SOUTH WALES CAVING CLUB

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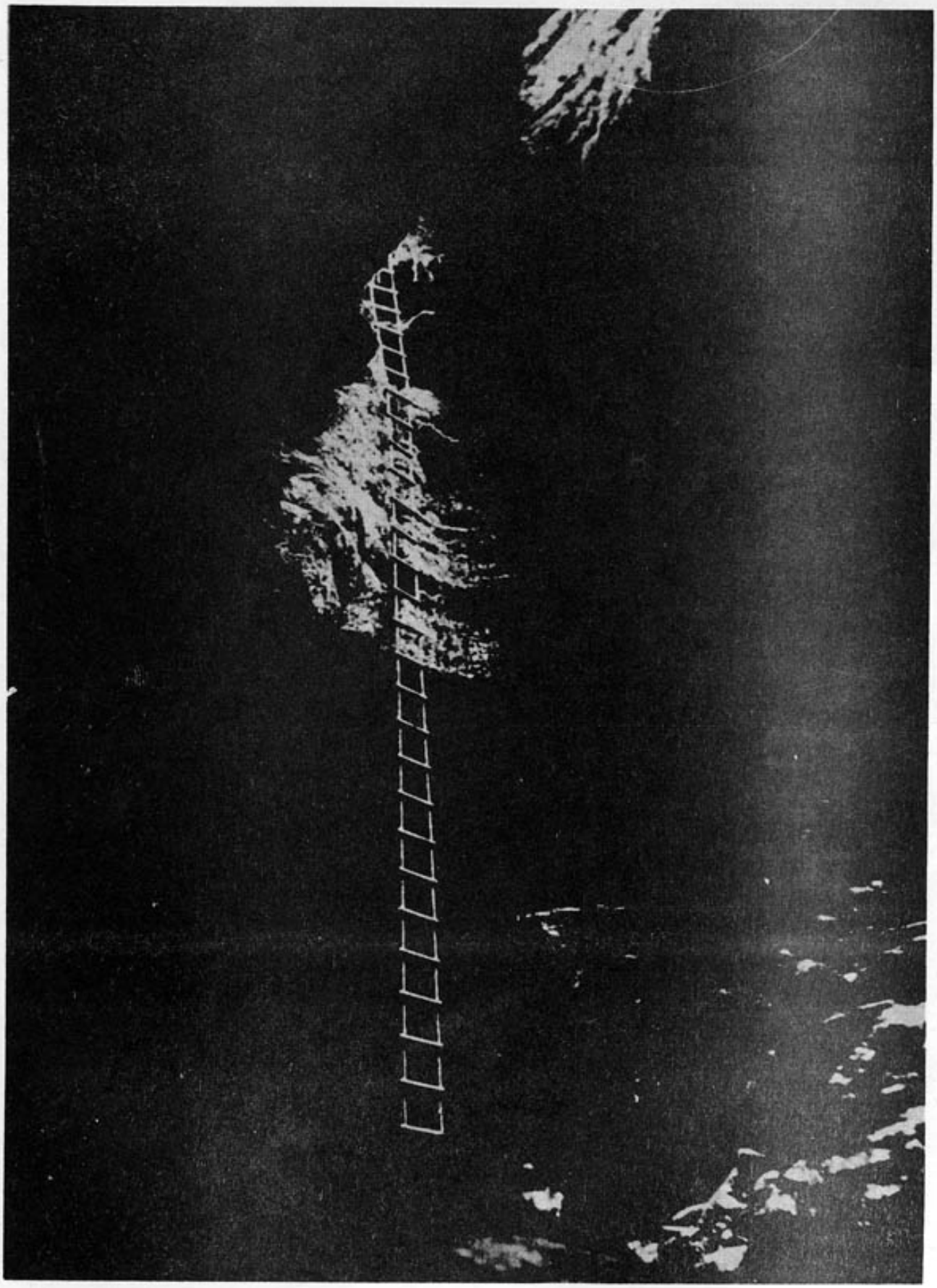
TWENTY FIRST

ANNIVERSARY PUBLICATION



"GREAT OAK TREES FROM LITTLE ACORNS GROW."

[proverb.]



Pwll Pant Mawr.

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FOREWORD.

Certainly, there are outstanding cavers and office-holders who might well have a better claim to the distinction of writing this foreword; I have been persuaded, however, that I am one of the links between past and present and that this compensates for other deficiencies. The roots of the Club, in the past, and its 'growing end' in the present, are one entity, though the majority of those who tended the Club's early development and who influenced the present are not with us now. These early members' caving life, so vivid in their time, can mean little to a later generation, although sometimes their names survive, quite impersonally, in a list of members, or in an old minute-book, or quite exceptionally, as the name of a cave passage. In this Anniversary Publication some of the thoughts and experiences of these earlier members will come back to us down the years. Future generations of cavers with their more sophisticated methods of cave detection and digging will wonder in their turn, at us, and try to imagine what sort of people these were who explored by deduction and sledge alone.

The last year has been one of outstanding exploration by our Club, but my own pride in our members' achievements is more in the qualities that made these possible--deduction, technique and calculated daring. But there have been other notable discoveries within recent years and in remembering these let us pay equal tribute to the effort put into our failures, and to our own members' persistence under difficulties. Every difficulty that cave exploration presents is challenged by our members, and the increase in cave diving is only one illustration of this.

The Balinka expedition was rather different to the Club's usual explorations, but here leadership and meticulous planning were displayed at their best. To an outsider the execution of the project must have seemed almost effortless -- every difficulty foreseen and dealt with in its turn. But we ourselves know just how much imagination, ingenuity and endless slogging effort was required in the preparations. Our Club has been accorded a very high decoration by our generous hosts and partners in the project, the Yugoslav people. There is, I think, a warmth and understanding between them and us which honours both.

We are most fortunate in our lady members, who (in their very nice way) are challenging the men in all activities; we all warmly approve.

One more thing of importance. Tradition is not just a word, it is a shared knowledge of how to act in situations not "covered by the book". From the earliest times our members have been careful of their behaviour underground and, through the years, by mutual criticism and discussion we have polished this into a tradition of decent caving. We are deeply indebted to Arthur Hill, one of our most ardent founder members, who guided us through our difficult beginning. We are trusted.

Is this foreward too laudatory? I think not, or at least it is unbiased in having been written by one who has been removed from active caving for a couple of years. It is curious to contrast the sick publicity accorded to drug weaklings with the activities of cavers whose strength is only apparent amongst themselves.

In conclusion, and if a foreword is the right place to do so, may an ignorant and often puzzled ex-Chairman thank every member of the Club for their support and courtesy during all these years and in particular those tireless officers who set him such a good example?

Edward Aslett.
Brecon. July 1967.

TWENTY-ONE YEARS.

The South Wales Caving Club has come of age. In its twenty-one years of existence it has become established as one of the foremost caving clubs in the British Isles. Its story is the story of Welsh caves, many of them small holes to be visited infrequently, others magnificent systems that have still only been partially explored and require expedition-styled trips to get to the furthest reaches.

In its twenty-one years, the Club has progressed from a small handful of cavers bent on unravelling the mysteries of the thin band of limestone that borders the edge of the South Wales coalfield, to a host of hardly less dedicated, but certainly more sophisticated wet-suited explorers.

Todays cavers rarely admit to caving for the sheer enjoyment of it — but it was this unashamed love of adventure that led members of the Wessex Cave Club to begin caving around the Pont Nedd Fechan area in 1936. The increased interest by various Mendip clubs led to Gerard Platten's founding of the 'Dragon Group' which frequently used the Gwyn Arms as their headquarters.

Dan yr Ogof was the main attraction to visitors and in 1938 many interesting discoveries were made, among them the Cwmdwr Quarry Caves and Ogof Pwll Swnd. Gower yielded some of its secrets to cave explorers and the bone cave, Ogof yr Esgyrn near Dan yr Ogof, was a major archaeological dig. It produced some thousands of human bones when E.J. Mason began excavations there in 1938. That year too the Welsh Group of the Mendip Exploration Society was formed and there appeared to be a gentlemen's agreement that the Wessex worked east of the Swansea valley and the M.E.S. in the valley and to the west of it.

The war caused a long period of unsettlement and many of those who had caved regularly in the area could no longer do so. Occasional work continued at Ogof yr Esgyrn and at Dan yr Ogof until the latter was closed in 1941.

Towards the end of 1942 the swallets at Sink y Giedd and Pwll Byfre received attention and the resurgence at Ffynnon Ddu was first looked at with the aim of locating the cave system beyond.

The Club was born on Easter weekend 1946 out of a desire to establish caving in South Wales on a basis that would satisfy all the clubs which had been active in the area before and after the war. The story of the twenty-one years since then is the story of Ogof Ffynnon Ddu, Dan yr Ogof and a host of other smaller but equally interesting caves.

OGOF FFYNNON DDU

TWENTY ONE YEARS EXPLORING.

OGOF FFYNNON DDU.

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OGOF FFYNNON DDU.

Ffynnon Ddu is a large forbidding spring near the Tawe by the bridge on the road to Penwyllt. For years the resurgence was known and it was used as the local water supply. There was a legend associated with spring; that a wandering chicken castrator had one day entered a hole nearby and had never returned. Many cavers came to the bubbling spring, but none followed the earliest explorer.

It was not until 1942 that it received serious attention.

Several openings in the immediate vicinity of the rising were dug out as they were reputed to discharge large quantities of water in time of flood. All appeared to be too near to saturation level. Powell's Cave by the Penwyllt road was examined and finally a small cave, then described as Ffynnon Jenkins, lying in the hollow below.

Quite a lot of work was done at Ffynnon Jenkins which was really little more than a rock shelter. A floor excavation led into a short but sizeable passage partly filled with debris - indeed, the passage was much too big not to go somewhere. Sounding of the walls led to the uncovering of a narrow winding passage, a very, very tight squeeze and a lake. The cave became known as Pant Canol. There were several interesting features and it held out great promise. The most attractive was a high level passage ending precipitously over the far side of the lake (at one of its deepest parts as one or two members will remember for a very long time). About 10 feet beyond, but unapproachable, there was the appearance of continuation. A triple extension ladder was laboriously transported through the cave and a trapeze act enabled examination of the continuation which proved to be a disappointing grotto. At the landing place a very strong draught blew through a very small hole. Due probably to the rather depressing effect of the place and the difficulties of making up a party this particular spot did not receive further attention until the inaugural meet of the South Wales Caving Club, when a further 50 feet of passages were added. The link up with Ogof Ffynnon Ddu was still a few years away! Pant Canol was surveyed and recorded with the B.S.A. as a M.E.S. Welsh Group find and part of the Ffynnon Ddu system. This interest was naturally passed on to the new club in 1946.

At the inaugural meet of the Club, Graham Balcombe and Jack Sheppard, leading figures in the new Cave Diving Group, donned their suits to attack the resurgence. It was explored for about 40 feet where a large rock obstacle prevented further progress. Efforts to blast this away were not successful. Interest was now thoroughly aroused in the Ffynnon Ddu system.

Ian Nixon and Peter Harvey were destined to open the cave for the August meet.

"My interest in Ffynnon Ddu was first aroused during Easter 1946. There was a big meet in the Swansea Valley at that time with a heavy programme of both caving and, during the evenings, meetings. The latter were in connection with the disbanding of the Mendip Exploration Society (Welsh Branch) and the formation of a new Club to be called the South Wales Caving Club, also an organisation to be called the Cave Association of Wales which has since died.

"On the caving side the programme consisted of trips into Dan-yr-Ogof led by Platten; digging in the Bone Cave (Ogof-yr-Esgryn) by Mason and others, and an attempt to enter Ffynnon Ddu via the resurgence by the Cave Diving Group. The divers on this occasion were Graham Balcombe, Jack Sheppard and Bill Weaver. The diving was not very successful and finished up by placing a large charge as far in as possible, the resultant bang effectively stopping the possibility of further work in the rising. However, it was while sitting in the hot sunshine watching the divers that I started to think there must be other ways of getting into the system behind.

"I teamed up with Ian Nixon and Whitsun saw us leaving Mendip for the Swansea Valley to start on a number of small digs which never really got going. There were two North of the rising in the same field which finished up in glacial drift, and were abandoned fairly quickly. I spent a long time in a tiny aven near Pant Canol trying to dislodge a boulder in the roof with a crowbar. I was successful in the end, and spent the evening having the dent in my head tenderly patched up by lady members of the Club (this was highly successful).

"We had discussion with our local friends in the Gwyn who considered that the rock on the East side of the Valley was so broken up that the chances of finding a big cave were poor. However, when talking later with Bill Weaver at a meeting in the W.C. at the Bristol Aeroplane Company works at Patchway, he mentioned the little cliff face on the track running up to the Penwyllt road. We had not paid any attention to this up to now as it was on Mr. Downey's farm, which was owned by Mr. Geoffrey Morgan. I wrote to him poste haste and obtained permission to make a dig at this spot.

"On the first weekend in July Nick and I arrived in Wales, and after contacting Mr. Downey, we started on the dig. It was a very hot and windless day, yet as soon as we removed the first patch of nettles it was obvious by the fierce draft which blew from the dig, that we had a connection with the cave. Every time we moved a boulder the dust around it was blown up into our eyes, noses and throats. After about ten feet it became obvious that we should need some timber. In those days wood was rationed to, I think, £1 worth per purchase, so the dig was tidied up and left until the August Bank Holiday, when a supply of timber could be organised. This weekend was also memorable for the luncheon we had with the Downeys, finished off with a fine blackberry and apple pie and cream. It was after lunch that Mr. Downey showed us a little cave further up the Pant on the left hand side. We explored this (but not far enough!) and named it Downey's cave.

"The four weeks to August Bank Holiday finally dragged by and the Saturday morning found us at the dig, complete with timber. The digging was easy and at about three o'clock with the help of Bill Weaver, we removed the last boulder. Passing at the time was a Yorkshire caver whose name I forget, and a girl called Joan, so the first short trip was made by five people. The first obstacle was the first lake, which in those days was pretty deep, as Bill discovered later. We all stood around, and as I believe is traditional, topped it up a bit. Joan, however, not being equipped with external plumbing, could not take part in this solemn ceremony. Past the lake we went, up the white way which then was a WHITE stal flow, and on until we came to the Toast Rack, Pluto's Bath and the river. It was obvious that there was a long way to go so we all returned but not without mishap. Bill completely disappeared into the first lake, with the exception of one arm holding his Nife cell (who cried Excaliber?).

"We then returned to the Gwyn Arms for a meal, and then were joined by Johnny Parkes, Roddy Pearce, Anne Boulter (now Mrs. John Parkes) and Pep Powell (now my wife, Phyllis) who had just returned from a wet trip in Llygad Llwchwr. I remember greeting them with the words "we're in" and in minutes they had changed back into their wet caving clothes to join us. The excitement was terrific as we all returned to the cave and managed in quite a high stream to reach the second pot. It was decided that this was a good spot to stop for the day.

"On returning to daylight we were surprised at the number of people assembled in the field outside the entrance; it seemed that half the Swansea Valley was there. One of them was Tommy Morgan and there was also a strange Doctor bloke who had cycled from Merthyr because he had lost his car, or something.

"That evening at the Gwyn, after we had cooked and eaten our stew in the ladies' lavatory, as was the custom in those days, the entry into the new cave was well and truly celebrated.

"The next day everyone who caved, and a lot who normally didn't, went into the new cave, various parties going different ways. The stream passage seemed to be full of people. I remember passing Cyril Powell and Toots Bannister somewhere near the third pot (no poles in those days). About four o'clock somebody shouted that the stream was rising (it wasn't!) and the cry went up and down the stream. It was not long before the cave was empty. During the day Charles Freeman and John Barrows (I think) climbed through a window in a side passage near the entrance and found a skeleton - presumably Smith's brother. Also near at hand was a large nest of cave pearls. I removed all these and except for a few they may be examined at the National Museum of Wales, where I thought they would be safer?

"That evening the Club held its second General Meeting in the bar of the Gwyn, and amongst other business officially named the cave OGOF FFYNNON DDU."

(Peter Harvey)

On the same weekend Ted Mason and his archaeological party at Ogof yr Esgyrn were caught up in the wave of excitement that followed the finding of the skeleton. David Jenkins, a new member, was in that party. He recalls:

"During the war I met Ted Mason and had an invitation to 'dig some bones' at a place called Ogof-yr-Esgyrn after the war. One Saturday in August 1946 Ted, Dr. Savory and myself arrived at the Gwyn Arms and, although I did not know it at the time, the Gwyn was to become my second home. At the back there were tents pitched all over the place but not a soul to be found anywhere. During the afternoon weird, wet and bedraggled figures began to appear telling me excitedly about high passages, stream passages, deep pots and, as one person put it, "It's b..... marvellous old boy!" and this accompanied by a hearty slap on the back. It had been my good fortune to join the Club the day that Harvey and Nixon got in to Ogof Ffynnon Ddu. From that moment on I was sold to caving.

"Others have joined on less dramatic days and indeed my happy illusion that every weekend was going to be like the first was soon shattered. However, those early weekends were wonderful, so much to be found and so many mistakes to be made."

After the day's caving there was endless discussion of cave pearls, the stream passage and the pots, which were very cautiously tackled on the first trips. Little did the first exploring parties realise how important and extensive the Cave was to become. Hopes were that Pwll Byfre would be connected underground. This was not to be. Indeed the result of the first survey led to some disappointment that Stream Passage itself was followed a comparatively short distance towards that objective. The stream joined the main artery of the cave from a sump that appeared to narrow down considerably and the main passage itself ended shortly in a mass of boulders. Outside digs were prospected around Penwyllt but none were seriously continued.

Events moved swiftly, however. Within two months John Parkes and party entered the Waterfall Series, a maze of passages which proved almost as complex as the then known part of the cave. Shortly afterwards Bill Weaver and party followed up the same route to add considerably to the passage length. The sump at the head of Stream Passage had remained a source of irritation since the cave was entered and in November the Cave Diving Group, led by Bill Weaver and with Graham Balcome and Don Coase in support, failed in a determined attempt to pass through the sump which was much too restricted. Just as in the case of Dan-yr-Ogof the underground stream held its secret and remained a tantalizing challenge.

Chapter 2. Stalemate.

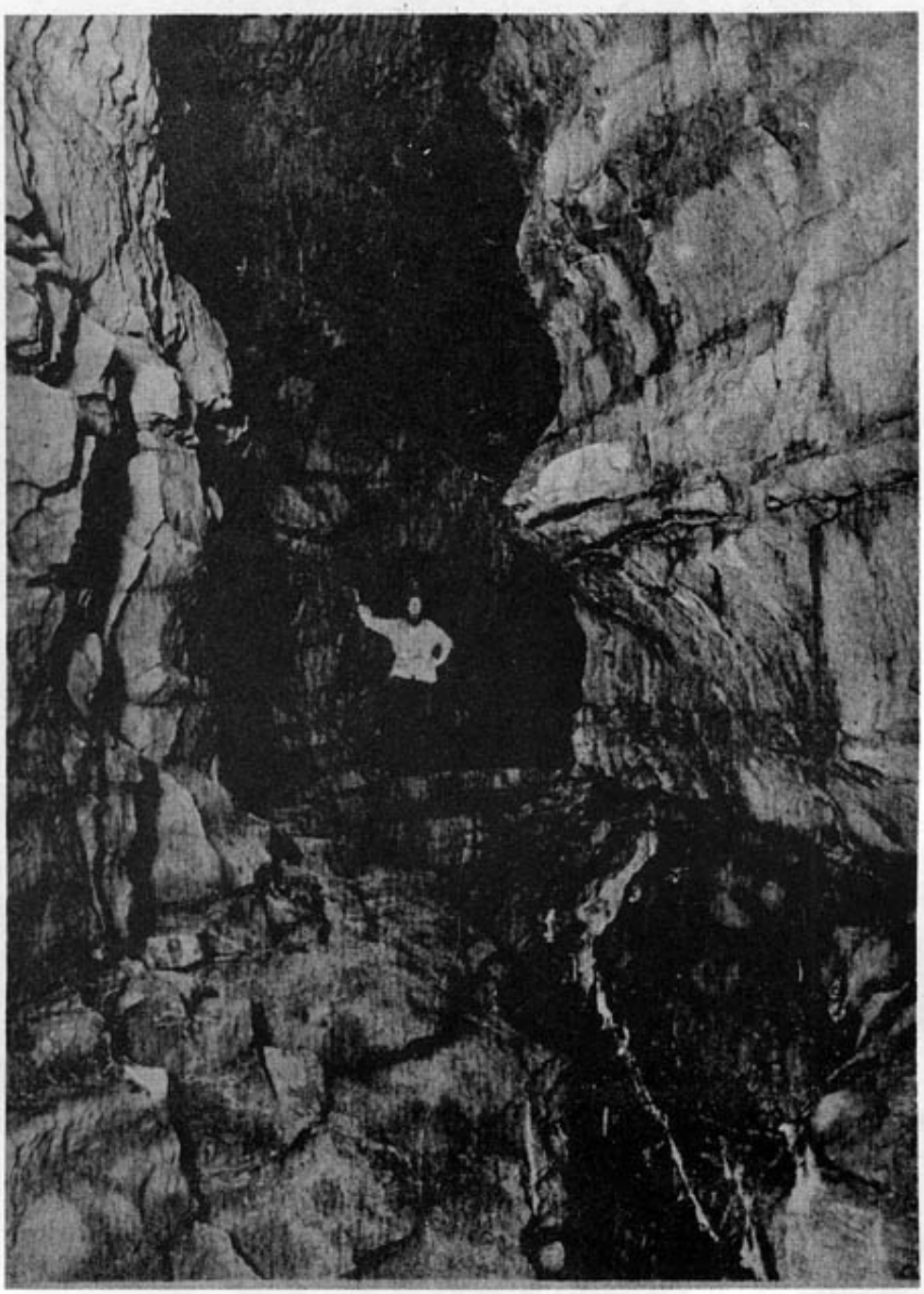
During the summer of 1947 an attempt was made to excavate an entrance at Pwll Byfre. This apparently hopeless task was abandoned as there seemed to be no real choice of a digging site.

In the following year the first use of scaling gear devised by Peter Harvey led to the discovery of an upper level of the stream called Maypole Series.

The main problem to further extension was the boulder choke at the top end of Upper Flood Passage. It is of no mean proportions, and it is the result of a collapse of the roof, leaving a huge chamber overhead in the R.A.W.L. Series known as Starlight Chamber. The cause is apparently that the East Passage once crossed the stream at this point with a fairly thin layer of rock left between. The presence of a large shale band in the R.A.W.L. caused a major collapse, and part of the debris crashed through the roof of Upper Flood Passage.

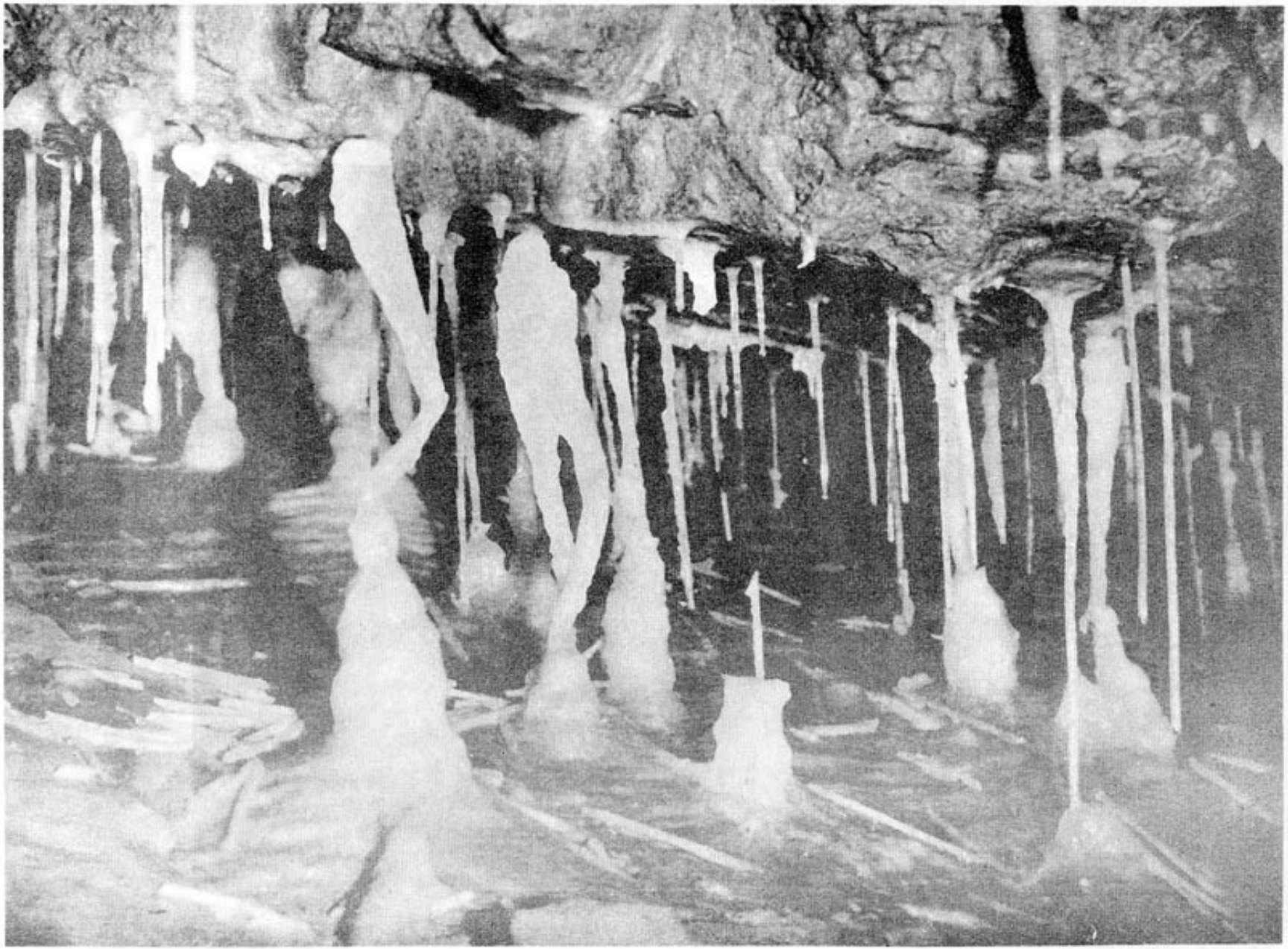
Although the stream has since found a lower level under the floor for more than a hundred yards downstream, it can not be attributed to the passage being blocked.

There were several attempts to get through the choke and the first was made by John Davies and Don Coase in 1948. Running parallel with the stream is a small passage in the left hand wall. It by-passes the boulders for a hundred feet or more and ends in a muddy sump. This



The main Stream Passage, OFD I

near Waterfall Series.



Stalactites in Roundabout Chamber, OFD.

sump was broken by syphoning off the water, but it was found that the passage turned right just beyond and went back into the boulder choke. Operations were suspended, the main obstacle being the quantities of mud still left in the pool.

Don Coase also probed the pots in the streamway by diving, to establish the First as 13 feet deep and the Fourth as 11 feet deep, the latter devoid of the numerous torches, helmets, boots, divers' weights and other impedimenta which had been dropped into it from time to time. Several other digs were started, and in one or two cases, small caves were entered. The original date of commencement of work at the "Ladies Dig" is somewhat obscure but it was certainly receiving spasmodic attention at this time. This was the deep swallet behind Penwyllt Quarry to which attention was originally drawn by Aubrey Glennie who considered that it was the most promising of the many in the area. The assault here was originally inspired by the lady members of the Club, in the hope that they would succeed where the male members continued to fail so miserably.

