SOUTH WALES CAVING CLUB
NEWSLETTER

NUMBER 35. MARCH 1961

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1. CLUB NEWS

Dr. Rob. Williams is planning to carry out a series of experiments on the problems of exposure in caves and has sent us the following notes on his intended research.

SUMMARY OF THE INTENDED RESEARCH INTO PROBLEMS CONNECTED WITH THE ENVIRONMENTAL CONDITIONS IN CAVES AND THEIR RELATION TO 'EXPOSURE'

Previous work on exposure, carried out mainly in connection with sea and mountain rescue, has shown that both the environmental conditions and the subjective attitude of mind in response to these conditions are major factors involved in cases of exposure. Little attention has been given to either aspect underground, despite the fact that 'exposure' is often given as either a contributory factor in causing the accident or as a complicating factor in the rescue operations.

The intention of the present project is to study aspects of the external environment and the reactions of cavers to that environment under controlled conditions.

The ultimate aim being to assess the equipment required for normal caving trips and for rescue operations.

It is proposed to use Ogof Ffynnon Ddu for these experiments as it is a cave which offers a variety of differing cave conditions and which is within easy reach of the S.W.C.C. head-quarters. The work will divide into three parts:

1. Measurements of the physical conditions in various parts of the cave. Air and water temperatures, humidity and draughts will all be measured and from this information Basal Temperatures for various areas in the cave can be worked out. (This will give the net effect of the three variables; temperature, humidity and draught met with in any particular type of cave).

2. Assessment of the subjective response of volunteers to varying conditions within the cave.

3. Assessment of the physical response of the same volunteers to those conditions.

These two latter parts will, of course, be carried out simultaneously.

The variable conditions will be represented by 'dry' areas, wet areas, proximity to a volume of fast running water and exposure to heights.

Other factors to be controlled will be the presence or absence of light, reserves of food, additional or protective clothing and the degree of activity under which a person is subjected.

To carry out this work about 12 volunteers will be needed. They should all have a knowledge of the cave and be experienced cavers. They should also be people who can take sufficient interest in the experiments to put up with the inconveniences the tests will entail.

Robert M. Williams.

LONG FOX MEMORIAL LECTURE.

Dr. Oliver Lloyd of Bristol University and the Mendip Cave Rescue Organisation will be staying at the Club over the Whitsun Holiday. During this time he has very kindly agreed to repeat his recent lecture on Cave Rescue originally presented at Bristol University. This will be accompanied by a film.

The lecture will be given in the large Common Room on Whit Sunday at 7.30 p.m.

ACTEN ALLWEDD INDEMNITY CHITS.

Members are reminded that these chits, copies of which were enclosed in

the previous Newsletter, must be completed and returned to the Hon. Sec. for forwarding to the Regional Office of the Nature Conservancy it it is their intention to make further visits to this cave.

CAVE RESCUE ORGANISATION.

The Cave Rescue Store in the H.Q. at Penwyllt has recently been equipped with 6 miners cap lamps, type NC113C obtained from NIFE Batteries, Redditch, Worcestershire.

CONGRATULATIONS.

To John Alexander on his engagement, to John and Mary Hirons, Bill and Margaret Harris on their marriages, Mr. and Mrs. John Hartwel on the birth of a daughter (Jennie) and Mr. and Mrs. Gwyn Evans on the birth of a daughter (Sian)

CHANGE OF ADDRESS.

John Platt, Flat 2, 4 The Drive, Hunton Hill, Erdington, Birmingham 23.

NEW MEMBERS.

We welcome the following new members to the Club:-

A. Davies, C.L. Greenstock, J. Hirons, J.K. Stephens, Mr. & Mrs. A. Sterens Mr. & Mrs. A. Waldron, J.A. Woodford. (See List of Members for addresses.)

TELEPHONE.

We are pleased to announce that a telephone has been installed at the H.Q., built on the 'pay-as-you-call' principle. The Club's number is ABERCRAVE 613.

2. A FURTHER DIVE IN O.F.D.

January 8th. 1961.

Object: to explore the main stream entry at the bottom of Oxygen Pot.

Since the bottom of Oxygen Pot is at the safe depth limit for oxygen breathing, and the passage in question appeared to go deeper, it was necessary for maximum safety to dilute the oxygen with a proportion of nitrogen and set the pressure reducing valve at a relatively high flow rate in order to keep a balanced O_2/N_2 mixture in the breathing bag, which in these circumstances is kept full and blowing off all the time through its pressure relief valve.

This explains the large twin cylinders which the divers wore on the back

of their harness. The mixtures used were:

	O_2 / N_2	Flow rate litres per min.	Safe depth limit, (ft.)
1.	70 / 30	3.2	65
2.	60 / 40	4.0	80

As it happened the maximum depth turned out to be 35 ft. After a short crouching walk down the section of passage visible from Oxygen Pot the divers were reduced to crawling in a wide bedding plane which turned north and east over a wide arc. Only a small part of this plane was penetrable as progress was barred by a section of very low roof some 8" high stretching right across the plane which at no point appeared to exceed 18" in height. Efforts to press on led to one diver's reserve oxygen cylinder being accidentally turned on by rubbing the floor, and the resulting inflation wedged him so firmly against the roof that he was unable to move until the gas had exhausted itself.

The main water flow undoubtedly comes from this bedding plane but we seem to have reached the practicable limit unless we can grow gills and dispense with the bulk of the apparatus. It might be possible to get a little further by dispensing with the big mixture cylinders which add some 6" to a diver's crawling height and using only oxygen, though endurance at this distance from base would need watching carefully.

The next target, though, must be to try to get 'dry' cavers through into Shrimp Series and see what lies in the upper series of dry passages around Shower Aven.

B. de Graaf and C. Owen George.

3. ARCHEOLOGICAL DIG NEAR OGOF FAWR, PENDERYN.

The first week-end in February saw a revival of an active interest in archaeology by members of the Club. A party consisting of Clive Jones, Rob Williams, Ann Williams, Bill Birchenough, Eric Inson and Neil Jones met the archaeological experts, Dereck Webley and Terry Burke at the Junction of the Aberdare - Merthyr roads and parked their cars opposite the pub. From here we set off northwards across the moor towards the dig. The distance to the dig had been variously estimated as "Just by the side of the road, blokes" to "About half a mile" - it turned out to be a mile and a half of hard walking

across boggy moorland!

