure 1 below shows the relationship of the main caves indicated by compass and tape surveys. Some of the gaps are now quite small. Note the fault through the mountain in Figure 1. This seems to be involved in both the Agen Allwedd / Daren Cilau gap at Birthday Surprise and also the Craig a'Ffynnon / Daren Cilau gap at Antler Passage. This article reports on new radiolocation surveys done horizontally between the caves to obtain estimates of the spatial relationships at these gaps.

The radiolocation equipment used was my own, coupled with the Mark 1 Ogofone now with Gwent Cave Rescue Team. Whilst the Ogofone is an excellent speech system, the automatic gain control and high sensitivity makes it unusuable for radiolocation: turning the antenna does not produce a clearly defined null, and the floppy nature of the antenna compounds this problem. The Mackin/France radiolocation circuit and construction notes will appear in a forthcoming article in Caves and Caving. SWCC now has a set of radiolocation equipment similar to this funded from the Greensites Project.

HORIZONTAL RADIOLOCATION TECHNIQUE

Radiolocation is normally used to fix a cave position on the ground surface above, i.e. to determine a vertical relationship by which the cave grid reference and depth are obtained.





The transmitter goes into the cave and is placed horizontal. The receiver is moved over the surface above looking for null signal bearings while being held vertically. The intersection of these bearings is called Ground Zero and the transmitter lies directly beneath it. To be effective, the transmitter must not be too deep otherwise the signal is weak and the null is very wide and inaccuracies result from interpolating its centre. On the other hand, the transmitter must not be so shallow that both the receiver and transmitter are at roughly the same altitude otherwise a false Ground Zero can be obtained, such as reported by Frank Reid in Speleonics 15.

By rotating the usual vertical arrangement described above through 90 degrees one can radiolocate horizontally between two caves rather than vertically from cave to surface. But this introduces a major problem for the receiver since he is constrained by the size and direction of the cave passages in choosing places for taking null signal bearings. Furthermore, if the transmitter and cave passages are in close vertical alignment a false Ground Zero may be obtained. This could be countered by operating the transmitter antenna horizontally, but then a false Ground Zero would result from close horizontal alignment of the cave passages.

This uncertainty of whether to go horizontal or vertical (and then deciding some suitable bearing) coupled with the contraints on receiver position leads to the requirement for an Ogofone by which new radiolocation antenna orientations can be negotiated as the spatial nature of the gap becomes clearer.

Practice at Eglwys Faen with the transmitter placed vertically in Western Passage and the receiver constrained to walk only on the tramroad outside gave good results. The tramroad is at a similar altitude to Western Passage. The arrangement was a good analogue of the Daren/Aggy gap, to the best of our knowledge, based on the tape survey and previous ogofone contact across the gap.

With the transmitter antenna vertical and pointing (say) North- South, one looks for a place along the tramroad where a null signal is obtained with the receiver held vertical and aligned East-West, i.e. at 90 degrees to the transmitter. By repeating this experiment with several different but carefully chosen transmitter bearings, the intersection of the null bearings fixed the transmitter to within 2m of its true position some 75m away determined by compass, clinometer and tape. So we have considerable confidence in the method and results.

AGEN ALLWEDD AND DAREN CILAU

The recent discoveries in January 1991 extending Birthday Surprise at the end of Priory Road in Agen Allwedd have closed the gap to Daren Cilau a little. Confidence in the alignment of the two surveys shown in Figure 2

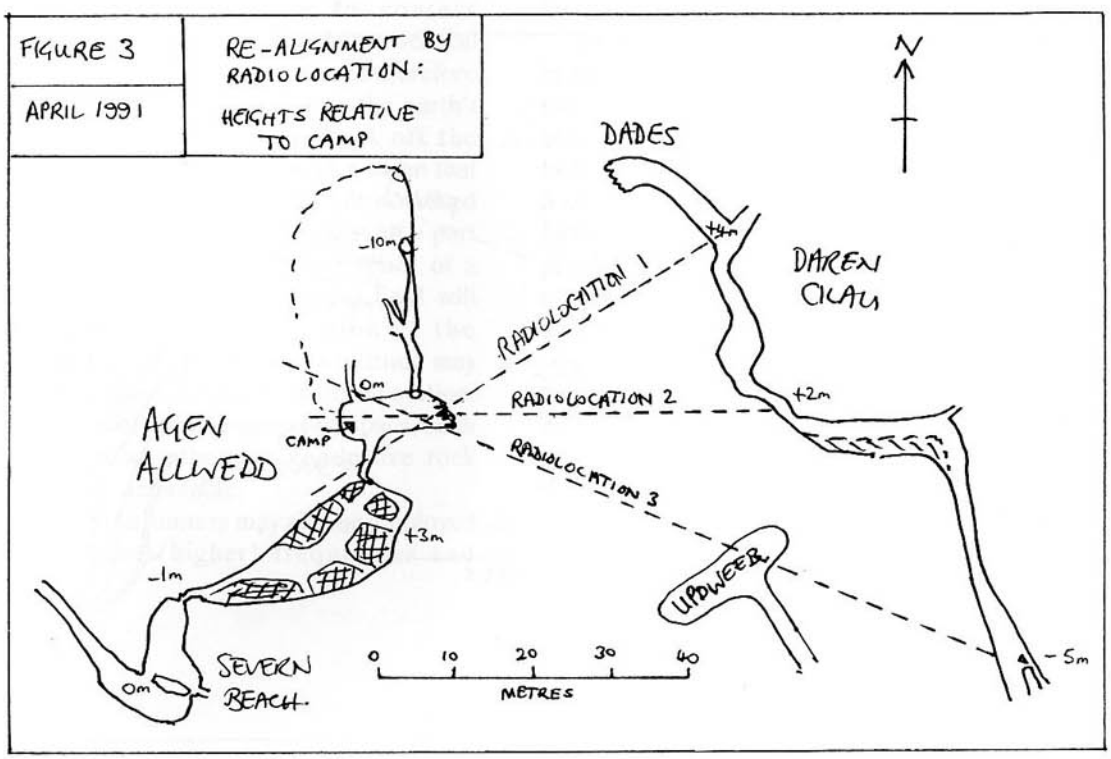
above is tempered by inaccuracies inherent in surveying long passages without loops, unexpected variations in magnetic deviation, and known errors in the present surveys. We decided to find out if the new Mother Of All Battles (MOAB) in Agen Allwedd and DADES Choke (Do Androids Dream of Electronic Sheep) at the far end of Daren Cilau were in fact opposite sides of the same boulder choke.

The new extensions were tape surveyed by Peter Smith from Cwmbran CC and myself in February. For the radiolocation in late March, Huw Jones from the Polytechnic of Wales and I went to DADES Choke while Martyn Farr and the Glynneath gang went to MOAB. The normal 45cm square wooden frame transmitter antenna was taken to MOAB, but due to the long and arduous nature of the Daren route a flexible receiver antenna was specially made using 15 turns of 25-way ribbon cable on a collapsible wooden cross. This gave 375 turns on a square of side 45cm. Both of these are parallel tuned for 874Hz. All the other electronics and Yuasa batteries were carried in plastic Daren Drums and all arrived dry, intact and worked very well.

Since we believed that DADES was roughly East of MOAB, i.e. the same choke, the transmitter antenna was first aligned vertically and pointing due North along the top edge. This should have produced a null in Daren with the receiver antenna aligned vertically and pointing West along the top edge. This was not found to be the case: the angle suggested that the transmitter was to the South, and at least 30m away judged from the signal strength.

We then decided to try the transmitter antenna in the horizontal plane and simply take several bearings on it. This resulted in some temporary confusion when I was unable to get a consistent set of null bearings. Since the alititudes were very close my vertical receiver antenna was near tangential to the lines of force no matter what angle I turned it to.

We then returned the transmitter antenna to the vertical and aligned it on two other bearings and obtained quite good concordance. The height difference was estimated with an analogue of the depth determination method used in classic surveys. We made an accurate tape survey of the relevant area in Daren Cilau and the results are shown below on the combined survey in Figure 3 which places MOAB some 50m from each of the nearest 3 point in Daren Cilau at at roughly the same altitude. This suggests digging possibilities in several directions. There are good draughts and digging prospects in the area on both sides.



However, the 50m gap is substantial leaving space for further passage to be discovered before the connection is made.

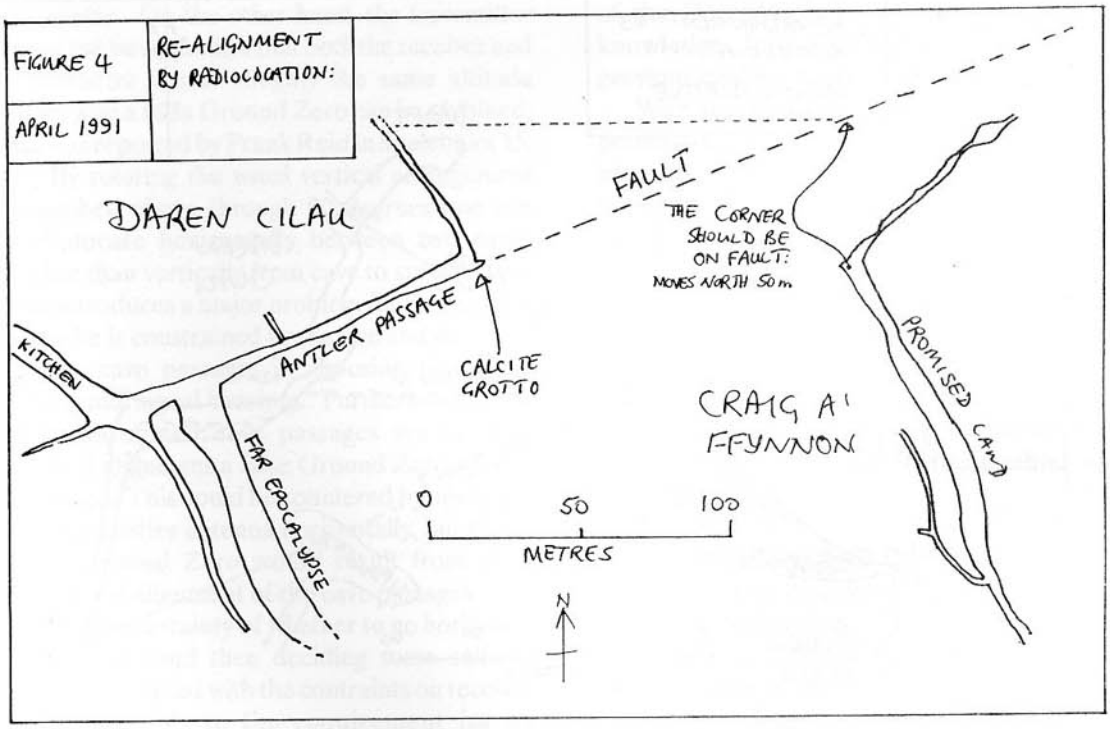
DAREN CILAU TO CRAIG A'FFYNNON

The tape surveys suggest that the narrowest gap is the top corner of the Promised Land to the calcite grotto in Antler Passage. The cave entrance position on the Parker et al Craig a'Ffynnon survey has recently been found to be inaccurate. Previous radiolocation work by Bob Mackin prior to the 1984 Daren Cilau extensions was disputed by that survey team. The cave has long straight legs without loops in which errors will accumulate. In view of what we now know, it seemed interesting to perform another cave-to-cave survey to find out if the two corners were in close proximity.

A major fault goes through the mountain from the Antler Passage grotto, The Kitchen, Frosty Passage, the Big Chamber with the 10m pitch, Birthday Surprise, and Resurrection. It seemed likely that the big bend at the top of the Promised Land should be aligned on this fault, and not 50m to the South of it as shown by the tape survey. It would be perfect if this natural feature provided the links between all three major caves.

Matt Ward and I took an ogofone and the radiolocation receiver to Antler Passage whilst another nameless group took the corresponding equipment into Craig a'Ffynnon. The ogofone worked well but the radiolocation signal was very weak. The operating range of the equipment is 200m and 130m respectively. The equipment was checked after leaving the cave and found to be working normally. So the reason for a weak signal was the separation. The nulls were very wide and had to be centered by interpolation. This reduces confidence in the accuracy of the result shown in Figure 4.

The Promised Land corner was re-aligned along the line of the fault and at a similar altitude to the Antler Passage corner. We determined this by having a vertical transmitter aligned at right angles to the fault and the receiver vertical and aligned along the fault for a null. We then put the transmitter on a North-South axis and discovered that the place in Daren to receive a null on an East-West axis was beyond the Antler pitch. We did not climb the pitch due to the inadequate fixed aid. We found that near the pitch the null angle was about 85 degrees. Estimates from the equation of the curve for the lines of force confirmed what the signal strength had already told us: a separation of the order of 130m. So these two corners are not close together and anyone interested in obtaining a connection would do well to look elsewhere.



GEOPHYSICS AND CAVE DETECTION

by Keith Ball

A Progress Report

Several geophysical techniques have been tried for cave detection near Penwyllt and Pant Mawr. These techniques make use of procedures which attempt to locate subsurface changes in physical properties. In application to cave detection, clearly the most appropriate parameter to investigate is the presence of a void in an otherwise intact rock. Limestones are often mildly conductive to electricity so that the presence of a resistant hole may be detectable, at least in theory. In a like manner, a hole is less dense than the surrounding rock so that measurements of density, using for example, small changes in gravity or sound transmission, should be effective at locating caves.