"Everything that happened in 1951 was eclipsed by the enforced imprisonment of Lewis Railton and Bill Little in Ogof Ffynnon Ddu for some 50 hours. When they entered the cave about 10.45 a.m. on Saturday, 25th August, to continue survey work at the extremities of the cave they did so in accordance with previous practice, intending to leave the cave the same evening. Unknown to them, rain during the day had swelled the Stream Passage and produced a full flood from the Boulder Choke, making it impossible for them to get out. No concern was felt by those outside until midday Sunday as it was known that special rations were stored in the cave for such an emergency. By this time the flood showed no sign of receding despite a temporary improvement of the weather during the morning, and the first emergency calls went out to various members of the club. The full story of this incident has been adequately covered elsewhere. It may be said that this was the Club's first emergency and that the forces which fought the flood throughout the Sunday night and Monday included all available members of the Club, Mendip Cave Rescue Squad, the Army, National Fire Service, Police, Miners' Rescue Squad, R.A.F. Mountain Rescue Squad, and the Yorkshire Cave Rescue Organisation party which responded but arrived after Railton and Little were released. The Yorkshire men missed the glory but rank among the heroes. Their vain journey and immediate turnabout was duty done in the highest traditions of their breed. The rescue was accomplished by a major diversion of Pwll Byfre water into the Nant Byfre surface stream (an engineering feat performed largely under foul mountain conditions) with a strong fresh team largely of Mendip C.R.O. members to reach the trapped men and inspire them to leave the cave to reach safety about 8.30 p.m. on Monday the 27th. Their hope had been that they would find improved conditions on the Tuesday morning, and they were naturally ignorant of the course of events outside the cave. It was estimated that their first chance to leave the cave would have been on the following Friday evening had not the rescue measures been taken.

"In common with events of a similar nature tremendous publicity was given to the matter in the national Press, while locally the rights and wrongs of the case were thrashed out interminably."

(A. Hill)

Far from being deterred Railton and Little pressed on with the survey work and by the following November an overland route was established to the Rawl Series.

Much use was made of the Peter Harvey Maypole, especially in Lowe's passage and Upper Flood Passage, to investigate what appeared to be high level openings. The passages were ideal for maypoling, as there are many ledges on either side, and a height seventy feet was reached near the Waterfall Series. No passages were discovered, but it was good experience.

The next attempt to get through at Upper Flood Passage was made in 1951. At the foot of the boulders on the right hand side is a fissure in the floor along side the wall. It is through this fissure that the stream can be heard some distance below. During Whitsun of that year an attack was made by Peter Harvey, Peggy Hardwidge, D.W. Jenkins and Sybil Bowden-Lyle. The floor of the chamber was attacked but this was given up when Peter Harvey discovered a hole in the wall which gave access to a small passage. Efforts were made to enlarge it but only Peggy could get in. The tube sloped down steeply to a small sandy chamber.

In June of 1952 a week was spent in Boulder Chamber by Peter Harvey, Peggy Hardwidge, Gwyn Sanders and Dai Hunt. The sump in the side passage was permanently broken by breaking up the rock in the floor and the stream can now be faintly heard on the other side. No effort was made to get through, and it was given up in favour of the dig in the floor of the chamber. The rock is well jointed and with the aid of wedges and explosives a depth of four feet was reached. At this point a tube running downdip in the wall was discovered. It was about eighteen inches across and Peggy being by far smallest was pushed in. There was a fissure in the bottom which helped to make progress rather slow. Ten or twelve feet down the passage was a pitch of about four feet, and from a very low bedding plane the stream issued. The passage proved to be too small to follow and by the quantity of water present it was judged to be only part of the stream. Richard Stanley and Les Hawes went down but with no more success. It would seem that at a very short distance downstream the passage is totally submerged as far as the rising.

Another problem connected with the Boulder Chamber was how and where does the flood water get through?

"On Sunday, November 3rd, 1952, Peter Cooke, a visiting Wessex member, Roger Smith and myself went upstream to the Railton-Wilde Series to do some photography. The water was about six inches over normal which made Stream Passage rather sporting. About an hour was spent taking pictures and then we returned to the stream to find the rising running much the same as before, but we noticed how much quieter it was. It was only after a bite to eat that we noticed that water was coming down Upper Flood Passage from the Boulder Chamber, so we hurriedly collected our gear and made for Low's Passage. The water there was already six inches deep but as this was an opportunity not to be missed we went on to Boulder Chamber, having a little difficulty in crossing the pot just beyond the waterfall. The floor of the chamber was under four feet of water which was issuing from the base of the boulders. A few minutes were spent in taking a photograph and we made a hurried retreat to Low's Passage. Arriving back at the step via the high level route we found four feet of water coming down.

"In February 1953 we again had the chance to see the flood water rising only this time we watched it from the beginning. It was raining quite heavily outside and with stream six inches over normal again. John Truman and myself went straight up Stream Passage to Boulder Chamber, hoping

for a high flood. We were not to be disappointed. As has already been pointed out there are several points where the stream can be heard along the southern wall, the main one being in the floor near the boulder fall. This, however, was quiet, the passage below being already full. The other places are fissures between there and the top end of the Waterfall Traverse, but the usual drain like noise was replaced by curious bell-like noises which gave way to rumblings and bangings gradually dying down to nothing leaving just the noise of the waterfall and the distant rising downstream. This rather ominous silence found us wandering up and down the wall wondering just where the flood would break through. But no, it just crept up on us, just the smallest trickle of water at the furthest fissure downstream, gradually creeping across the chamber. Then another fissure started leaking, and the depression in the floor started to fill up. The silence was broken by the water pouring into the topmost pool and so into Upper Flood Passage. The dig of June the previous year filled up very slowly, with no visible current which shows that the passage under the floor takes but a fraction of the total flow. The noise increased to a roar and soon that water started to come straight through the boulders. As the water was approaching waist deep another picture was hurriedly taken and we made our way to the safety of Low's Passage."

(D. Hunt)

One of the most interesting additions was the break through by John Truman into Pant Canol via the Upper Toast Rack Series in 1953. Pant Canol had been known since 1942, and if more had been known then about air circulation in caves, O.F.D. would have been found four years earlier. It is still undecided whether a few hundred feet had been added to O.F.D. or three and three quarter miles added to Pant Canol! Some months later it was surveyed by Jack Myers, Noel Dilly and others, and the result appears to have solved the mystery of the skeleton found in O.F.D. A fissure near Pant Canol entrance connects with the fall of boulders at the back of the skeleton chamber, at the foot of which the bones were found. He must have fallen down this fissure from the surface and died a miserable death from the effects of a broken leg and exposure. Over the years the fissure had become choked with debris. So ended the mystery of the man who was last seen entering Ffynnon Ddu blowing a trumpet, as legend describes him; or is the mystery best left unsolved for the benefit of future visitors?

The survey of Downey's Cave was also carried out, and if only to prove it is part of the O.F.D. system, at least one person made the very tight crawl into Pearl Chamber.

Much work was done in Starlight Chamber. The main draught was found to enter a small boulder choked passage at the back, and during the week-end of the Coronation in 1953 an aven was broken into, since named Coronation Aven. Due to the dangerous state of the walls and roof the dig was abandoned for some time, but during the next year the aven was partly by-passed, and another small chamber entered just beyond, where the draught filters through large boulders. It was quite a safe place to work in, but one still had to run the risk of crawling under Coronation Aven.

Even back in 1956 Arthur Hill had said, "In spite of the obvious danger of the place, it is the only way on to the major part of O.F.D."

Bat Aven in the Railton Wilde Series attracted the attention of Bill Little and Noel Dilly and it was finally climbed via five pitches totalling 130 feet or so, to a choke. This was dug but failed to yield an alternative entrance or high level passage.

Once more the searchers turned to the surface. The Gent's Dig, previously known as the Ladies' Dig before being abandoned, was re-viewed with interest as a possible link up with O.F.D. It is the last down dip, of a line of shakeholes on the high ground overlooking Penwyllt. The Byfre dry valley passes the dig to the east. Several weekends were spent by Les Hawes and a team of diggers before they broke through into a cave. Their excitement was short-lived for it extended for about 50 feet before choking again.

The survey had been finished in 1953 after four years' continuous work. In 1955 an electromagnetic survey device was carried to the highest point in Pillar Chamber and it was located as being only 20 feet below ground level. The underground party realised how close they were to the surface when they heard the sound of Glyn Thomas tapping on the rock with his hammer. At the beginning of the following year the tests were repeated, this time more accurately, and showed the survey to be only 20 feet in error at the highest point in Pillar Chamber.

At the end of March 195 another determined attempt was made on the sump in the high level passage running parallel to Boulder Chamber. The previous attempts had been discouraged by the presence of a deep pool of mud topped with water which lies in the most constricted part of the passage. On this trip, however, the expedition was armed with a pump and there was some hope that if the mud and water were stirred to a sufficiently creamy consistency the pump might be able to move it.

"Although the pump had successfully stomached a large quantity of water, it jibbed at a diet of mud and after the pump and hoses had been removed to a safe ledge, a line of mud slingers led by Peter Harvey and followed by Les Hawes, Gordon Clissold and friends began paddling the mud towards the exit. Les remarked during this interlude that according to Don Coase the extension of the passage only led back into the boulders, but he was prevented from making further pessimistic observations of this nature by an involuntary well aimed handful from in front.

"In a short time the passage began to resemble a bath full of chocolate pudding of an interesting texture, and the cry came that the roof of the sump was visible. Beyond this the passage was seen to rise steeply and become large enough to crawl in. It was not long before, by lying half-submerged in the remaining mud, it was possible to worm under the arch and up the slope.

"Les's memory had proved only too accurate, for after a few yards crawling the passage came to a stop in a grotto of jammed boulders, thinly cemented with calcite. The small holes in this mass showed only more boulders, so that further progress here seems impossible especially as the only place of shelter is back through the mud sump.

"It was a disappointed squad of Chocolate Soldiers that regained the surface; but at least the impracticability of the place went on record."

(Brian de Graaf)

There appeared to be no progress. Every effort that the Club made seemed to be destined to fail. A legend grew up that the Cave was inhabited by a strange and mysterious guardian called Smith, who thwarted all new-comers in their efforts to creep into his domain. It was recalled that even on the day that Harvey and Nixon entered the cave he had been digging potholes in the stream bed to delay their progress. That very night he had filled Boulder Chamber with boulders and had secured himself in the further recesses of his castle. Smith's habitat seemed impregnable.

There were many attempts to explain the formation of the O.F.D. system. Perhaps the most controversial of them all was put forward by Peter Harvey. He believed that the Byfre Fechan which sinks at Pwll Byfre was a relatively young inlet and that the original state of affairs was that the Nant y Moch river, which today joins the Nedd Fechan, flowed across the moor to join the Nant Llech Pellaf which flows across the grit and joins the Tawe near Abercrave. In those days, the moor must have been very much higher than it is today. Gradually the river sank, and there are several places to the south west of Pant Mawr at which it might have done so. The river flowing underground formed passages like those in the Rawl Series. As the Nedd valley was cut down the water table was altered, causing flow of water towards the east. The Nedd captured the underground water of Pant Mawr. The most interesting part of this theory was that there ought to be some sort of connection with Pant Mawr and O.F.D. It also meant that any system at Pwll Byfre was likely to be a small and undeveloped one like that at Sink y Giedd.

New tactics were called for, and Les Hawes began creating a diversion with some researches into the Cwmdwr Quarry Caves.

"Quarrying activities in the 1930's brought to light the existence of a cave system on the eastern side of the railway line at Penwyllt. In May, 1937, Platten, Roberts, and others made the first descent into Cwmdwr Cave (later called Cwmdwr 1) and the following description was given in Y.R.C. Journal No. 23 - "Entrance 20 ft. above quarry floor. Ladder down 20 ft. rotten rock, steep slope of scree, three connected chambers and a short but interesting stream passage". Notes kept by E.E. Roberts add in July, 1938 - "Short part 68 degrees true, long descending part 248 degrees, i.e., runs out under quarry floor".

"Quarrying seems to have continued for a short time after this, until a break-through occurred into the passage just beyond the entrance, which ran roughly parallel to the quarry face. Following this, a series of charges brought down the roof of the "main chamber" leaving a large hole in the quarry floor and exposing a passage some 15 ft. deep running back into the working face. Work then ceased at this section of the quarry. The hole in the quarry floor was found eminently suitable for the disposal of quarry spoil and was largely filled by this dumping process.

"What stopped further exploration in the known passages before the entrance was completely blocked has not been recorded. It seems likely that boulder chokes stopped progress and that little or no work was done to force them. Another factor may have been the rapid deterioration of relationships with the quarrymaster which Platten recalls following strong objection being made to the use of the cave as a dumping ground.

"The personal notes of E.E. Roberts - 3rd/5th July, 1938, indicate that the cave was still open when the new cave (Cwmdwr 2) was discovered. This is confirmed by Arthur Hill's notes "A new hole opened by quarrying operations in Penwyllt Quarry, and brought to our attention by Bill Doyle, was examined. A 10 ft. climb on to a false floor and a small opening was visible, down which a stone would run for a considerable distance. The hole was opened out and it was possible to look down a distance of probably 40 ft. A rope was hung down this rift and we proceeded to the main Quarry Cave as it was thought this was a new connection. No sign of this rope was found after a complete search here and it would seem that an entirely separate cave exists here." Exploration of the new cave took place in August 1938 and a full report and survey by P. Raynes appeared in Vol. III of the Mendip Exploration Society Journal (1938).

"Nothing further seems to have been reported on either cave or cave remnants from that time until interest was renewed by the author, John Hartwell, Bill Clarke and Glyn Thomas roughly two or three years ago. Presumably the events leading up to the opening of the Ffynnon Ddu system completely overshadowed anything that the Cwmdwr Caves could offer, but it is interesting to note the absence of any comments at that time on the possibilities of these caves being associated with the Ffynnon Ddu system. The high grade O.F.D. Survey since published has enabled us to relate the cave to surface features and there seems to be little or no doubt that the Cwmdwr Caves are indeed part of the Ffynnon Ddu system.

"Although Cwmdwr 2 is useful in establishing the general idea of the cave development in the area - it takes second place in plans to excavate in the quarry. The blocked Cwmdwr 1 has been chosen for the present attempt to get into this part of O.F.D. beyond the railway line. Interest centres on the "strike" passage, known from earlier reports to be running in a westerly direction under the quarry floor. It is known to slope down steeply and it is hoped that its junction with a further "dip" passage will be at a sufficient depth to have escaped the effect of quarrying and drift infilling. The point of excavation is some 800 ft. from the railway line and almost double that distance from the now defunct Penwyllt Inn.

"Work has proceeded irregularly and has suffered from the usual distractions to which digs are prone. A visit to the quarry with the original quarrymaster fixed a point at which a break-through into this passage had taken place. This was some 20 ft. from the quarry face and away from the major dumping area. However, cross section trenches failed to locate this hole. Since then, the main effort has been directed to clearing quarry debris from the open section of the passage, with the object of finding the roof level downwards from the collapse and digging under the roof until the end of the debris slope is reached. The fill was reported not to extend more than 15 ft. from the quarry face but the source of this information is apparently not 100% accurate.

"Work is complicated by occasional collapses of the sides of the dig where frost action and perhaps the effects of quarrying have produced extreme shattering of the bed-rock. We are also hampered by a scree slope to one side of the dig, which, despite levelling work at the base, often adds to the excitement."

(L. Hawes)

While Les and the diggers created their diversion at Cwmdwr, Gordon Clissold and another team sneaked back into Boulder Chamber. Former parties had attacked the left hand side of the choke, the many spaces in the centre and the right hand floor of Boulder Chamber, but without success. Little attempt had been made to dig in the right hand boulders, and it was thought that if the boulders fell from the Starlight Chamber direction there should be larger recesses on the right and the most promising place to dig. On the 22nd. September 1958 the choke was studied and a recess found which would give a protective roof and wall.

"On the 28th September, accompanied by a strong working party, very good progress was made but we soon lost the protective roof. In a short time the tunnel became unstable and the appropriate name of 'Hush Tunnel' was given to it. The following weekend a small space in the left floor was pressed but this failed to produce the way on. A further eight feet was excavated but unfortunately the weekend finished with two feet less than when we had started. This seemed to be the general pattern of the dig for several weekends, the digging parties being forced to seek the safety of Boulder Chamber when several loud rumblings of collapsing boulders could be heard somewhere deep ahead in the choke. The location of these collapses has never been discovered. During the digging on the 27th. October we could hear rubble falling into what appeared to be a large space below our boulder floor, so we dug in that direction and uncovered, in the meantime, two solution tubes in a solid right hand wall. Shortly afterwards we were able to peer into what seemed to be a small boulder chamber with only a large boulder preventing us entering. This was soon chemically removed, but a further boulder fall took its place. The time to leave was overdue but the temptation to avoid waiting a fortnight to know what lay beyond was too great and we set to with renewed vigour. The new fall was cleared in record time but for a large boulder which we removed after rather a strenuous effort, not wishing to make the same mistake twice. The way lay open and we dropped ten feet into a small boulder chamber down a short boulder slope into a fair sized passage entrance. Beyond, our exploration was curtailed by a deep pool which appeared to be a complete sump, and a small aven which when climbed led to the solution holes previously mentioned. A small trickle of water found its way into the pool, but scolloping showed the main direction of flow was out into the boulders to Boulder Chamber.

"On the 3rd. November during a high flood we managed to get to Boulder Chamber where we found the chamber, now known as Hush Chamber, completely filled with water, which in the height of the flood had been flowing through Hush Tunnel. Another exploration that day was out of the question, but we had found proof that the flood water in Boulder Chamber came from Hush Sump.

"In the hope that a way on could be found beyond Hush Sump we took in a party the following weekend, but in spite of a soaking it was to no avail. Our attention was centred on the boulders once more, but there appeared to be no obvious place to dig, so we tunnelled towards the slight sound of water falling in boulders. This turned out to be a mere trickle but the tunnel led us to a solid wall bearing slightly right, in which direction we concentrated our efforts. The end of the weekend saw almost double the distance of Hush Tunnel excavated and a glimpse of what appeared to be a small chamber in solid rock with one boulder holding up our progress. Unfortunately our weekend efforts had tired us and we were left to

dream for a week. At last the week passed and a small party was again in the boulders. The problem to pass the one blocking boulder seemed impossible at first, but a few boulders which we thought were key stones holding up a large boulder pile were gently removed with a lump hammer and the way lay open. We were rewarded, not with a small chamber, but a large passage which seemed, at last, to be the way into O.F.D. 2. This led us to a junction of three passages. The first and largest we followed down dip (Dip Passage) to a pot (Pot Sump) the bottom of which was completely filled with water. Under the water we could discern two submerged passages of fairly large dimensions. Dip Passage led us around a shallow pool and finally to a large pool in the centre of which we could see a flooded pot hole which presumably led, via the submerged passage, to Pot Sump, and then Hush Sump. The water was too deep to wade so we turned our attention to the other passages. The one leading forward in the direction of the dig unfortunately led us to a stalled boulder choke where we felt a slight draught from a small choked solution hole. The remaining passage we climbed at a steep angle upwards in the direction of Starlight Chamber. The floor was covered in sand like that found in the Starlight Chamber Pit. The top of this passage was blocked with boulders but took a good draught. So ended our exploration, just when we felt we had found the way into the unknown system of O.F.D. The dinghy was, once more, put into use and the slight hum of water in Dip Sump investigated, but with negative results and no air space found. The following weekend in low water conditions we heard a definite roar of the stream, but unfortunately we hadn't the dinghy so the problem of what lies beyond Dip Sump remains unsolved. It is almost certain that in drought conditions there is an air space above Dip Sump, but whether it is sufficient to allow penetration has yet to be discovered.

"There seemed little more to do in the passage so we tried the boulders at the junction. A few boulders were removed and a connection made with a previous dig in the right hand passage leading from the Boulder Chamber mud sump passage. We paid a visit to the Boulder Series during a 2 ft. over the step flood, to study the flood conditions. Hush Chamber was flooded to a depth of 8 ft. so we had to try the alternative route. This we found was less comfortable than the Hush Tunnel route and decidedly more dangerous. How very easy it would have been for the original diggers to have found the Boulder Series; there was hardly anything to stop a straight crawl through to the junction. Pot Sump was flooded to about 8 ft. over normal and as far as could be estimated so also was Dip Sump. Fortunately the water fell about 6 ft. in the Sumps in 4 hours and the escape route was not required for the return trip; the water over the step was then 10 ".

(G. Clissold)

Noel Dilly believed that the new extension of the Boulder Series in O.F.D. lacked one fundamental indicator: "Nowhere in the series prior to the end of December was there a localised draught."

"Gordon Clissold and his helpers had been digging at the end of a passage in stalled boulders without much success. This was the situation when Bill Little, Brian Fenn and I went in to have a look around and to do some digging. Having decided that the previously dug site, although draughtless was probably the best place to dig we set to work. Having no

Chemical assistance we progressed slowly attacking stalled up blocks ahead of us. At first we ignored the persistent "drip-drip" of mud which fell from above and to our left. But soon we had to abandon our efforts on the stalled up boulders and just as enthusiasm was waning we were joined by Arnold Jones and W. Harris, who attacked the "mud-boulder" mixture with enthusiasm.

"The dig was now progressing upwards above the digger and due to the watery nature of the mud, the force of gravity, and the slope of the passage it rapidly turned into a self operating dig. The Passage was rapidly developing into an ankle deep mud bath and many digging implements were used as paddles to assist the mixture on its way to pot sump.

"After two hours of digging everyone in the party could be described as muddy. Enthusiasm once more started to wane, the passage was "fuggy" and "clammy" and everyone was miserably wet and muddy. But I had just filled my lamp and just for sheer cussedness sake I decided to take another look at the mud wall at which everyone had decided to "call it a day". The mud wall was some six feet high and about three feet above me. Absentmindedly I attacked the base of the wall with a crow-bar thinking if I undermined it, it would collapse, not thinking upon what it would collapse. It did, upon me!

"Once more I became the "abominable mud-man". After digging myself out and extracting my helmet lamp and spectacles from their respective balls of mud I was delighted and excited to notice that the fug had cleared.

"As quickly as I could with my "mud-caked" hands and soggy equipment I got my helmet and lamp in good order and rejoined the others who by now had cleared out my mud funnel and were forcing themselves in turn into a small chamber at the foot of a boulder pile. The most important fact now being that there was an appreciable draught which chilled our soaked bodies and bent our acetylene flames.

"The draught continued upwards into the boulders which formed two sides of the chamber and with this interesting observation we left the cave with provocative and excited discussion of O.F.D. II."

(N. Dilly)

Chapter 4 ..... And Thrust.

In April 1958 the rescue organisation received a severe test; David Jenkins slipped in the Waterfall series and was knocked unconscious. It took about seven hours to complete the rescue, which was successful. The experience gained led to many improvements in technique in the Rescue Organisation.

At the beginning of the summer in 1958 the Cave Diving Group made an attempt on the sumps discovered by Gordon Clissold in the Boulder Series extension. Reports came back of "the discovery of a diving site in South

Wales which at first sight seems to rival even Wookey Hole in the size of the passage and the crystal clarity of the water". (O.C. Wells).

The dive, however, produced no open passages. The initial progress at Boulder Chamber seemed to be halted. Digging progressed near the sumps in an effort to bypass them entirely, but as Clive Jones said:

"Digging in Boulder Series is like digging up through a bag of peanuts, every nut removed brings down a shower of others to take its place. However our digging seems to have started a movement in the floor of Coronation Aven. Two holes were noticed in the floor by Bill Harris. He then persuaded a party to go to Starlight and have a look, and after a preliminary survey the digging committee retired to the Gwyn. Around a warm fire and a pint of beer it was decided that the boulders in the aven looked safer than they ever had. Another pint of beer convinced everyone that Coronation Aven was the place to dig.

"The original plan was to bring down as many of the boulders as possible from the Aven and drag them into Starlight using a pulley block and tackle. However luck was on our side and the larger boulders came down jambed across the Aven to leave a clear and safe route into Coronation Chamber.

"The way on seemed to be through the hole in the floor of Coronation Aven.

"Bill Birch, Bill Harris, Eric Inson and a bloke from Aberdare whose name I can never remember, spent 4 or 5 hours removing the boulders from the floor of the chamber. Then by a form of chemical removal in which Pickfords do not specialise, the hole down was made big enough to squeeze through. Another two hours and they had progressed about 150 ft. beyond the Aven. What a 150 ft! It was a real prospect-wrecking passage, a bedding plane 10" to 15" high.

"A larger party went in the following week-end prepared for a big find, but got no further. There appeared to be two ways on. The first was a boulder choke where the draught disappears in a downward direction, and the second in the bedding plane on the right."

(J.C. Jones)

The surface work continued and during the winter of '58-'59 Bill Birchenough and some others set off up the valley to the east of the Engine house to search for shakeholes with "wind" in them. There was snow on the ground and Bill Little found a small rabbit-hole with melted snow around. A few days' digging produced a hole leading to a 20 ft. square chamber. At the bottom of the entrance climb a tunnel about 10 feet long was excavated and led to a draughty rift. The place was called the Hot Air Mines.

It was soon abandoned however. Diving seemed to be the only way of beating the elusive Smith.

Chapter 5. Counter Attack.

Brian de Graaf took an interest in cave diving, sparked off by Wells' dive in Hush Sump. In August 1959 he repeated Wells' effort and proved that Hush Sump connected with Pot Sump, an interesting discovery, as it did away with the need to carry gear all the way through the boulders before setting up a base. A retreat was called, and the same party returned to the main rising in the cave to repeat the dive done by Balcombe earlier. The passage was found to be impassibly narrow after about 100 feet and a sharp right angled bend. The sump at Gothic passage was also dived on the same occasion. Within 60 feet impenetrable cracks prevented progress.

Diving seemed to be established as the only means likely to enter O.F.D. 2. There followed a series of dives that were reported in logbook form:

September 5th 1960.

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

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

September 18th 1960.

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

Here the customary brick was left to anchor the line.

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

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

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

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

<u>October 8th 1960.</u>

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

The party then wired on to the brick and made the (official) ascent, after a false start up a blind water filled solution tube 20 ft. down, into yet another vertical sided aven with no easy way out on to land. So were our hopes of at last setting into O.F.D. II dashed! The usual layer of slime, coupled with vertical fluting of the rock, made leaving the water a difficult matter but with much assistance from the other, one diver struggled out and was able to sit astride a narrow bridge of rock which on

the far side plunged down into a second pot, also static. The only dry way out of the chamber seemed to be via a small and inaccessible double window high up in one wall.

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

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

October 9th, 1960.