The dig is in a dry swallow-hole in the grit. In the north-west side of the swallow-hole there is a rock shelter with a grit cap and a boulder strewn floor. There is a possibility that this shelter may have a long history of use by man for shelter on the moor. It was known that it had been used in recent times by the Crawshays of Merthyr as a refuge during their shooting expeditions over these moors in the early part of the century. Archaeological evidence of this period of occupation soon came to light - remains of a tumbler and a whisky bottle! A small piece of neolithic pottery had been found near the shelter and it thus seemed possible that the site had a history of spasmodic occupation covering more than 3,000 years. It is known certainly from other sites in the area that there was a definite, if somewhat sparse, population in the region in neolithic times.

The first task was to remove a number of grit boulders from an area at the back of the shelter, an occupation familiar enough to most of us. As there was a large number of these boulders, removal of any one of which started two or three others rolling down on to the unfortunate person digging, the job took some time. During this boulder-removing work an interesting discussion developed as Bill Birchenough expounded his new, simplified system of archaeological dating. In this scheme all remains, whether archaeological in the usual sense or genuine rubbish, can be dated into one of two categories, Pre- or Post-Railway. The discussion showed that there are various sub-classes to be considered in using this time scale, G.W.R., Taff Vale Railway and many others!

It was during the boulder removing activities that speleology brought some of its knowledge to archaeology. Two large boulders had to be removed and, by the strangest co-incidence we happened to have with us a long length of black and red cable, an exploder and a box marked "Danger" which proved to contain banger. The archaeologists viewed the use of chemical persuasion with some misgiving but two well-placed charges succeeded in shattering the rocks without bringing the roof down around our ears.

At this point in the proceedings we were joined by Edward Aslett, who brought with him some coffee as potent as the banger we had just let off!

The dig was proving rather barren from the archaeological point of view but it was decided to continue the clearing operations for a while in the hopes that something would appear. Something did appear quite soon but it was not an archaeological find. The removal of the two large boulders and the debris around them revealed a hole. A hole such as leads cavers to shout "It goes"! The edges were gardened and it was tested for depth by dropping first pebbles down and then, accidentally, Neil's hat. The stones gave some very satisfactory rattling noises as they were dropped; Neil's hat just vanished! At this point speleology took over completely and the archaeologists became as enthusiastic about our new hole as we were. Several of the party went down the hole which proved to be a rift-like opening some 20 feet deep opening out into a small chamber, in which Neil's hat was found. There were a few feet of passage leading from the chamber but the way on was blocked by another ruckle of boulders. The descent into the hole required considerable care as there was a tendency for soil and boulders to run-in as one climbed up or down and it

was obvious that if the further pile of boulders was to be tackled some extensive gardening would be required. It was, however, late afternnon by then so it was decided not to attempt to dig through the lower boulder choke but to start the trek back to the cars carrying with us the knowledge that it might go on. It is certainly a hole that will repay further investigation, especially in view of its proximity to Ogof Fawr and Ogof Fechan, and we have every intention of re-visiting it.

On the archaeological front, Dereck Webley has other digs in the area and is willing to risk the consequences of cavers digging with him, despite what we did to that dig, and would be very grateful for offers of assistance.

Ann Williams.

4. SOME FACTORS INFLUENCING CAVE DEVELOPMENT ON THE N. CROP OF THE SOUTH WALES COALFIELD.

Due to the great development of cave exploration and surveying during the past decade in South Wales, it is felt that sufficient information is at hand to enable an attempt to incorporate all available information into a synthesis in which similarities in cave development and structure may be used.

This article is not intended to deal in detail with any one cave system, but to treat broadly and in parts statistically, as far as is possible; with data derived from the many excellent surveys available. It must be pointed out that the generalities arrived at may not be applicable to any one cave, and much of the evidence cited is based on the writer's observation which may be interpreted in a different manner by another person.

SUCCESSION AND STRATIGRAPHICAL POSITION.

The caves considered are confined to the Carboniferous Limestone. A composite succession is shown overleaf. As can be seen, caves are not confined to any specific horizon but are spread generally over the whole of the succession. The writer does not know of any caves in the oolite group but this may be due to lack of knowledge of the Brynmawr area. However, in certain areas caves are confined to certain strata or groups of strata e.g., near Craig-y-nos the larger caves are found in S 2 e.g. Ogof-Ffynnon-Ddu, Tunnel Cave, Dan-yr-Ogof. The Llangattock caves are situated in S 1 e.g. Agen Allwedd, Eglwys Faen. Thus it would appear that there are favourable parts of the succession where the probability of cave passages being found are greater.

EXAMPLES OF CAVES	ZONE	SERIES	THICKNESS	NOTES
	D 3	UPPER LST. SHALES	0-25'	THICKEST AT PONT-NEDD-FECHAN
PENDERYN POTS	D 2	MEDIUM TO DARK GREY LST.	0-150'	
		CLAY, THIN COALS		
PWLL PANT MAWR	D 1	LIGHT OOLITE	0-60'	
		HONEYCOMBE SDST	10'	
		LIGHT OOLITE	30'	
CAVES AT CRAIG-Y-NOS	S 2	MED. TO DARK BLUE-GREY STANDARD LST. (SEMINULA LST)	300'	
			U/C	
CAVES AT LLANGATTOCK	S 1	CALCITE MUDSTONE GROUP	0-50'	Not found W. of Nant-y-Moch At Brynmawr the group consists of a series of CHINASTONES interbedded with rubbly oolite and grey green marl .
				U/C
	Z	OOLITE CORAL BED GROUP	0-150'	Not found W. of Penderyn Thickest at Black rock.
	K	LOWER LIMESTONE SHALES		Limestone formation near Merthyr and Brynmawr.

O. R. S.

The characteristics of such layers are obscure, and it would require considerable further work to elucidate this position. However, certain common characters emerge;

(i) Oolites in general have few passages developed in them.

(ii) Favourable horizons are generally those of well bedded limestone with an abundance of distinct bedding planes, or a limestone with intercalations of shale or marl. The apparent paucity of bedding planes in the more massive oolites may also explain the comparitive rarity of cave development in this rock type.