Very Low Frequency (VLF), and as a consequence Very Long Wavelength, Electromagnetic (EM) geophysical techniques make use of a property in which swords are beaten into plough-shares. Many military communication systems make use of very long wavelength transmissions to contact submarines. Usually these aerials are vertical and transmit radially. The signals are therefore largely plane polarised parallel to the earth's surface. In any case reflections off the stratosphere and the earth's surface mean that the transmissions are effectively plane polarised by the time thay have circulated around a part of the earth's curvature. The presence of a conductor in this radio-frequency field will perturb locally the orientation of the transmissions, and this change in attitude may be detected using sensitive instrumentation. The presence of a non-conductive space, such as a cave, in an otherwise conductive rock should also be detectable.

Portable transmitters may also be employed using different (higher) frequencies and experiments with a Horizontal Loop Electromagnetic (HLEM) Technique have also been used at Penwyllt. The transmitter and receiver are usually set at a constant separation, in this case, of 50m.

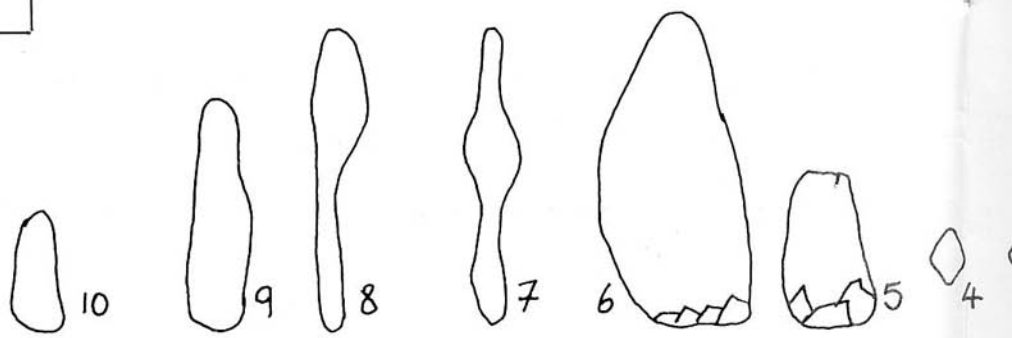
Results from these surveys do not indicate a clear EM response from caves within the dry limestones in this part of South Wales. A particular form of EM (E-Phase) offers the best potential for further investigations.

Radon measurements suffer from the effects of variable thicknesses of overburden but the readings obtained may be used to correct gravity data for overburden thickness. Gravity data obtained from above Pant Mawr indicated a negative anomaly of 0.07 mGal over background fluctuations of 0.05 mGal, caused by variations in the nature and thicknesses of overburden.

Work undertaken by geophysicists at the University College, Cardiff, using a seismic reflection technique, also shows promise. The procedure is effectively echo sounding, with the sound energy source being provided by a sledge hammer contacting a metal plate. The returning shock waves are collected by sensitive microphones (geophones) and the data is electronically processed to give subsurface sound velocity distribution patterns. Again, problems arose from the nature and variable thickness of the unconsolidated overburden, but investigations are continuing.

In conclusion, a small number of techniques in the armoury of the geophysicist have been tried over known caves. Few, with the exception of resistivity surveys and gravity measurements, have shown a relatively unequivocal response. Some techniques show sufficient promise that further work is proposed. One of the major problems is the presence of variable thicknesses of peat and glacial drift, that fill hollows in the limestone surface and interfere with the tenuous signals from deeper within the limestone. These early investigations provide very useful information. More careful selection of test sites may pay dividends, even with those procedures that up to now have not been fruitful.

SURVEYED BY -
H.A. LANGFORD M.J. HERBERT
I. ANDERSON I. MILLER
S. WEST M. WARD
1.3.91 and 20.4.91



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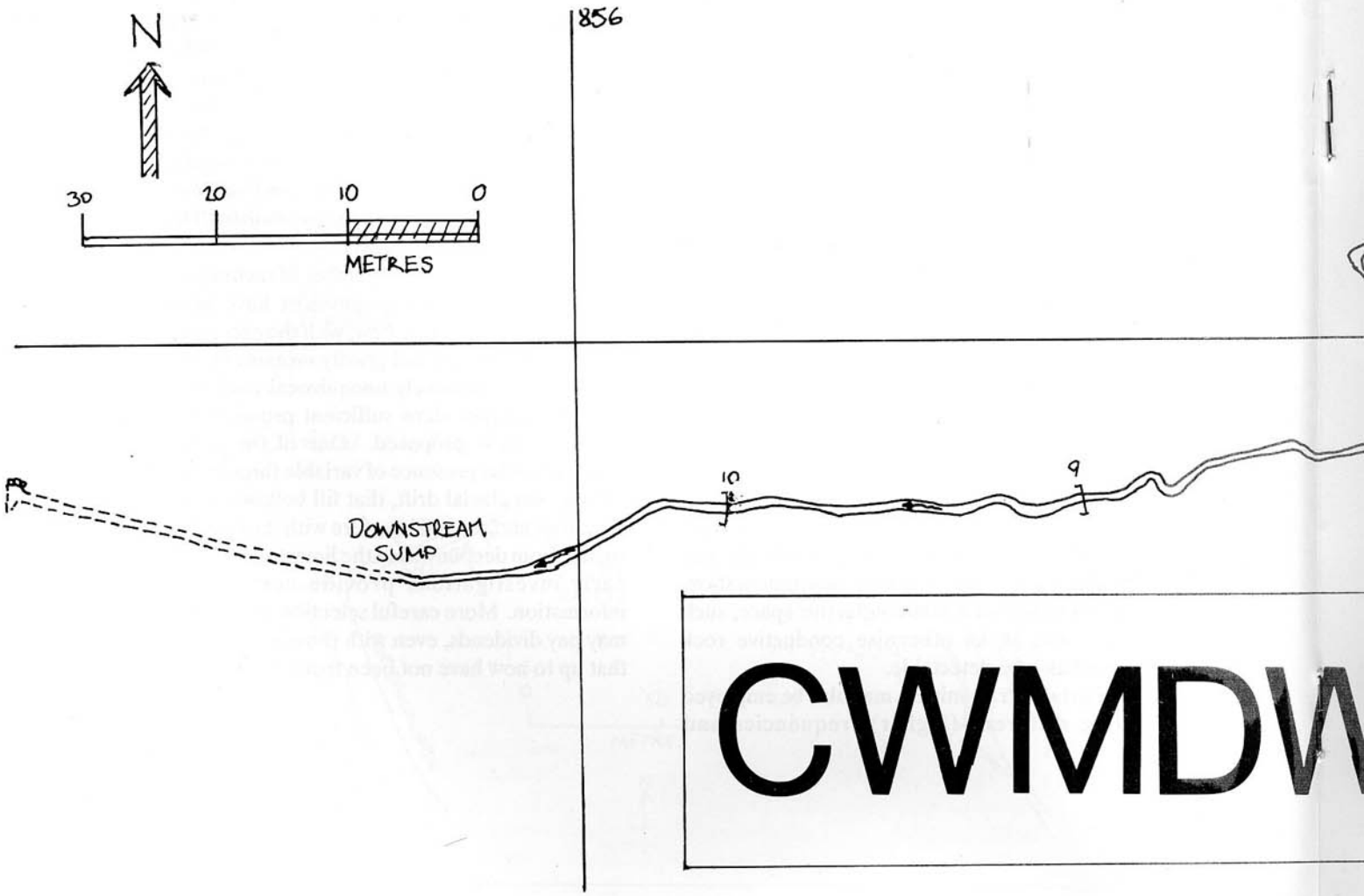

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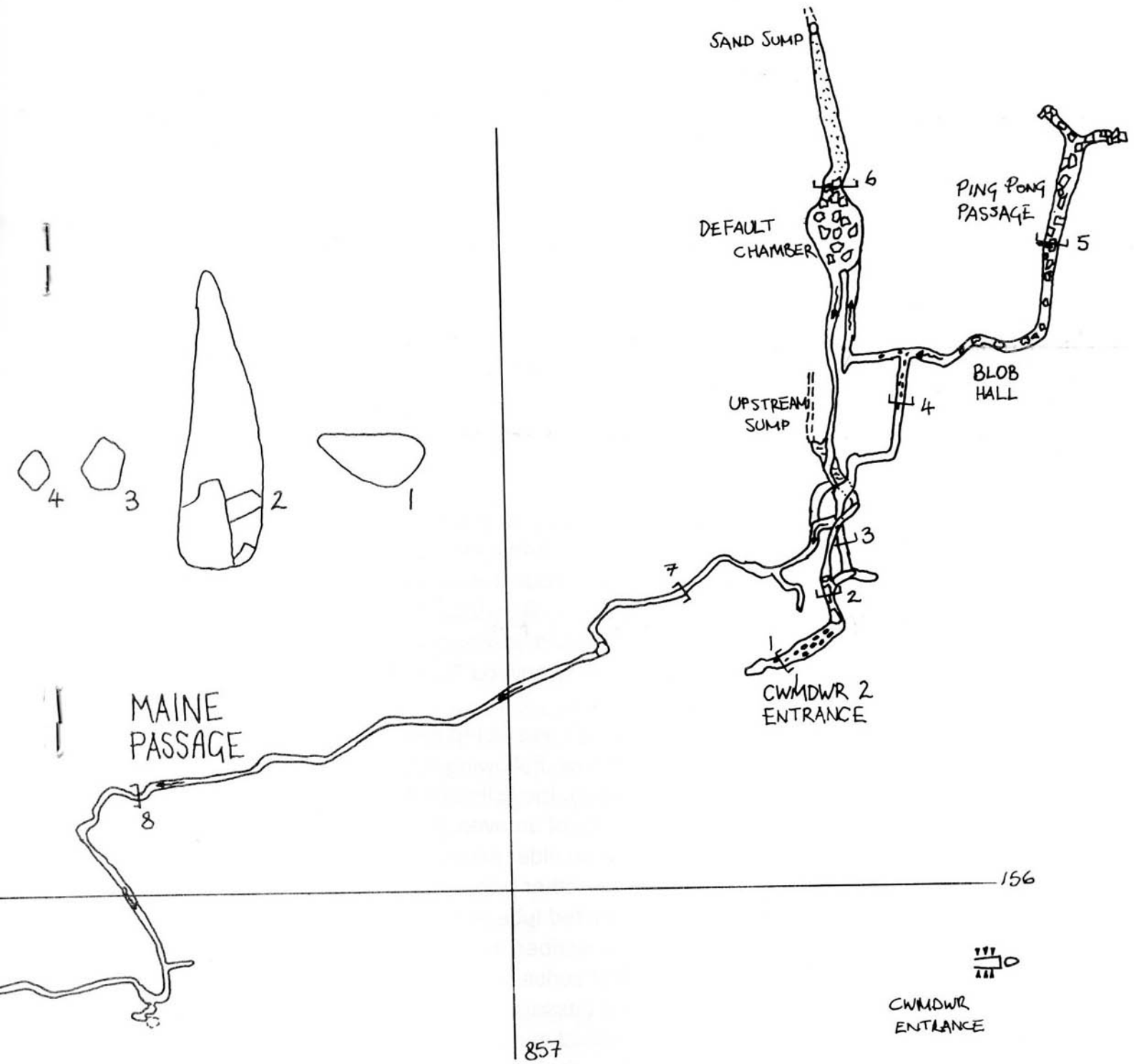

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PLAN

Cwmdwr II or Cwmdwr Quarry (New) Cave

by Helen Langford
and Malcolm Herbert

Introduction

Cwmdwr II was rediscovered late last year by members of the South Wales Caving Club and helpers. After a concerted amount of effort and enthusiasm had gone into finding the cave, it was soon realised that it had previously been entered, indicated by several nailed boot footprints and a bone button. This article recounts both discoveries of the cave, the new extensions and its future prospects as a digging site.

Cwmdwr II - The First Time Around

In the summer of 1938 a 20ft rift discovered during active operations in the Cwmdwr Quarry was briefly examined by Arthur Hill, Bill Doyle, Mr. E.E.Roberts, and others. The discovery was further investigated by Arthur Price, P. Raynes, Arthur Hill, and Bill Weaver. They followed the rift down to a boulder floor, through a small passage and descended a 20ft ladder pitch into a large 40ft long passage, this they entitled "The Master Passage".

A rather odd cube of sand standing 3ft high was noted near to where the ladder pitch (now the entrance shaft) is now. Following the passage, (only the remainder of which is still present today), they climbed over a 6ft high blockage and found themselves at the base of an aven. From the roof of the aven led three passages all belonging to an older series and all impassable. At the main passage level two other passages headed off. The first one rose steeply into a narrow constricted tube which terminated in a small chamber with a white calcite floor described as flowing down an impassable rift together with another older series passage, again impassable. Back at the aven the second passage quickly closed down to a choked sink. However, a 37ft passage almost immediately branched off this only to end in a small chamber with yet another choked sink taking water. While surveying the team made an interesting observation that the water flowed in the opposite direction to the nearby Cwmdwr Quarry Cave.