The original intention was to go straight down bottom-walking to the bottom of Oxygen Pot and investigate the main stream entry using large twin cylinders filled with oxygen giving 2½ - 3 hrs., (determined by the CO2 absorbent) endurance, but an incurable high pressure leak on one set made this unwise. Instead, it was decided to clear up as much detail as possible nearer home and the team set off for Nyphargus Niche with a scaffold pole each, to try to get into the dry passage. The luscious mud soon turned this attempt into a real 'greasy pole' competition, in which the greasy pole won every time: that is until one diver lay on the two poles set side by side and allowed himself to be walked up. Away went No. 1 into a long rabbit hole of a passage, christened Shrimp Series, which after some 200 ft. rising steadily up dip ended in a cross passage which contained several mud-choked branches and a small static sump through which an air space could be felt. Near this a vertical shaft was climbed for 50 ft. which ended in a number of small sharp edged solution tubes, still negotiable.

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

Time was now getting on and it was felt that the base party would be getting worried, so a return was made, collecting the maypoles on the way, and base regained some 3½ hrs. after setting out.

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

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

(Brian de Graaf.
Charles Owen George.)

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 balance O_2/N_2 mixture in the breathing bag, which in these circumstance 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.

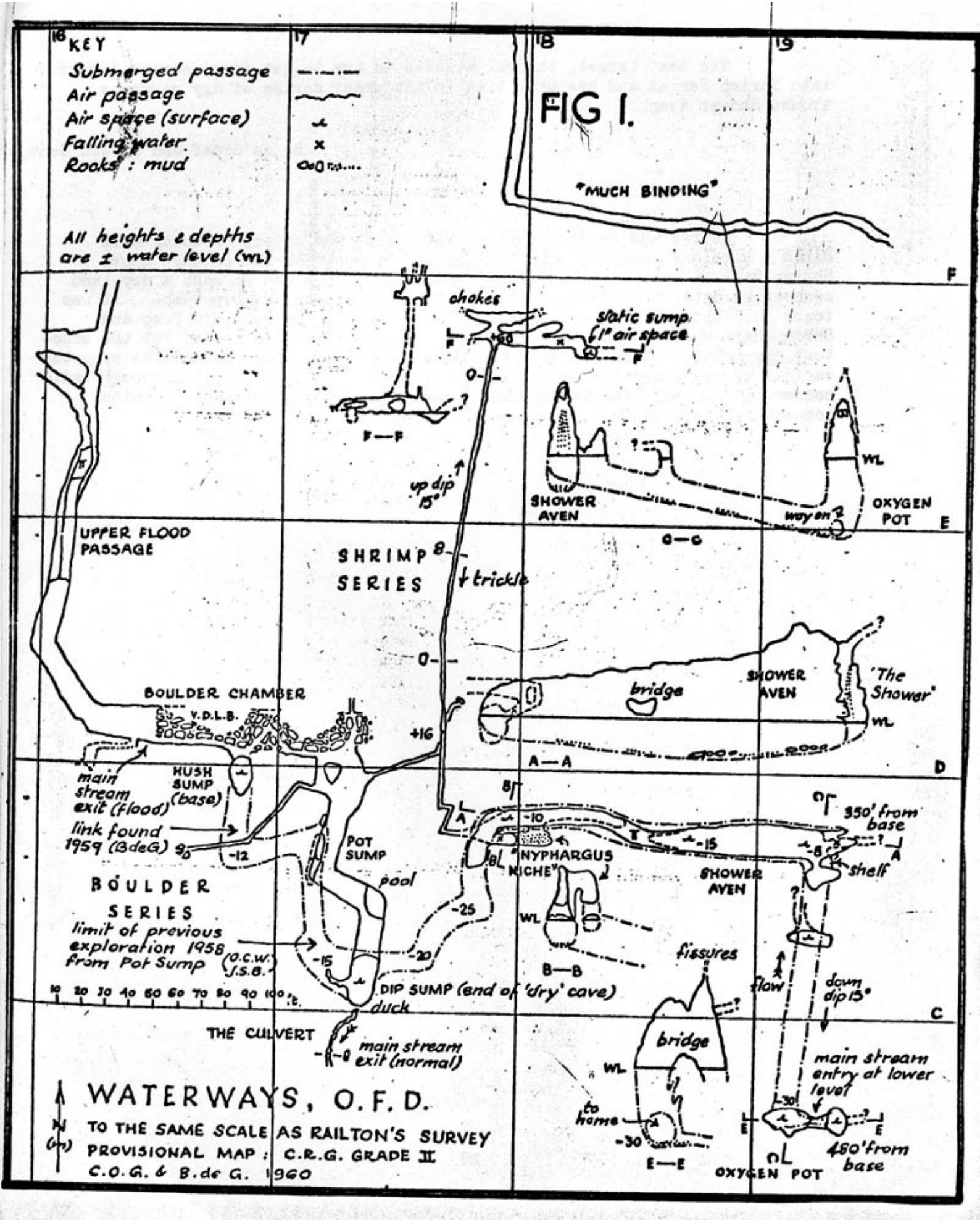
As it happened the maximum depth turned out to be 35 ft. After a short crouching walk down the section of passage visible from Oxygen Pot the divers were reduced to crawling in a wide bedding plane which turned north and east over a wide arc. Only a small part of this plane was penetrable as progress 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.

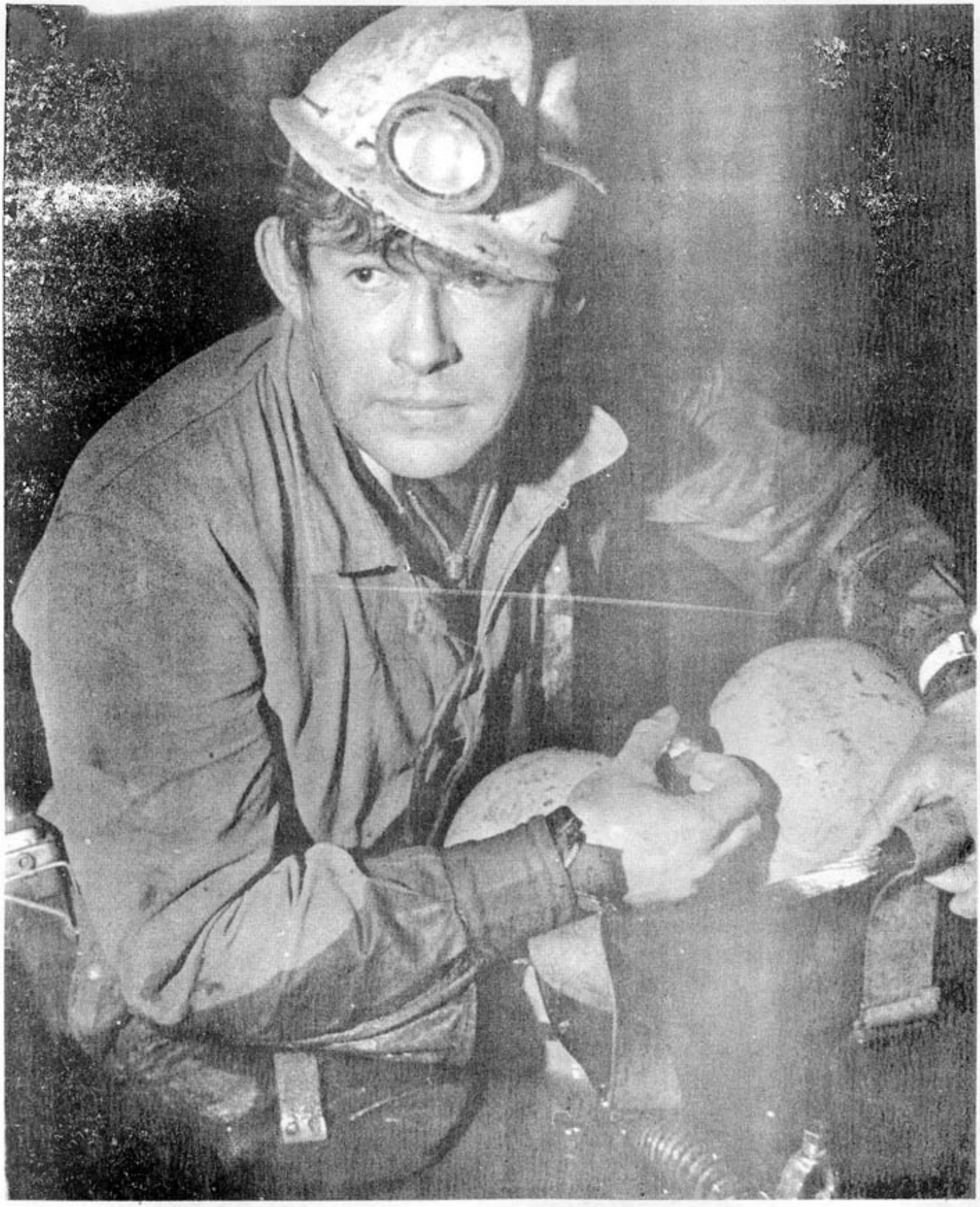
The main water flow undoubtedly comes from this bedding plane but we seem to have reached the practicable limit unless we can grow gills and dispense with the bulk of the apparatus. It might be possible to get a little further by dispensing with the big mixture cylinders which add some 6" to a diver's 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.

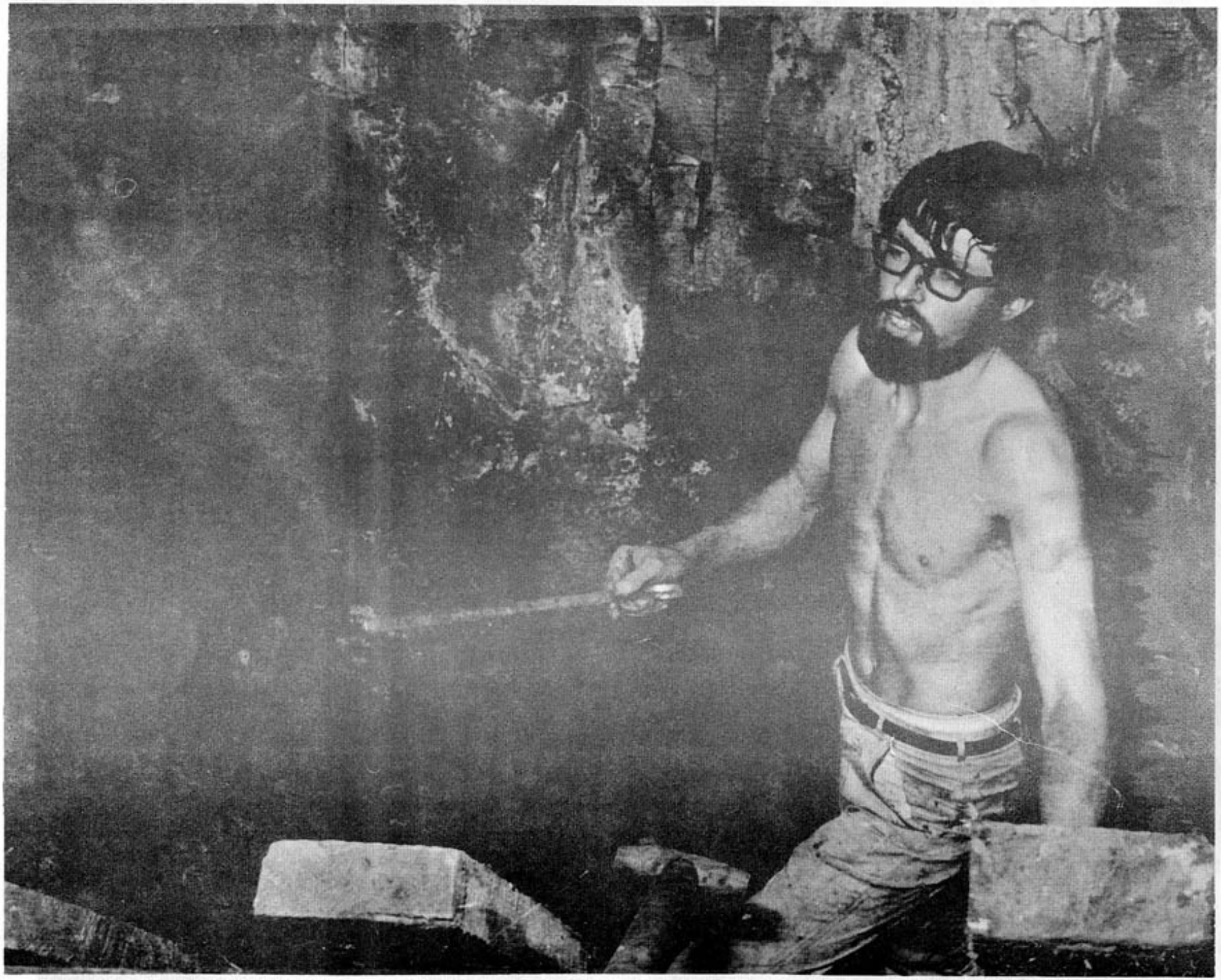
B. de Graaf and C.Owen George.

George and de Graaf made a visit with the object of using Bill Birch's wireless locating apparatus to try to position the passage above Shrimp Hall in the hope of being able to dig through and so make a dry land connection between Boulder Series and the passages behind Dip Sump. It was found possible to establish telephone communication between Dip Sump and Shrimp Hall which was a great comfort to the divers and a relief for the monotony for those waiting at base, though on the return trip through the sump the various wires caused the divers some confusion. Unfortunately although radio connection was made the two operators were too far apart to make physical connection possible.


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



Preparing for a cave dive.



Operations on the surface during the breakthrough to OFD II.

Chapter 6. On the Surface.

Exploration of the Shrimp Series was at a standstill and the attentions of the members were focussed once more on Cwmdwr. Clive Jones tells the story:

"The trouble, in 1954, was that the exact location of the cave was not known so trial pits were made but without success. Les Hawes made a study of the history of the place and was able to get in touch with a number of the original explorers and the quarry master. A spot was chosen to dig and the project continued spasmodically until 1959, when John Platt, Tony Holroyde and Bernard Woods spent a week's holiday at the site. However, things were not easy and a considerable amount of timbering had to be carried out. At Easter 1960 the dig was worked continually and by Monday evening a hole down into the cave could be seen. The Tuesday was spent in shuttering and on the following weekend Bill Little, Bill Birch and some others got into a cave. I say "a cave" and not "the cave" because I'm not certain that the new entry was into the cave surveyed in 1938. There was very little agreement between the old description and this new cave.

"The discovery of the cave was a big disappointment to some of us as we had expected to see an obvious place to dig into bigger things. As it was, we had four alternatives, none of which seemed very promising. These were:-

a) The S. end of the main chamber.

b) A small hole in the side passage down which the stream disappeared.

c) A hole further along the side passage, which contained some very interesting scallop markings.

d) The boulder choke at the end of the side passage.

"We didn't like the look of (a) because we suspected that it went to the surface, and the boulder choke (d) looked difficult to handle. The scallop hole received a little attention but we got the impression that it was a long job and enthusiasm waned. The stream was the obvious thing to follow especially as it was accompanied by a howling draught. So we threw our lot in with the wind and water and started to enlarge the 3" x 12" crack at the end of this miserable little passage. This particular stretch of digging was probably the most bloody-minded hole the club has ever dug but it was also the most determined effort on one dig we have ever had.

"Usually the blasting started on Friday evenings with two or three trips on Saturday and Sunday. The hole was forever being blocked by debris which dammed up the water and often charges could only be laid lying on one's back with water up to one's eyes. Progress was slow and we made only a foot or two each weekend but we always managed to get to the most infuriating corner by the Sunday evening. Peering round it we always saw another foot or two of crack and another corner. Then approximately on November 5th 1960 we had a bit of luck. I arrived at the club at 10.30 p.m. on the Saturday, to find Charles George preparing to return to the dig having spent

all day at it. He was bubbling over, he had got around another corner and there was nothing but black space beyond. David Jones and I joined him and moved what seemed like heaven and earth to get into that space, but by 1.30 a.m. we'd had enough. 9 a.m. the following morning saw Charles, Seaton Phillips and I back at the hole, one hour later, we were standing up on the other side. All three of us were, as we thought, on the threshold of Ffynnon Ddu Two.

"When the handshaking and back thumping was over we set off into what is now Dim Dwr. Soon, the way was blocked with sand and some very beautiful mud formations so we returned to the stream and took the route to the "big stuff". The discovery off The Drain was a bitter blow and we grovelled unbelievingly in that mud-filled mousehole looking for the way on. We then got our senses back and realised that we'd lost the draught so there must be a side passage. Sure enough, upstream there it was and it carried the draught but in a short while it was too tight to get through. We then decided to return to blasted passage for banger but found another tight side passage which claimed a pair of my trousers but which led nowhere. On returning to the stream, we met Bill Little, who has a nose for cave finds, and whilst Charles and Seaton went for the banger I sat and smoked Bill's cigarettes. They were gone for over an hour and had crawled up another tight hole near blasted passage but failed to get to the end. After starting to blast the hole with the draught we returned to the club for a meal. A few hours later, after more bangs, we were still unable to get through.

"The following weekend Bill Clarke got through the squeeze and reported an aven with the draught disappearing into a boulder choke half way up. It took several more bangs before we were able to get to the aven and we spent five weekends at the boulder choke. The draught was certainly the strongest in the cave but soon the dig was up through boulders with no quick retreat if things began to move and this forced us to give up. We pushed some side passages at the top of the aven but although they opened up there seemed little prospect of any way on. In February '61 the dig through Dim Dwr sand was started. Metal trays were taken in and by shovelling and pushing they were loaded with sand and dragged back to the bigger passage. The draught was good, but not as good as in the aven, but the digging was easy and by the end of the month Seaton Phillips, Gwyn Thomas and Arnold Jones got to the end of the sand constriction and found 70 ft. of passage big enough to stand up in. The draught belted down a side passage on the right whilst the main passage, for what it was worth, ended in a sand-filled pit. We started to dig both, but soon gave up the side passage as it turned too many bends and we made the mistake of digging it too small. This was probably the biggest mistake we made in Cwm Dwr as this led to the Jama by an easier dig than the one we decided to pursue.

"The shaft from the surface was now giving serious trouble and was in danger of callapse at any time. It was a bind to have to go back to stage one but it had to be done or we'd lose everything, or even worse, we'd be trapped inside a hole we'd dug ourselves. Bill Birchenough's cave detecting device was used for the first time and a route made up through a very unstable aven. John Harvey "obtained" concrete pipes and after several months of work, a new, safe entrance was constructed.

"By Whitson 1963 we had blasted a hole over 70 ft. long from the bottom of the sand pit and were about to give up this unequal struggle when a black space turned up round a corner. There was the sound of a rushing

stream and the draught was stronger than ever. Nearly everyone at the club worked at that hole over the holiday and on the evening of Whit Monday we squeezed into a miserable wet bedding plane which closed down in about 20 ft. to an even more miserable looking dig than the last one. There was little or no draught that day and we were all dejected, tired and fed up.

"The following weekend Bill Little's nose was twitching and he decided to go with Bill Birchenough and Terry Lloyd to have a look at what all the fuss was about. They dug at the bedding plane but decided it was not much use and started to return to the surface. Bill Birch then noticed that the draught was going up a rift in the roof and in two bangs time they were standing in a vast new cave.

"The new discovery consisted of a large passage 15-20 ft. wide and 60-100 ft. high blocked at both ends with massive boulder chokes. The dig had come in near one of these chokes and it was pure luck that a collapse in the floor of this passage had joined with the rat hole we were digging. There was a reasonable size stream which fluorescein soon proved connected with Ffynnon Ddu beyond boulder chamber. This stream entered the cave from a boulder choke on the right side of the main passage. A number of attempts have been made to get a dig going in this choke but without success. It does not look a formidable choke and it is more stable than most in the Swansea Valley. The trouble is that it is a wide choke and a number of places are diggable but no-one has decided on one spot and gone at it.

"Near the point where the dig came into the Jama was an impressive dry boulder choke. This received a fair bit of attention at first and a small chamber was entered at the top. This chamber appears to be at the top of the boulder heap but no way down the other side was found.

"The stream in the Jama wound its way down an impressive stream passage and sank at the foot of a very unstable boulder choke. A number of attempts were made to find a route through these boulders but they always ended in very unstable situations with boulders all around and no obvious direction to dig."

The concentrated effort on Cwmdwr had paid off but the missing miles of Ffynnon Ddu were still missing.

Chapter 7. Decoys.

Bill Little and party surprised everyone one day by finding several hundred feet of passages within a few minutes of the entrance to the cave. He describes the discovery of Fault Series:

"Well there it was, a path going right past and worn smooth by hundreds of cavers during the last 5 years. Where Main Passage joins Flood Passage there is a chamber on the right which I have always known

as Fault Chamber (O.F.D. Grid Ref: 4.4/D.8). On one side of this the fault is apparent in the wall above the hole leading to the Bedding-plane Crawls. On the other side of the chamber is a steep calcited "boulder" slope reaching to the roof from which came a trickling stream of water.

"More recent examination suggested that this "wall" was in fact a choked passage. Several days of blasting out the calcited blocks have now proved this to be so to the surprise of those who thought we were wasting our time.

"On Easter Sunday, Neil Jones, Eric Inson and myself, blasted enough to squeeze into a space still so thick with smoke that we could not see our own feet. For a few minutes Eric and I groped about in turn whilst the other remained at the squeeze to guide ourselves back with our voices sounding strangely distant through the nitric fog. It was useless trying to explore until the air cleared so we went off for a couple of hours and returned again.

"The smoke had cleared sufficiently to see why we had not gone far before. In front the 10 ft. wide passage we had entered was choked by a steeply rising bank of clay and behind us the chaos of blocks we had squeezed through rose steeply back in the same direction from which we had come. We climbed up more calcited blocks, passing a curtain draped side passage, to find flat mud banks at the top of this slope. On the left the little stream had cut a trench and we walked along its calcited bed leaving the expanse of cracked mud flats undisturbed and watched over by two unusual stalagmites. Both are under a yard high, glittering white and erected upon circular cones of red mud.

"The passage carried on, the roof still rising until some 30 ft. high: then the slope of floor deposits increased again and the passage ended suddenly at calcited blocks. We estimated the length of the passage at some 300/400 feet from where we started blasting in Fault Chamber, also estimating a total height of about 120 ft. above Flood Passage. The side passages visible by the mud flats became too tight after only a few feet. Opposite, a small passage had a floor of 'gours', at first dry, then wet. Some 30 ft. in was some 'cave ice' unfortunately broken and sunk in the cause of exploration but the next bend became tighter and we lost interest. Another side passage was explored when we returned to the curtains. My first impression was that we must be close to Pant Canol (another Cave to the North of this part of O.F.D.) but rather higher. A week later with the help of Neil Jones, Laurie Galpin and for some of the time, Bill Hughes we did a 'Grade 6' survey of the main parts (Grade 4 for the short side passages). We also named this passage Stairway Passage.

"There's nothing like careful surveying for finding more cave. A ledge by the mud flats concealed a narrow little passage which we had not noticed before. After a few feet of narrow twists we crawled over some fallen blocks into a larger passage leading downwards again. Halfway down, a 'keyhole' passage on the left became choked. At the bottom another 'tube' passage also became mud choked. This latest extension which also went up again from the fallen blocks was christened the Back Stairs. Bill Birchenough found some snail shells amongst the 'boulders' at the top end of this passage.

"There are no formations in the Back Stairs of any individual significance, but much of the walls have a sparkle of gypsum. There has not

been any gypsum found in O.F.D. nearer than the RAWL series to my knowledge and perhaps this is significant. The height gained between Flood Passage and the upper ends of this new series must surely bring us up into the same beds of rock as those around the RAWL series. As yet I've seen no sign of any large shale band but perhaps the way leads upwards still further amongst the collapse or choke at the top of Stairway Passage. A rising shaft could perhaps be blown out here (I've already started) and we might find the RAWL shaleband.

"Where did the passage come from? Not Pant Canol; Stairway Passage is too high. But then we don't know where Phil's Parade (in RAWL Series) goes after becoming sand choked. Could they be one and the same passage? Then what lies between? because if it is the same passage it must belong to the oldest part of the O.F.D. Cave System. Except for the lower end of Stairway Passage and the almost separate Back Stairs, the passages are not on the Fault Line. A geologist's opinion on this series would be interesting."

(W.H. Little.)

There was a lull in activity. Enthusiasm waned a little because of other interesting projects or perhaps because of the failure of the big attempts to find O.F.D. II.

There was a temporary increase in activity when Alan Coase and Tony Iles found the Tiger Aven in the Waterfall series. It was interesting because it seemed to be extending in the right direction for a major extension.

"After examining every possible way out of Crystal Pool Chamber we made our way through a tight squeeze into a small rift chamber. This lies parallel to and north of C.P. Chamber and had been entered by one person (who?) previously. The footprints noted went only a few feet while we pressed on to a finely decorated aven. This we rapidly climbed and found its attractions to increase rather than otherwise for although the calcite is a muddy grey-brown, near the top it lightens and there are many fine curtains, erratic columns, pearls and small grottoes. The height to the top was estimated at about 50 feet and the climb was pleasantly sporting, though descending is somewhat "hairier".

"At the top we were able to squeeze between a boulder and some fine gours into a well-decorated passage containing a striped curtain which is partly responsible for the name of the aven and passage. This continued for about 100' before a halt was enforced by a constriction. At the same time we became aware of a rapid increase in every source of water and we beat an extremely rapid and very wet retreat down the Aven.

"A hurried dash back to Upper Flood Passage confirmed our worst fears, the route was waist deep in pounding, peat stained water. A quick consultation and we decided to make a dash for Lowe's passage. Initially progress was only moderately difficult but the added flow of water from Waterfall Series made us rope up with our waist lengths. Progress was then limited to one man moving and three clinging on. Eventually a particularly straight, smooth-sided stretch was reached where progress became impossibly

dangerous so we attempted to return. Unfortunately we seemed to have reached this point at the peak of the flood and return proved equally impossible. Traversing was out of the question so we climbed up to a convenient hole and waited. A fairly rapid seeming four hours passed and we were then able to progress to the chain and had reached Roundabout Chamber when we met the rescue party - to whom our thanks and apologies.

"Two weeks later the two of us returned with Neil Anderson and a lump hammer. The latter proved more useful in penetrating beyond the constriction though Neil who returned to C.P. Chamber helped us to determine the relationship of the high rift which we entered with the chamber below! Our height above the floor seemed again to be about 50' and we were able to look directly down into C.P. Chamber. Above us the rift continued for at least 30' and a ledge could be made out. We quickly examined the more obvious inlet passages but again time was running short and the major part of the rift was left unclimbed. The rift was later named Re-Solution Rift by Bryn Thomas.

"This was the object of our next trip on the following day when with Neil, Eileen Davies and John Bevans, we rigged a ladder from the rift into C.P. Chamber. 49' was required for the descent from the lower ledge but 30' more is required for a good belay. (N.B. A rawlbolt has now been fixed at the top of the pitch.) Whilst John and Tony were climbing via the original route to ladder the pitch, Neil followed Eileen through a tight bedding plane into a small but beautifully decorated chamber (E1 Chamber).

"Once up the ladder we found the rift easy to chimney and quickly reached the top ledge. At one end was a small circular chamber with two passages entering from opposite sides. Each led to small chambers, one (E2 Chamber) with fair possibilities of extension and the other (Truncheon Chamber) containing fine stalagmites and pools in which the crystals are large and botryoidal.

"Other passages were found at varying levels but their examination has so far been rather superficial. A traverse was also made across the rather exposed top ledge but the far side did not yield any obvious possibilities. The one large way on is in fact still higher up where the rift has narrowed to an aven. This Bill Little and Alan attempted as a straightforward climb on October 3rd, but while apparently possible, the climb is so exposed (some 100' to the floor of C.P. Chamber with a nice ledge to bounce on half-way down), the holds so crumbly and the belay points so few that the attempt was postponed until maypoles can be brought in."