EFFECT OF STRUCTURE:-

The South Wales coalfield may be looked upon as an elongated basin with the limestone forming the rim. The drainage in general, crosses the limestone from N.to S., although there are one or two notable exceptions e.g. Clydach

As a result of the regional position, drainage, and structure, the following points may be considered:

(i) The water table will cross any one stratum in a line parallel to the outcrop of the limestone i.e. E.W. approximately (Fig.1.)

Consider a large block of limestone, jointed and with bedding planes. Water enters at the surface and flows and seeps along joint and bedding planes until it reaches the water table. It is thus quite conceivable that the water will be saturated with $CaCO_3$ by the time it reaches the water table. Throughout a long period of time the joints above what may be called the calcite saturation zone, will become more open and channels will develop along them. Drainage will tend to become increasingly confined to such channels. Consequently the passage of water to the water table will be speeded up considerably, and the contact area of water and limestone will decrease, until a situation is arrived at in which the surface of the water table is not saturated with the calcium carbonates.

An important theory of cave development states that caves are formed primarily at or in the region of, the vadose-phreatic interface, where the water is not yet saturated with $CaCO_3$ (Swinnerton 1932; Cvijic in Sander 1921). Thus in a favourable layer, a cave passage will tend to develop in an E.W. direction.

(ii) Active streams flowing underground in favourable strata will tend to flow in a N.-S. direction along the line of dip.

There are obviously many exceptions, in which streams flow E. W. e.g. In Ogof-Ffynnon-Ddu and Dan-yr-Ogof (in part), but in these the line of flow is, to a measure, controlled by the outlet into the Tawe Valley at Craig-y-Nos, and local changes in dip, due to the Tawe Valley disturbance.

EFFECT OF JOINTS.

The joint pattern over most of the N. Crop is remarkably constant. Approximate strikes of the main joints are 10° - 60° - 90° - 330° and 290°.

The passage trends of several caves will now be dealt with. Only a few illustrative examples will be described in detail.

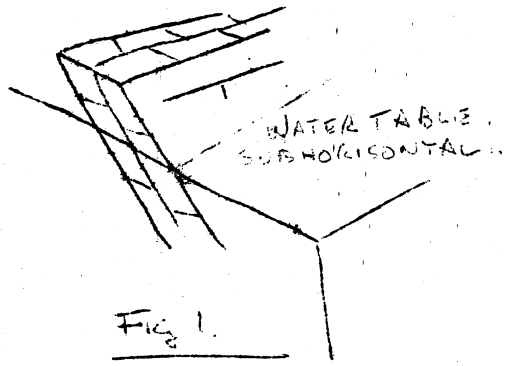


Fig 1.

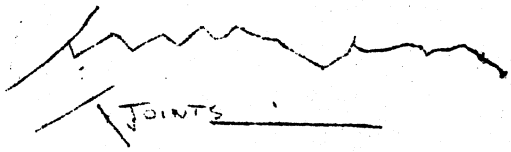
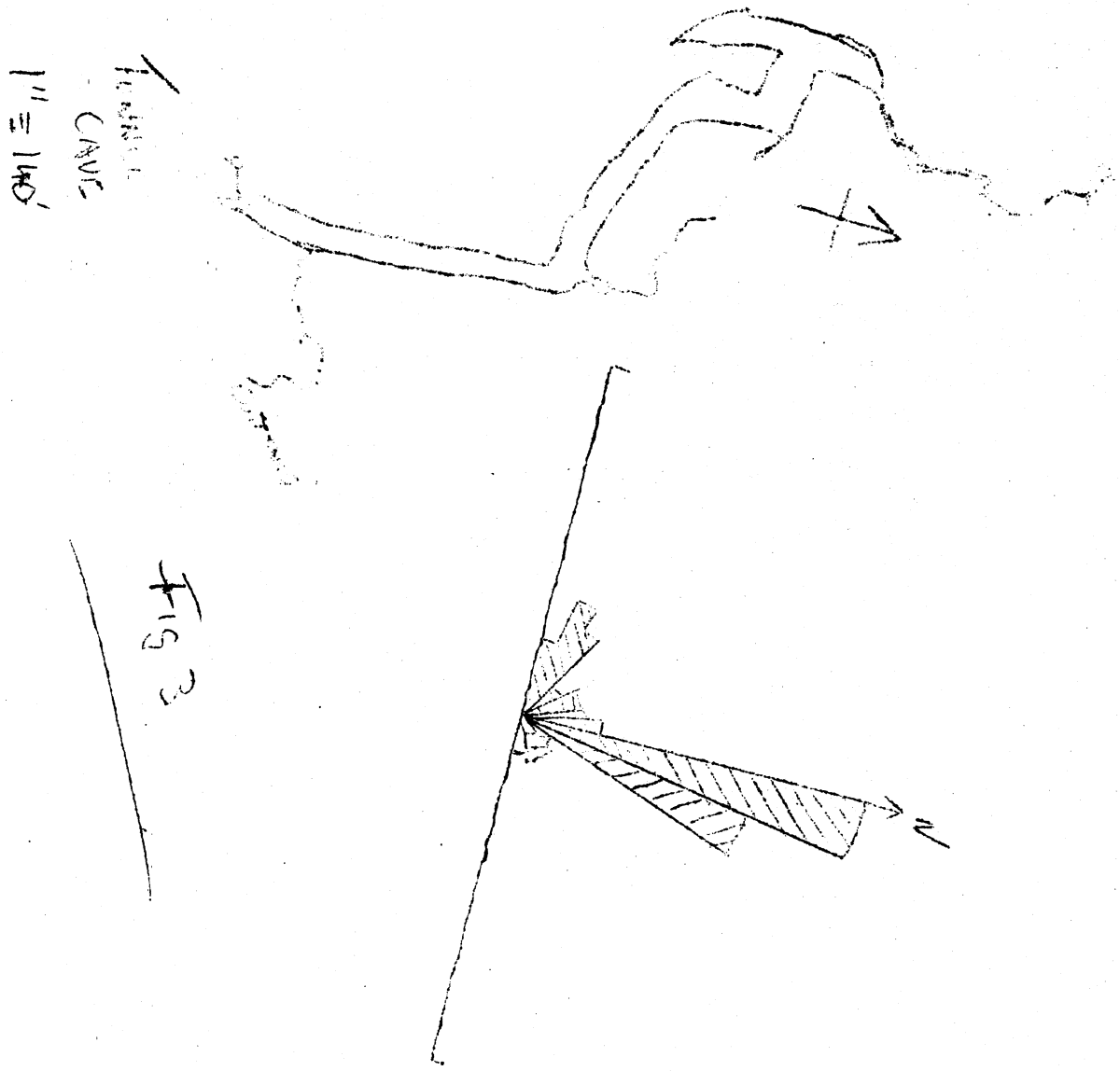


Fig 2.