The cave was only open for just over a fortnight before the advancing quarry blocked the entrance rift leaving the cave hidden for 42 years.

In 1957, in his article for the SWCC newsletter, Les Hawes hinted that the cave remnant in the quarry face might well be the lost Cwmdwr II, and that the surveys were similar. This was not infact the case but in the original survey from 1938 and the 1957 sketch of Cwmdwr Quarry there are similarities and they are included with this article. (Figures 1 and 2).

Cwmdwr II - The Rediscovery

In October 1990, Simon Amatt noticed a point in the Cwmdwr Quarry where water could be seen sinking away. Together with Clive Jones he found that there was a small hole, with sides of a cave shaft showing. On the10th November work was started by Clive, Sam, Allan Richardson, Brian Clipstone, Alan Wood, and Neil Weymouth. They found that there was a shaft 4ft by 7ft full of quarry scalpings and dug this down to a depth of 4-5ft.

The following Saturday saw Alan Wood, Pete Mylan, Tony Baker, Helen Langford , and Malcolm Herbert digging at the shaft again and with over 200 bucket loads being pulled out saw the shaft down to a depth of about 12ft. Digging continued on the Sunday with help from the Wolverhampton Caving Group and by 3pm a passage was uncovered at one end of the shaft, it consisted of a slope of scalpings leading to 150ft of cave. This cave after the discovery of footprints, was undoubtably the cave discovered in 1938 and the survey of that date tended to back this up. The only possible way on seemed to be where the stream ran away through sand fill at the end of a small passage. During the following week, Malcolm and some fellow students started work on the sand fill, and by removing the sand a sump was created. It was thought that past an arch there could be seen a passage, but this turned out to be a very small chamber and from this point the dig became a major operation. The cave was surveyed with more detail and also tied in with the Cwmdwr entrance gate by Malcolm, Helen and Ian Anderson. (Figure 3).

Cwmdwr II - The 1991 Series

A Technical Dig

It was then obvious that a more 'serious' approach was needed. The first weekend in December saw the terminal dig attacked using a hired submersible pump. Problems came in a variety of forms, with the SWCC extension cables not having any 110v connectors, the generator not running properly and it having to be jammed opened with a screwdriver, lack of comminications and bad air building up in the small chamber prior to the dig. But the water was pumped out to the surface (about a 9m head) and sand successfully removed. This proved that it could be dug and a lot of hard work was put in by Mike, Catherine, Ian, Bruce, Andy Ward, Brian Clipstone and others.

An application was then made to the SWCC committee to obtain a pump for continued digging operations, and they generously provided a hand bilge pump, which was broken on it's test run. The pump could not handle the amount of head to the surface, so some other way of getting the water out of the dig was required.

A dam was then built, just back from the sump, and to continue digging the water was bailed (the repaired hand pump broke again) with buckets behind the dam. But this sand only version had too many leaks so a second concrete version, the Elsie Little Memorial Dam was built.

On Easter Monday , Malcolm, Dai Bancroft, Jason Tyler and Pete Hall were back digging at the end of the sump, and the dam enabled the sump to bailed completely. During the day the air at the end of the dig got progressively worse, with Pete and Malcolm at the digging face doing quite a lot of panting and gasping (not in the biblical sense). But then at the end of the afternoon, the air cleared and a sizable draught was then streaming out of the end of the dig.

The following week, Malcolm, Helen and Neil Weymouth demolished the old dam and built a third version, with more cement and polythene sheeting with the facility for automatic draining. This would mean that if it rained the water would automatically flow through the dam and into the sump, enabling bailing to take place on the next digging trip.

Through the Sump

On the 13th April, Malcolm persuaded Gary Nevitt, Iain Miller and Eleanor Flaherty to bail the sump again and carry on digging in what was now a cold, draughty, mostly submerged site. Malcolm and Gary (the ones wearing the wetsuits) did the digging, and even though most of the water could be removed, it still filled up quite quickly. The water, which was rather similar to drinking chocolate made spoil removal difficult, but the diggers were drawn on as the passage roof had now started to go back up. At 3.00pm, Malcolm forced his head and shoulders into a small chamber and could then see through a 15cm high sand squeeze to passage beyond. After removing helmet, belt and lamp and pushing against the wall behind, this was passed after about half an hour's digging and thrutching, with the passage beyond leading to a junction. The streamway was littered with small red balls and a yogurt pot, from the Blob Hall borehole. These indicated that Blob Hall would be upstream from the junction, but Malcolm and Iain failed to find it's location, in what was about 30m of crawling passage ending in two chokes. After 15m downstream, there was a chamber on a fault, but which required a ladder to descend into it. Malcolm and Iain returned through the sump to the others and a ladder was then obtained from the club.

Accompanied by Neil Weymouth and Alan Wood, the 13m pitch was then descended into a chamber, which at one end a boulder slope led to a sand filled passage, while at the other a streamway went off. This after 15m, led to a small chamber with a calcited rock bridge across it and contained a sump pool, with crystal clear water entering from the right hand side. The flow here was noticed to be greater than that followed down from the chamber. The canyon type streamway was then followed for about 200m to a sump, with only two small side passages noticed, both blocked with sand after a short distance.

The following day, Neil dived in the upstream sump, but after a short distance the sump became too tight for him to continue with the available gear. The sand dig at the far end of Default Chamber was also looked at and was seen to be promising. Problems with the sump also developed, as the volume of the dam was now too small to hold the contents of the sump and the possibility of both the dam and sump being full was being realised. The sump was also silting up as people passing through were dragging silt into the lowest part of the sump, with Malcolm and Helen finding it rather awkward when they were coming out, especially as it was by now half full of water. A 30m section of bagging was laid through the sump, and the contents of the sump can now be pumped through and down the pitch.

Subsequent Work.

Helen's Horror Improvements.

The next weekend saw more activity, and the on the Friday evening Malcolm, Gary and Iain bailed the sump and improved Helen's Horror, making it larger and digging out a sump pool at one end in which the suction hose was inserted. It took about an hour to pump all the water out, but this can be done quicker, as there have been further design improvements. Also the dam is now left empty, but it will still have it's uses, for instance when there is a pump failure (inevitable) or if there is a small amount of water entering the cave it can be kept behind the dam and pumped through the sump at regular intervals.

This meant that on the Saturday a virtually dry passage could be made through the sump and this was again improved by Gary who spent most of the day digging it out even further.

Survey and Radio Location.

A survey was made of the entire cave by Malcolm, Iain, Steve West and Matt Ward involving 90 survey stations. The lowest point of the cave, the downstream sump was measured at 34m below the top of the entrance shaft. The cave in now about 370m (1200ft) long. Coupled with this Brian Clipstone and Sam were underground with the ariel for radio location, with Stuart France and Jopo on the surface. Both Default Chamber and the Upstream sump were located. Default Chamber was placed in the quarry, west of the borehole, and the Downstream Sump being located 130m west of the shaft, just north of the flat area between Cwmdwr Quarry and the track to the cottages, and is currently marked with a white stake. The estimated depth here is 40m, which allowing for the change in surface height, seems to tie in with the survey. On their travels, Brian and Sam found Blob Hall and the borehole, about 10m up from the junction in Ping Pong Passage. The borehole had intercepted only the side of the passage, and a 10cm shift would have meant that it would have missed it completely.

Climbing.

Steve and Matt also started a climb up towards a north trending tube in the roof of Default Chamber, but were defeated by bad rock and the consequent lack of protection. This climb was then tried by Iain Miller from the top of the ladder pitch, but again there was insufficient protection so on the Sunday, Iain and Steve returned and placed five bolts on the traverse and are now about half of the way there.

A few weeks later, Iain completed the climb but it only led to a blind tube.

Twll Gwynt Oer Water - Dye Trace.

A trace was done over the weekend as well, with Alan Wood placing some dye in Twll Gwynt Oer, and detectors were placed in Ping Pong Passage, the Maine Stream, just down from Default Chamber and downstream from the Upstream Sump.

On the Sunday, Malcolm removed the detectors and found that the Upstream Sump pool a rather nice shade of green, indicating rather positively that the Twll Gwynt Oer water enters at this point. The amount of flow would also seem to indicate this as none of the other inlets are this large and it also makes up the majority of the water reaching the Downstream Sump. The dye was placed at 3.00pm on the Saturday and seen in the Maine Stream at 11.30am on the Sunday. It can be also noticed that while water coming in through Helen's Horror dries up quite quickly, a stream still continues to flow down Ping Pong Passage, although this will also probably dry up in drought.

More Digging.

Malcolm and Brian Clipstone started work on the sand dig at the north end of Default Chamber and this now extends for 8-10m and ends in yet another sump, although it is hoped that this is just a perched remnant as there is no sign of water having flowed out of the pool for quite a while so plans for it's removal are in hand. Other only other dig sites being currently looked at are two sand filled side passages from the Maine Stream, both on the left hand side and heading up dip.

Access.

There are currently no plans to gate the cave, even though it is inside the Reserve boundary (just). It is hoped that any party wishing to visit the cave will first ask at Penwyllt about the current state of access as this could change in the future. The main access 'problem' is Helen's Horror as this will fill rather quickly in wet conditions (how wet is not yet known). The hand pump will not be kept in the cave, but at the club, as it will require regular servicing and cleaning out. A 15ft ladder is needed for the entrance shaft and a 40ft ladder for the Default Chamber pitch. The latter has two bolt belays and a spreader will be required. There are also a couple of natural belays that require a rather long tether.

Future Prospects

There are digging, climbing and diving leads in Cwmdwr II and hopefully the recent effort put in by the eager minority of cavers from SWCC and a variety of other clubs will pay off in further passage being discovered and making this article out of date before it is published. Continued exploration in Cwmdwr II will hopefully provide a way into the cave "discovered" using resistivity [Stuart France and Clive Jones 1990] during the summer of 1990 and this would provide a major extension to OFD heading towards Twll Gwynt Oer, as well as revealing more of the secrets beyond the Cwmdwr upstream choke.

For more details about the work in Cwmdwr II, you can refer to log book at Penwyllt, which records all the digging trips into the cave and other notes about features in the cave.

Acknowledgements.

We would like to thank all those people who helped in putting together this article. Especially Iain Miller for the photo's and the Polytechnic of Wales for it's computing facilities (which will be sadly missed !).

Hopefully everyone who took part in the discovery of Cwmdwr II will approve of the article and those people and others who read it will be spurned on for further 'monster' discoveries.

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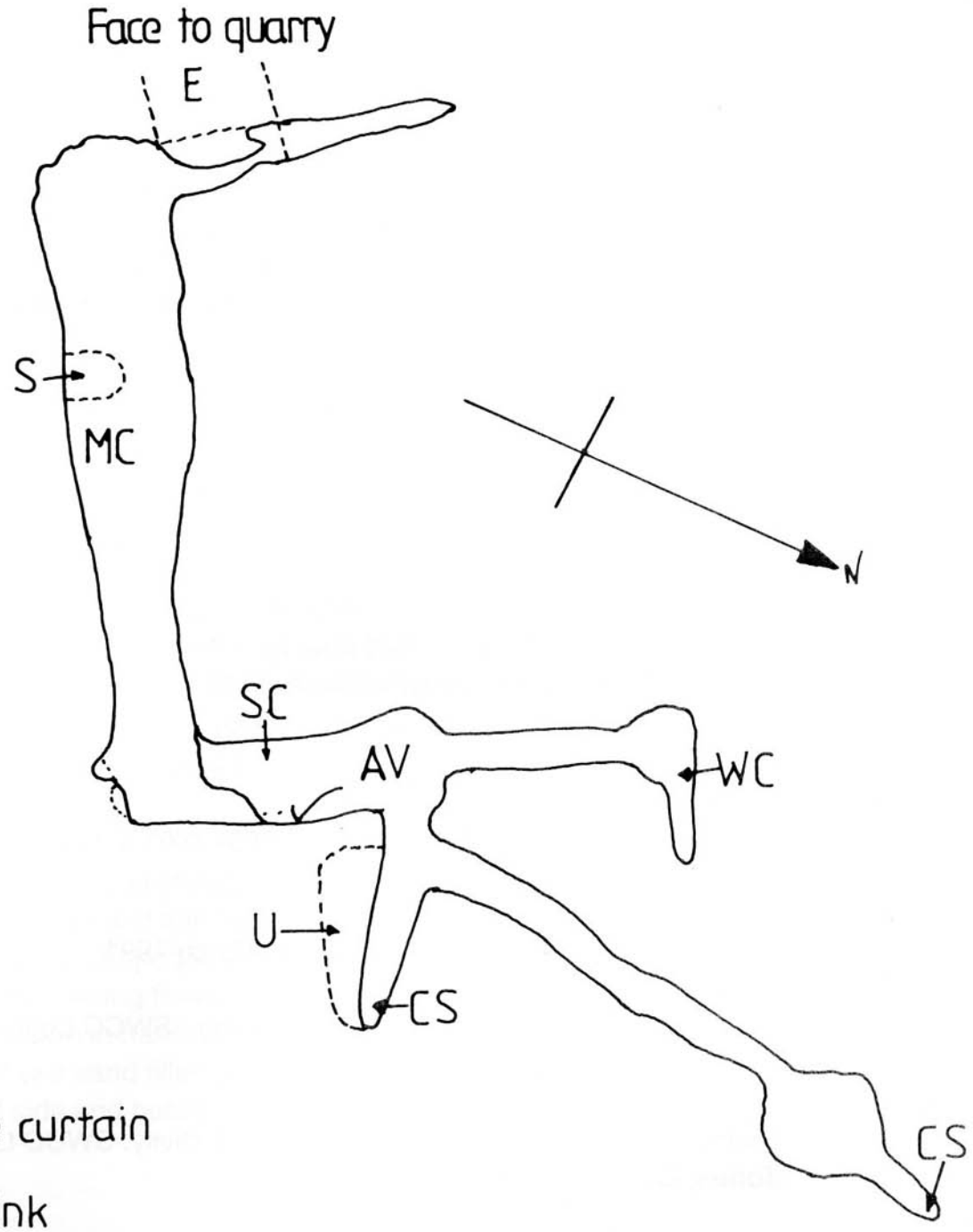
CWM DWR (New) QUARRY CAVE PLAN.