(A. Coase)

Chapter 8. The Beginning of the End.

After the excitement of the Tiger Aven discovery there were spasmodic attempts to dig in various places. One of the most spectacular schemes was put forward by Charles George, who suggested syphoning the Dip Sump in an effort to lower the water in Shrimp Series sufficiently to enable a proper examination of the place to be made.

No one took the idea up so it was left to the divers once again to show us the way on. John Osborne takes up the tale of the successful attempts.

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

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

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

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

"Not daunted we attacked the other four ways on; one ended quickly, another led back into the lower passage and the third was a squeeze into a small chamber. This left the last as a small chamber with two small ways out. Almost beaten we split up and each followed the passage of our choice. Mine dropped through boulders into a low crawl for 250 ft. into the first large chamber. Near the roof was a route out, also small. Here we caught Smith, because I heard Charles and Terry talking and wriggled out of a letter box in the wall of a Chamber which they were just concluding did not go, (except for a hole in the floor which seemed 100 ft. deep). I lowered rope and we followed a draught in to a side passage 2 ft. by 3 ft. Smith tried to block this with a boulder 2 ft. by 3 ft., but we pushed it over the edge of a 12 ft. wide passage which was then seen to stretch off into the distance to the left and, appeared to be 100 ft. deep. We therefore left it and on the way back found a route down to the bottom of the first 100 ft. hole without there being a way on. We returned with only the one really hopeful passage left which we were aware of.

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

"The Yugoslavia Expedition had been promised the ladders so that one last visit was arranged for July 24th and on this occasion we were joined by Rod Stewart, making a team of four. As on both the other occasions, helpers were easily found and more wood was carried in for the Boulder Dig which has been given a new lease of life. We first of all

set off a charge in one of the new passages to make smoke. This was seen in Coronation Series. Hammer blows were heard in the boulder dig, but the radio device was not used as it is to be hotted up to increase the range.

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

"IT'S OFD 2"

"We were so confident that we left most of the ladder and set off up the passage. This was as large as Rawl and seemed to be getting bigger. One side passage was followed for 150 yds. to a small stream but it was not pushed downstream. The main passage continued due north to a major fork. We followed the biggest passage east which got bigger, i.e. 20-30 ft. wide and 50 ft. high. The floor as one would expect, contained fallen blocks. This passage opened out into a cross-roads with all ways vast. With some difficulty we chose one way which was followed by other forks. This continued for several hundred yards with few formations except for a crystal and rimstone pool.

"By now it was obvious we had won and our pleasure was only increased by rounding a corner to hear the roar of a stream in the boulders below. We climbed down into the streamway and then agreed to split up. (This was later found to be the Cwmdwr Stream - Ed.)

"Upstream the boulders forced us upward, up and up, climbing a boulder pile until we were an estimated 200 ft. above the original chamber; then the cone began to drop into the passage beyond. Above was a rock bridge with boulders the size of a small house on it. The way up could be seen just before the peak but the top could not be made out - some aven! The continuation was not fully explored. Several side passages were entered from the original chamber and they all continued on, very large (Rawl type).

"The stream was then followed on upstream, below the boulders, for some quarter of a mile.

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

"It was immediately noticed that it was much higher than when we had come in the cave and was peaty coloured. Upstream the water seemed always moving in rapids or cascades but, marvellously, no waterfalls in the main stream. After 480 yds. two waterfalls fall into the stream from a height of 40 ft. or so. At 560 yds. there is another. The passage is very like the stream passage with the roof out of sight. The boulder floor is made slippery with many sandstone blocks. At 660 yds. there is a noticeable change in the passage as from here on there is a series of pot-holes in the floor all about 5 ft. dia. and deeper than I am. After 100 yds. of this we were tired and at 800 yds. we turned back. At this point the passage was still as large as ever and going strong.

"So ended the first stage of the exploration. On our return there was a large party waiting for us, to help with portering. Their presence is



A victorious Terry Moon emerges through the New Entrance to OFD II



This skull of a horse was found just inside the new entrance to Ogof Ffynnon Ddu II during the excavations to open the entrance.

always appreciated and their cheerful help allowed us to recognise how tired we all were feeling. Never again let it be said that the youthful members are not ready, willing, and able."

"At the end of July, the Club Expedition set off for 'Jug' and amongst all the equipment was the special ladder needed for the climb out of the sump into the new series. The key was gone, with the door locked!

"We spent the next weekend digging in Boulder Series and a great deal of work was done in timbering and defacing images of divers. However, the story of the digs will be told later but sufficient to say it became obvious that a better site was needed.

"Accordingly, the divers again sallied forth on August 13th, determined to prove where the draught comes from in Coronation Series. Once the decision was taken, the lack of a key became unimportant and three eight foot maypoles were to be used as a lockpick. Three divers passed the sump and assembled the poles and soon a sweating, black evil thing was lowering a ladder for the others.

"Once in, the objectives were as follows. One man stayed at the pitch and put in the rawlbolts for the sky-hook and the others went to the boulder choke taking the draught. We had arranged for a party to be in Coronation Series and they were to listen for voices. If they could not hear anything, then hammer blows were to be used and if both these failed a small charge was to be set off to create smoke to enable the dig to be fixed accurately and then the dig was to be started from below.

"The divers soon found that voice contact could not be made, at least, not from the new cave out, and the charge was laid. Interestingly enough, however, the top party could hear everything, and they listened to the diver preparing the charge. Within twenty-five seconds of the impressive bang they collected the consequences of a bang in a small space. However, the contact was made. The divers returned without any other exploring being made.

"The Boulder Series dig was then discreetly abandoned and a large scale attempt was made on the dig in Coronation Series. This dig is also in a dangerous boulder choke and large quantities of timber have been taken in. Again the story must be told in full in another article but it is sufficient to say that one person did get through into the new series and out again before we had to watch the dig collapse. Now, after several more attempts, the boulders are winning and, once more, it was thought better to look for a safer way in.

"Came the Dawn! After the rush and push to get the dry way in, the divers had laid low. When it seemed that the dry way was not easy with or without their help, they plotted again. Loathsome things did crawl upon the sea and a new dive was planned.

"So on September 17th, the July diving team were joined by Colin Graham. Several others had planned to join in the dive but when all things were considered three agreed to hold back in the interests of maximum safety and all three helped the other divers!

"We dived in clear, low water at 11.15 and left the gear in the usual place, and by 12.15 were in the dry series. The objectives were

firstly to use Bill Birch's radio device to fix the position of the Smithy to see if it was the Jama extension. Secondly, the Cwm Dwr streams were to be coloured with rhodamine B in the drain and fluorescene in the main sink. The stream in the Smithy was to be observed for the colour.

"Accordingly, we carried a large amount of tackle, the heaviest item being the battery for the hotted-up radio device. We passed the mound of smashed boulders from the Coronation Dig and pushed into the squeeze which exists at several points in the new series for the first two hundred yards. The pitch was laddered as 45 ft. this time and we progressed without incident to the Smithy.

"The transmitter was set up at 1.30 at the highest point in the passage after a 45 degree climb up the boulders. Rod, meanwhile, climbed down to the stream and immediately reported the presence of Rhodamine B in the water. He followed the passage upstream to a fork. One large passage went right, one sharp left, and a tiny one straight on. The coloured water came from straight on! To have explored it would have risked blocking the passage, so it was left for a later visit. A quick look suggested the others were not connected with the small one.

"At 2.25 p.m. we set off for the main stream which had not been fully explored. With the water much lower, the part previously visited was viewed with delight by the party except the two who adopted the expression of bored guides. 'This, Gentlemen, is the largest formation in the streamway (at 102 yds.) and here is the 10 ft. cascade (at 263 yds.) where the first explorers fought with the flood. If you look carefully you can see where the helmet scraped on the rock!'

"The five of us marched up the stream delighted with its size and shapes. Generally, it is the same as the Stream Passage but, occasionally, it becomes a tube about 20 ft. x 10 ft. high. The first and second waterfalls were passed and the region of potholes was entered. Although they were easier to see with the water low, their depth and frequency caught us all out at some time. In all, we estimate there are some 20-30 in the section explored.

"At the second series of small showers, in a part white with calcite, one wall was climbed up to a hall with the top forming an aven, the roof out of sight.

"However, the main stream was our objective and we were pleased to find the potholes become less frequent until at 1290 yds. we came to a sump in what was obviously a new water course. Undaunted, we retreated and climbed into an old oxbow which ended in a crack, undaunted, we retreated and climbed into another ox-bow leading off from the first. This paid off and after 170 yds. we were able to climb down into the stream again. We were then able to admire the view for some time as we plodded up, for the stream had been rising all the time, and at 1720 yds. we had climbed into a seam of rotten stone. Where it formed the bed of the stream the floor was of thin flakes of the stone with potholes below. Several of us fell into these holes as the rock collapsed so that we were pleased when we passed this section.

"Soon after this we came to a large waterfall, coming from a great height, and which contributed perhaps twenty per cent of the water in the stream. After this the passage decreased and entered an odd zone. The stream quietly disappeared in rifts in the floor and then in bedding planes

in the sides until we were clambering over boulders with no sight or sound of the stream. Then at 2287 yds. we rounded a bend to meet the stream again. The passage grew in height and it became normal stream passage. Soon, however, we noticed the passage walls were dry in parts and the air was thought to be warmer. The roof dropped (or we climbed) and the small formations were seen to include moonmilk. We began to think we were at the Byfre when we rounded a bend at 2720 yds. to see the way on blocked by a 22 ft. waterfall. This was falling from a 10 ft. dia. passage some 10 ft. from the top of a 40 ft. chamber. There was no way round, nor was it possible to climb it with the quantity flowing so we turned back at 4.20 p.m.

"We picked up the radio device from the Smithy and pushed on out. On the way we found a short cut to the stream for future use, and dived back at 9.20 p.m. A large party was again there with coffee and willing labour and we were out by 10.15 p.m.

"The radio fix had been successfully made and the point on the surface is some 130 ft. south of the last one taken in the Jama! . The Smithy is, therefore, the Cwm Dwr Jama passage continued and this connection is to be investigated again. The stream below is not running in the Smithy passage but takes a longer route in a smaller passage. This new passage will be looked for in Cwm Dwr."

(J. Osborne, C.O. George)

The dive had been successful, and led to some interesting conclusions. The Smithy was found to run under the old Brickworks Quarry, and the radio fix had been only 130 feet south of the previous fix in Cwmdwr. The stream from Cwmdwr was located definitely in the new cave and it was found to be running in a lower, newer passage at a different level to the Jama continuation.

Several avens were noted in the Mainstream and the possibility of upper level passages seemed to be good. As regards distance, it seemed unlikely that the Byfre had been reached, but the height gained seemed to indicate that there would be very little difference in height between the Top Waterfall and Pwll Byfre.

The main result was that Cwmdwr was known to be part of the O.F.D. system and the connection was relatively close.

Opinions on further large-scale extensions were divided. Charles George believed that O.F.D. III would be found as an extension to the top end of the Jama in Cwmdwr. He also believed that the extension of the stream beyond the top waterfall was likely to be in a system of bedding planes.

As an entrance was essential between the Club and the Byfre a lot of prospecting was done. The hole with the severest draught was chosen - one near the old Engine House.

Engine House dig was the most carefully planned dig of them all. Its vertical shaft was shuttered with heavy wood and it descended rapidly to eventually attain a depth of over thirty feet.

As a result of the rough survey that the divers had done the connection between Coronation aven and the new cave was thought to be a long dig. However, their efforts on a later dive showed that the connection was in fact within shouting distance. This was too good a chance to miss. The dig that had been more or less abandoned was started in real earnest. The way on was through the boulders in the floor of the aven so it was decided to have a go at what was once considered the impossible.

Clive Jones, Eric Inson and John Osborne started to push through the boulders one Saturday morning. "We dug out about a cubic yard of mud and small stones from between the bigger boulders and went down like the clappers. Suddenly the draught increased and the bottom of the hole fell in with a beautiful rumbling noise, straight into Ffynnon Ddu II.

"The hole was small but negotiable and Eric went down. We heard lots of boulders crashing and shouts from Eric telling us that he was all right. Five minutes later, he returned with a piece of banger wire left behind by the divers. This was it.

"We examined the situation and even though we were very excited, we didn't like what we saw. Anyone going down stood a fifty-fifty chance of being clobbered and we decided that shuttering was essential.

"We found plenty of enthusiasm for the project that evening in the "Gwyn" and soon had an army of helpers enlisted. As you all know, I have always had an eye for the quick 'quid' and David Hunt turned up that evening - easy prey.

"I bet him a pound that the following day we would have a dry way into Ffynnon Ddu Two.

"Sunday morning and the battalion gathered at "Y Grithig". Timber, tools, ladder, rope, sampling equipment and rope were stacked ready for "in"; David looked suspiciously at this pile and said nothing, but hung onto his wallet.

"That evening I paid up a pound as the place had fallen in before, during the day, and we could see no way of tackling the problem.

"Another week passed and we had another go. This time we were able to start timbering and got one round and a roof into position. Again the club worked like troopers and brought a vast pile of wood to the dig and Eric Insen, Terry Moon, Charles George and I were left to carpenter our way through the choke.

"The boulders came out magnificently and the timber was driven, nailed and braced into position. Everything went very well and in a couple of hours we had a hole through. This enabled us to look at the underside of the choke and it wasn't very pleasant. We decided that it could be timbered, and got down to get the job done. We had completed over half the shaft a few hours later when funny things began to happen.

"Boulders had been dropping out from under us all the time and rumbling down into the cave and for the past hour a gritty dust had been falling like rain from the aven above us. Suddenly, everything moved. The thick mud became liquid, the small pebbles rolled out everywhere and a few medium-sized boulders crashed from under us. Then everything became solid again - it was almost like a change of phase. We continued timbering at a feverish rate and ten minutes later, it happened again.

"This time, a boulder came down from the aven and landed between Charles and Eric. They scarpered yelling to Terry and me to do the same. All four of us landed in a record-breaking pile in the solid passage and whilst we were gathering our breath boulders crashed down the aven just before the dig.

"We came out." (Clive Jones)

The two digs from inside the cave, in the Boulder Series and in Coronation Aven, were best left alone.

The divers returned. At the beginning of October a very large party arrived at Dip Sump carrying maypoles and heavy loads of gear.

"Unfortunately, on our trying to use the skyhook the ladder kept snagging and John had to climb the ladder while the courleve was held by the other two. With such a strong party we were able to take the maypoles through to the new streamway. It was found that a large party needs more time to cover the ground, and after a snack by the Cwm Dwr - Byfre stream confluence, Rod and Charles rushed the radio to the waterfall, to meet the time schedule with the surface party. The radio was never located, despite great efforts by the surface party. A quantity of fluorescene which was put in at the Byfre was not seen at the waterfall, although a three-hour watch was kept.

With the maypole the waterfall was climbed, and to our bitter disappointment the passage at once changed its character. It flattened until in a few yards the stream sumped into a very wide and low bedding plane. It appeared to go down dip. The water yielded numerous bugs, some of which were collected and identified by Clare. This looks like being a dead end.

"The draught appeared to have got lost some 350 yards back down the mainstream. Clive and Colin climbed into an ascending rift, fairly wide, with the north wall solid and the other loose and made up of unscrewed blocks, 'nothing solid'. They climbed 100' and could see a further 100', but 'it was too dodgy'. This spot bears a marked resemblance to the David Hunt dig near the wall, just above the Byfre.

The stream was retraced and all climbable ledges and avens were roughly examined. There was no trace of lateral development; it all seemed to be vertical and will need major climbing attacks. The stream is a lot more exhausting than one would expect and I believe that everyone was ready to move out once we were back at the confluence, though we did all go to gaze at the formation below the lime kiln.

"On the 55' pitch I found the lifeline jammed and climbed free to clear it. Since I was tired this was a stupid manoeuvre, as I all but fell off - there is a good lesson here. Poor Clare had a nasty tumble as she crossed the boulders below the pitch. Being weary, we decided to follow John's longer but easier route from Collapse Chamber, though the indefatigable Rod chose to take his load out via the bedding plane passage. As it happened, this was a fortunate choice. Climbing out of the lower series up to Collapse Chamber meant negotiating a shaft, which was a rift

partly filled by boulders, with a slight chamber in the middle. This had appeared quite stable, but as a precaution it was taken singly as far as the Chamber. John and Colin were still clear in the series below, with Clive and Clare in the chamber and Bruce climbing to join them. I started to climb the second stage, where I could see Rod standing some twenty feet above in Collapse Chamber. As I was mounting a very large 8' square boulder it moved perceptibly. I froze and warned Clive, as Rod had felt the vibration travel up the boulder pile he was standing on. Bruce was now emerging into the chamber to join Clare and Clive, when with no warning, the boulder wall above my head started down. It is hard to imagine a more awful feeling of horror than when in the instant of being hurled down, one is struck on the head and squashed into a crouching position, unable to breathe. No sense of pain, just a ghastly realisation that one is irretrievably stuck. Rod was able to climb down at great risk to himself to see that he could do nothing to help. Bruce, meanwhile, had just popped his head into the chamber to see a large boulder coming straight for him, 'I ducked', and in fact saved his life. Clive saw my feet and knew he was helpless to do anything, when suddenly there was a further slip and I got thrown out. The three of us followed Bruce down the shaft, while Rod called down to warn us that he could feel the boulder mass moving under his feet.

"In safety at the foot of the shaft we were convincing an incredulous John 'my safe way' was now gone, when with a splendid rumble the floor of Collapse Chamber vanished into the shaft blocking it utterly. Rod was left unsure whether or not all or any of us had survived. He spent a wretched half hour until we were able to negotiate the long alternative way back.

"It was a very tired party that was greeted by a most welcome band of kind helpers as they emerged from Dip Sump. Even the dive out was fraught with trouble as both divers and their loads got snagged in the old guide wires laid in 1960. Without the support of that early morning party, willing to wait til 1.0 a.m., we would have been in real distress."

(C. George).

That diving trip was a real jinx trip. Rod Stewart recalls:

"Smith was really fighting back that day. On the way in Colin got tangled up in the old cables and the trouble we had with the skyhook was only the beginning of it all. When we reached the top of the waterfall and found there was no extension we were very disappointed. Clive lost his pipe when climbing and, ominously, Charles' watch stopped dead on 5.00 p.m. No fluorescein was found and the surface party failed to locate our radio. Bruce lost his ammo-box when climbing a boulder-filled rift and a large block fell and smashed it, narrowly missing him. Even I had a severe shaking when one of the rottenstone ledges gave way when I was walking on it. Back near the 55 ft. pitch Clare had a nasty fall, and then Charles nearly fell from the ladder.

"The worst part of all was when I went around through the bedding planes and the others went through to Collapse Chamber. The way up from

there was through a hole in a sort of funnel of boulders - I suddenly felt a movement in the floor I was standing on and Charles cried out to the others to retreat while he held a block back with his foot. The next thing I was aware of was a peculiar noise - all the boulders went fluid, and Charles was bobbing around with only his helmet showing. It was terrible and I could do nothing to help. I just watched as he disappeared downwards making a funny hissing noise as if all the breath was being pressed out of his body. I was certain that all the others were lost, but I waited for a while not really knowing what to do. I dared not to cross the boulder floor that had all collapsed downwards, and was about to depart when they reappeared. I've never been so relieved in all my life.

"Of course we had lost the box of batteries and on the way out through the sump the lack of ballast forced me against the roof. I had to abandon the frogsack with the wireless device and £150 worth of aneroid barometer. Then I got tangled up in the cables and by the time I eventually emerged from the water my pressure gauge was on zero. I returned on another bottle to retrieve the frog-sack.

"If there had been nobody to greet us on the other side of Dip sump we would have been in dire straits."

Chapter 9. The End of the Beginning.

There was a further lull in activity. The accident seemed to temper enthusiasm and it was April again before a further dive was made. This was to be the last dive through Dip Sump, although the reluctant four did not realise it. They were John Osborne, Rod Stewart, Colin Graham and Mike Cobourn.

"Once in the water the die was cast, and all four swam through crystal-clear water in convoy. There was one point of interest; a white fish, 2½ inches long, with black eyes; it did not attack so we left it alone. The pitch was climbed, and by mid-afternoon we gathered in the Smithy for a bite. We had just agreed to meet back there at seven o'clock when there was a loud bang. We immediately realised that it must have been Clive in Cwm Dwr, so we set off up the stream to trace the draught. The radio refused to work in the stream and by then the fumes were thick. The passage smoking the most was blocked with boulders, but Rod could hear hammer blows for a while, then all was quiet; no radio, no hammer blows, no smoke. We almost choked on our own smoke-making exercise, so we agreed to split up and follow the passage of our choice.

"We all retreated into the large chambers that point towards Cwm Dwr, and then scattered. My route was up near the roof and I chose it because the stream could be heard down below. After twenty feet a steep tight squeeze was manufactured which led into the boulders proper. Although a bit hairy, there was a window which looked into a chamber with a

spongework boulder over most of the roof. A stream could be heard in there, so some effort revealed a route down for ten feet and then back up the other side of a three foot wide wall.

"Having proved that a tight boulder squeeze can be done with all fingers crossed, the chamber was entered, and the stream below was inspected. The lower route was impassible, so I climbed up ten feet and noticed that boulders had been moving. No reason for this particular movement could be seen, so I looked around, then noticed that the boulders were smeared with mud! A further thirty feet and a route was made into Cwm Dwr Jama.

"Filled with relief at not finding a party crouched over a banger-wire, I searched for human company. It was not until I found that the ladder was not in the entrance that I was sure that there was no one else in the cave. The pitch is tricky, but it was really worth it to sneak into the Club for a snack.

"About the time I had started my sandwich, the others in the cave began to worry. It took a further half-hour to convince Bruce that there WAS a way through and then we returned to the boulders to find Rod and Mike almost through. Rod then went to the surface to complete the through-trip, and Bruce went in, to the astonishment of Colin who was waiting in the Smithy. Their worry removed, morale soared and the new route was discussed enthusiastically. When Rod returned, Bruce was traded-in, and we came back out of the sump, raising the drawbridge to the first series."

(J. Osborne).

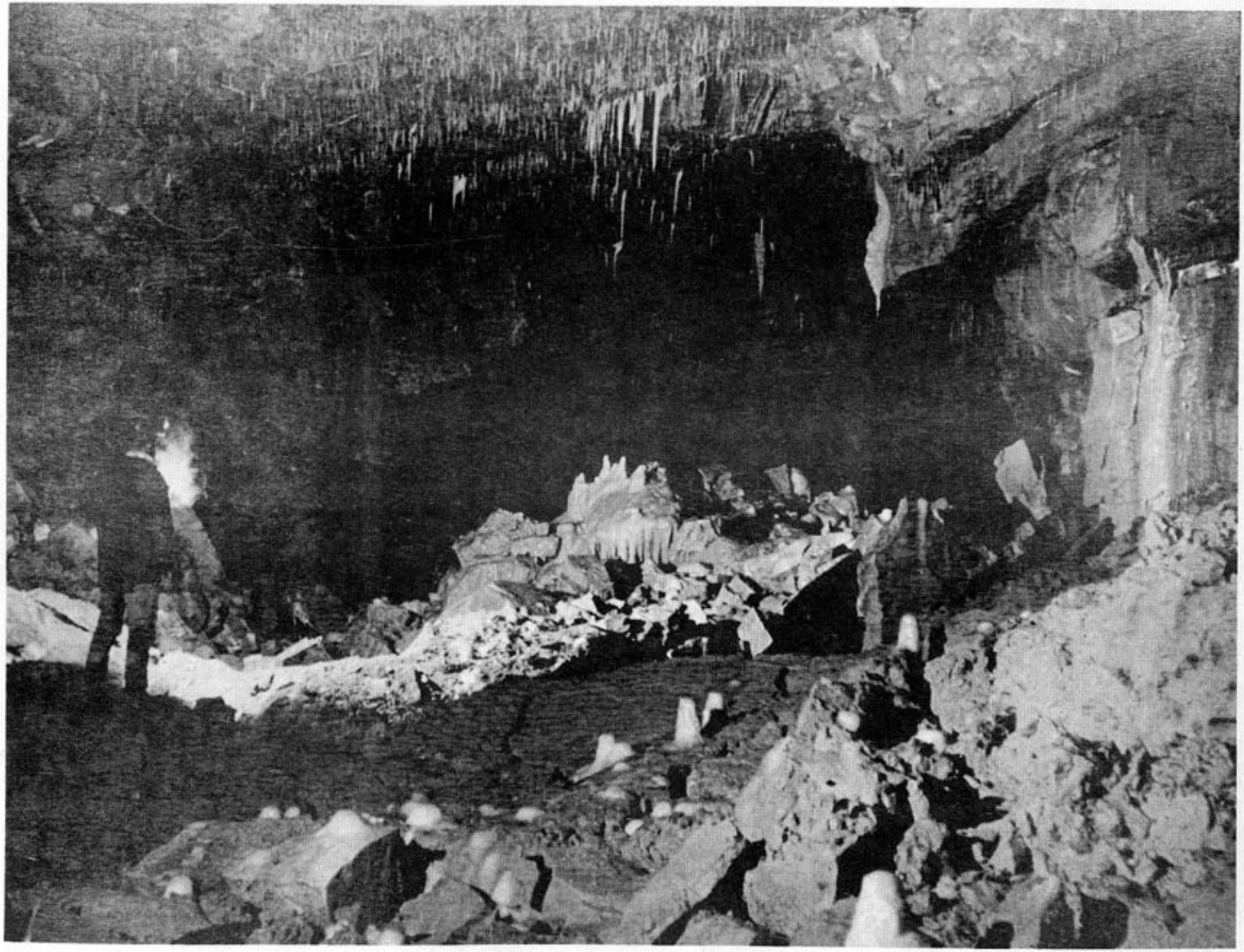
A safe route was engineered, and by the following weekend the first tourist trips were making their way up the mainstream. At the Marble Showers an aven was climbed and an upper level series above the stream entered. The map on the common room wall was rapidly filled in, and the numerous question marks erased.

Chapter 10. The End?

One question remained, however. Was there an extension beyond the Top Waterfall? It was an evil looking place and the divers shunned it. The difficulty of carrying diving gear through Cwmdwr and up the streamway appealed to very few, so it was never done.

In May this year Paddy O'Reilly maypoled into an inlet about two-thirds of the way up the Main Stream. The passage beyond the top of the maypoles was narrow and winding and was floored with a peculiar "Moonmilk-like" substance. The small stream was followed till the way petered out, but Colin Fairbairn climbed a chimney to find himself in a large network of dry passages.

Little did they know it then, but the network of passages was to



Gnome Passage Cgof Ffynnon Ddu II, at the junction with Chasm Passage.

lead to the completion of the objectives that had involved so many members of the Club over the previous twenty-one years.

On the return journey to the series the following day they found a large canyon passage heading more or less due north. A dangerous choke forced a halt but the following week, aided by Susan Bradshaw and John Osborne, it was passed and the route went around into a small square stream-way. Upstream here led to a chamber, later called the Arete Chamber, where there was a choice of routes. Straight ahead there was a boulder choke while around to the right there was a climb into a small passage which looked into the side of an 'enormous passage or chamber'. A ladder was needed so a Labyrinth on the left of Arete Chamber was examined only to find that it reconnected with the large canyon found earlier.