PLAN OF PART OF AGEN ALEWEDD

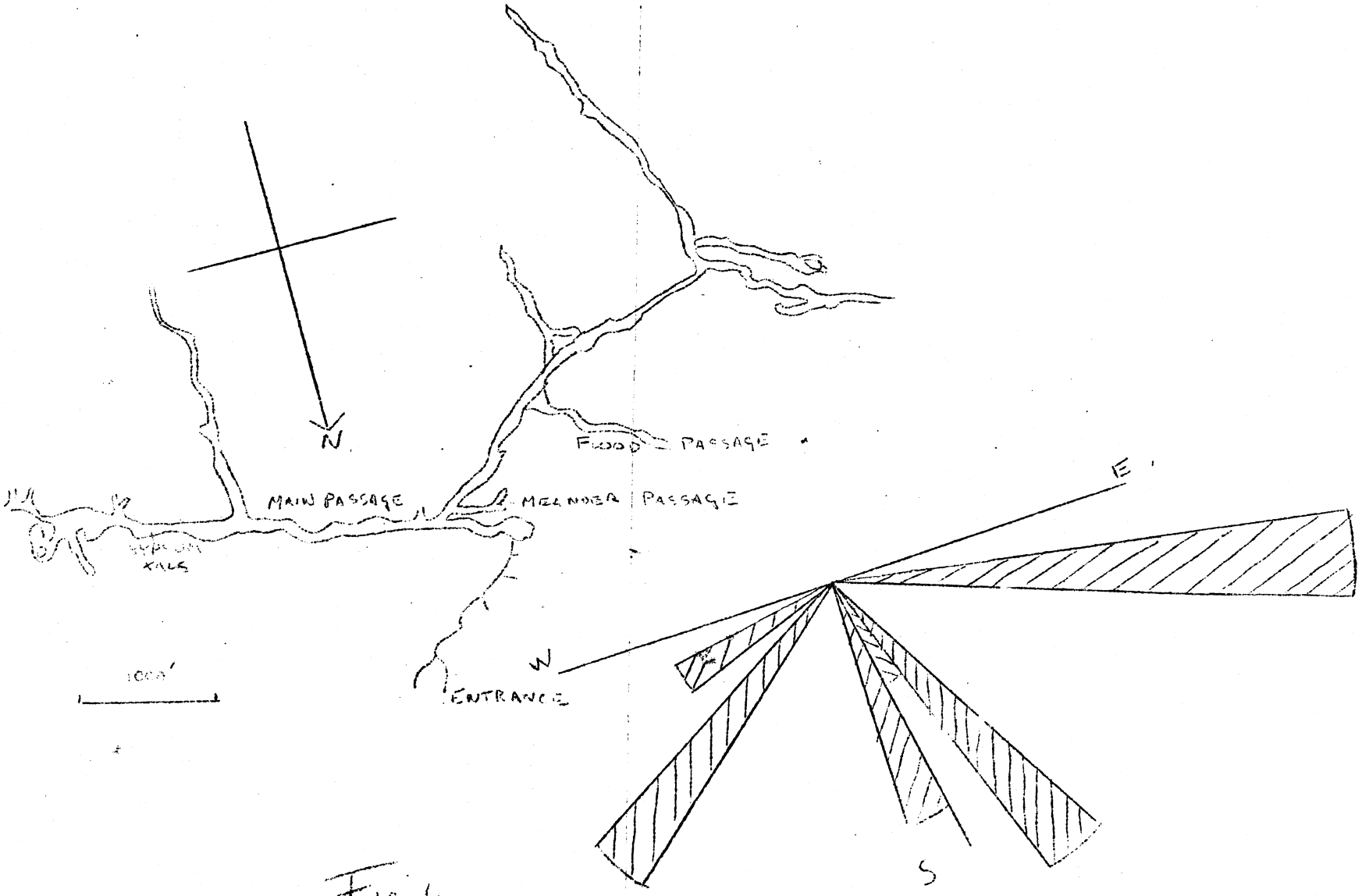


Fig 4.

TUNNEL CAVE.

The survey published in the S.W.C.C. 10th Anniversary publication is used and treated as follows:- Trends of the passages are measured and also the lengths of each leg. Due to the small scale of the published survey the main trend only of passages with a meander plan are taken. The total length of passages having the same trends are summed and then recalculated as a percentage of the whole. These percentages and lengths are then plotted on a rose diagram, the lengths of the constituent rays representing the percentages of passages with the same trend.

The analysis of this cave system is extremely tedious due to the small scale of the survey and also due to the fact that the accurate analysis of passage trends leaves much to be desired. e.g. due to lack of access to the cave it is not possible to decide whether a passage e.g. Cross Passage is due to meanders developed along a major E.W. joint, or due to enlargement along a series of intersecting joints trending N.W.-S.E. and N.E.-S.W. (Fig.2.)

Fig.3. shows the rose diagram for Tunnel Cave. As can be seen there is a marked maximum trending just E. of N. and another subsidiary cone, almost at right angles to the first. (just N. of W.) Both correspond to joint trends at 10° and 290°.

The same type of development is apparent for all of the other Craig-y-Nos caves, especially Ogof-Ffynnon-Ddu, except that the W. by S.W. trending passages are better developed.

AGEN ALLWEDD.

A similar analysis is attempted for this cave near Brynmawr. A plan and passage analysis is shown in Fig 4. Due to the inaccuracy of this preliminary survey and the small scale, it is not intended to be conclusive. Passages alligned to the following joint trends are seen - 330° (up to 360°) and 290° - 60°. The 290° trend is reflected in the direction of Main, Flood and Meander passage.