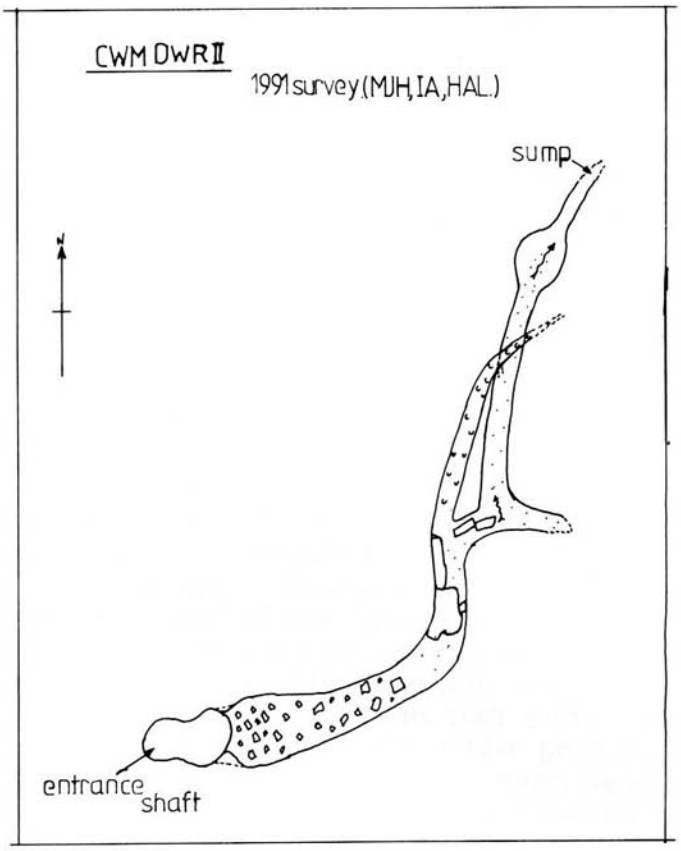
Scale : 1cm to 4ft



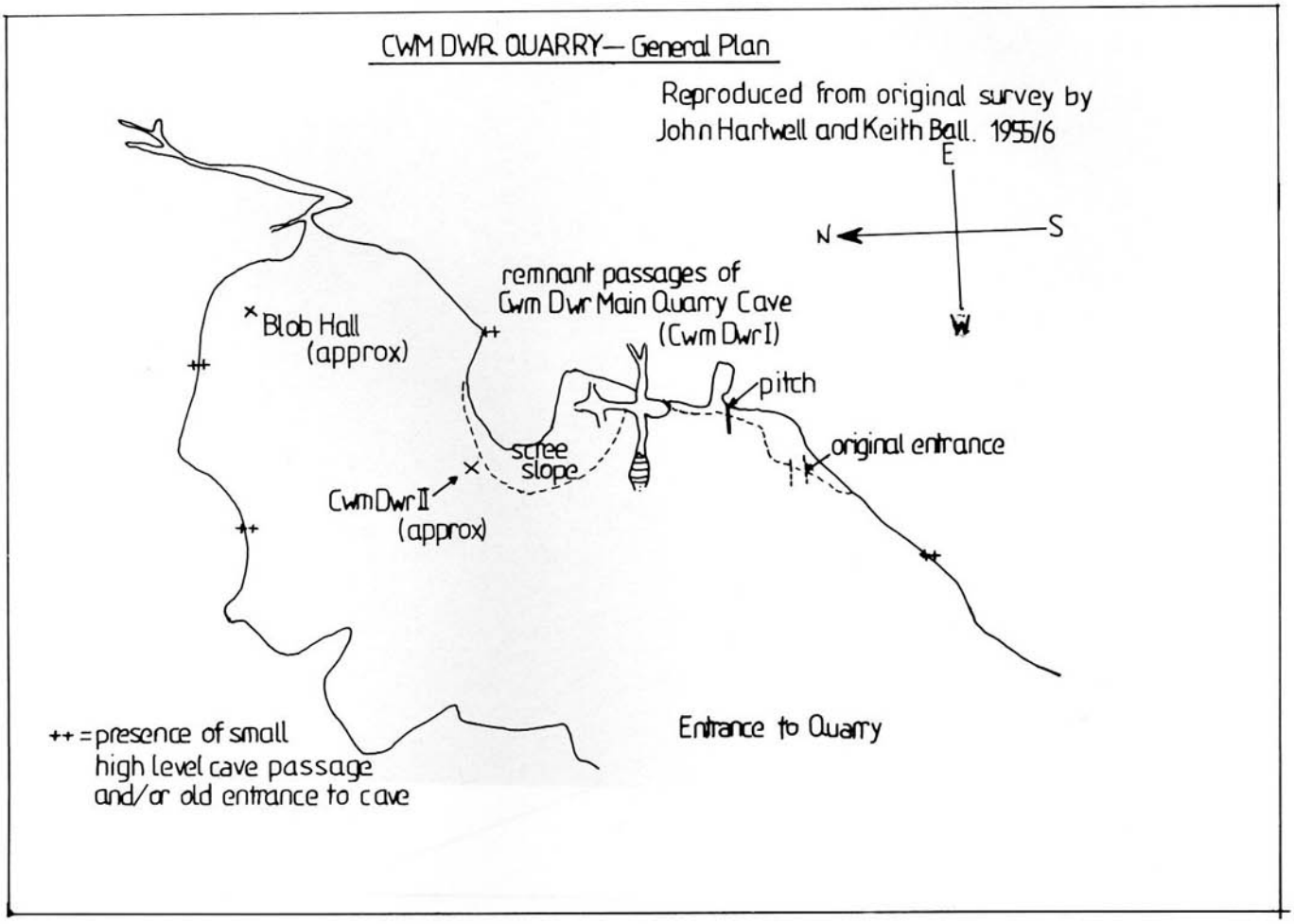
KEY:

E. entrance
SC. stalactite curtain
U. undercut
CS. choked sink
S. sand
MC. master cave
AV. aven
WC. white calcite floor

Cwm Dwr II - The original 1938 survey



Cwm Dwr II - 1991 Survey



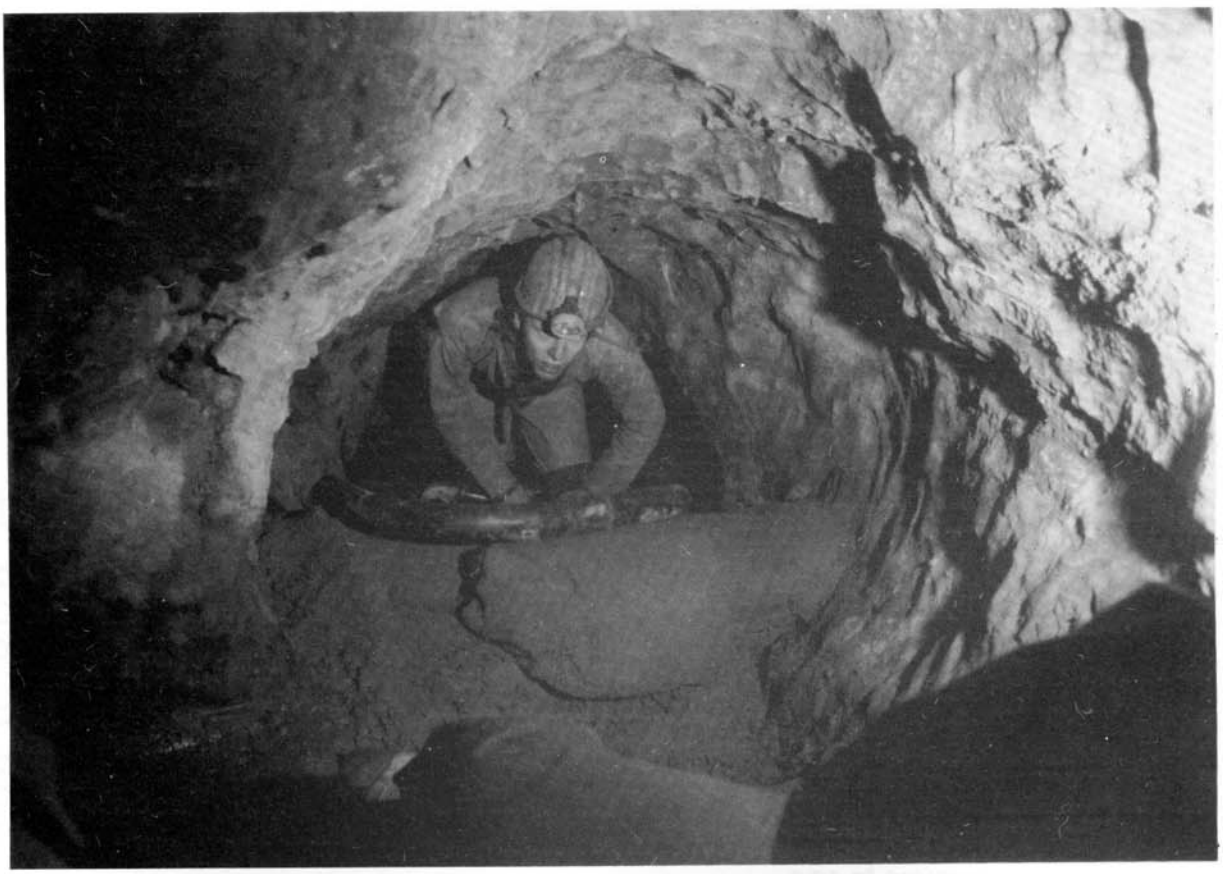
Cwm Dwr Quarry

3D CAVE SURVEY VIEWS

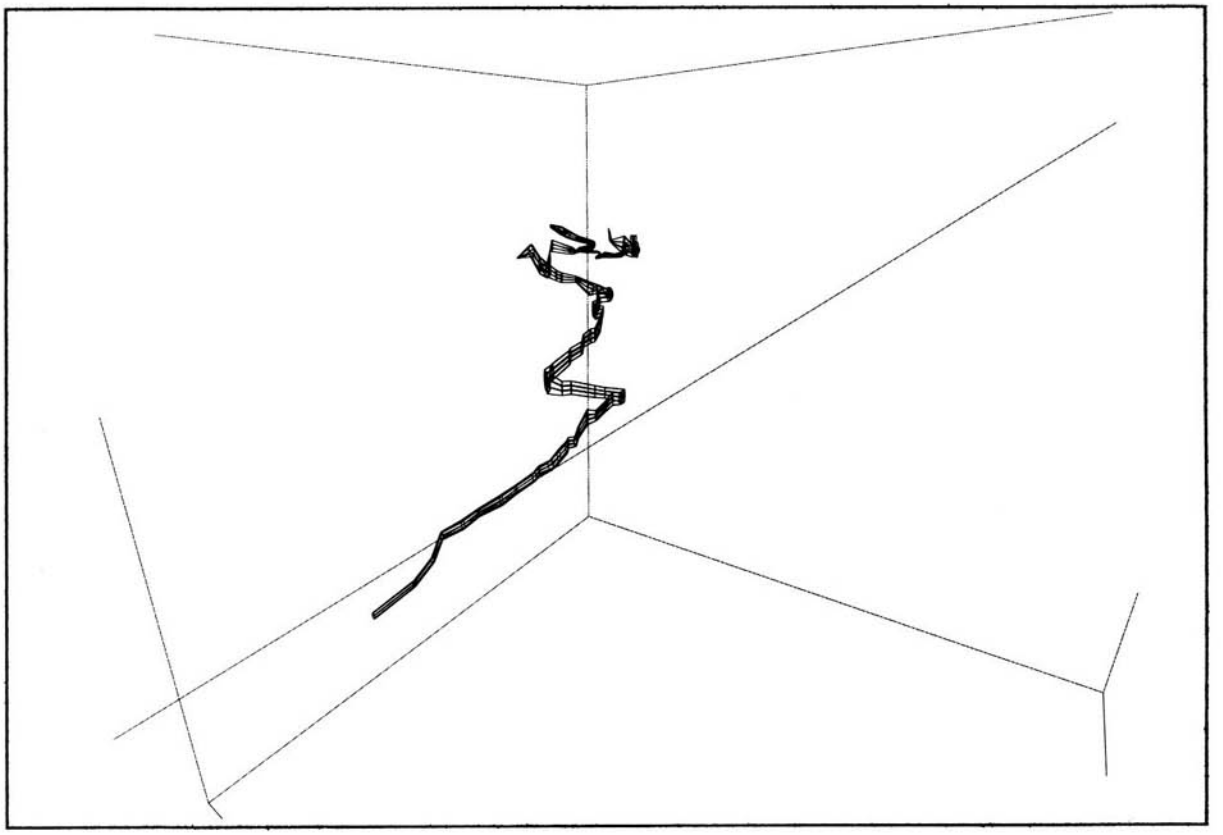
Author's Note, November 1991.