"Returning we followed the stream (Salubrious Passage) down. The floor was heavily covered in vast deposits of the white slippery stuff that we had found earlier in the series. The passage descended rapidly and headed more or less due South. We had high hopes of heading in the right direction to bypass the Top Waterfall so imagine our surprise when we found ourselves walking in a passage with our own footprints in it. We had found our way back to the passages that we had entered on the first trip to the series. A bit disappointed at having put so much effort into getting back where we started we examined one or two of the side passages.

"One passage meandered around to the left and into a small chamber where we saw a wonderful formation. A huge orange stalactite, bigger than any other in South Wales, fully twelve feet long, shaped like a Trident and right beside it an equally magnificent stalagmite boss-white, and with a knobbly top like a Judge's wig. We gazed at these two fine formations for a long while, before passing on to another stream that was to all intents and purposes a twin to the one we had maypoled into. Time was short. Straight across, a big passage led to a very high rift. The floor was about fifty feet below us and a traverse out over the hole only led to another.

"We followed the stream up and down for a short distance in a viciously meandering passage which we assumed reached the Mainstream upstream of our maypoles. Time again forced us to call a halt, so at least we had to return once more to try to force the series beyond the Top waterfall.

"A week later we were back again. We put a ladder down the fifty foot drop and I descended. A quick look confirmed that the passage went both ways so the others followed. The tall rift passage boasted some of the finest formations that we had so far seen, one on the left-hand wall was reminiscent of a 30 foot tiered wedding cake with a magnificent 10 foot stal at the top. After a short distance we were forced to use a twenty foot ladder to reach the floor again. A vast curtain, all of 50-60 feet high, hung down on the left and the way on was through a stalactite door at its base. Treading cautiously through the gap we followed the draught along the boulder-littered passage till we came to an aven. The floor of the aven sloped away to the left and we could hear the noise of a river in the distance. Excitedly climbing down the slope we managed to chimney down to floor level to find ourselves in a deserted stream passage of mainstream proportions. Our excitement was short-lived when we realised that we had merely descended to the oxbow in the mainstream about five minutes away from

the top waterfall. Back we went to search for other higher routes but to little avail. Our only success was in traversing along in a narrow high-level meander for a few minutes to a point high above the stream level where we thought that we could see a further passage on the opposite wall but it would require some sort of a boom to reach.

"The next alternative was the small stream near the Trident, but it proved to be too difficult with high level traverses and thigh deep quicksand (we called it Swamp Creek). The downstream end of it cascaded out over a huge drop into the mainstream and probably it is the huge aven that the divers noted on their trips to the Top Waterfall.

"The last objective on this particular trip was the huge passage noted before. A short pitch gave access to it and it soon joined with another fine 'Jama-type passage', called Gnome Passage because of the hosts of small elf-like stalagmites. Gnome Passage ended in one direction in a boulder choke but was not pushed in the other direction. The "big passage" also continued in a northerly direction but shortage of time forced us to call a halt that day.

"We lived for the following week's trip. That large passage just had to go. Friday night found us kitted up and entering Cwmdwr once again. We went straight to the Chasm-like passage and descended a slippery climb. On the other side of the climb the floor rose again over a pile of boulders and at one spot an overhang almost defeated us. Terry Moon, however, did it with a 'faith and friction' hold and lowered a line for the rest of us. Straight ahead there was a fork - to the left closed down in a boulder choke but to the right there was a howling draught. We felt the drop in temperature as soon as we entered the passage, so we wasted no further time. At the next junction (Bhowani Junction), we bore left following the draught till we were stopped by a deep Crevasse, at the far side of which there was a 20 ft. drop to the floor. We had no ladder.

"On the return we were all of us very tired and our responses must have been slow. Colin slipped at the awkward overhang and sprained his ankle. We thought that we had a major rescue on our hands till we realised that he could hobble along as well as the best of us. We arrived on the surface after about fifteen hours. Smith had claimed his first victim in the new series.

"That was the trouble with the new series. It was so far in, it took a good two and a half hours to get there and almost four to get back. Those six and a half hours involved some really severe caving. So before one could contemplate doing any exploring in the farthest reaches one had to envisage trips lasting anything up to fifteen or sixteen hours at a stretch. It was the era of the 'mega-trip'.

"One weekend, however, we decided to push it to its limits and to hell with how long it took. John Osborne and Rod Stewart were prepared to stay for twenty-four hours without sleep but Susan Bradshaw and I wanted to defy the sceptics and camp underground.

"Our first success on this trip was to locate the furthest downstream end of the series at the Great Oxbow. Then we turned our attentions to the pitch at the end of the Crevasse that had defeated us on our previous visit. We descended the pitch and followed the draught in a large shattered deserted streamway heading mostly eastwards. Rod frightened the life out of the rest of us by bringing a huge section of the wall down and ahead

Susan and John were 'making the way safe' and shaking the rafters at the same time. Beyond one particularly shattered pile of boulders there was a 45 ft. pitch which descended to a 'decent' passage again. Within a few hundred feet the way on was blocked by a boulder fall, but we thought that we could hear the rumble of a river in the distance. We returned to the campsite without incident.

"Back at the campsite we ate. Susan and I had lamb cutlets with French fried potatoes and sliced green beans, followed by grapefruit cocktail and coffee with wholemeal bread and St. Paul cheese. John and Co. burned their oxtail soup but nonetheless devoured it (or at least one mouthful each). At this stage Terry and Martin decided to leave the cave, and after John and Rod had hung around for another hour or so, they too decided to make their way out.

"Susan and I arranged a tarpaulin in a corner to keep off the draughts and spread out our wetsuits as mattresses, before settling down for the night. The dry clothes and sleeping bags were so comfortable that we did not wake up for nine hours, and after a hearty breakfast we set off to explore the right hand end of Gnome Passage.

"There were some quite large passages with massive boulders scattered on the floor. Most of the passages interconnected with one another, and finding a main route was difficult. At one point we entered a passage with several striking 'totem Pole' stalagmites; at the end of it there was a pile of rubble. It had all fallen from a small aven and looked almost as if it were builders' rubble, it was all so small and neatly piled. Some black specks attracted our attention and on closer examination we realised that they were probably bat droppings! There were no bats to be seen, however, but we did find something equally interesting. At several points on the wall there were dead flies covered with black mould, and one moth. In the pile of rubbish we found many land snails, which could only have got into the place through a hole from the surface. The aven contained no noticeable draught, but in view of the finds we thought it might be worth a revisit with the intention of locating an alternative entrance.

"After finding a very large chamber nearby and also one with a one and a half foot thick shale bed roof we decided that it was time to call a halt.

"We left the cave after spending thirty-eight hours underground.

"The prolonged trip was a great success. Besides providing a second day's caving without the need to trek all the way up the streamway we came within a few feet (although we did not know it at the time) of both O.F.D. III and a new entrance to the whole system."

(P. O'Reilly).

The discovery of the aven with snails was a great stimulant. Bill Birch's radio machine was brought to the spot and it was located on the surface. The following week the test was repeated at the scree run-in at the end of the passage and two way communication between the surface party and those underground enabled a series of tests to be made.

One of the interesting facts about these closing stages of the

story was the reappearance of the original discoverer of O.F.D., Peter Harvey, on the scene. On this particular day he was busy unscrewing pieces of limestone from the small face that had been exposed after the first radio fix when someone pulled away some turf nearby. This exposed a hole filled with scree through which was filtering banger fumes. As the underground party had just let off a bang those on the surface dug like fury and within an hour a hole appeared and the grinning, sweating face of Terry Moon emerged and said, "Give us a shovel then!" One was passed through and within another hour everyone was out busily congratulating each other and marvelling at how close to the surface the entrance was and yet how cunningly Smith had camouflaged it.

In the following weeks the cave was invaded by hordes of busy sightseers, but only one party returned to the shattered area called the Shambles. They managed to bypass the final choke by traversing along from the head of the pitch, and were faced with another choke but lamp trouble foiled their bid to pass it.

The latest stage in the exploration of the cave Ffynnon Ddu came a few weeks ago when O'Reilly and party followed up the crossing of the traverse. To bypass the boulders an interesting climb was done but it involved a 30 ft. pitch at the other side. The climb has now been proved unnecessary.

The roar of a big river was very loud and as they descended a boulder ledge to look into a collapsed river chamber, they remembered that the weather had been very bad as they entered the new cave. It had been reported that there were 2 feet of water on the Step in OFD I.

A ladder pitch of fifty feet or so led down into a faintly familiar chamber, with cascading water all around. "We were afraid that we had descended to the river downstream of the waterfall, the shape of the passage was so similar to OFD II. Upstream, however, the low roof was new to us and when we rounded the corner and were greeted by a foaming cascade of water fully ten feet high we knew for sure that at last we had entered OFD III. The concentrated effort since June had paid off handsomely. We stood around and congratulated each other."

The next day some long maypoles were taken in. As the water had not dropped it was foolhardy to attempt to scale that cataract. The attempt was postponed for a week. A strong party returned, but conditions on the surface were worse. It had been raining heavily for the best part of the week and the river was in severe flood. However, it was impossible to resist the lure of the raging torrent and they maypoled in to a high level of the stream. It was apparent almost immediately that this new section of Ffynnon Ddu differed quite a bit from the other two. Initially it was possible to follow the streamcourse but not at stream level. There was a bridge of boulders about 20 or 30 feet above it probably formed by collapse of undercut walls. Two very large inlets came into the stream from small holes high up. There were sections of very beautiful calcite flow frequently covered in a mass of helictites.

Eventually the dry route petered out and the party were forced to descend to stream level. At various stages they had caught sight of the inky black slow-flowing river below - they feared that it might be deep.

"We entered the river feeling like as if we were entering Hades on the river Styx. To our surprise it was only chest deep at most places,

and because of the large passage size the current was not strong enough to prevent us battling upstream against it. Under normal conditions it would not be much more than waist deep anywhere. There were places where the undertow gave us some trouble but by clinging to the walls we made our way upstream.

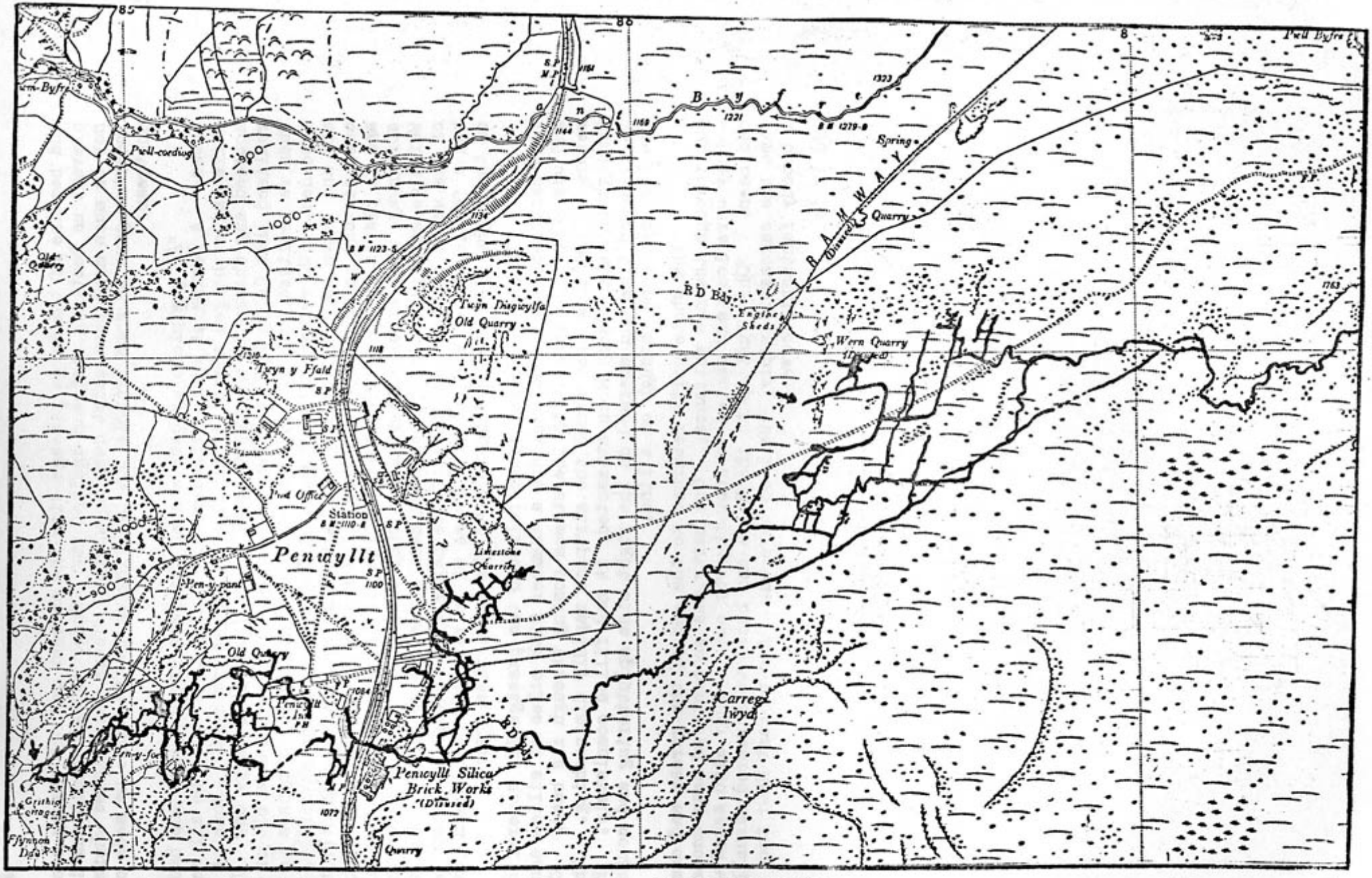
"At one place we came across the rest of our party who had gone on ahead. A series of small cascades was holding them up. We all rested a while and exchanged anecdotes about our journey upstream. None of us had noticed any change in the water level so we decided to carry on. Then we realised that Colin Fairbairn was not with us. There was a bit of concern when we realised that he had last been seen looking for a bypass to the cascades. We returned downstream and found him waiting patiently. "Run off and leave me, would you?". Together again, we traversed over the cascades and continued on our way. The stream meandered quite spectacularly and in places we found ourselves crawling in the water in the low undercut streamway. Eventually there was a sump from which all the water issued. While we were searching in some boulders for a bypass to the sump, the level of the water dropped, and five of the party went through the sump, which now had a few inches of air space. Three of us returned downstream just to be on the right side of the sump in case the level rose again.

"It did. Those beyond followed the passage for several hundred feet past sandstone beds and into a chamber with piles of silica sand. The end was a boulder choke with the stream coming through its base. On their return to the duck they found the airspace rapidly diminishing. Three got through but when Terry Moon attempted, it had filled completely. He dived in a second time and emerged on the right side spluttering and coughing. The last man came through on a line.

"The whole party returned to the end of the stream and came safely out through the new entrance. One party was encountered near Gnome Passage - they were lost and wanted to know the way out. They also asked where we had been. "Oh! Just up to the Byfre and back" we answered casually. Back came the sarcastic reply, "Well so have we. And to Pant Mawr too. This is a bloody fantastic cave." "

And it is.

———————o———————



Scale — Six Inches to One Statute Mile or 880 Feet to One Inch = 1/10560

1000 Feet 500 0 1000 2000 3000

1 Furlong 0 ½ ½

OGOF FFYNNON DDU

FIG. 2

(Editor's Note: The material for the above article was extracted from the records of the Club. The bulk of the material has been taken from newsletters and specific references are given here; my thanks must go to all those who have taken pains to record their finds or their theories; and to those who were too busy to record their discoveries, I must apologise for not including their efforts.)

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5	July	'53	The Heights of Low's	W.H. Little
6	Sept.	'53	Boulder Chamber, O.F.D. The first ascent of Bat Aven in O.F.D.	Dai Hunt W.H. Little
7	Jan.	'54	The Pant Canol Link-up	Dai Hunt
11	Feb.	'55	The Gent's Dig	Les Hawes
16	May	'56	An independent check on the survey of O.F.D.	Norman Brooks Bryan Ellis
20	July	'57	The Mud Sump, O.F.D.	Brian de Graaf
21	Nov.	'57	Cwmdwr Quarry Caves	Les Hawes
23	April	'58	Boulder Series, O.F.D.	Gordon Clissold
24	July	'58	Cave Rescue operations in O.F.D.	Gordon Clissold
26	Feb.	'59	Trying Hard (in O.F.D.)	Clive Jones
29	Aug.	'59	Three Dives in O.F.D.	Peter Guest
33	Aug.	'60	Cwm Dwr Cave Cwm Dwr 1 1960	P. Raynes B. Woods
34	Dec.	'60	The Search for O.F.D. 2 (1) Stream Passage (2) Cwm Dwr Cave	B. de Graaf C.Owen George C.Jones
35	March	'61	A further dive in O.F.D. Cwm Dwr Quarry Cave	B. de Graaf C.Owen George Noel Dilly
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44	June	'63	Cwm Dwr Jama Radio Survey of Cwm Dwr Jama	W. Birchenough Club members
52	Jan.	'66	Tiger Aven, O.F.D.	A. Coase
53	June	'66	Digging the modern way	C.O. George
54	Sept.	'66	Ffynnon Ddu II	John Osborne
55	Jan.	'67	Dry Way? Latest Developments in Ffynnon Ddu II	Clive Jones Charles George
56	May	'67	The End of the Beginning First Tourist Trips	The Divers Paddy O'Reilly
57	Sept.	'67	A Few More Miles for Ffynnon Ddu	Paddy O'Reilly
1956	10th Anniversary Publication, The First Ten Years			A.H. Hill

DAN YR OGOF

THE CAVES BENEATH THE BLACK MOUNTAIN.

THE DISCOVERY AND EXPLORATION OF THE DAN - YR - OGOF CAVES

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PART 1 -- DAN YR OGOF.

Unlike the continuous efforts that have been possible in the search for the complete Ogof Ffynnon Ddu system, the story of the exploration in Dan yr Ogof has been a much more intermittent one. It can, in fact, be divided into a number of periods of which the last two come directly within the scope of this publication, for the earliest pre-date the existence of the Club.

a) 1912 - initial discovery by the Morgan brothers.

b) 1937-46 - exploration by the Dragon group of the area beyond the Lakes.

c) 1946-60 - intermittent exploration by S.W.C.C. finally prohibited.

d) 1964 to date - renewed S.W.C.C. access and major discoveries beyond the Long Crawl.

Associated work and discoveries in the area, notably of Tunnel Cave and Pwll Dwfn, and at Waun Fignen Felin, also play an important part in this story although the full potential has probably not yet been realised.

When the Club came into being, the known extent of the system was the half mile or so discovered in 1912 and consisting in the main of the present show cave and the three lakes; plus the near mile of chambers and passages entered by the Dragon Group in September 1937. The system now totals over five miles.

Although the discovery of the series beyond the Lakes does not strictly belong to Club history it certainly makes interesting reading. As many of those early cavers were founder members of the Club the story deserves a place in our archives.

E.E. Roberts describes the efforts that led to these discoveries in 1938. It is interesting to see that Swansea valley weather was pretty much the same then as now.

"Most important of all, from Glyn Tawe I did the Vans, came down the Giedd to Sink-y-Giedd, a choked swallet against a little cliff with shale (rottenstone) at the base, traversed three miles of fell, no clints, many stretches of slab, and so down by the steep dry groove above Craig-y-Nos to Dan-yr-Ogof rising. A cave indeed! I could not cross the flooded beck into the great black entrance, but that did not matter, for at the Gwyn Arms I learnt that the owner and his brothers had been in ¾ mile and used a boat.

"A real caving expedition was worth while, and for this I enlisted Platten and Gowing for the last week of May, and much correspondence followed over the boat question ..... Gowing and I went one day to Briggate to inspect a strange craft which looked like a cross between a baby's bath and a balloon tyre. We fingered it, discussed how easily it would puncture and what would

happen if it did, then said we would take it along. Five pounds, Franklin Pneumatic Boat, 4 ft. 8 in. by 2 ft. 6 in. inflated, 3 ft. by 8 ins. diameter deflated, weight 7 lbs.

"Then it had to be packed up, and the picture of two men and a young lady assistant kneeling on and maltreating the boat in an effort to expel several hundred cubic feet of air through an infinitesimal orifice must have been highly diverting to the customers who gathered round. But at last the spoils were carried off in triumph and embarrassment, as the five foot paddle looked very like a double-ended fly-swat out in the street. Gowing has since sawn it in two and put on metal ends which screw together, but for Wales we substituted a cricket bat arrangement.

" 'The weather fights for the big caves.' This truism was some consolation as I drove along in May, 1937, through awful rain, and crawled in a thick fog from Buxton to Leek; the sun did come out before I reached Wales, but Dan-yr-Ogof was in hopeless flood.

"You don't find roomy hotels at the heads, however beautiful, of coaly valleys, but my colleague at Brecon gave welcome and ready help and we established ourselves, one at the Prices' delightful little inn, Gwyn Arms, Glyn Tawe, and two at Carreg Haffes farm behind it. Mr. Jeffrey Morgan of Abercrave had readily given us leave to explore Dan-yr-Ogof, which he had kept possession of, and watched, to prevent destruction.

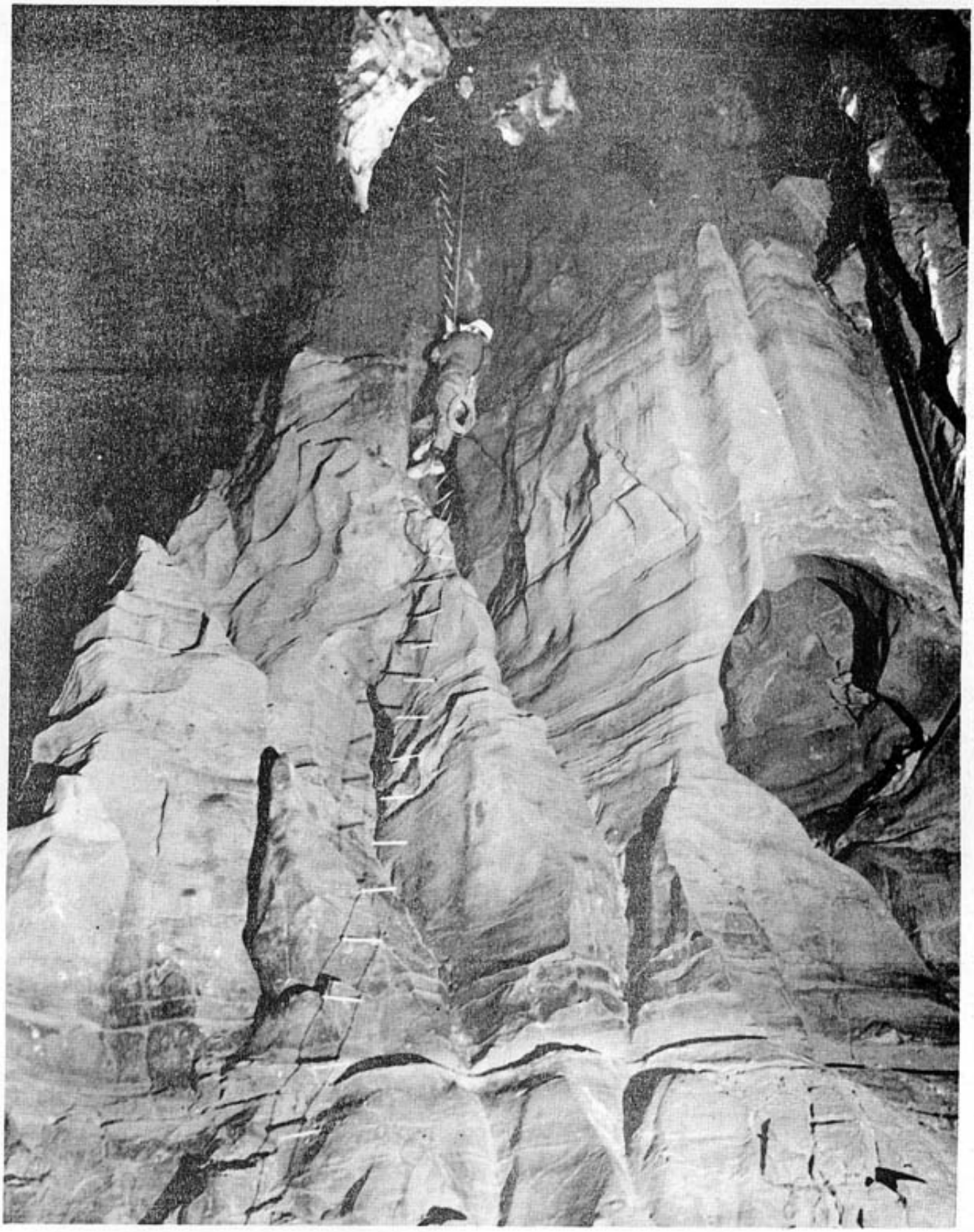
"He came up and told us the tale of 1912, how he and his brothers had found a dry cave above the river cave (which can only be followed a painful 80 yards) and explored it up to a great pool, how a coracle had been bought and in it Mr. T.A. Morgan had voyaged 40 yards across the pool and 20 yards up a tunnel, landing near the foot of a waterfall. Pulling the coracle back with string, three others had followed, and after the leader had climbed the cataract and seen a watery tunnel beyond they had retreated.

"Dan-yr-Ogof.--The Tawe owing to a thick bed of drift does not go underground, and the Llynfel is the short and bounteous tributary which issues from the fine arch in the wooded curve of the western fellside between Gwyn Arms and Craig-y-Nos. The name (Undercave) is really that of the adjacent farm, and the cave might well be dubbed 'Cave of Boats'. High above are two small dry caves of archaeological interest.

"Reinforced for Sunday by Nelstrop we were guided in on the 23rd, a wretched day, to the lower of two holes on the R. bank, then by two short crawls in opposite directions at higher levels to a small hole, now fitted with an iron door, into a roomy and very fine passage above the river. In it three pools are impounded, two rather deep, but not worthy of the rubber boat, which was dumped till needed.

"Past gours and a gushing waterfall we came to a junction, T1. A wide passage, right, led to a slope into the First Canal. A waterfall from the roof stopped us, but later Nelstrop rushed it and came to a dead-end. A bit behind, an upward crawl brought us to a hole we had seen before reaching T1.

"Going left at T1, we came under a bridge to a place named "The Parting" by the Morgans, and Gowing climbed into an upper passage. A few



The descent of the Abyss, Dan yr Ogof.

yards further is T2; to the left here a loop runs back to behind The Parting. To the right after a long and interesting bit of travelling, mostly good going, we finally crawled out on to the top of the scree in the unmistakable and impressive Bridge Chamber. On our immediate right was another hole, the end of an alternative way in.

"Under the Bridge off the scree was a 20 ft. wide high chamber and we looked left over boulders to the First Pool, but first we went down scree to the Second Canal and left a candle burning there. The First Pool was deep and 12 yards long, but Nelstrop showed us the way; somewhere ahead was a great roar of water. Over a steep bank was a shallower pool, some 20 yards, and then we stood on a narrow beach and looked at the Third Pool, the Coracle Pool as it proved; it simply ran away into darkness. I confess that till we found the Three Pools it had never occurred to me that we were going to be up against pools of the Marble Arch type. I had thought only of passages of ordinary width and short pools. With that ominous roar ahead we agreed that the Morgans' crossing of 1912 was a great effort.