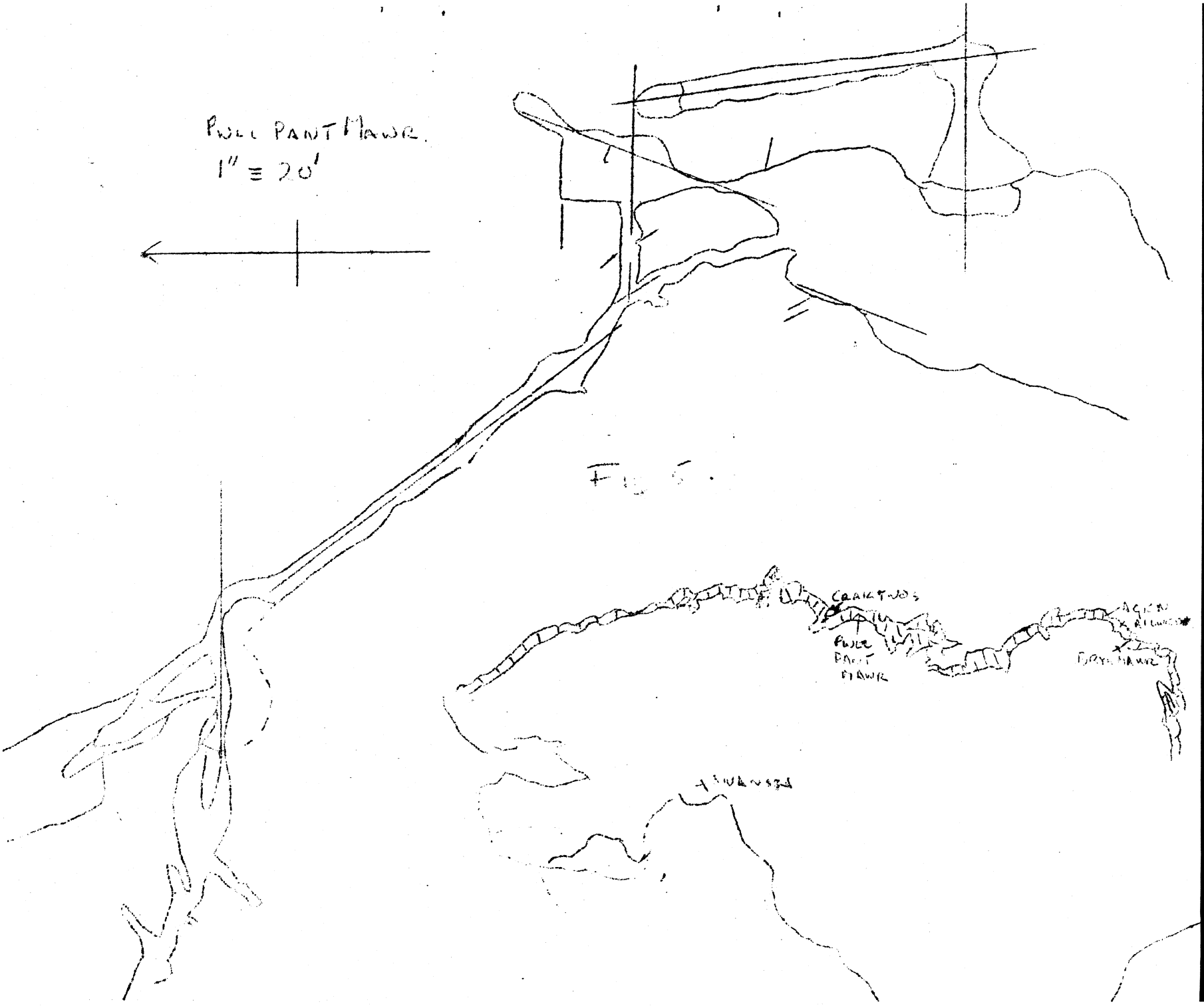
PWLL PANT MAWR.

This cave, developed near the watershed of the Nedd Fechan and Tawe Valleys, consists of an 80 ft. vertical drop from the moor and then a dip passage for about half a mile, reaching a depth of 360 ft. in all. Part of the cave plan is redrawn in Fig. 5. and is of the passages upstream from the entrance pot, The main joints are drawn in.

The main passage seems to be developed along the 10° joint trend.

USE OF ROSE DIAGRAM.

As is readily apparent, the advantage of a compass rose diagram for statistical analysis of passage trends is not in cases where such a trend is obvious e.g. Railton-Wild series in Ogof-Ffynnon-Ddu, but in series which consist of complex and possibly superimposed network development.


PULL PANT MAWR.
1" = 20'
CRAIG-YOS
PULL
PANT
MAWR

In this article the rose diagrams were used in a horizontal plane, but passage trends may also be analysed by equating the plane of the diagram with a vertical, or any other convenient plane.

Where the cave is very complex, e.g., in steeply dipping or folded beds, it may be necessary to have recourse to a stereographic method, in which normals to the planes of the passages are plotted as poles on a stereographic net. By this method the passage trend of large areas may be compared. e.g., N. Crop and S. Crop caves. While the homogeneity of a cave or series may be tested by breaking the field down into a number of smaller areas of investigation.

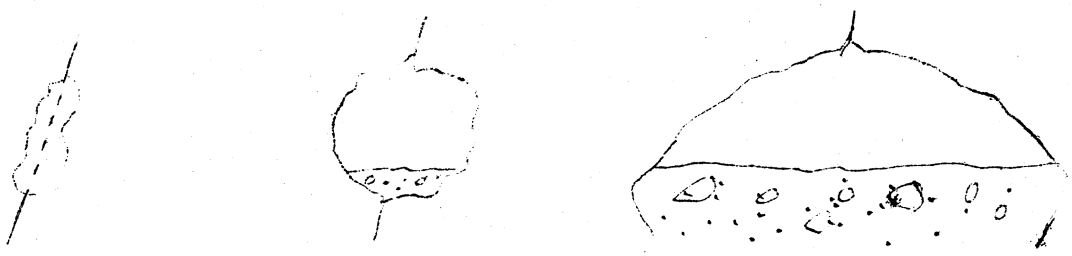
It may be possible at this juncture to classify stream cave passages on a similar basis to surface streams in terms of dependance on joints.

(i) Youthful passages, which are caused by enlargement along joints planes. Streams have steep profiles, the passages being higher than wide.