The three-dimensional images of Cwm Dwr II which follow were created as part of my final year for a BSc in Computer Studies. The images were created using a PASCAL program which used the UNIRAS FGL graphics routines. UNIRAS is a series of FORTRAN procedures, which go to make up a powerful set of graphics applications. It is supplied free to all polytechnics and universities, and at the Polytechnic of Wales it is implemented on a DECVAX 8800 minicomputer. Soft copy output was via DECWindows on a VAXStation, while the images shown here were produced on a laser printer, via a PostScript file. Currently the UNIRAS routines are unavailable due to problems created by an upgrade to VMS (the DEC operating system).
Work is continuing with 3D survey images as in other areas of computer-related cave cartography, including plans to standardise all computer based survey data in South Wales.

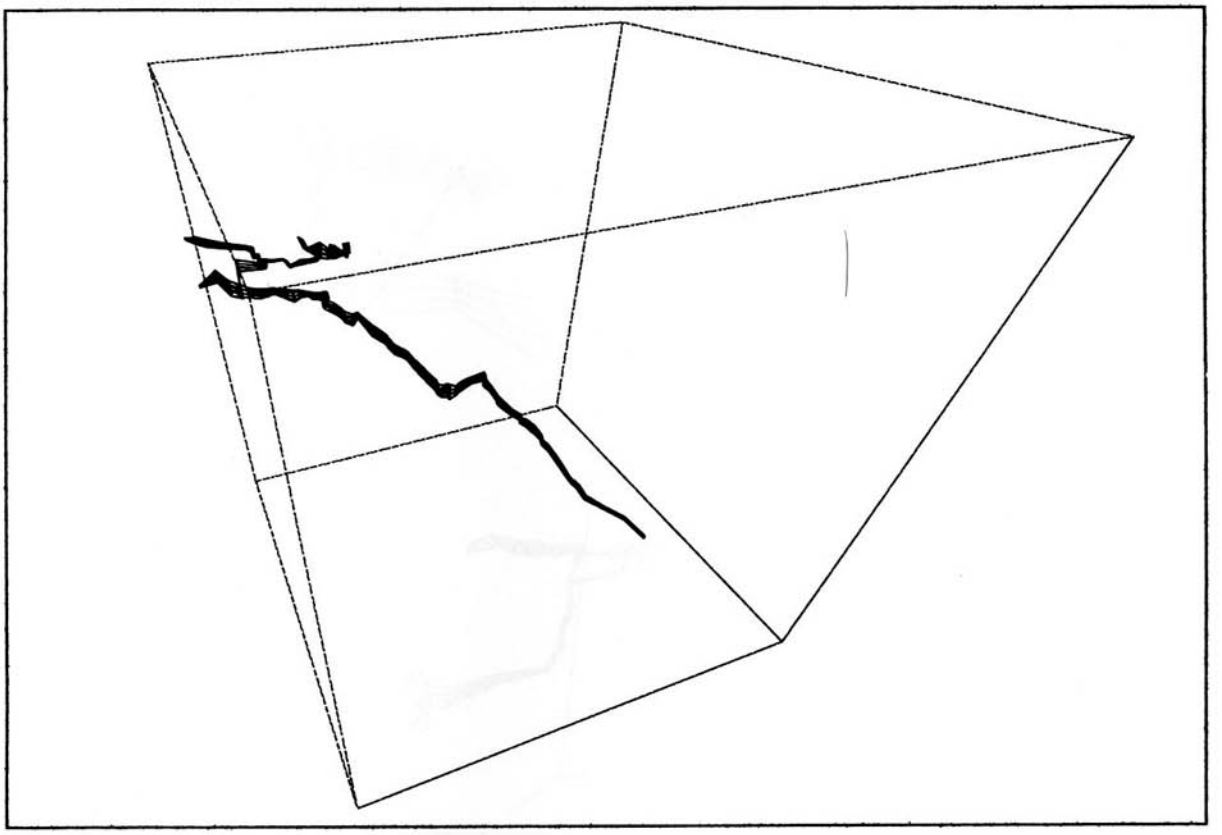
Malcolm Herbert.



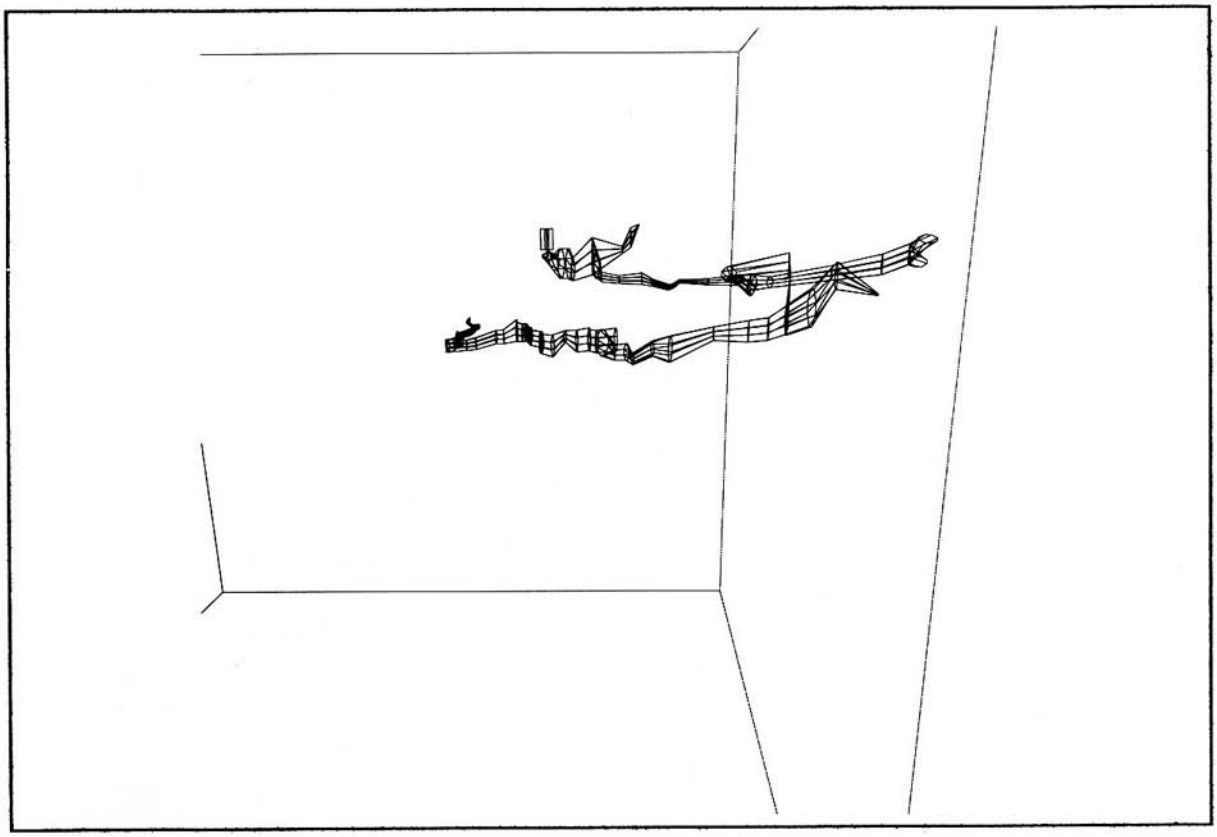
Malcolm at work in Cwm Dwr II Photo: Iain Miller



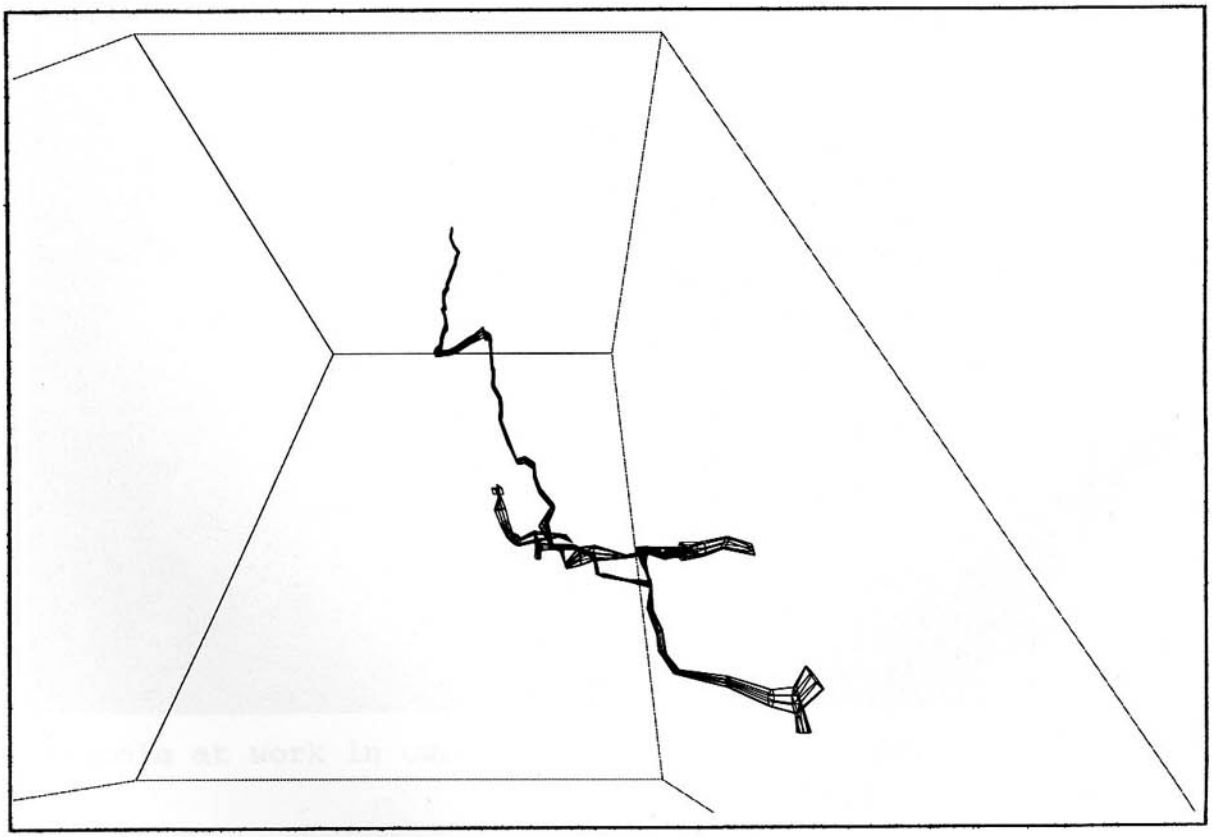
Looking NE at 10 degrees above horizontal. Zoom factor 2.



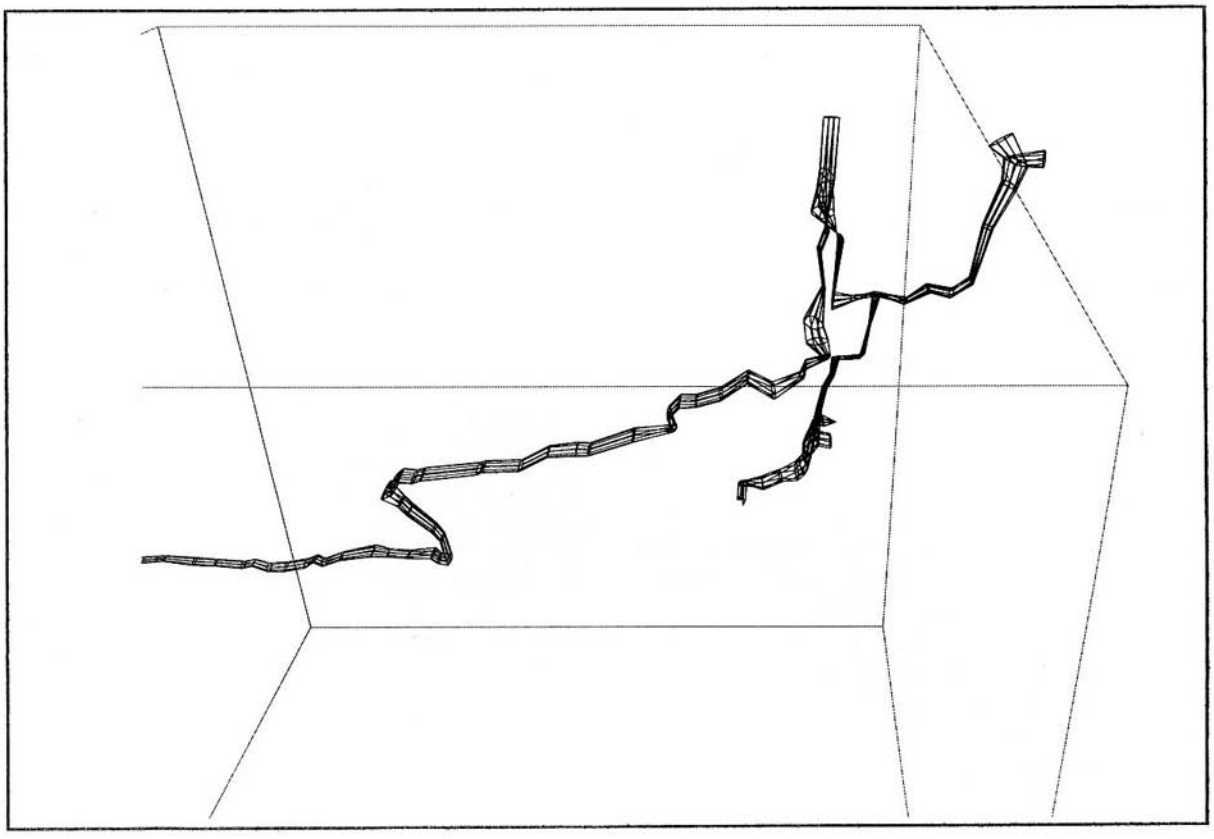
Looking SE at 45 degrees above horizontal. Zoom factor 1.