"Nelstrop made a gallant attempt at wading--at low water it goes about 30 yards--then we went back and waded the corner of the First Pool into a passage whence a way led down to a canal, the Second Canal as the candle in the distance showed. At the top of the Bridge Chamber we crawled up through the other hole into a magnificent chamber, evidently "The Cauldron," and going on past very fine stalactites came to an open space and a drop.

"Here on a ledge was a bottle, securely sealed, and on the paper within we read, "June 1912, J.L. Morgan, T.A. Morgan, Edwin Morgan, Morgan R. Williams (gamekeeper)." Somewhat uncertain now as to whether the pool of the coracle was not somewhere further ahead, we climbed down the drop, came to a T Junction, went down to a canal with a waterfall from the roof, went back and came to a gushing waterfall. With one shout all four declared we were nearly out. We had come down Gowing's climb to The Parting.

"With the rubber boat the Stalactite or Cauldron route was retraced. At the First Pool 'Cymry' was inflated and made its first voyage, a very wet one for the writer. Blown up much harder, two went over in it and two waded. Sitting in this size of rubber boat with one's feet out over the bows, it feels easy to upset. Practice in daylight soon shows that this is almost impossible, since when filled with water the boat is remarkably stable. A twelve stone man needs some skill to prevent water coming over the rounded gunwale, and must avoid rolling. To get in or out you stand astride of the boat in shallow water; the problem of landing on a ledge from deep water has not yet been solved.

"On the Third Pool Gowing with string attached went out over ninety feet and reported a closing in with a low tunnel discharging a strong current but running askew. He had to cut the string to get back. Nelstrop then went out 140 feet, got into the tunnel and saw the fall, but with the makeshift paddle the current was far too strong. So after Platten and I had paddled on the pool we retreated.

"Our news of three pools was a puzzle, the Morgans having coped with only one pool. After thorough discussion Mr. Ashwell Morgan decided to go in again, and on the 25th he came up from Swansea and went in with Messrs Ashford and David Price and the three of us. This time we took a

passage above the Bridge, which twisted round at once and led to the wade in the far corner of the First Pool. Mr. Ashwell Morgan simply could not recognize the place in its flooded condition, and it was not until Gowing had taken 'Cymry' into the tunnel and seen the waterfall, and we had explored everything back to the Parting and to the Pools again, that the identification was agreed. As I was leaving Glyn Tawe a week later after four days' fine weather Platten rushed in with the news that the First Pool was down four feet, and the chances good with low water. But clearly a fleet of boats would be required.

"During the summer Mr. T.A. Morgan's old enthusiasm blazed out. Using a two-man boat of wood and canvas with side air chambers, he and Miss Coote and Mr. Ashford Price crossed the Coracle Pool. It must be recorded that Dr. Coote swam the whole way back. Climbing the side of the low cataract they went fifty yards through deep water, and climbing another cataract came under a lower roof to a Fourth Pool stretching into the distance.

"Moreover Mr. Morgan somehow managed to get two wooden ladders into the Cauldron. Tied together they reached up a 30 foot wall to a narrow passage which in 29 yards led the party into the fine 'Red Chamber'. Here there is obviously an upper storey. For this Mr. Morgan provided ladders short enough to be got in, and with these in October Platten and two others found two chambers and a passage between.

"For the September attack Platten recruited an army from Somerset and bought 'Red Cymry'. As usual I took along an awful flood and drove the first half-hour in dense fog. It was hardly worth while going in on Saturday. The old hands and Dr. Baker found the second and third pools almost one, but we all boated. Ashford Price and Miss Coote made a determined attempt to get up against the current, pulling on the roof and sides of the tunnel, but gave up when a piece of rock came off into the boat.

"Only two Southerners were at the supper to which Mr. J.L. Morgan entertained us, but a carload arrived at ten, proudly sounding the praises of South Welshmen. From Bristol over Aust Ferry they had worked their way in the dark through the colliery districts, men riding on the step to show them the turns, and good fellows going miles out of their way to pilot them. Three men arrived in the night.

"Fifteen went in at eight, Baker and I at ten through a dense flash-powder fog. 'Cymry' was found soft and could not be blown up, so I arrived at the beach to learn to my joy that nine including Dr. Baker, were over, and the pool definitely lower. Weaver and Harris were first over against an awkward current in the tunnel; Weaver went on ferrying while Wigmore and Harris took 'Red Cymry' up the cataracts. Harris found the Fourth Pool a backwater without visible inlet, but Miss Coote noticed a cave just where one emerged from under the low roof. Here was excellent landing, and the ferry only 15 yards.

"Ten people crossed; I got left behind while exploring a loop which ran steeply up and down to cracks by the first landing. We put in our time digging through the beach to lower Second Pool. The ten were pretty quick and came back reporting marvels; they had reached a great Boulder Chamber and stopped beyond at some awful mud.

"We others adjourned our crossing to the morrow, and all were out in mid-afternoon to meet the advance guard of the sightseers. Mr. J.L. Morgan entertained us to dinner at the inn, and after the world's workers had driven off, at his house, where 'Cymry' was tested and the fault traced to the pump.

"Entering on September 20th with a wild idea that a train was to be caught at Swansea at 5.30, Miss Coote, Messrs Ashwell Morgan, Ashford Price, D. Price (Gwyn Arms), Wigmore, Platten and Roberts found the pool much lower and no current in the tunnel. The landing was above water, in fact the flow comes under the rock there. With all three boats in use ferrying was very smart and great fun.

"The 1937 Cave begins with a black limestone passage, rather low, dead-ends. An easy climb at its start led into a good passage leading to a fine chamber. Ware a deadly little hole in the floor! A roomy passage with grottos took us into the lower storey of a big chamber, an overhang being straight ahead. A climb up the right wall finished in the entrance of a big passage, on the way back found untracked and 100 yards long, very fine and lofty in the further half, with a pit at the end and chances at the bottom. Going in, we traversed into a long chamber ending in a boulder slope.

"Here we began to have trouble with some of the five acetylene lamps, which got worse and worse in spite of pricking. Through a narrow exit in one branch we came to the mud, which was tackled and a two storey chamber reached. The upper storey went and we came into an extensive low chamber with many pencil stalactites. (Mark your entry). Keeping left in the higher part we entered a lofty aven with a strong drip, and fed.

"Narrow passages led to a terribly narrow crawl. Here T.A. Morgan and I struck, and while the other five went through to wallow in mud, I climbed an ascending rift to a boulder choke with breccia of two kinds which made one wonder if the surface was near.

"It was a great show and there is more to be found. A month later Platten's party got forward 100 yards to a sound of water, and found extensions off the chambers.

"By the time we returned to the ferries, only one acetylene lamp worked feebly; our retreat was made with candles and feeble electric lamps. The water had fallen yet more and one paddled out into the ocean of the Coracle Pool with the barring spike of Saturday high over head. Meeting the ferryman and his glimmer reminded one of ships at sea."

(E.E. Roberts.)

The mention of "the terribly narrow crawl" is of interest. Lumbard gave a more colourful description of a visit he made, also in 1938.

"At last the end of the cave is reached ..... Platten and one or two others had been as far as seemed possible up a particularly filthy way called 'the Mud Crawl' - and quite justifiably, for it is a place where one must crawl with chest in mud about eight inches deep. After many twists and turns around which there was a strong current of air, the way was blocked

by what seemed an impossible squeeze at the top of an opening some five feet high. However Paul Backhouse succeeded in pushing himself through. And so here where it seemed very unsafe, another 60 yards (sic.) were added. It still went on but was like a drainpipe half full of water and here it was thought that the river could be heard."

(Lumbard)

After the formation of the Club a great amount of time was spent in exploring the vastnesses of Ffynnon Ddu, and records of exploration in Dan-yr-Ogof are not continuous. Difficulties over access were also partly to blame for this, although numerous small discoveries and several attempts at diving were made by Don Coase and John Davies among others. Among the more significant finds of this time was that of Corbel's Chamber; and just before a total ban was imposed, entry had been made into the series above Boulder Chamber.

Outside the system, considerably larger finds had been made, notably of Pwll Dwfn in 1947 and Tunnel Cave in 1953. Work on clearing the sink at Waun Fignen Felin which had been started before the war was continued by Paul Dolphin and more recently by Clive Jones.

Eventually, after long discussions in which Les Hawes played an important part, the cave was reopened to both the Club and public at Whitsun 1964.

Attention was immediately focussed on the Long Crawl. In the initial burst of enthusiasm many members probed its secrets. Despite rumours of one girl passing the terminal constriction several years before, no progress was made. Neil Anderson, Ian Powell and I began chipping away in a desultory fashion for a number of weekends till other finds induced us to revise our priorities.

Many of these finds now pall into insignificance in view of subsequent events. Nonetheless they fed our enthusiasm, and when the time comes for a more detailed look at earlier discoveries it may well prove that their significance was never fully realised. This may be especially true of the tubes, August and Pearl Passages above Boulder Chamber and Wigmore Hall, although of far more importance at the time was the finding of the Siphon Series.

SIPHON SERIES.

This dated from November 1964 when Doug Baguley, C. Henson, (Hinkley G.S.) and myself baled the perched sump beyond and to the left of Lake III. Being the only one in a wetsuit on that occasion I made my way through when there were a few inches of airspace to reach a further very murky pool. Beyond this the passage forked, later exploration revealing that the left hand fork (to Razor Passage) terminated within hammer sounding distance of a similarly unpleasant tube (Knockers Passage) which connects to the Show Cave. Ahead, however, lay a most evil-looking mud sump, which despite the attentions of various Club members, including Bill Little,

refused to yield a way through for some months. Then, on a trip with John Dryden and Tony Iles in March, a small air space was detected and on lowering myself into the inch of water and eight inches of very soft mud I was able to push past the countless worms and shrimps, and via three small air-bells enter an equally muddy tube beyond. A few minutes elapsed and then muddy tidal waves commenced. Animal splashes and snorts overtook the silence and with a tremendous expletive a muddy helmet surfaced to reveal Laurie Galpin. After muttering a few unkind thoughts about mud sumps and the taste of the water he returned to save Mary the trip and to assure John and Tony, who were having lamp trouble, that they were welcome. A hundred feet or so of hands and knees crawling led eventually to a point where the passage was silted up except for a small stream-cut gorge which revealed further open passages ahead. We returned later with digging tools and despite Tony's pessimism he flung himself into the digging so enthusiastically that we feared for his (mental) health. Eventually we became aware of a dip in the passage and it seemed that there was a small puddle at the lowest point. After several premature attempts to get oversized bodies through an undersized hole, we found ourselves swimming in the 'small puddle' which was approximately 70 feet long, ten to thirty feet wide and, as we found later, twelve to forty feet deep!

Later on, the lake was dived by Charles George who passed through the sump at the end and entered a further lake. A closer look at this lake on a subsequent dive with some inexpert assistance from myself revealed no obvious way on, and so our thoughts of Dan yr Ogof II were temporarily quashed.

(One fact noted when II was found, however, was that the lakes in the lower series there bore a close resemblance to the last one described above. How similar to the discovery of OFD II might the discovery of DYO II have been. One interesting exercise is to wonder whether divers could have located the end of the Long Crawl among the numerous avens and passages that abound.)

The summer of 1965 saw two particularly important developments among the exploring parties. With increasing experience the University club from Swansea were now beginning to 'push' the valley caves rather than using them for training and sporting purposes. At the same time an attractive and very capable young lady from Cray began to lose her enthusiasm for purely 'tourist' trips and rapidly became an asset to the "Dan-yr-Ogofians" in her ability to wriggle into the tiniest holes the cave could provide. Her entertainment value, too, was high, for several times we had to divest her of over-trousers or boiler suit in order to regain her company from a particularly reluctant passage. Alas that this was the era of the wetsuit!

Unfortunately our exploration plans had already covered the Long Crawl and for some months Eileen was subjected to being the only one to see the inside of some of the cave's smallest chambers. Our thoughts eventually turned back to the Long Crawl. The selected weekend at the end of October found it filled with Swansea University Caving Club members with the same objective as ourselves. "Ah, Well, next weekend ...." we thought. It was not until the following Spring that we were able to fulfill this objective.

Then, with John and Laura Stratton, Eileen and I pushed on ahead to the squeeze while the others admired the formations in Straw Chamber. I paused at the start of the tight tube while Eileen wriggled on, shouting back to ask where the constriction was supposed to be. She reached a chimney down, reversed quite easily and returned. Great excitement -- clearly there was a way on, but our attempts to arrange a trip with a small companion were again thwarted by several weeks of bad weather.

Over the Easter bank holiday we were poised to go but frustrated, until a fairly favourable forecast on Tuesday morning, 12th April, coupled with the knowledge that it had not rained for twenty-four hours encouraged us to set off for the Crawl, despite the absence of a beach between Lakes II and III and the existence of less than a foot of airspace in the lowest part of Lake III.

The Discovery of Dan yr Ogof II.

Bruce Foster had been the obvious choice to follow Eileen through, and they set off with 25 feet of ladder while Neil Anderson, Colin Graham and myself set about maypoling in Shower Aven at the start of the Crawl. We had just climbed this when back came a speechlessly excited Bruce. After about five minutes we had deciphered that "it went". There was a big chamber below but they could not reach it as they had not got enough ladder. We quickly provided more, but mindful of the water situation, Neil and I achieved record time back to the Show Cave, received a favourable report, and just as rapidly returned to the waiting Colin. Deciding at the outset that it was to be 'smallest first', I took up the position of rear-end-Charlie. The others wriggled through quite easily but I found it one helluva thrutch but eventually extruded through the squeeze and reached the top of the chimney just as the others were returning after a first quick look around.

Neil in fact was on the ladder telling me all about it, and I all but had to climb over him to get down and see for myself.

The excitement was incredible, everybody talking at once -

"It wasn't just a chamber ..."

"The straws!"

"No. The Straws."

"I feel like kissing somebody!"

"Try Eileen."

"I haven't shaved.."

Eventually a plan was formulated, and Eileen, Bruce and I stayed to look again. "No we wouldn't enter new ground till the others had returned with food, spare lights and a weather forecast." However, Bruce's light reduced to a glimmer within minutes and he returned to the Crawl for a spare one that he had left there. He would be back 'within half an hour'. Meanwhile, Eileen and I wandered through the Canyon quite overwhelmed by the straws and

helictites and by the sheer size of everything. And so into the beginning of Monk Hall, but not yet probing into the vastness which could be seen beyond the corner.

Back to the Crawl. No Bruce. A look up-passage and back again. Still no Bruce. After an hour we decided to look in the Crawl presuming he was stuck without a light. So back through the squeeze, easier from the inside, and along the Crawl. Still no sign. So we decided to move on out and raise the alarm but having rather wearily reached Boulder Chamber we were met by Rod Stewart, Bill Little and Colin Graham with food, and, more important, the news that Bruce had caught up with the others and had gone on out.

With food inside us our weariness vanished and we about-turned back to the squeeze which now admitted me like an old friend, and so on to Monk Hall amidst the exclamations and enthusiasm of the newcomers. Past the Monk and again into the unknown to find immediately vast clouds of straws, the 100 feet cascade, which Bill (who hadn't joined us on the original trip because of a recently sprained ankle) was up in as many seconds. Then over a small climb to look into the crystal-lined waters of the Green Canal. To its left, through some short straws, there seemed to be a small bedding chamber - entry revealed, instead, The Hangar. A quick examination showed no really quick way through the boulders there so we returned to the Canal where Rod tried a brief and almost desecratory swim around the first few bends.

Back towards the ladder, where earlier Bruce, Eileen and I had briefly descended to a lower series and reached a lake similar to those at the end of Siphon Series. As we passed by the Crystal Pool we noticed a shadow, or was it a passage? It was. We entered Flabbergasm Chasm having passed it by at least three times. And what a passage! It really defies description even now, but then, without a footprint in its entire length, it was truly magnificent. Whilst most of us were more or less struck dumb, Rod found tongue and to his only printable adjective the passage owes its name. The rhyming slang and the 'Chasm' arise from the twenty foot drop into the Canyon which we nearly christened when mistaking it for a shadow on the floor, just beyond the ten foot straw pillar that is a fitting final formation in that passage.

Eileen and I waited while the others explored the lower series. By now, after over twelve unprepared hours, our lights were glowing dim, and our stomachs, although temporarily refurbished by our light snack, were audibly reminding us of their existence. We eventually resurfaced at 3 a.m. to find Dr. Price awaiting us in the restaurant. We bombarded him with details of our finds, to be rewarded by the offer of anything edible we could lay our hands on.

<u>Mystery.</u>

One curious point particularly emerged from the day's caving. When Eileen got to the bottom of the chimney she was confronted with the initials P.O. inscribed in the mud. It was several days before the mystery caver was traced, but it turned out that on their big attempt on the previous October, Pete Ogden, from the University Club had dug out the squeeze

and passed through to the top of the pitch! His return journey the following week was postponed (as was ours) by the bad weather and he was unable to follow it up.

The Exploration.

Once the squeeze had been beaten it was only a matter of time and weather before the major extensions were entered. Much of the following report takes a diary form and is as complete as I have been able to determine. The totally unexpected reaction of the press, radio and television was as overwhelming, in a different sense, as the discovery itself. It led to considerable financial benefits to the Club and also to unfortunate acrimony among a few members.

The Upper Series.

14th April. Eileen, Bruce, Neil and Rod led a large party into the system to continue exploration while Charles George had agreed to take some pictures for the Daily Mail. They also took in a boat, reached the head of the Abyss and found their way to the Rising.

Having returned to Leicester for photographic equipment and being delayed and diverted on the return by the heavy snowfall I led a photographic party in later on the same night passing the others on their way out in the Crawl. Unfortunately, Frank Baguley could not pass through the squeeze so with Derek Holt he returned, leaving only two of us to photograph. The first photograph, of the Green Canal, appeared a few days later in the "Telegraph".

Almost immediately after that trip the thaw set in and while much time was spent in preparing equipment, only one trip was possible before the end of the month.

17th April. Bill Little, Bruce, Eric Inson, Laurie Galpin and Noel Christopher crossed in very high water conditions and made some very worthwhile 'mods' to the squeeze.

30th April. This proved to be a better weekend weather-wise and many people descended on the Club, to such an extent, in fact, that 'rationing' was unfortunately necessary as the management were only allowing a maximum of 15 into the cave at any one time.

By this time and until such time as the Committee met, the explorers had formed a committee to handle matters, with Bill Little (as the only member of the Club Committee) as chairman.

The Lower Series.

The large party mentioned before reached the head of the Abyss and Bill Birchenough, Bruce Foster, Noel Dilly and I descended. Noel and I proceeded over the Saddle and on through Thixotropic Passage to reach

the active streamway in the region of the 'Washing Machine' - a 'Dilly factor' distance of two miles although the time taken had only been thirty-five minutes!

Subsequently several connections were made between the Upper and the Lower Series, including:-

Four Pots Passage, extended by Noel Christopher, Bryn Thomas and John Bevan.
Elliptic Passage - Eileen, Colin, Rod and Chas.
Worm Way - Bryn, Bruce and Alan Murray.

The completion of the first round trip is rather confused as so many routes exist but in the middle of May both the Noels completed the shorter loop via the Abyss and Elliptic Passage while surveying. Another party close behind including Bryn and myself inadvertantly put Virgin Passage to the indignity of a rear-entry having previously taped off the other end for biological purposes!

Dali's Delight.

Towards the end of May, Eric made an epic free climb up the side of the Abyss into a most peculiar area later christened Dali's Delight by Bryn, who with Bruce, Alan, Jem Rowlands and I were grateful to have the life line for the climb. On that trip much of the obvious ground was covered and on subsequent explorations a fifty foot pot was descended to a phreatic area, while later on at the beginning of this year a dome-pit 100 feet deep was climbed but only gave access to a small rivulet. Repeated efforts by various members to climb an aven with a significant draught were eventually successful but only led to a suspended boulder choke.

Lower Series developments.

27th August. Records show the entry of a small chamber, Toad Hall, but the chief entry extension to the lower series was on Good Friday '67.

Terry Moon found a sizeable airspace on the furthest known sump-cum-lake of the lower series and with a small party extended it upwards of 2000 feet. It consisted of a large maze of tubes and meanders. The place is known as Mazeways. There was a further series of sumps which Terry later dived - however, he only managed to loop the loop and swam from one to the other. Exploration in this area is not recommended unless there are at least six inches of airspace at the entrance.

Dan yr Ogof III.

While many extensions were made in other parts of the cave, notably to Hangar passage by Eileen and Colin Fairbairn, the obvious way on, that at the Rising, proved obstinately impassible until the weekend of September 24/25th 1966. That weekend water levels were particular low and Terry and I led separate parties of Wessex members to the Rising after a tour of the

Upper Series. We combined forces to attempt to lower the sump by digging away at the beach and at the same time to scale the wall above. Despite precarious and hilarious attempts to create a human pyramid the latter was ultimately more successful and although no apparent way on could be seen, a climb in the near-vertical rift provided access to a small black hole very similar to the Crawl but containing an even stronger draught. Another awkward rift led into a beautifully decorated passage with many helictites (Birthday Passage), at the end of which a view down for 40-50 feet revealed the peaty, rippled, sandy bed of the stream.

Lack of time and tackle led us to turn back here although those of us who could were back the next day. Terry had to go back to work, and the party was joined by Alan Murray and Susan Bradshaw. I descended first and quickly went down to the sump which was, as I expected, only a short distance away. I returned to the ladder, but as there seemed to be a delay I went on to the first corner to see if it continued. Indeed it did, high but narrow and in fact I had quite slowly passed two more corners before returning to the others. The atmosphere was as excited as on the first breakthrough, but the excitement had a subtle difference. On entering Flabbergasm Chasm, for example, we'd almost been silenced by the sheer beauty of the formations, the symmetry of the passage section and the scalloping. Now we were awed by sheer size rather than beauty. Entry to the Mostest, a fine meander containing excellent crystals, gours and flowstone more than compensated, as did the fine sand formations near the end of the main passage.

The further we went, the larger became the passage size till we reached Pinnacle Chamber. Subsequent exploration of III, or the Great North Road as it became known when its predominant direction was known, added little for several months despite penetration of and under the enormous boulder and sand choke at the end which formed the Blackpool Sands. Then on the 8th April Dave Judson with a small Yorkshire party climbed an aven near the Mostest to find:

The Far North.

This bifurcates shortly after entry with a series of very large passages and chambers terminating to the west in a vast and very broad choke containing much grit and decomposing argillaceous material. Similar grit deposits are found beneath several very high avens which have not yet been scaled. This section of the cave has been little visited as yet and there seems every prospect of extending it given suitable weather conditions.

NOTES:

Several radio tests have been carried out which are recorded fully in the Log book, but the more interesting points are summarised here.

i). The river passes under the Show Cave near the metal drain near to the Parrot.

ii). Cauldron Chamber was located at about 240 feet just to the south of the dry valley.

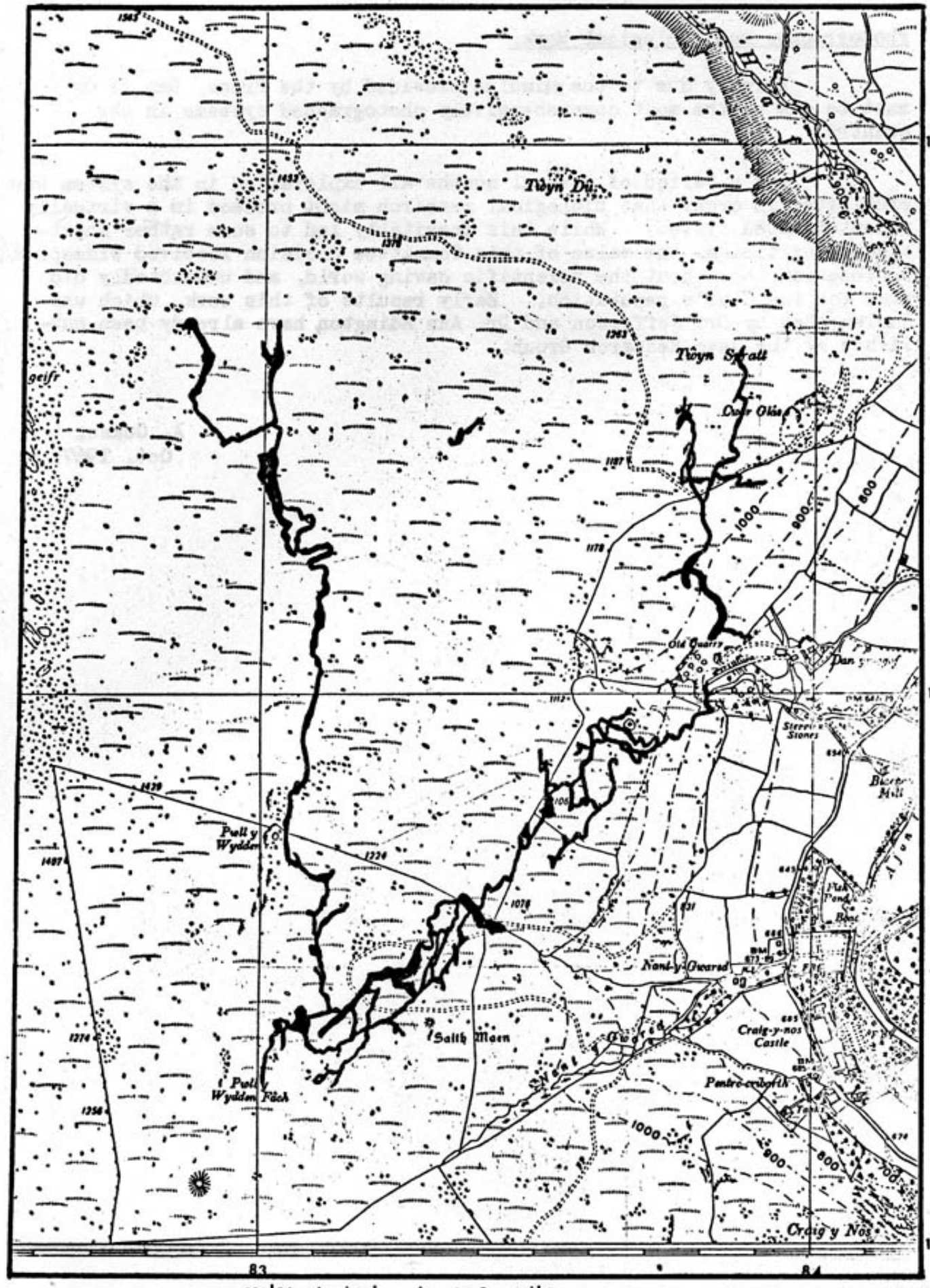
iii). The beginning of the Long Crawl was located at 145 feet below the lowest point in the large unnamed doline east of Pwll y Wydden.

Photography, and Biological Work.

Largely due to the stimulus provided by the Press, Dan yr Ogof must be one of the most comprehensively photographed systems in the country.

For a period of several months all exploration in the system was prohibited in order that biological research might proceed in a virtually uncontaminated system. While this inevitably led to some rather short-sighted criticism, the value of this Committee decision received widespread approbation throughout the scientific caving world, and undoubtedly did much for the Club's reputation. Early results of this work, which was implemented by Dr. Jefferson and Dr. Ann Edington, have already been published by the Cave Research Group.