(ii) Mature passages in which, although the trend of the passages are controlled by joint directions, passages are considerably enlarged. The stream profile is shallower, the main enlargement of passages being due to roof-fall with the attendant solution or attrition of the fallen boulders. There is small or considerable enlargement of passages due to meandering. The rate of sideways abrasion being faster than that of downcutting. Passages will tend to have an equidimensional cross section.

(iii) Old age passages in which trends are not directly related to joint directions; the passages are broader than high; the rate of deposition of detritus is greater than that of erosion.

All the above stages are intergradational, and the stream course may be abandoned at any one stage.



(i) (ii) (iii)

Other factors which would influence such passages are:- rapid influx of such material as reworked glacial drift; lithological type and raising or lowering of the water table.

From this preliminary investigation the following points emerge:-

(i) Cave passages are developed along joints, and even most complex passages can be related to enlargement along different joint trends.

(ii) Passages approximately parallel to dip and strike of the beds are preferentially developed. Even in these cases, however the passages are aligned along joints which approximate most closely with the dip and strike. In beds which only dip gently this is not quite so apparent but still appreciable.

(iii) Large passages are developed in E.W. directions while the N.-S. passages are of small cross section with an active stream development. It is suggested, therefore, that the E.W. passages are developed under phreatic conditions (i.e. below water table) and the N.-S. passages are vadose, in the main, although they might have been initiated under phreatic conditions.

In conclusion therefore it is seen that the majority of cave passages along the N. Crop trend just E. of N. and slightly S. of W. Passages in any one area, are generally confined to a certain horizon or rock type in any given area.

Diggers?

Keith Ball

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Sanders E.M. 1921. "The Cycle of Erosion in a Karst Region (after Cvijic)," Am. Geog. Rev. pp 593-604.
10th Anniversary Publication S.W.C.C.
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Survey of Pwll Pant Mawr by D. Hunt and W.H.Little. S.W.C.C.

STOP PRESS

FURTHER CONGRATULATIONS

To Brian and Jean Fenn on their marriage and to Mr. and Mrs. Bill Toye on the birth of a son (John).

5. CAVE DIVING WITHOUT TEARS (?)

in three easy lessons

1. POTTED PHYSIOLOGY.

To the spectator diving may appear to be absurdly easy, merely a matter of donning apparatus and then taking the plunge. Those who dive, seem to waste time in testing their equipment and fussing unnecessarily.

This, the first of three articles concerned with diving is an attempt to dispel the mysteries of diving, to damn our critics and to enlighten all prospective 'dip chicks' of what they can look forward to; (miles of new cave we hope!) Nothing is so fascinating as the suspected rabbit warren of unexplored passage, but to search in safety the diver must take great regard of diving hazards. Here is an outline of the physiological problems posed by diving, with particular emphasis on 'closed circuit' apparatus which we consider on balance to be safest for cave diving.

PRESSURE.

Water weighs heavy and for every foot descended the water exerts a pressure of 0.445 lbs. per sq. in. Thus at a depth of 33 feet, the water pressure is equal to 'one atmosphere', or 15 lbs. psi. The effects of this pressure can be classified into two categories; (a) direct and (b) indirect.

(a) Direct.

Pressure acts on the body equally but is of importance in:-

(i) Ear Space.
(ii) The Sinuses
(iii) Lungs and Abdomen.

Unless the water pressure is compensated within the body, pain and physical damage will occur in these spaces. A variation of pressure of a pound or two causes great discomfort, while greater pressures are liable to prove fatal.

(i) The ear drum is highly sensitive to pressure change. Once pain is felt, the pressure difference that gives rise to it can be equalised by swallowing and causing the Eustachian tubes to open. Failure to equalise may lead to a ruptured ear drum.

(ii) Sinuses are easily relieved by blowing into the nose. With both ears and sinuses, a cold can cause a blockage in the air ducts and will render safe diving impossible or at the least very painful.

(iii) The lungs are very vulnerable and cannot operate against a positive pressure of more than a pound or two. A pressure greater than 2 lbs. will lead to a ruptured lung. It is essential when ascending through any depth of water that air is released from the body at a rate consistant with the speed of the ascent, otherwise a burst lung may result. Conversely if a diver should fall

underwater he must compensate rapidly or he will inevitably be crushed by the pressure squeeze. It is absolutely vital to keep breathingin such circumstances so equalizing the internal and external pressures: to hold one's breath is fatal.

In all diving apparatus thereis a definite mechanical resistance to breathing which increases with depth as the gas breathed becomes denser under pressure. Beyond 300 ft. oxy./nitrogen mixtures become too dense for the human frame to shift so that deeper experimental diving uses helium instead of nitrogen to reduce the overall density. Only those who have never suffered from respiratory ailments ought to attempt diving.

(.b) Indirect.

Gases under pressure lead to curious results when breathed by a diver. The subject is one of considerable complexity and is not fully understood even by the boffins. Before diving is is essential to know the symptoms and causes of the following disasters which can overtake anyone breathing gases at pressure, whether underwater or in a dry compression chamber.

The three important gases are Oxygen (O_2), Nitrogen (N_2) and Carbon Dioxide (CO_2), which is fundamental to the human system since it controls the breathing rate. Others such as Carbon Monoxide are simple and have but one result (death).

(i) Oxygen.

When breathed at a concentration of 100% at a depth of more than 33 ft. (in sea water) it can lead to unconsciousness and convulsions. This is the depth corresponding to a pressure of 2 atmospheres absolute so that if you weaken the O_2 concentration e.g., by mixing it with nitrogen you can go deeper in safety provided your gas flow rate is adjusted to correspond. Even an aqualung reaches this limit, at 297 ft. down, but by then you may be in difficulties with no.(ii) below.

The effect is erratic, but the known safe limit is 33ft. (or 28ft. in fresh water owing to its greater density). There are few warning symptoms - therefore dont exceed 33 ft. at 100% O_2, otherwise 'Oxygen Pete' may get you.

Anoxia (a shortage of O_2 in the circuit); one feels happy until suddenly, blackout and death if help is not forthcoming. For all practical purposes, no warning signs. Remedy, good equipment, well tested, and strictly observed breathing drills.

(ii) Nitrogen.