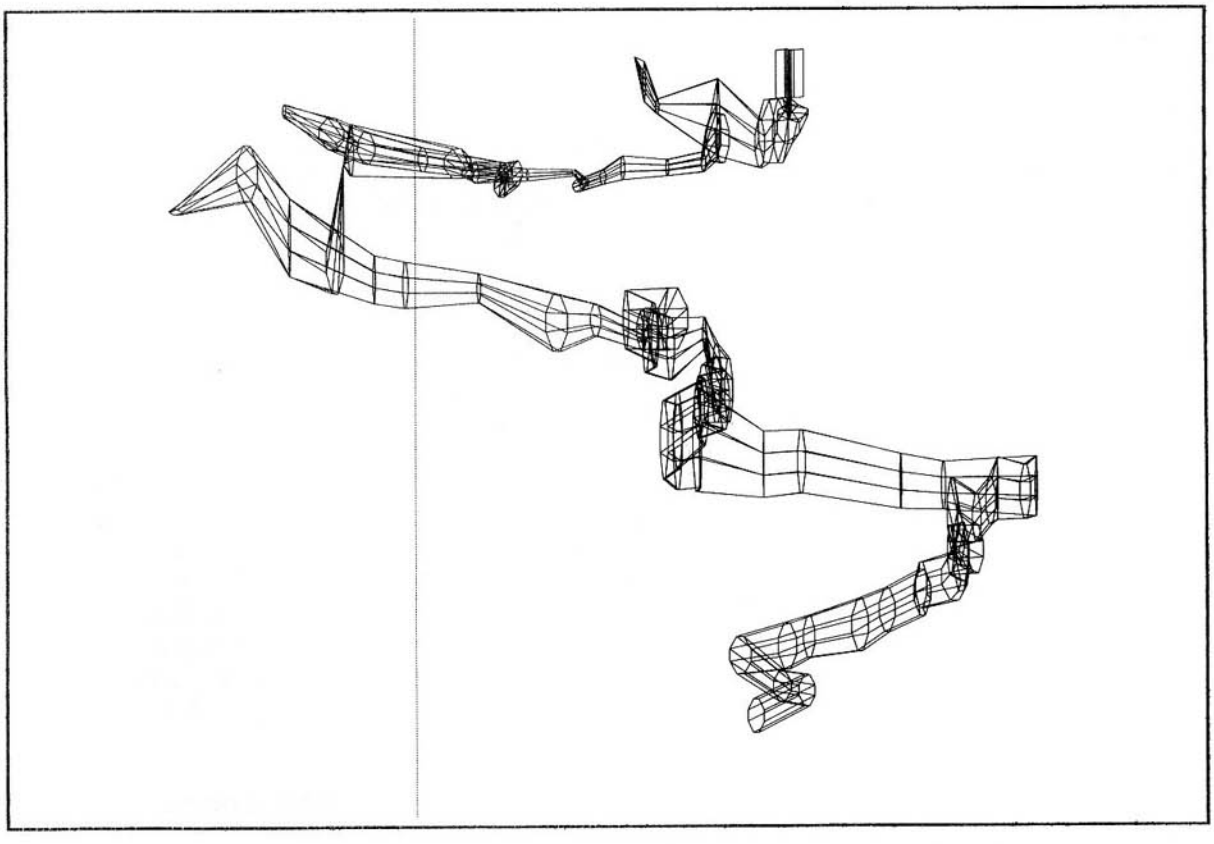
Looking E at 10 degrees above horizontal. Zoom factor 2.



Looking W at 45 degrees above horizontal. Zoom factor 2.

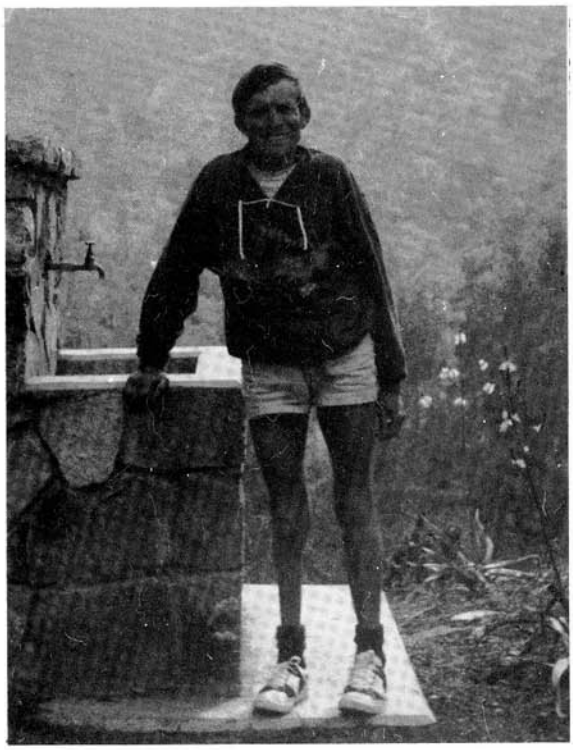


Looking N at 60 degrees above horizontal. Zoom factor 3.



Looking NE at 10 degrees below horizontal. Zoom factor 5.

MR. BRUCE FOSTER



On the 4th June 1991, Bruce Foster sadly passed away. Eric Inson was asked to speak at the funeral service on Saturday 8th June,which many members attended,and his speech makes a fitting obituary.

Bruce was a man of many facets,interests and qualities. Most of us will probably know only some aspects of his character. He was a member of a large family,and was very much a family man with children Dominic,Bethan and Chloe.
He travelled widely,both in Britain and throughout the world - as the son of an RAF Officer,and then during his work as a land surveyor. One useful thing he acquired was a good grasp of languages. He also,as a child,contracted polio,which caused him some physical disability,but this made him more determined to succeed and to compete with others on equal terms,especially in caving.
Bruce was born in Cambridge,went to school in Hampshire,South Wales and Northumberland,and also lived in Germany and Southern Africa. His work took him to many places,including Malawi and Saudi Arabia. His first job was in Banwen,only a short distance from Abercrave,and following his return from Malawi,he moved to Abercrave in the early 1970's,and hence lived in Wales longer than anywhere else.
I first met Bruce in the mid 1960's,when he came caving as a student with South-West Essex Technical College. He then joined SWCC,and was very much involved with the great discoveries in Dan-yr-Ogof and Ogof Ffynnon Ddu in 1966-7. Along with Eileen Davies and Alan Coase,his picture was in many newspapers and magazines following the Dan-yr-Ogof breakthrough,and he took up cave diving especially to get into Ogof Ffynnon Ddu,as this was the only way in 1967.
Once Bruce had settled in Abercrave,despite his work taking him to places like the North Sea,he became part of the local scene,both in caving and non-caving activities. Originally he lived at Golygfa Gwaith Nwy (Gasworks View) then moved to 135 Heol Tawe. In doing so,he took on the mammoth task of improving the property whilst still continuing with all his other activities,and earning a living.
Some his activities included;

- Parent Teacher Association work with both the local primary and comprehensive schools.
- Help at the Penrhos Youth Centre,and acting as Scout leader for the Caehopkin Scout Group for some time when they were

short of a leader. (In both of these he introduced young people to caving)
- He was a member of the Territorial Army for some time.
- He was also interested in Politics,was a member of the SDP and later the Alliance,and engaged in canvassing work during elections. Bruce's house was always well decorated at election time.

In recent years,Bruce's main interest and energies have been in promoting cave rescue,in all it's aspects,and he was always the first to turn out for animal rescues,whether it was a sheep trapped on a cliff or a terrier lost in a culvert. His name was number one on the local RSPCA list.

Bruce always maintained that cave rescue should become independent of SWCC, and this has now happened. He was never interested in committee work,preferring to get on with the job,and was always active.

Some of his rescue activities were;
- Organising and maintaining equipment.
- Acquiring equipment such as lamps and chargers from closing collieries.
- Help with practices and training sessions.

But let's not forget the most important aspect: organising actual rescues. With local call-outs,Bruce was always the first to turn out. He was a very able controller - you could rely on his analysis of a situation,and his decisions about the best course of action. Personally,I always felt comfortable when responding to a call-out when Bruce was in charge. He was also very good at co-ordinating with both the police and the press.

The need for a new rescue vehicle involved Bruce in much new activity in fund raising. While other people were talking about how to raise funds,Bruce was out there doing it - selling lamps, splints,flasks,and clothing,and persuading other bodies to make donations or give grants. In all of this,Bruce was very actively supported by Annie.

Bruce was always present at club social events,making a valuable contribution - someone else will have to learn the words of songs such as "Lilian" and "Caving Matilda".

Bruce was elected an Honorary Member of SWCC at the last AGM. However,no-one had told him he was being proposed,and he only found out when he received the notice of the meeting. A slightly puzzled and worried Bruce asked me: "Why have I been proposed? I haven't done much for the club,all my efforts have been to do with rescue." It took me some time to persuade him that he had done much for the club,and that his work for rescue was very much in the club's interest. Subsequently he admitted to feeling very honoured and pleased that he had received Honorary Membership, and that people thought so much of him.

I will conclude by saying that all of us - Bruce's family,the club,the rescue service,the local community - have suffered a great loss. I am certain that I speak for everyone when I say that I feel honoured and privileged to have been a friend of Bruce's.

Eric Inson,June 1991.

A GOWER COAST CAVES SURVEY

by Melvyn Davies

The south-west coast of the Gower peninsula between Worms Head and Pwlldu Head is 11 miles long and consists almost entirely of carboniferous limestone. It contains a large number of caves (ref.1) and many of those above high water mark are archaeological. The greater part of this coast is owned by the National Trust while two sections of it are leased to the Countryside Council for Wales as a National Nature Reserve.

As warden it was my very pleasant duty over the period 1987-90 to visit all the caves and prepare an assessment of their archaeological value. Two internal reports were produced for CCW covering 97 caves,and 13 of the most important caves were included in a recent publication by BCRA (ref.2).

A committee has been set up called the Gower Caves Advisory Group with representatives from Cambrian Caving Council, the National Trust,CCW,and archaeologists from the Royal Commission on Ancient Monuments and the National Museum of Wales. Following consideration of the various reports and 2 field visits the National Trust decided to organise a more detailed survey of the caves. The survey took place from 16th to 28th September 1990 and was carried out by 8 members of a volunteer team set up by the Trust's archaeologist Dr Emma Plunkett Dillon, together with geologist Dr Graham Jenkins, and two of us from CCW. A full report has been produced which may be consulted by cavers. The volunteers comprised a biologist, an archaeologist,a surveyor,a geographer and 2 undergraduates, as well as 2 men who were devoting their annual holiday to the project.

It is believed that this is the first detailed archaeological caves survey and 'teach-in' ever in Britain as earlier work was always concentrated on a single site. Also modern surveying equipment of astonishing accuracy was employed,and all participants benefitted both from the training and experience in cave survey,and in the identification of a prehistoric bone cave.

Only caves on National Trust property were surveyed,and even here,important sites like Lewes Castle Cave,Red Fescue Hole and Leathers Hole had to be omitted for lack of time. Although Lewes Castle Cave was explored,equipment failure prevented any measurements being taken. Red Fescue Hole and its obvious occupation evidence was demonstrated to some members of the team.

PLANNING THE SURVEY

Upon arrival team members were supplied with a sheet describing the aims and method of the survey. Dr Graham Jenkins gave an illustrated introductory talk putting the aims in the context of

current studies into past sea levels. M Davies followed with a talk on cave archaeology in Wales,and Dr Emma Plunkett Dillon described what the National Trust expected from the team. She also attended for three days including the de-briefing session on the last day. The 97 caves already known were divided into 9 groups for survey,but due to lack of bench-mark data,faulty equipment,and the need for training in methods to be used,only 3 groups were covered.