A. Coase.
Oct. 1967.



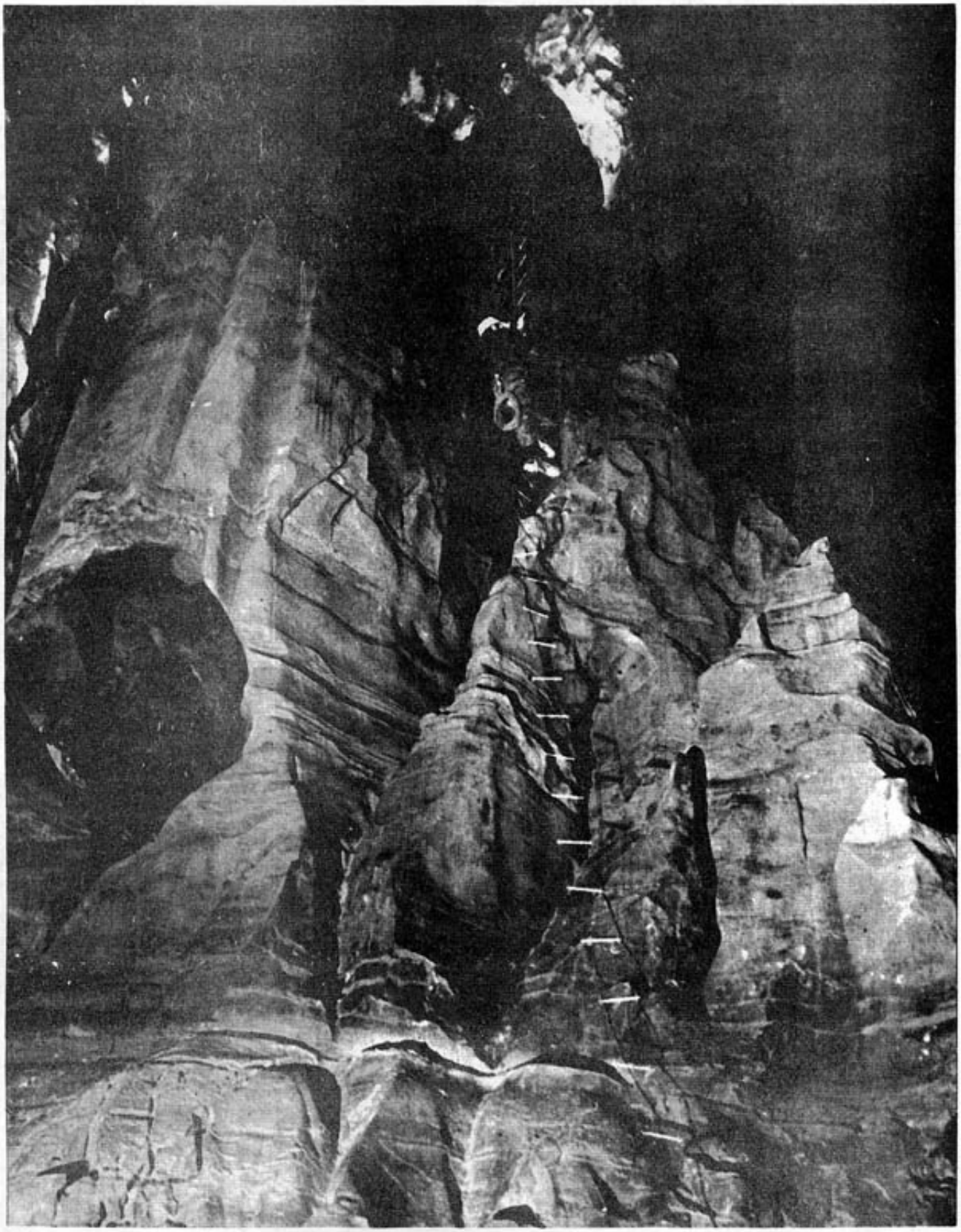
scale; six inches to one mile

DAN YR OGOF IN RELATION TO THE SURFACE FEATURES

FIG. 3



Flabbergasm Chasm , Dan yr Ogof.



The descent of the Abyss, Dan yr Ogof.

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PART 2 — TUNNEL CAVE.

The entrance to Tunnel Cave lies behind and beyond the Restaurant of Dan-yr-Ogof, at the top of a little gulley which runs into the bracken-covered hillside. The cave had been known for years and was seldom visited because of its shortness and lack of interest. The brick dam at the entrance so held back the stream flowing through the cave that in wet periods the water reached the roof a few yards in and formed a trap. Even in dry weather much of the total length of 150 feet was knee-deep. The cave terminated in a low crawl on the wet pebbley floor followed by a small low chamber with three walls and a roof of chocked blocks. The only feature was the draught which made the cave colder and more miserable and even this was ignored until the investigation of draughts in Ogof Ffynnon Ddu had yielded rich rewards. Could the same happen in Tunnel Cave?

In the autumn of 1953 Edward Aslett, Bill Clarke, Bill Little, David Hunt, Clive Jones, John Truman and I put in a lot of hard cold work. Usually the working party numbered about three: there just wasn't room for more! Hammers and crowbars were out of the question because progress was forwards and upwards, and the work was carried out by small explosive charges let off in crannies between the smaller blocks. The debris that fell was raked out by someone lying in the comparative safety of the low wet crawl which had a solid roof. Later the work was slowed down by having to use a short wooden ladder to get up to place the charges and then removing the ladder before firing.

It was between three and four in the afternoon of Sunday, 27th December, 1953, that John Truman went up the ladder to a shelf-come-alcove between big blocks to clear some loose debris. Shortly he announced that he had a capstone over his head and a flat-topped block below with a space about 8 inches high and 18 inches wide between them - he said he was going to try to get through. The rest of us got well back down the crawl and hoped that nothing would move except John. After a little grunting, John shouted down that he was through and standing up. I went next, followed by David Hunt and Edward Aslett. We certainly could stand up, but all we could see was a wall about 5 feet away, a flat roof about 8 feet above our heads and a floor of large jumbled blocks at our feet; in every other direction was nothing but whitish smoke - the product of our 'bangs'. I lighted a candle and left it by the hole from which we had crawled before setting off at right-angles to the wall and finding another in a distance of about 15 feet. Meanwhile the others had swung off to my left and were soon announcing out of the smoke that the floor was going up to meet the roof. I followed the wall the other way, calling to the others to follow. After groping along for about 100 feet, I reached a floor of white gravel; here, the smoke was thinning and the huge size of the passage became clear. The others soon joined me and we paddled along a shallow stream meandering between flat-topped virgin mud-banks. We left the stream where it seeped out from the left-hand wall and in single file scrambled up over a mound of blocks. Down the other side we reached a 'T' junction of another huge

passage where, to the left, the roof soon came down to meet the floor. Here was another large mud-bank with lovely mud flowers or drip patterns. To the right, the way on was up a block-strewn slope where we picked our way so as not to destroy delicate calcite drip formations on the rocks. The size of the passage became less - a mere 3 to 8 feet wide with a height of between 10 and 20 feet. The floor was covered with large and small blocks and progress was slow because in places we had to climb up and crawl between jambed blocks and then down again. Sometimes progress was along the floor and at others up near the roof and a considerable amount of 'gardening' was required to remove insecure blocks. At length we found ourselves up near the roof with irregular fissures in the floor and an awkward-looking 10 feet drop to deal with. Here we decided to call it a day; some of us had headaches from the 'banger' fumes; it was getting late and those at headquarters would be getting worried. We all agreed to continue the exploration the following Saturday - and so we did.

This time the party was John Truman, David Jenkins, Edward Aslett, David Hunt, Bill Little, Bill Clarke, Ashford Price, John Barrows and myself. The start at 5 p.m. was late, but we had been paying our last respects to our old friend and member, Davy Price.

We took with us a 100 foot rope, a 30 foot ladder and a short crowbar. We soon reached the previous limit of exploration and found that the 10 foot drop was not so difficult as it had appeared the previous Sunday and in a short distance we reached The Junction, although we did not realise it at the time. We carried straight on in what is now called the Steeple Aven route. From The Junction the passage was freer from blocks and at first was about 2 feet wide and 10 feet high which changed to a figure '8' passage where one could crawl along either the top or the bottom. Later only the top tube, about 4 feet in diameter, was passable and this sloped up steeply. We went slowly and carefully because the passages were well adorned with reddish coloured straws, but I regret to say that these have since been swept away by careless cavers. At the top of a steep position the passage became a low crawl and at first it looked as though the way was blocked by a calcite flow, but a small opening on the left was just big enough to squeeze through into a level and well decorated hands and knees crawl which soon changed to the figure '8' section again, and we were able to stand up. Here a branch passage went off to the left, later to be known as 'Crossways'. If I remember aright we stopped for a smoke and then realised that the two Bills were not with us. We decided that they had gone off into some passage we had missed. We went straight on and to our surprise the passage went down steeply before levelling off into a very meandering passage of comfortable walking height with a sandy floor and decorated walls. A low passage to the right was ignored and the way became larger until we reached a short climb after which we were scrambling over blocks again and soon we were looking in odd corners in a low chamber for a way on. This was found at the entrance to the chamber: a 6 foot diameter tube, starting 7 feet above the floor. About 50 feet along this tube was a ruckle of boulders which went up to the roof and a number of these blocks were carefully removed and a crawl way was made past the obstruction. (Subsequent 'gardening' has removed all signs of the crawl.) Beyond this we descended a steepish sandy-mud slope into a sizable chamber with a roof height of about 60 feet which was promptly named 'Aven Chamber'. At first there seemed no way on and then at the

end of the left-hand wall an awkward 8 foot climb was found into a crawl passage leading to another chamber from which a 15 foot climb led to a meandering crawl soon found to be impassable due to some stalagmite columns near the left-hand wall. Here the crowbar was used to useful effect and we continued, but soon found that at roof level there was no way on. We were able to chimney down about 12 feet to find a crawl blocked with stones, but David Hunt, then in the lead, soon cleared a way through into a large chamber with a sandy floor. More climbing and crawling led into another chamber from which we could make no progress, so we set off back on the return journey. Just beyond Aven Chamber we met the two Bills, who were rather annoyed because they had found a 15 foot pitch on the route they had taken, and we had the ladder with us. All well satisfied with the day's work, we got back to the Headquarters at 1.30 a.m.

The next day we all went into the cave again to explore the route found by the two Bills. We were soon at The Junction and took an unobvious fork to the left. In a short distance a traverse started - the passage being an opened-out joint about 30 feet high - progress was either by using jambed blocks or depending upon 'faith and friction'. Soon we heard falling water and had to chimney down to a sandy floor with a clear-cut narrow gash going off to the left to where the water was falling (The Cross Joint). The way on was up a 12 foot climb, round some corners with another climb and a crawl which brought us, scrambling on big blocks, out near the roof. Suddenly, the roof height increased and a passage ran off to the right - the other end of Cross Passage. Soon the traversing began again and continued until we could chimney down to the rocky floor of a small chamber (Marble Arch). There were two ways on and we took the larger one to the left and from then on we could sometimes get along at floor level and sometimes by traversing about 6 feet up because it was too narrow at floor level. Very soon we were at the top of the 15 foot pitch: the limit of the two Bills' exploration. At the bottom of the pitch was a sandy floor and a slope up to a 20 foot climb into a narrowish passage with some very nice crystal pools in the floor (long since destroyed by careless cavers). This led into a chamber with a climb down over huge blocks, followed by another scramble up and a 20 foot climb into a small passage that soon diminished into a crawl to a 'T' junction. To the right there was no way on; to the left, David Hunt in the lead just about filled the passage and there were blocks in his way. It really looked as though this was the end, but the draught that whistled its way past spurred us on and David started passing blocks to me to pass back. Eventually we were able to crawl through to find ourselves in a lofty chamber with a stalagmite cascade sloping steeply upwards which, thanks to conveniently spaced stumpy stalagmites, was climbable to a low-roofed chamber. A delicate traverse led to another stalagmite cascade but this was not attempted on this trip: there was easier work to do exploring a passage running off a balcony on the first cascade and two other passages leading from the bottom of the chamber.

These explorations completed, we set off back and all went well until we were on the homeward side of the 15 foot pitch. I was leading and soon became conscious of strange ground and then suddenly, at a corner, found myself looking down a 50 foot pitch! We retraced our steps and discovered that I had taken a downward passage where I should have traversed upwards; after this, we got out without further incident.

This completed the exploration of the major routes in the cave, but during the following weekends and months further work was done. Clarke and Little explored the '50 foot pot' to find it was only 35 feet and discovered a series at the bottom and the alternative route into it via Saddle Corner and its traverse. A party led by Clarke explored the right hand fork at Marble Arch and found the passage that gives an alternative route to the 25 foot Pot. Little, Hunt and I explored to Christmas Grotto and Little, Hunt and party did the traverse in Cascade Aven Chamber and explored the second Cascade. Many of us helped with the operation "Upit" in Aven Chamber but David Hunt drilled all the Rawl bolt holes that made the ascent of a total of 100 feet possible: unfortunately, to find practically nothing.

We have to thank Clive Jones, John Alexander, Gordon Clissold, John Hartwell and Helpers for their hard work in a very draughty, cold wet dig at the top of Cascade Aven by which they opened up the way down into Cascade Aven Extension and its 1,000 feet of interesting passages. Another grand job of work was done by Clive Jones and a large party in the making of the shaft from the moor that has turned Tunnel Cave into one of the foremost 'through' caves in the country.

Perhaps one day work in Balcony Passage or Cascade Aven Extension may lead into Tunnel Cave Two.

January, 1967
Sutton Coldfield.

C. Lewis Railton, A.M.I.E.E., M.Inst.W.

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PART 3 -- PWLL DWFN.

Pwll Dwfn is the only true 'Pothole' that Wales can boast. It descends a depth of 310 feet in a series of pitches, and there is no lateral development at the bottom. The pot is of extreme interest, because it is located in an area that, until the discovery of Dan yr Ogof II and III, boasted no caves. It is extremely likely that there is some sort of connection between Pwll Dwfn and the Dan yr Ogof and Tunnel Cave systems.

The pot was discovered in Whitsun 1946 by Low and Dolphin as they were walking along the old cart track after days of heavy rain. They heard water running at the site of the present entrance even though there was no surface stream.

"The sound was located as emerging from a small boulder-strewn hollow, but this did not excite undue interest as the ground was obviously saturated, and many shakeholes taking water.

"At a later date Low succeeded in forcing his way beneath a large boulder, reporting a small opening down which the traditional pebbles could be thrown, and in August 1946 we contrived to split this boulder, which then collapsed and filled the opening. We removed one portion but were unable to lift the other and no further work was done at this site until the S.W.C.C. Easter meet of 1947 when we were joined by Paddock and Lander.

"On Easter Monday, this party assisted by two caving widows and a small dog removed the offending boulder and Dolphin remarked, 'we could spend a couple of hours digging and see how things looked then'. Prophetic, since it took just two hours of easy work to open up the entrance.

"The end of the system was not reached until July 5th. but several visits were made in the interval, revealing a pitch for which ladders had to be made or borrowed before exploration could proceed. On these later trips we were joined by Weaver, Parkes and Harvey.

"By the time exploration was complete much loose material had been removed from the pitches, but when first entered the cave was most unsafe, and it should still be treated with caution."

The cave seems to have been formed by the intersection of two faults. Although the surrounding mountainside is heavily pitted with shakeholes there was no evidence of any underground system till Pwll Dwfn was discovered. There is a small spring issuing from a rock face a little to the east but there is nothing to tell the innocent passer-by that a ten-foot thick covering of rock is all that covers the first chamber which is almost a hundred feet deep.

The entrance fissure leads to a small tunnel which in turn leads onto the first pitch of twenty feet and down a boulder slope to the second pitch of forty-five feet. The third pitch, thirty feet, leads to the bottom of the first fault-developed rift. Here the way on is through

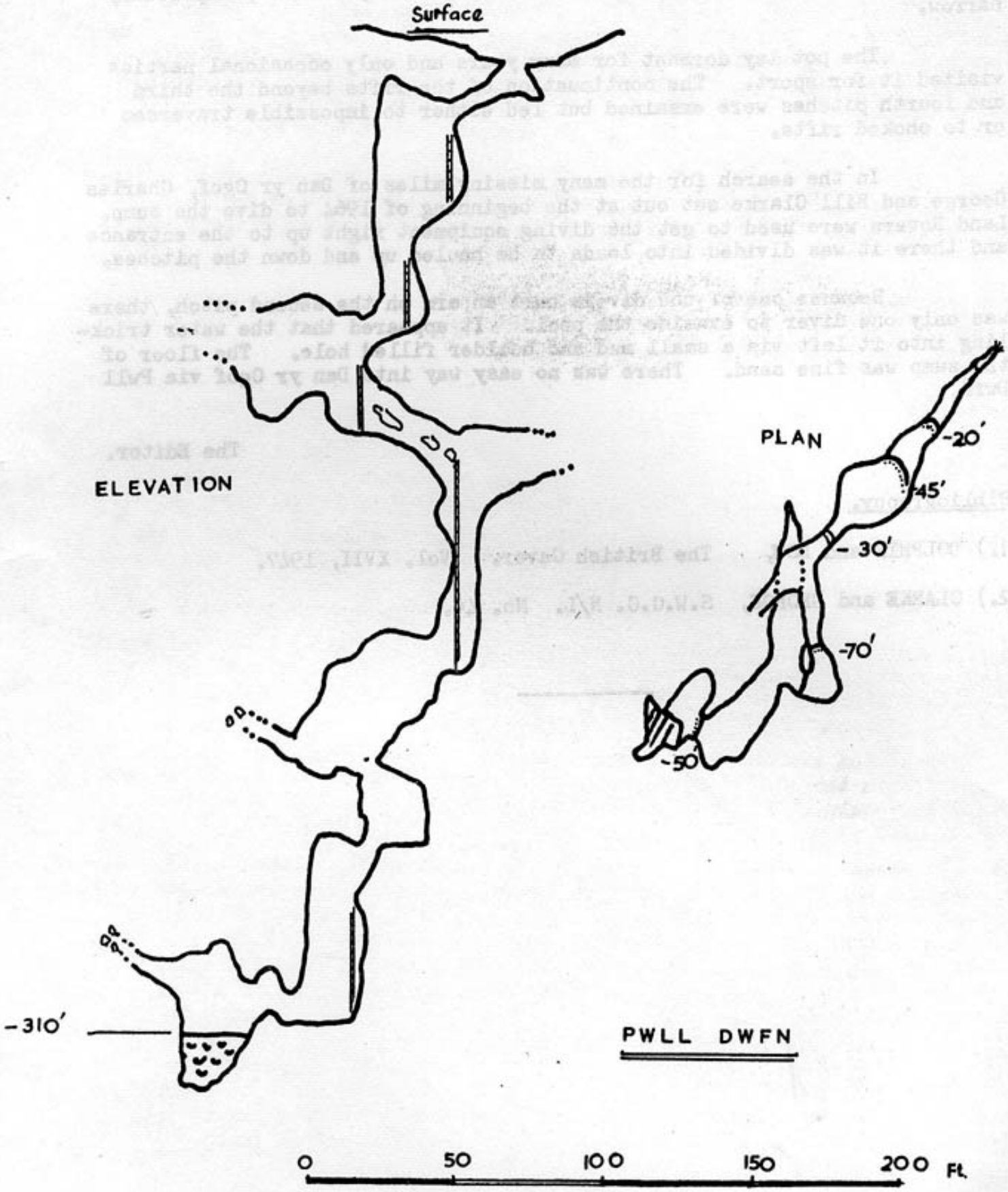

Surface
ELEVATION
-310'
PLAN
-20'
-45'
- 30'
-70'
-50
PWLL DWFN
0
50
100
150
200 Ft.

FIG. 4

another rift at about 45 degrees to the direction of the original. The fourth pitch of seventy feet leads to a shattered area and eventually the fifth pitch, fifty feet. At the bottom of the system there is a scramble over a pile of boulders to a small chamber with a deep pool of blue water. Beyond the pool the rift appears to continue but is, in fact, impassibly narrow.

The pot lay dormant for many years and only occasional parties visited it for sport. The continuation of the rifts beyond the third and fourth pitches were examined but led either to impossible traverses or to choked rifts.

In the search for the many missing miles of Dan yr Ogof, Charles George and Bill Clarke set out at the beginning of 1964 to dive the sump. Land Rovers were used to get the diving equipment right up to the entrance and there it was divided into loads to be hauled up and down the pitches.

Because one of the divers hurt an arm on the second pitch, there was only one diver to examine the pool. It appeared that the water trickling into it left via a small mud and boulder filled hole. The floor of the sump was fine sand. There was no easy way into Dan yr Ogof via Pwll Dwfn.

The Editor.

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PART 4. -- WAUN FIGNEN FELIN.

One Saturday night at the beginning of 1963 in the smoky beer-spilling atmosphere of the Gwyn it was decided that time was again ripe to tackle Waun Fignen Felin. A pencil and the back of a cigarette packet were produced and plans were made.

A winch would be required to haul buckets and boulders out of the shaft, some means of carting the spoil to the dump would be necessary, drilling for shot holes, slings for boulders and above all good solid shuttering to hold back the sides. Pit props, waggon planks, giant steel meccano and scaffolding were each considered and their merits noted alongside the now considerable list of items required for the project. Another list of people who could obtain what we wanted was drawn up and a rough idea of what it would cost was arrived at before Mrs. Price managed to get everybody to the lawful side of the front door.

On the Sunday morning a number of people were able to recall the spele of the night before and it was decided to go ahead with about ten people each contributing £2 and a week's work to the project. The larger items of equipment would then be sold to the Club if they were wanted, so we could then afford to spend money on capital equipment. Bernard John was prepared to make a winch, John Harvey knew of one he might be able to purchase and John Osborne had a contact who could get hold of ex W.D. balloon winches. Bill Clarke was contacted to obtain two tons of timber and to help us cart it to the site and extra transport was recruited by bringing David Terry and Phillip Mathers plus their Land-Rovers into the group. David Hunt was then persuaded into doing the carpentry and Dick Baynton, Bernard Woods and Terry Lloyd got to work on a motor provided by John Harvey to drive one of Bill Birchenough's generators for the Kango hammer which was borrowed from Mark Skinner. Roger Smith and David Dilly obtained canvas sheets and a 160 lb. tent for shelter, whilst Noel Dilly and Clive Jones arranged the explosives, boulder slings and tipping bucket. Dick Baynton was put in charge of the treasury and last but not least, John Spooner arranged transport for the carpentry equipment required for shuttering. Then last and least came Jan Powell.

A few weeks later the equipment was at Penwyllt, work had started on improving the track to the site and Denis Kemp's camera was recording the other efforts being put into the job.

The week before August Bank Holiday was glorious and with temperatures in the eighties, Bernard Woods put the finishing touches to the generator, but on Friday came the rain. Saturday morning Bill Clarke was at the dig with the first load of timber by 9.20 a.m. and by the end of the day it was all systems go with the other two vehicles and all the horde on the job.

The dig was on the site of Paul Dolphin's 1937 - 1948 attempt, which is in a large swallow hole about ¼ mile S.W. of Scwd Ddu on the River Haffes. This hole is the main drainage of a peat bog which covers an area of approx. ¼ square mile and in normal weather water sinks about 30 ft. from

the base of the cliff which forms the southern side of the swallow hole. Due to weathering, the cliff face, which is about 50 ft. high, is very friable and except for one bed about ½ way up, it was considered unsuitable for the anchorage of the cable railway. However this problem was overcome and a cable which was laterally adjustable over the top of Dolphin's old shaft was rigged up. Combined with this a stop on the cable enabled the bucket to be positioned where we required it over the shaft. The cable ran from the cliff face over a shear legs used to tension the cable to an earth anchor in the river bank. A pulley block on the shear legs carried the winch wire and the winch was then sited just behind the shear legs. The bucket used was a 10 gallon pail mounted in a tipping cradle. The hauling cable ran from the winch to a running pulley on the cable railway and this pulley was anchored to the cable stop when raising and lowering the bucket and to the bucket when it was being transported from shaft to dump.

The first job was to secure the 12 ft. of Dolphin's shaft which remained. One side of the dig consisted of a vast boulder which weighed several tons, another side was solid rock and the rest loose rubble. This rubble was cut back until a vertical face was produced to allow the first set of timbering to be fitted neatly in front of it. Three horizontal timbers each measuring 64" x 12" x 3" backed with half a dozen boards 7" wide and 2" thick. All the timbers used in the dig were scrap from the breaking up of railway waggons, the larger timbers being either oak or jarrah and the others being a mixture of hard and soft woods. Thirty-four large and seventy-seven small timbers cost £5.

The large boulder, known to previous diggers as GOD, was considered sufficiently wedged to be left alone and with this secure start the rest of the week was spent sinking and timbering the shaft to a depth of 35 ft. The shuttering was considerably assisted by the fact that the shaft followed the cliff face and most rounds of timber required only two pieces, each being rammed home with a sledge hammer. The dig was through loose boulders which were either lifted out on the winch using a soft wire boulder sling, or if over 3 cwt. were drilled and blasted. The holes drilled were 1" and the usual depth was 3" - 4"; these required less than ½ oz. banger to split them to the size required. A certain amount of chemical sculpturing was carried out to break off parts of a boulder to leave behind a shape which would take the timbering.

All the equipment worked well and any repairs or modifications required were carried out promptly by the 'digs' welder at Penwyllt. The only snag was the winch wire, which was initially put on the drum too loose. This resulted in the later coils which went on under tension cutting into the lower loose coils. This was overcome by rewinding all the cable under tension.

The bottom of the shaft at the end of the week looked most promising and it was generally considered that only another 6 - 10 ft. of digging was required to get to the valley floor and the cave. The stream which was then sinking near the dig, after a week of wet and windy weather, could be heard a little to the left of the bottom of the shaft. The new shaft wandered a little from the original one, the timbers of which were still in perfect condition.

Once again "Dolphin's Folly" was a going concern, thanks to the efforts of a week's grand slam and in particular to the Land-Rovers, which were bashed up and down the track at an ever increasing rate all the week.

After the initial enthusiasm only occasional weekends were spent on the dig. Nonetheless it still went downwards and still the draught howled in and out.

There were severe floods in the winter of '64 and the old winch was covered in peat when it was re-examined - the tide mark indicated flooding to 8 ft. above the top of the shaft.

The whole place was modified considerably - a new winch was installed and conveyor belting lined the shaft to prevent the bucket catching the shuttering. A trap door at the dog-leg at the bottom enabled people to work while the bucket was raised and a telephone line was installed from pit bottom to the winch. Clive Jones (S.W.C.C. N/L 52) was the chief digger at Waun Fignen Felin and his theories about the formation of the swallet stimulated a lot of back breaking work in 1965.

The dig was stopped when the Long Crawl was passed in Dan yr Ogof, but may well provide us with another entrance to the whole system. It is doubtful if the fascination for digging holes will die out and especially Waun Fignen Felin - its potential is yet to be realised.

Those Involved.
(1963-1965).

TOOTH CAVE

GOWER

Tooth Cave - Gower. Report on the Archaeological Work.

by

J.C. Harvey, R. Morgan, D.P. Webley.