N_2 is an inert gas, but at depths of more than 120 ft it causes narcosis (drunkenness) with all that can involve (ask Clive Jones). Remedy; come up quickly - but not too quickly otherwise you may find yourself suffering from:-

Decompression Illness ('bends') caused by N_2 going into solution in the blood under pressure. On surfacing it is released in bubbles in the tissues, like soda water. Very dangerous and painful. Remedy: always decompress

when necessary on the correct tables, which means sitting around for calculated times at particular depths while the gas evolves harmlessly from your tissues. Result - you freeze to death instead

(iii) Carbon Dioxide.

As mentioned before, this gas controls the breathing rate. Consequently if you get too little there is no stimulus to breathe and you pass out through anoxia. A nervous or inexperienced diver feeling his breathing restricted by his set may 'overbreathe'(rapid panting) so washing the CO_2 out of his tissues leading to this effect, which can also be demonstrated by a simple parlour trick. (see us later in the common room). A slow,deep breathing rate is the pattern to aim for.

Too much CO_2 on the other hand, if your chemical absorbent is vitiated, overstimulates your breathing rate, leading to paralysis of the reflex and so back again to our old friend anoxia. This effect usually gives good warning as your absorbent gets used up relatively slowly, so on the sign of an undue increase in breathing rate with possibly headache and nausea, you move slowly back to base.

(iv) Shallow water blackout.

A sudden loss of consciousness at shallow depth can be caused by working too hard, mental strain, diving on an empty stomach, diving on too full a stomach, too much ale the night before etc. etc.

With so many possible snags to breathingunderwater it is only wise to be extremely fussy in caves. There is after all no air surface to make for if in distress.

TEMPERATURE.

The loss of body heat to the water is rarely noticed when underwater. The hands lose dexterity and feeling is reduced, mental confusion may occur, but it is only on surfacing that one realises how chilled one is. Cold is dangerous to morale and it is imperative to wear as much clothing as possible. A balance must however be struck with the quantity of lead required to sink the woolly bear.

For interest, the following table gives some values for the conductivity of several types of suit.

Material	Conductivity in B.T.U./hr./^{o}F./ft.s
Bare Skin	65.00
$\frac{1}{4}$" Woolly underwear (Still Water)	13.40
$\frac{3}{8}$" Foam Wet Suit.	9.60
Rubber suit dry and Woolly Underwear.	0.68

UNDERWATER VISION.

The effect of using a mask underwater greatly improves natural vision but there is still a high degree of refraction in the ratio of 4 : 3 , while the diameter field of vision is also reduced. Hence our wildly exaggerated tales!!!

SOME PSYCHOLOGICAL FACTORS.

A word should be said here about the psychology of diving. Remember, when you are under water you are literally 'out of your element'. Although breathing oxygen gives one a superficial confidence the subconscious mind is not to be fooled so easily: consequently one's reactions, even to the slightest unusual occurrence, tend to be exaggerated. Some divers dislike wide open spaces of water and prefer a tight passage which they can feel: others would run a mile from such a squeeze.

The crowning doubt that may assail a diver's mind is that his equipment may let him down. In caves, where the chance of escape to an air surface in an emergency is limited, the breathing set must be absolutely reliable, and we make it a rule that it must have an emergency reserve of gas. A good diver keeps his kit in perfect order and so minimises any worries on that account.

You're bound to have doubts and worries in this occupation (unless you're quite insensitive) and such feelings are highly valuable in keeping you aware of the warning symptoms described previously. The successful diver is the one that recognises these fears and makes good use of them while keeping them under control. Panic at any time brings one's chances of survival down to nil. One must aim to be relaxed, slow moving and quietly confident.

This article has of necessity had to be severely condensed, but anyone interested is welcome to turn up at Easter and have a go, when we hope to do some diving in a convenient pool. Aqualung and closed circuit apparatus will be available.

Charles Owen George and Brian de Graaf.

6. CWM DWR QUARRY CAVE
25th February 1961.

Some observations on the recent survey of the cave.

While drawing up the recent survey of th whole cave I have been surprised

at the amount of information which is apparently available, and the number of interesting interpretations which seem to offer pointers to the caves beyond. It is not without some trepidation that I put my ideas on paper because I am sure that I shall be proved incorrect by actual discoveries inside the cave.

Main Passage.

That is the large passage which runs in a southerly direction from below the entrance pitch. At first sight this passage would seem to offer little chance of linking with O.F.D.II, but Ibelieve it has one of the two best potentials of the whole cave. Remember first that it is not really a near surface passage, and that if the quarry had not artificially lowered the surface it would be 80-100 ft. beneath the ground. The importance of this passage in the development of the cave is emphasised when one considers the surface features which correlate with it. The boulder choke at its southern end is exactly beneath the vertical section of a shake hole which lies in the quarry wall. It is also on a general line with the shake hole situated in the buttress above the entrance and the one lying around to the northern side of this buttress. I believe that the small cave in the north eastern corner of the quarry is in fact the northernmost extent of this passage. Thus my thesis is that this passage was once the main drainage passage along the general direction of development of the cave. Another feature which I consider supports this idea is that if this passage were to be produced, at its present inclination and direction for 200 ft. it would run exactly into the top of the aven. Thus I believe that the water flowing down the aven is in fact draining from the continuation of this passage. It is reasonable therefore to ask if it is worthwhile to continue to make the rather difficult trip to the aven to dig, rather than to attack the boulder choke at the end of the main passage, and to try this way to get into the high level passage which I consider runs over the top of the aven, and is in fact the way on to the 'old' cave system. At Penwyllt we are pretty high up and situated on naked limestone, thus I would consider that the early formation of the large cave passages such as we find in the Rawl series in O.F.D. would not be situated too deeply beneath the surface. These passages I feel convinced will have a better possibility of long continuations, rather than those of the present master cave with its relatively minute amount of water and tiny passages. The present water which flows along the first part of the known passage, and that which falls down the aven are I believe relatively recent invasions of the present cave system, and have had little or nothing to do with its formation.

It would be unwise, even foolish to ignore several facts which are available and do not fit easily into this thesis. Firstly, the passage below the entrance shaft has no known northerly continuation, and would appear at first sight to turn a right angle and continue eastwards into the existing passage in the quarry face. I would suggest however, that the continuation would be found if one dug amongst the boulders against the northern wall of the entrance chamber. Another fact that does not immediately fit in, is that the northernmost limit of the passage of the small cave in the north eastern corner of the quarry slopes quite steeply downwards. This might of couse be the beginning of a northern limb of the cave system. It could also be argued that the aven is in fact the vertical continuation of the main passage, and that it does not extend on beyond it in a southerly direction. I just do not know about this, but I intend to try and find out.