THE EQUIPMENT

In the first week an EDM (Electronic Distance Measuring) instrument was supplied by the National Trust fitted to a theodolite capable of measuring to one second. Unfortunately errors began to arise in using the EDM and it became clear that it needed mechanical repair. No results obtained using this instrument were included in the final data. At the same time a Sokkisha auto-matic level was being used for work inside caves, but it proved too slow for levelling from the cliff top down to the cave entrances. In the second week a Geodimeter 420Lr became available and it proved to be reliable and extremely accurate. It was employed for putting in all the TBMs (Temporary Bench Marks) and heighting cave entrances,but it was not taken down from the cliff tops to the caves to avoid any possibility of damage. This Geodimeter was also used to confirm results obtained with a similar instrument 5 months earlier,and no discrepancies were found. A Suunto compass,clinometer (both +/- 0.5 degrees) and tape were used for cave interior surveys, and these are obviously less accurate. The South Wales Caving Club are to be thanked for lending this equipment for the survey. A portable electric drill was used for drilling holes to take permanent 3/8 inch bolts at the cave entrances,but it's charger proved faulty for some days,and a few sites are marked only with paint spots.

SUMMARY OF RESULTS

Working from 4 Ordnance Survey Bench Marks a total of 10 TBMs were marked on the Gower coast platform,and altitudes determined for 14 caves. Floor plans,varying in accuracy,were drawn for 7 caves,and a profile drawn for 4 caves,the greatest care being lavished on the important sites Minchin Hole and Bacon Hole.
The actual archaeology of the caves was only examined cursorily, but some instances of damage or disturbance were noted,in part--icular digging of small holes by metal detector users in Minchin and Bacon Holes,also in Bosco's Den. In all probability,due to the extent of previous excavations,this has caused no real damage.
In one case urgent official excavation was recommended in order to recover human bones which have been rendered visible through erosion. This was Spurge Hole,and the bones were carefully covered over with earth.

FUTURE WORK

Time did not allow the recording of floor details for the large and important caves Minchin Hole,Bacon Hole and Bosco's Den, however the original A3 plans are available and can be used in the caves when marking in what is left on the cave floor. The limits of previous excavations are easily delineated, e.g. the cut edges of stalagmite floors are still prominent,and old trenches are now marked by slight subsidence. Also archival records held by M Davies (and possibly by J G Rutter of Oxwich, Gower) are available for filling in details. It is considered that floor plan details should be filled in as soon as possible, and photography used to record cave entrances and contents. Using the Minchin Hole plan it may even be possible to add excavation details from the work by Mason and Rutter in the 1950s which was never published in full.

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A REVIEW OF ARCHAEOLOGICAL CAVES IN BRECKNOCK

by Melvyn Davies

The area covered in this review is the old county of Breconshire, in which archaeological caves are few in number despite much digging by potholers. Massive excavations in cave entrances like the one at Ogof Craig-a-Ffynnon (a cave now just outside the county boundary) failed to yield any bones, and the smaller excavations at Agen Allwedd, Ogof Gynnes and Porth-yr-Ogof among others were equally bare. Of the six caves to be described here only in two cases was the excavation a planned search for archaeological remains, and only one was successful.

OGOF-YR-ESGYRN SN 8378 1604

Also known as Bone Cave in the Dan-yr-Ogof Show Caves, it appears that R H D'Elboux had his attention drawn to it in 1922, and he commenced excavation the following year with his students from the University College of S. Wales and Monmouthshire (now UC Cardiff). The finds were rich, far richer than anything else to be described here (ref.1), and all were ascribed to the Romano-British period. Unfortunately the associated human bones, some found in close proximity to fourth century pottery, were said by a famous pathologist of the day to be

> "hardly more than medieval in date"...

This may account for the lack of interest shown in the cave until 1938 when Edmund J Mason started a long series of excavations, helped by fellow members of the South Wales Caving Club and under the general supervision of the late Professor W F Grimes (ref.2). He found evidence for a Middle Bronze Age III occupation which was probably domestic, and a Romano-British occupation which was in two phases. This latter period had seen the burial of some 40 people in the cave (ref.3). The site has now been converted into a remarkable archaeological show-cave. Realistic figures are portrayed in the act of excavation based on Mason's work, while other figures represent a Bronze Age family cutting up meat for cooking.

EGLWYS FAEN SO 1926 1566

An excavation here was thought desirable because the cave, just south of Crickhowell, was known to have been open since at least early last century (ref.4), and increased use by potholers was thought to be destroying sediments. A tradition that the cave was in use during the Chartist riots has not been supported by hard evidence. A passage in the eastern series was selected and a trench opened in April 1971 by the author assisted by staff of the Nature Conservancy (the cave is on Craig-y-Ciliau National Nature Reserve). Under a hard layer of stalagmite a stoney wet clay was present across a tunnel about one metre wide and 0.75m deep, but it was not archaeological. Inspection of clays and sands in the great Entrance Chamber of the cave has proved equally unrewarding.

CHARTIST CAVE SO 1273 1519

Known to Theophilus Jones as "Stabl Fawr" because horses were in the habit of taking shelter in it,locals also call it Ogof Fawr. The entrance must have collapsed somewhat since the last century for what remains today would be too low for horses. Human bones were encountered in the cave, high on Mynydd Llangynidr,when R.G.Lewis and other members of Severn Valley Caving Club were digging at the back of the cave in search of an extension in 1970. Accompanying the bones were many animal bones,a clay pipe,coal,and a flat stone with a round hole through it. A pathologist reported that the human bones were comparatively recent being no more than 50 to 100 years old although there may have been fragments from more than one individual (ref.5). An inquest was held and what with police disapproval and the lack of archaeological evidence, apart from slight confirmation of Chartist period use, Lewis abandoned his excavation.
Unhappy with this conclusion the author wrote to Lewis in 1976 (ref.6) and received a reply within 2 days (ref.7) which unfortunately threw no further light on the subject,the animal bones having been discarded without proper examination. It is still possible that an archaeological layer with human and animal remains had become contaminated with 19th century deposits,so the cave awaits further study.

POWELL'S CAVE SN 8498 1533

Sometimes known as Penwyllt Cave, this is a large tunnel alongside the road from the A4067 to Penwyllt village, with a second opening higher up the hill. Sometime in the 1970s it was excavated by members of the South Wales Caving Club in pursuit of an extension,and bones of bear were found. There is no further information available. Such a large entrance must have been open for a very long time and it is possible that occupation evidence might be found if a full excavation was performed.

TWLL CARW COCH

No grid reference can be given for this cave as its exact location has not been revealed. It is an excavated shaft somewhere on Cwm Cadlan north-east of Penderyn,dug some years ago by J C Jones of the South Wales Caving Club (ref.8). Human bones as well as bones of dog and red deer were found,and the youngest human skull was claimed to be about 600 years old. Later on a radiocarbon dating on a bone was said to be 4,000 years old, but nothing was published. The finding of human and animal bones throughout a shaft 35ft deep was said to have baffled the visiting archaeologists, and the enterprise was abandoned.

OGOF FFYNNON DDU

Top Entrance - SN 8635 1589
Bottom Entrance - SN 8476 1514
This vast Swansea Valley cave was dug open by members of South Wales Caving Club one day in 1946. During their explorations in one of many dry side-passages they descended through a hole in the floor entering a small chamber which contained a human skeleton. This was examined next day by Edmund J Mason (ref.3) who decided that the skeleton had entered the cave via another, unknown entrance and had fallen, without injury, through the hole into the chamber. Because the drop was some 8ft he had been unable to climb out again. Nothing was found with the body; photos were taken by Mason and for the National Museum of Wales, and then the find became mixed up with a local legend about a traveller who had entered the cave, again through some unknown entrance, and never came out.
Not content with this explanation, the author visited the spot in October 1976 and examined the Museum photograph kindly provided by Dr H.N.Savory. A rather similar photograph was published by Mason (ref.3) but the actual bones have been lost. The state of the bones suggested immediately that they were much older than local living memory or legend. Also,to have penetrated that far into the cave,the explorer must have had a reliable light, and the simple placing of a few stones would have enabled him to climb out from the chamber. The chamber itself was sealed by clay at the lower end, but the upper end consisted of a roof fall comprising slabs, Devonian sandstone cobbles and stalagmite. The author concluded that the skeleton had been introduced into the cave before the time of the roof fall and must therefore have been many centuries old. The condition of the bones was consistent with cave burials excavated by the author elsewhere dated variously to the period Neolithic - Romano-British (ref.9).
One further discovery is associated with Ogof Ffynnon Ddu. When members of South Wales Caving Club dug their way through an ancient collapse into what became the Top Entrance of the cave in September 1967 they found a horse skeleton partly cemented in stalagmite at the foot of the entrance slope. It was examined next day by the author and later part of it photographed. As horse had died out in Wales by the Mesolithic period, the skeleton must have been something older than 6,000 years. Unfortunately a full anatomical description was never published and the bones are believed to be lost.
In 1970 two flints supposedly found in Ogof Ffynnon Ddu were examined by Dr H N Savory. One was a core of grey flint from which microliths may have been struck while the other, found 8ft away in the same streamway, was a flake of different material and date. The find was never published and it has not been possible to locate the exact find-spot (ref.10).

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Melvyn Davies
Gower

9 October 1991

REGENERATIVE BRAKING SYSTEMS IN S.R.T.

by Frank Salt.

Author's Note; The article which follows,although mechanically correct,has to be taken with a pinch of salt.

As a person who first cut his teeth on hemp rope ladders in the 1950's I have seen a number of changes in caving techniques and equipment over the years. These changes,although they have lightened and reduced the bulk of the equipment dragged through the cave,have done little to reduce the physical effort needed. This effort,alas,increases with age and weight,in my case at least. Recently,whilst looking into possible lifting methods for rescue work I examined a small air motor. A small three cylinder radial device,it was less than 150mm. diameter,and required an air supply of around 700 Kpa (100 psi) to drive it. It occurred to me that if the unit was directly coupled to a capstan,a small air winch could be produced that would give a 110 kg pull (70% effiency) - a useful effort if one is trying to lift a stretcher up a shaft.

Of course,compressed air isn't readily on tap in a cave or on a cliff rescue,but developments over the years in the field of diving have produced some lovely lightweight compressed air bottles. A 40 cu/ft. bottle mated to the air motor via a variable pressure regulator quickly produced the basis for a system that would lift 100 kg a distance of 100m.

The project would probably have rested at this point had I not been visited by a Texan caver. He described in detail a Texan expedition to some of the deep pits in Mexico. There,motorised ascent devices (M.A.D.) had been the order of the day,and were so popular that the last members of the party to ascend were in danger of carbon monoxide poisoning from the exhaust fumes! He felt that the application of the 1992 exhaust emission standards to MAD devices would probably ease this situation,as would their conversion to run on LPG.

At this point,I suddenly realised that in the air winch system we had an environment-friendly MAD technique. By chest mounting the capstan winch on an alloy breast plate,it was possible to lift oneself vertically with only the hiss of compressed air. The diving bottle on one's back neatly counter-balanced the air winch on the chest,and the rope,which was wrapped around the capstan, was passed through a jumar for safety.

This system,of course,tended to be bulky and heavy (40 kg), and required regular visits to the dive shop for "top-ups". Then one day I was reading an automotive magazine,which contained an article on a new bus made by Scania. Here,the bus braking effort was stored and re-used to supplement it's forward power. I saw instantly that that this regenerative braking system could be applied to the MAD device.

By varying the diameters of the three pistons in the air motor in the same manner as the pistons in an aqualung compressor,it has become possible to use the motor in a dual role. Thus,one can abseil down shafts using the motor as a friction device, compressing the air and charging up the diving bottle in the process. The compressed air can then drive the unit in reverse,lifting the caver back up the shaft.

Because of the Second Law of Thermodynamics,one can't of course rise to a level equal to the descent. However,this problem was solved by holding a 50 kg rock which was abandoned at the bottom of the cave. This extra weight on the descent enables more energy to be stored to overcome the shortfall required on the way up. (As one has no wish to see caves slowly fill with 50 kg rocks from this technique,a large rubber bag for water ballast could be used in wet caves.)

Further energy conservation is also being studied,where excess heat produced when running the air motor in descent mode can be used to help keep the caver warm. At the same time,the refrigeration effect noted while using the compressed air in drive mode has been successfully tapped to keep an esky cool. The bulk of the current equipment,and it's weight (100 kg) makes it very difficult to take caving; then again,one has to have a project for one's old age.

I am sure that the next generation of cavers will be able to take up the challenge,and with the aid of technology produce a self-contained system that can take itself caving,leaving one free to do other things.

EQUIPMENT AND TECHNIQUES

Once in a while you come across really good techniques or novel equipment ideas which ideally are simple,effective and cheap. This column is for publishing these for the benefit of all,and I am starting it off with a few choice items and hope that others will contribute ideas in future Newsletters.

Stuart France

OLDHAM LAMP LASTS 50 HOURS ON MAIN BEAM

A 4 volt Oldham lamp can be made to run on main beam for 3 times longer than normal by fitting a 6 volt 2.4 watt halogen bulb in place of the standard 4 volt 4 watt bulb. The amount of light is obviously less,but it is quite acceptable and similar to the performance of an FX2 lamp.