The fascinating thing about this cave is that in it we are in the middle of a cave system, and that in almost any direction we have the possibility of an extension. The next sites which offer rewards to the digger are situated in the passage which extends beyond the blasted passage on the entrance sideof the system and runs in a north westerly direction. This passage is quite large and runs upwards away from the start of the squeeze at - 86 ft. (the quarry floor being taken as 0 ft.) to end in a boulder choke some 90 ft. away and 17 feet higher. Water drips into the cave from above this choke and flows into a boulder filled pit half way along the passage. It is possible that this choke which takes a slight draught might be dug through and lead on to another descending passage. However, I am of the opinion that this choke is probably the base of a shakehole which has been obliterated by quarrying, and that its main line of drainage was into the boulder filled hole - the passage floor. This hole, the bottom of which is about six feet lower than the general passage level has been investigated superficially already, and it is obvious that a great deal of work will be necessary if it is to be forced.

The position of the hole is such that it is remote from the rest of the cave system. It is difficult to imagine it connecting with any other part of the cave, and thus any extension however expensively won would be of considerable interest. I feel however that until the more obvious potentials of the cave have been investigated it might be more rewarding to leave them for what they are; interesting sidelines.

Next we pass along the blasted passage, itself a fine example of tenacious digging under appalling conditions to the chamber where it is possible to stand once more. Besides the main way on this chamber has passages leading off both to the left and right.

The right hand passage is a narrow squeeze which seems to lead back in the direction of the older known part of the cave. It is of interest to my mind in that it might lead into the same cave system as the previously discussed pit. However it will need someone more tenacious at squeezing through narrow passages than myself, or otherwise a considerable amount of labour to enlarge the passage. Blasting away at solid rock as we all know is a protracted job with minute results, and unless it can be forced by an intrepid squeeze expert, it is probably not worth considering further.

The left hand passage quickly ends in a sand choke. This passage is blocked with sand which appears to have a finer texture than that of Dim Dwr, but it is just possible that this passage is in fact the upstream continuation of the Dim Dwr passage. If this is so, it might prove rewarding to trace it back in the hope that one might break into a dry sandy system.

This leads naturally to Dim Dwr itself, to my mind one of the easiest and most neglected digs of the whole cave. It has been argued that Dim Dwr is the continuation of the passage the other side of the squeeze, as I have hinted above, I am not so sure of this. I think that the rocky gap between the two stretches of sand was caused by recent water coming down the blasted passage and washing the sand down the rift passage. Dim Dwr passage itself takes a draught and slopes gently downwards, the roof coming down to within about 9 ins. of the sand at the present end of the passage. Along the walls of the passage there are relics of mud floors which are ample evidence that the sand has occupied

several different levels in the passage at various times. The passage itself runs in a westerly direction, that is, away from the rest of the cave system. Dim Dwr by its very size, the fact that it takes a draught and its position seems a commanding and ideal site for a dig. A little digging has been done by means of filling an oil drum with sand and dragging it out. I wonder if it would not be easier to make a bridge or channel of oil drums and divert the blasted passage stream along Dim Dwr and wash the sand away. I believe that the several levels of mud floor in Dim Dwr can be explained by assuming that somewhere along the rift passage, perhaps at the drain, that the stream has been blocked and backed up to drain along Dim Dwr thus undermining the existing floors. Perhaps we could continue the process and enlarge the passage enough for us to be able to get through. The scallop marking on the wall is evidence that this passage has taken a considerable amount of water, thus the passage must go on, I do not believe that it could just vanish into thin air (or cracks!).

Continuing along the present water channel down the rift passage, several narrow squeezes are passed in the left hand wall of the passage. If any of these can be forced by squeezing the explorer is to be congratulated, otherwise I fear that the amount of labour required to follow them makes them just too expensive to consider. Soon we come to the T junction the left hand branch of which leads to the aven.

The aven itself has been the site of considerable activity especially as it appears to take most of the draught of the cave. However, I must immediately state that I do not consider that this site has any great potential. I believe that the draught is passing upwards along the narrow recent channels which join the top of the aven with the large passage above it which might be more easily entered by by-passing the boulder choke at the end of the main passage. It is difficult to dismiss the aven so lightly, and I could very easily be wrong. One idea I should like to test is to discover if the water falling down the aven and soaking away in the boulders beneath actually flows back into the known cave in the left hand passage which enters near the drain.

The right hand passage leading from the T junction takes the main stream of the cave and runs a zig-zag passage until it finally closes down at the drain. The above mentioned left hand passage enters the cave here. This passage I believe offers the second best possibility for the digger to reach the caves beyond. This passage takes a slight draught, has several inches of water flowing down it towards the drain and has a mud and sand mixture floor.

The fact that the water is flowing down the passage should not deter the digger, for the extension to Agen Allwedd was also found on the upstream limb of a passage.

The reason that I back this dig so heavily is that it lies at the bottom of the dry valley which extends in an easterly direction behind the cottages. The passage also lies in line with the main cave passage and the aven along what I believe to be a major line of development. I suspect that much of the water which flows along this passage is probably water from the dry valley, and that by digging here one has a double chance of breaking into a cave system, either an extension of the present system or else the dry valley cave system. This dig is not particularly difficult although it is quite wet. When Dick Basham, Mary

and Laurie Galpin dug there last we built a dam across the passage thus stopping the main stream passage draining into the dig. We then bailed as much water as we could out of the dig and then removed the sandy mud. I would recommend that next time someone tries the dig that they shift this water with a sludge pump.

Finally there is the drain itself, this rather narrow passage six inches wide and twelve inches high takes all the water which flows through the cave. This dig however, suffers the same disadvantages as all others in solid rock.

I have only to wish all diggers the best of luck and to admit that five feet of passage found anywhere in the cave is far more important than any amount of armchair caving. If anyone breaks through anywhere to the caves beyond I will be delighted however incorrect they may prove my ideas. I, like Clive Jones, want to know "Where the hell is O.F.D.II?".

Noel Dilly.

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