CYCLON CELLS

Two 5 amp-hour 2 volt cyclon sealed lead acid cells (£5.75 each) fit in a compact diecast box and give up to 15 hours on main beam with the 6 volt bulb described above. The cylindrical construction with a polythene tube enclosed in a metal outer makes Cyclons much more mechanically tougher than Yuasa batteries which are ABS plastic boxed and known to give problems after hard mechanical shocks. Also,2 cyclons equals a 4 volt lead acid battery,so they are compatible with Oldhams for cyclic recharging. Indefinite float charge is also possible with a slightly lower charger voltage. I have a prototype on trial now and these will probably be the basis for the next generation of club hire lamps.

BEST KNEE/ELBOW PADS EVER

This Rock Steady Crew invention for Daren Cilau trips is simply unbelievably comfortable and effective. Buy a metre length of Size F Tubigrip bandage from Boots (about £2) and cut it into two lengths. Cut two pieces of good quality Karrimat roughly 25x15cm. Wear the Karrimat in direct contact with the knee, lower femur and upper tibia,and hold it in place with the tubular support bandage. It will stay in place all day. Use size D bandage for elbows. Wear the normal pull-on neoprene pads on the outside of your caving suit as well.

DAREN DRUMS

Ammunition boxes though waterproof are heavy,cumbersome and inefficient in terms of volume carried per man. BDH bottles do not have reliable seals and are rather too long for their diameter. The easiest way to carry gear underground is in a tackle bag,and one which is a well-packed sausage shape is easiest to move whether on or off your back.

Enter the Daren Drum. This is a very tough plastic cylindrical drum about the same diameter and half the height of a medium size tackle bag. So you can fit two in a tackle bag with some Karrimat packing all around. The drums have a wide diameter screw down lid which is water-tight and it should be secured with a wire against unscrewing in transit. I hope to have a supply soon for sale in aid of cave rescue funds.

HOW TO PACK A BOSCH DRILL

There seems to be no drum or ammo box of a convenient size for carrying a Bosch drill. A length of lorry size tyre inner tube sealed at both ends with Jubilee clips will provide the water-proofing,and wrapping this in a large sheet of Karrimat held in place by snoopy loops (tough rubber bands cut from a tyre inner tube) will provide shock-proofing. A couple of Yuasa 12 volt batteries, wiring,and bits will fit into a Daren Drum. Then it can all be carried quite easily in a single tackle bag.

And finally, to end this first Equipment and Techniques column, here's one from the Editor...

PACK A BALACLAVA

I won't claim this as an original idea, as it's something I've seen other people do on several occasions, but it's so effective it seems a shame not to pass it on. Fleecy balaclavas are now made by several manufacturers of outdoor clothing, and have a big advantage over the more traditional woolly type,in that they take up very little space. They can therefore be carried easily in a small polythene bag inside a caving helmet or oversuit pocket, ready to put on when hanging around - while waiting at the bottom of a pitch, for example, or on a digging trip. I borrowed one for the recent trip to Italy and was amazed at the difference it made. The benefits are psychological as well as physical, and I didn't feel cold at all, even while waiting for quite long periods on SRT trips in the very cold Alpine caves. The material itself is thin enough for the helmet to be worn at the same time. My balaclava has now become a permanent part of my caving kit, and will be in my helmet on every trip, as unforeseen circumstances can often lead to a long wait (the gate mechanism on Top Entrance failing, for example!). Good quality examples cost around £15 but this, in my opinion, is a wise investment; after all, in a rescue situation the onset of cold is often a major factor and a balaclava could make all the difference.

Tony Baker.

Photo: Sue Williams

Now that the ball has started rolling, send your useful tips on equipment and techniques to; Tony Baker, Flat 2, Joanne Court, Hill View Road, Twickenham, Middlesex, TW1 1EY.

LETTERS TO THE EDITOR

DUTY OFFICERS ARE NOT NEEDED

The club has for a long time operated a system of Duty Officers at weekends mainly to perform two functions: issue cave keys and collect money. But the system has ceased to work as originally intended,due to lack of support.

Most active cavers have more interesting things to do than spend their weekends sitting around the cottages looking after hordes of visitors from other clubs,tidying the place up and chasing people for cash. Hardly surprising is it?

The May 1991 AGM voted by a small margin to allocate weekends to active members and demand they attend as Duty Officer,and to make it that individual's responsibilty to find a replacement if the date allocated was inconvenient. The committee,it seems,is now trying to put this idea into practice.

One can but wonder how such compulsion is intended to be enforced. What kind of service can be expected from conscripts? Prohibit refuseniks and non-attendees from using the cottages or throw them out of the club? How much bitterness and shame will this leave?

One simply cannot compel anyone to do voluntary work. Driving active members away will not help solve the problem. The Duty Officer system is obsolete and no longer appropriate,not widely enough supported,and needs replacing. I have two suggestions here to stimulate a wider discussion and hopefully produce some more carefully thought out proposals over the next few months.

As to keys: adopt a system whereby bona fide clubs (or approved leaders in the case of some caves) request keys in advance through the post,and regular visitors can be issued with annual keys at their own expense. SWCC members would continue to use the keys in the cottages as "annual club keys" on a self-service basis. This system permits access for local clubs mid-week. The paper permit for DYO should stop since it serves no useful purpose: quite often committee members are not present to sign permits and the criteria for issue are arbitrary,if they exist at all; the whole exercise is a pretence.

As to money: adopt a system whereby visiting clubs pay in full by cheque at the time of booking,and all casual visitors have to be signed in as members' guests. Members pay their own and their guests' fees by signing a personal "credit account card" kept in the cottage. Members may also obtain surveys and so forth on credit. From time to time each member is invoiced for the amount owing,and members settle by cheque through the post. This is modern,cashless and civilised.

Finally,if the committee cannot stomach the end of the Duty Officer system,they could instead exercise just a little restraint and shorten their meetings to one hour instead of four hours,and the extra hours then made available would supply Duty Officers for six months of the year,which cancels the present shortfall.

Stuart France.

Editor's Footnote: While I'm not going to take on the role of official apologist for the present system,there are a few flaws in Stuart's argument which need to be dealt with. Firstly,the DYO permit system exists at the request of the showcave management,

by whose permission we have access to the caves: any change to the current system would need their approval. The criteria for issue of permits are by no means arbitrary; access to DYO is available to SWCC members,and to approved guest leaders who are permitted to take only members of the club for whom they are nominated.
Stuart is also wrong to suggest that "quite often committee members are not present to sign permits" - a weekend when no committee member is at the club is extremely rare; check the hut sheets for evidence of this.
Also,a system where cave keys were sent all over the country would require a great deal more administration than the present one,and would present a serious security problem. Giving a club their own key on an annual basis creates problems,too; as a former member of a club who had their own key to Agen Allwedd I could tell of many difficulties encountered when the custodian of the key is away on holiday,or when no-one knows who last used it.
(Just as with DYO,remember that SWCC only administers access to Ogof Ffynnon Ddu on behalf of an outside body,in this case the Countryside Commission for Wales. The club can only recommend changes.)
With regard to the money system; well,by the beginning of October nearly fourteen hundred pounds was still outstanding from unpaid subscriptions - this would seem to indicate that Stuart's proposed method of collecting hut fees from members would create a major headache for whoever was running it,apart from the obvious work involved in sending out all the invoices. There would also be bad feeling caused if,say,a member was sent an invoice for more than he calculated he owed,and in chasing late payers. Additionally,Stuart doesn't suggest how,for example, visitors could buy surveys etc. under his system.
Finally,as anyone who has been among the last to leave on a Sunday will testify,members and visitors are notoriously bad at washing up,cleaning the showers and so on,and while it is <u>not</u> the Duty Officer's job to do these things,he or she can effectively delegate to make sure that the cottage is left clean and tidy. Generally speaking,it seems that the current system works very well when a Duty Officer is present and only falls down when there isn't one. What do other members think?

Tony.

Would Penwyllt run smoothly at weekends without a Duty Officer?

Letters to the editor,on any topic,are welcome and should be sent to; Tony Baker,Flat 2,Joanne Court,Hill View Road,Twickenham, Middlesex,TW1 1EY.

THE CALCITE SAGA

The Story Continues...

Dawn rose over the small Smokeless Zone,our oasis of intellectual activity and philosophical thought,but it was a grey dawn.

Gone was the bleak blackness of 5475 nights that had darkened the lives of the sleeping inhabitants,but it was the approaching greyness,that would normally be associated with Major political figures,rather than our small humble community of the 300,that was now threatening. Times they were a changing,but in which direction?

A new time had come,this happening after the affair of the Chinese teacher,where new political forces were dominant and those from far away held the power at the dwelling.
But they failed to notice the rekindling of the custom and once again the alehouses were atalk of it's re-emergenge. The custom was alive again,on the island of Clegg,on the mountain of Nig and ,in fact,next to the helicopter landing pad,but they chose to ignore it,they were too intent on self-importance and destruction.

From afar they could see it ,those of the baseball caps,skidmarks and Blue Vans,but they chose to ignore it,they could not accept that drift into obscurity,their own greyness had defeated them. It was not good enough to rest on those memories of great trips that they had done,now was the time of the younger members of the oasis,the Goblin from Ystradgynlais and Flashcar from the South to hold sway.

This new age,when grey would eventually turn to blue was upon them,they would call it the time after the Twisted Gnome,where one by one the humble community spoke out against the settling greyness.

Mr.G.K.Jones is 85.

EXTRACTS FROM THE LOGBOOK

29.6.91
Downstream sump in Cwm Dwr II dived, 40m of small (2.5ft high x 1ft wide) very muddy passage (zero vis.) followed to T-junction. Right hand to silt bank, left hand too tight. No way on.
Upstream sump looked at to check size. Dived for 15m on single hand-held tank. Very small body-sized tube. Crystal vis. and small unusable air space, no space to turn round. Left as going lead 'cos Neil Weymouth has looked at this site and I don't know if he's planning a return visit. If he's not I am, so hands off! Many thanks to Malcolm Herbert and Ian Middleton for an excellent carry.
Gavin Newman.

1.7.91
Ogof Carreg Mawr. Not a place for big persons. V.interesting, more to follow.
Bob Radcliffe.

18.8.91
D.Y.O. Boulder blocking way into Mazeways III removed. Both divers to Lake Chamber.
M. Paganuzzi, A. Whitehouse.

1.9.91
Dug Peter's Dig in Cwm Dwr Quarry. 6ft of mud and boulders removed. Ends in enlarged joints - big dig required. This is the last of the possible ways to resistivity cave to be tried. Any ideas?
Neil, Clive.

15.9.91
D.Y.O. Radiolocation. The 18" squarial wiil not pass the Long Crawl, we need a 16-17" one! The tube on the right just before the flat-out tightest bit was radio-located and found to be at NGR 8334 1558, alt. 262m.
Stuart.

Compass Error. SWCC Suunto Compass no 741740 is not giving consistent readings. So, if you have been using it your readings are u/s.
Stuart.

5.10.91
O.F.D. I Flood Conditions. Very strong diesel fumes in entrance area, but the worst was in Lowe's passage (main boulder choke in full flood) - almost sickening in concentration. Somebody has big problems!
Andy Freem.

24.10.91
Found tube most likely to lead to Cwm Dwr II in Charlie's Despair. A successful evening.
Malcolm, Julian, Jason plus 2.

NOTES FOR CONTRIBUTORS

Articles on any topic which may be of interest to club members are welcome. I don't mind how it is submitted, but here are a few guidelines.

Text can be submitted on disk (3.5" or 5.25"), typed, or handwritten. If you're writing on a computer then disks are clearly favourite as it saves me typing everything into my system. Handwritten copy should be legible and proper names - especially Welsh ones - written in capitals. Supply a 'phone number so I can check anything I can't read.
(As you will have seen, some of the material in this edition was submitted as "camera-ready" pages. While this saved some time when putting this one together, I'd like to avoid this in future as it gives me no chance to correct spelling or other mistakes, doesn't allow me to include photographs etc., and leads to a range of different styles and typefaces on different pages. Please submit text and illustrations etc. separately. If you're worried about mistakes creeping in, then I'll send you a copy of your work before it goes to press.)

Illustrations should be black-on-white, clear, and suitably captioned. If you include a scale, remember that diagrams, surveys and so on often have to be reduced or enlarged to make the most of the available space. Very small text labels may not reproduce clearly if your work has to be reduced to fit a page.

Photographs are especially welcome, and need not relate to an article - I'd like to have some available to use in their own right, especially caving shots. They can be submitted in any form; colour or black-and-white, prints, transparencies, or negatives. I'm in the fortunate position of being able to copy transparencies and print b/w or colour negatives of any size or format. If your photographs are to illustrate an article, send me as many as you have and let me choose the ones I want to use, as an extra photograph can sometimes be used to fill a spare half page at the end of an article. If you're sending photographs through the post, slides should not be in glass mounts, and th- should all be securely packaged. Valuable originals may be be' off sent by Recorded Delivery or Registered Post.
I will, of course, take great care with any material subm. and return it promptly after publication.
All photographs should have accompanying captions, and photographer identified so that he or she can receive a byline

Finally, remember that I can only publish what people submit! If you have an idea for an article, get writing. Don't worry if you're not the next Shakespeare, as I'll sort out whatever you write, correct any mistakes and make it vaguely readable before I publish it, checking the final result with you if necessary. If you're preparing something for the Newsletter, give me a ring to let me know so that I can plan around the available material.

Tony Baker.

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