Tooth Cave is situated in the Ilston valley (SS 533907) in an area rich in archaeological sites. To the north, a stream disappears at Llethrid swallet, a large and well-decorated cave. At the southern end of the valley, the large entrance to Cathole dominates the valley floor and the Parc Cwm chambered tomb. The present cave was entered in 1961 by two of us (Harvey and Morgan) together with G. Richards.

While digging at the end of a twenty-foot entrance passage it was realised that an apparently solid wall was calcited glacial fill and a passable hole was broken in it. A well-decorated chamber led off and developed into a rift which, farther on in the cave, joined the mainstream passage.

The first indication of the site's archaeological significance came to light when a stone was lifted from the rubble slope in the first chamber and revealed a complete human skull. In the passages leading on into the main part of the cave a lower jaw and a few fragments of pottery were found. The finds were brought to the notice of the National Museum of Wales, and, to allow speleological work to continue, the deposits in Chamber 2 and Chamber 1 were excavated.

The cave entrance is 20 feet above the valley floor in a small cliff face from which a talus of broken blocks spreads outwards towards the valley. Inside, there is a mound of blocks that is a mirror image of the talus outside. The present entrance was filled with mud debris and glacial blocking. It is unlikely that it was an open site in prehistoric times, but an antler was found in the clay suggesting that much of the fill may not be very old.

The Excavation.

Chamber 1.

A trench was set out at right angles to the valley, covering approx. half of the floor area and this was excavated. The surface was found to be a thin mud layer covering the large limestone blocks. The trench was excavated to a depth of 4 feet at the middle and to 10 feet at one side.

It was found that the occupation was confined to the earth layer which thinned out, but continued, under the stalagmite bosses on the blocks.

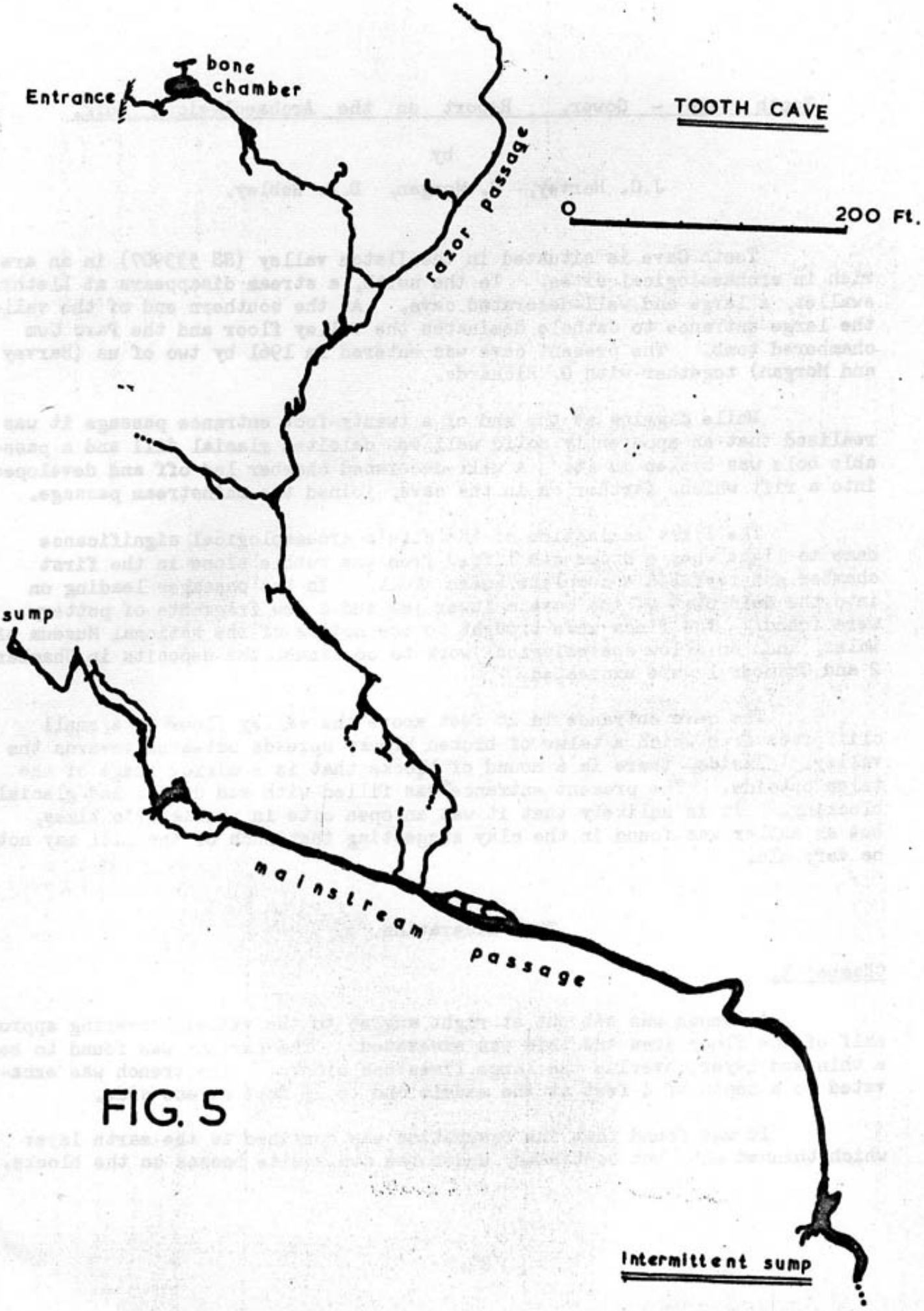

bone
chamber
Entrance
TOOTH CAVE
razor passage
0
200 Ft.
sump
mainstream passage
Intermittent sump

FIG. 5

The trench was delineated by large limestone slabs placed on end, and although these did not appear to be deliberately set up, they did provide a natural setting where two human skulls and long bones had been placed. Between the talus and the back of the chamber was an area of charcoal, but no sign of burnt soil or stone was evident. Most of the archaeological material was found associated with the charcoal. Human skeletal material was found all over the excavated area, the larger pieces arranged in discreet piles, the smaller, such as phalanges, indiscriminately. Animal bones were found at the same level on the floor, but also in cracks and crannies in the chamber walls. Stalagmites were generally situated near the edges of the chamber and human long bones were found beneath their bases in the brown soil. The deposits were much disturbed but there was evidence of human material in their relative anatomical positions; notably (i) a line of vertebrae, (ii) two long bones. One of the skulls had been deliberately broken and the pieces were found packed together curvature within curvature near the long bones in the pit made by the naturally aligned slabs.

Chamber 2.

Its surface was covered with small thermoclastic angular blocks noticeably smaller than those in Chamber 1. Between the stones and at their base was a clay fill which appeared to have flowed down the walls with the dripping water. The prehistoric pottery, human and animal bones all came from near the surface of the clay and stones. Below was a sterile layer of sand lying directly upon rock. Unlike the bones in Chamber 1 which were brown in colour (manganese deposit from the water), these were clean. Intense calcification had occurred on the northern side, the pottery and bones being covered in a thick layer of calcite. One of the few instances of human skeletal material in its correct anatomical position was observed here where a set of phalanges of one hand was found embedded in the calcite. A human jaw was found on the lip of the passage before it plunged down the large rift. No part of the cranium was found there, or in the cave below.

The Finds.

Chamber 1.

BONE.

1). A bone needle (Fig.6, 8), 106 mm. long, 10 mm. wide at the flattened base where a clean hole is punched. The hole is not made by boring from each side as was the normal Early Bronze Age method, but is of equal diameter throughout. It is made of sheep's bone.

2). Spatula (Fig.6, 7). A piece of ox-rib split to expose the cancellous inside. It differs from the normal Beaker type in its shorter length and the presence of cancellous tissue.

3). Bead with a continuous hole through the bone shaft (Fig.6, 6), X-ray analysis was necessary to confirm it as bone because of the calcite covering.

FLINT.

4). Polished discoidal knife (Fig.6, 1) of a general egg-shaped form. Except

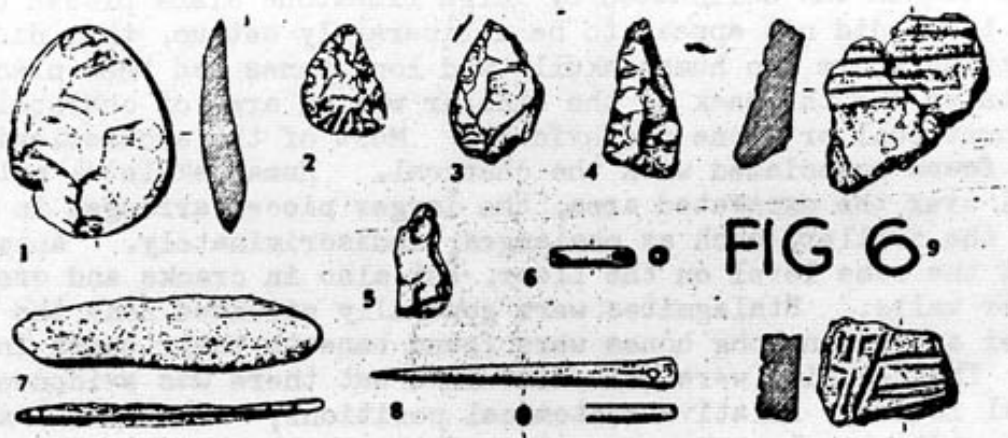


FIG 6.

for a slight blemish the instrument is perfectly symmetrical. The edge has been ground and straightened more intensively on the right side. It is completely polished over a white patination which covers the blue-black colour of the flint. It differs from other specimens in Wales, all of which have straightened edges.

5). Knife, sub-leaf shaped, with the back edge straightened; the functional edge is curved with neat pressure flaking. It is of blue flint.

6). Knife of blue flint, of triangular section shallow at its base. Pressure flaking is steep at its functional pointed end. Much cortex remains on the dorsal right-hand side, while the left is much pressure flaked and polished.

7). Scraper, triangular. It is white and the ventral surface is smooth; the dorsal is matt finished after the removal of cortex by pressure work from the centre to the edges, one of which is rounded - a feature sometimes associated with leather dressing tools.

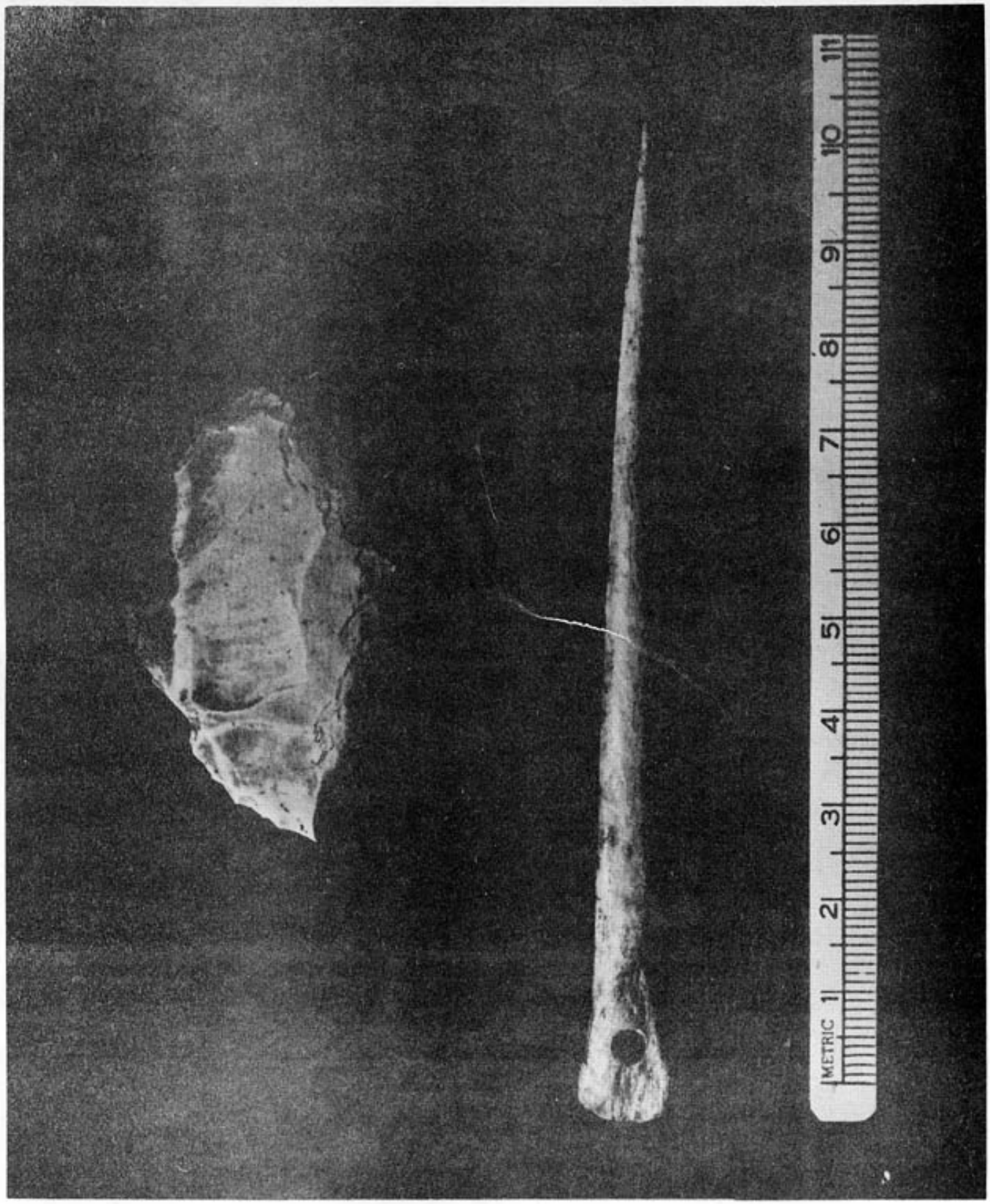
8). Four white patinated dark blue flint flakes.

Chamber 2.

FLINT

1). A broken scraper of greyish brown flint slightly patinated; the working edges conspiciously steeper than the work in Chamber 1.

2). Eight flakes all of greyish brown flint, one appears to have been part of an implement - a blade or a straight-sided arrowhead.



Bone needle and polished flint
unearthed at Tooth Cave.

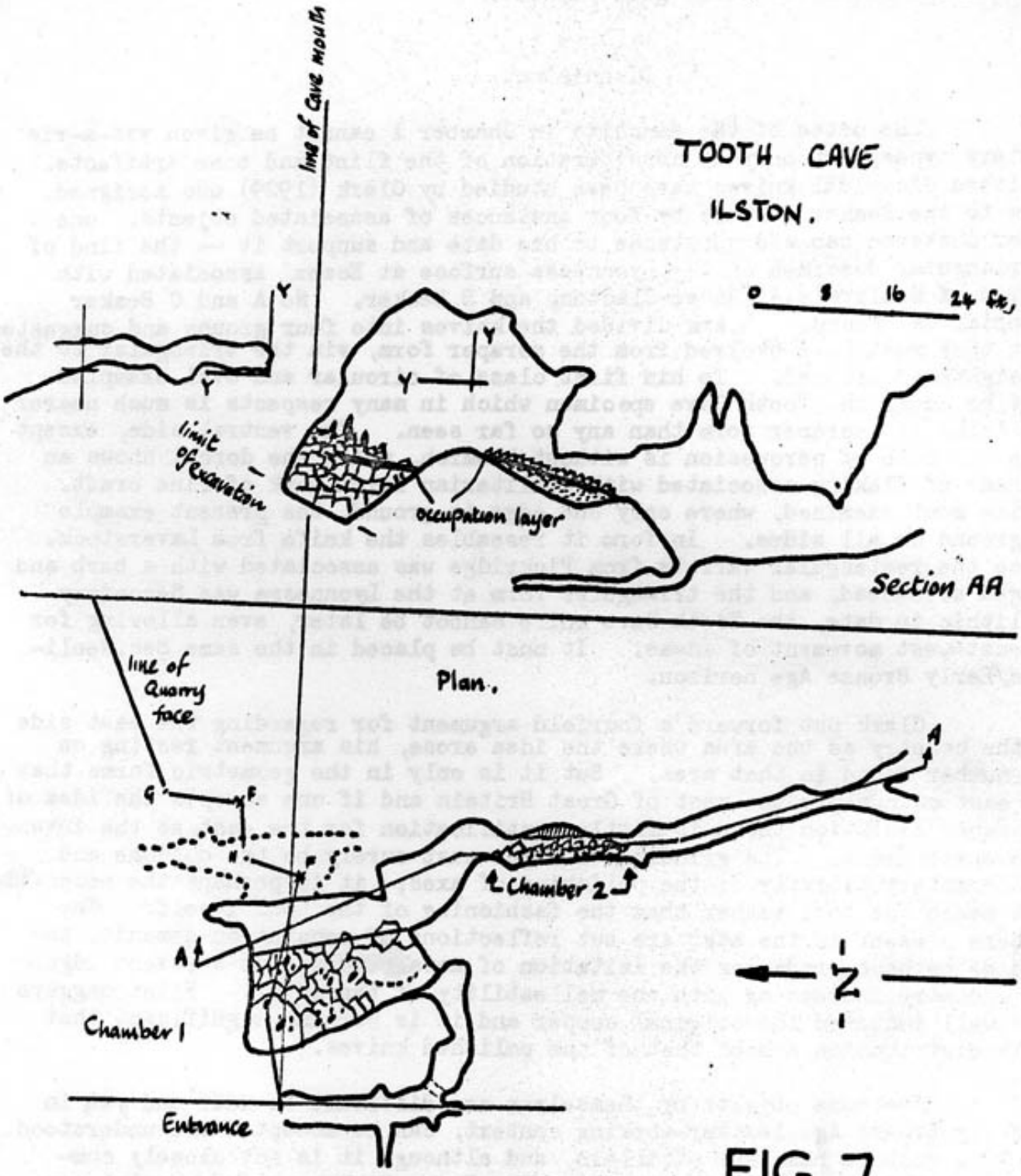

TOOTH CAVE
ILSTON.
0 8 16 24 ft.
line of Cave mouth
Y
Y
Y
Y
limit of excavation
occupation layer
Section AA
line of Quarry face
Plan.
G
F
A
A
Chamber 2
Chamber 1
Entrance
N

FIG. 7

POTTERY.

Many sherds of Middle Bronze Age pottery (probably part of an Overhanging Rim Urn) were found associated with the human skeletal material. The presence of a layer of calcite that has been deposited on them since they were laid makes their study difficult. The ware is typical of its age and has shell and flint grit present.

Discussion.

The dates of the deposits in Chamber 1 cannot be given vis-a-vis pottery types, but only by consideration of the flint and bone artifacts. Polished discoidal knives have been studied by Clark (1929) who assigned them to the Beaker culture by four instances of associated objects: one other instance can add substance to his date and support it — the find of a triangular specimen on the Lyonnesse surface at Essex, associated with sherds of Neolithic A, Rinyo-Clacton, and B beaker. No A and C Beaker material was found. Clark divided the knives into four groups and suggested that they must have evolved from the scraper form, via the triangular to the straightened oblongs. To his first class of circular and oval examples must be added the Tooth Cave specimen which in many respects is much nearer the 'classic' scraper form than any so far seen. The ventral side, except from the bulb of percussion is without blemish, while the dorsal shows an economy of flaking associated with utilitarian flint work of fine craft. Unlike most examined, where only one edge is ground, the present example is ground on all sides. In form it resembles the knife from Laverstock. Since the rectangular variety from Pickridge was associated with a barb and tanged arrowhead, and the triangular form at the Lyonnesse was Secondary Neolithic in date, the Tooth Cave knife cannot be later, even allowing for an east-west movement of ideas. It must be placed in the same Sec.Neolithic/Early Bronze Age horizon.

Clark put forward a fourfold argument for regarding the east side of the country as the area where the idea arose, his argument resting on the number found in that area. But it is only in the geometric forms that the east outnumbers the rest of Great Britain and if one accepts the idea of a scraper evolution there is little justification for the east as the inventive environment. The grinding of edges must surely be the outcome and complementary activity of the polishing of axes; it is perhaps the necessity that makes the tool rather than the fashioning of the tool itself. The numbers present in the east are but reflections of population demands, the demands perhaps producing the imitation of metal tools, the straight edges and geometry increasing with the malleability of the metal. Flint daggers have well imitated the original copper and it is perhaps significant that their distribution echoes that of the polished knives.

The bone objects by themselves are difficult to date and yet, in an Early Bronze Age leather-working context, can be accepted and understood. The bone spatula has many parallels, and although it is not closely comparable with many from Beaker graves, the Gorse Bigbury beaker burial produced an implement (now destroyed) which bore a striking resemblance to the Tooth Cave specimen. Smith and Simpson (1966) suggests they were leather-

working tools by association in male graves, with metal awls, scrapers, and knives with rounded edges. The present assemblage fits well into this category. The bone needle has three points about it which are worthy of consideration. (1) It has the remains of the epiphysis still present. (2) It is not made from a split bone like many Early Bronze Age examples but has been carefully ground, scraped and polished to a fine point. (3) The hole has not been made by the hour-glass technique. However, high-quality bone techniques were well known in the Wessex Bronze Age and there is no reason why the present finds should not have come from the same horizon. The Upton Lovell necklace of bone points has both techniques present, hour-glass and punched. This latter technique need be no later than Wessex Group 1. The bone head has also close parallels in many sites and nowhere more than the Upton Lovell barrow hoard, where a similar bead was found. The shallow pressure flaking of the edges of the flint knives also suggests an Early Bronze Age date.

One other item of evidence must be mentioned to support the Early Bronze Age date. At least one of the skeletons had been originally laid in a crouched position, but it is of interest because the top of the skull had been deliberately broken and the pieces placed in a neat pile. At Sutton 268 (Fox, 1943) found a completely smashed beaker placed curvature within curvature behind the skull of the crouched burial. The similarity between the two acts must be more than coincidental and support the same date for the Chamber 1 - a B1 Beaker association. In passing perhaps B1 Beakers owe much to Rinyo-Clacton forms and the presence of the former in South Wales accounts for the absence of the latter.

The date of Chamber 2 is made easier by the Middle Bronze Age ware. The presence of shell and flint grit suggests an early form and the burial need not be much later than Chamber 1. It is of interest to note that all the flints from this chamber are of a cherty beach flint in contrast to the good quality 'downland' flint from Chamber 1.

A Note on the History of the Cave.

A study of the whole cave - about 5,000 to 7,000 ft. of passage shows evidence of at least four phases in its formation, the last being provided with dateable evidence - the Early Bronze Age deposit beneath the stalagmites in Chamber 1, and the calcite flow over the Middle Bronze Age bones and pottery in Chamber 2. After the archaeological passages the cave follows a rift and the way on is through a boulder fall in the floor, where, 15-20 ft. below, the rift continues and one enters a stream passage. This passage is noteworthy because of its horizontal nature; it is obvious that it extends beneath Chamber 1 and out under the valley floor. Another of its junctions called Razor passage extends at the same level towards the valley. The whole pattern of the cave suggests a simple river system with tributaries.

Theories of cave formation are legion and all have some truth in them; the present cave seems to be an example of Woodward's Stream Piracy theory (Woodward, 1961). He suggests that after a pre-cave epoch of solution in a non-integrated system of fissures, crevices etc., there is a

change of status in which a turbulent water table meets the 'pro-cave' area of rock. Geological events leading to a rapid increase of water, e.g. ice-melting, fall or increase in sea-level, or any natural event leading to a water table being established at a 'pro-cave' area will initiate a rapid increase in fissure or channel enlargement. It is probable that cave passages developed in long horizontal planes will echo a former water table level at which solution had been most active. The level of the passages below Chambers 1 and 2 in Tooth Cave are about 100 ft. O.D. and therefore we must look for a geological time when the water table in the Gower was at about this figure.

After the initial cave formation, passage enlargement, and the fall of the water table, the river would run over a pebble bed. This is present in the main stream passages, but later there is evidence of the river not flowing, since a layer of calcite was formed over the pebbles - a phenomenon associated with glacial conditions above, holding back the water as ice. At this time permafrost might penetrate areas of cave near to the surface. In interglacial times the stream would be rejuvenated by the release of melt waters. In the cave this has resulted in the water cutting itself a new channel through the calcited stream bed. Joints, loosened by permafrost ice wedges collapsed and caused rock falls and enlargement of chambers near the surface. At this time, Chamber 1 probably took on its present form. The present entrance and the originally larger one did not exist at this time but the last ice age (Smestow Cold Period) cut out the Llethrid Valley and exposed the cave entrances, partly filling them with glacial debris and some of the smaller passages with frost cracked angular pebbles. A further period began and soil began to form in the main chamber to be followed by a further period of slow calcification associated with the formation of stalagmites in Chamber 1 - a phenomenon which can be dated since it occurred later than the Early Bronze Age. This has been equated with Atlantic times (Apsimon, Donovan, and Taylor, 1960).

The Cathole entrance lies in a similar position to Tooth Cave in the valley, relative to the sea level. Macburney (1959) layer D corresponds to the occupation of Tooth Cave and therefore today's entrance was present at the same time as the Tooth Cave one. The Creswellian occupation, just above bedrock, shows also that the entrance was open but new in Upper Palaeolithic times - i.e. both entrances had been formed just before the Upper Palaeolithic, probably by the Smestow glaciation.

Cave formation and enlargement could not have started before the Mindel glaciation in East Gower since the sea level stood at 200 ft. At the peak of the Hoxne Warm Period it was 100 ft. (Mitchell, 1960), and it is then that the first stages in cave formation must have commenced, the main evidence being the long stretches of passage at the 100 ft. level. The calcite covering to the pebbled stream bed can be correlated with the Gipping Cold Period, and the recutting of the stream, and calcite with the Ipswich Warm Period. The periods of permafrost in the latter could have caused the enlargement of the chambers nearer the surface and the Smestow for the exposing of them to the valley. Since that time there has been no massive return of the water to the cave, the main Llethrid river bed having been gouged deeper; periodical flooding of the lower part of the cave occurs only at times of excessive water surface drainage.

APPENDIX.

Chamber 1.

Examination of the cranial remains suggests a minimum of six individuals.

1).	male	- 40-60 years	DC, M, T
2).	male	- near 60 years	DC, DM, P, T
3).	male	- 30-35 years	DM, P, T
4).	male	- near 20 years	DC
5).	female ?	- young adult	DC, P
6).	female ?	- about 13 years ?	DC, P, T

Evidence from post cranial remains indicated that the individuals were affected with varying degrees of osteo-arthritis from the age of 30 onwards. A reconstruction of two of the males present in the Chamber indicated that they were approximately 5 ft. 7½ ins. in stature. The dental health of the group could be assessed from the numerous teeth preserved. There was a distinct absence of carious cavities and dental abscesses were rare. Small deposits of tartar were noted.

Chamber 2.

1).	female ?	- near 15 years	DM, P
2).	female ?	- adult	P

(The symbols indicate the remains on which the conclusions were drawn. D - damaged, C - cranial remains, M - mandibular remains, P - post cranial remains not necessarily complete, T - teeth.)

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THE CALCITE SAGA

A TALE OF MENS' SHIRTS.

THE CALCITE SAGA.

A coachloddy grinned along the winding roar among growling and drivelling hills. Woollen sheeps stuttled in alarmclocks and slank off seeking acrilan pasturth new. Several Beards of Parody frattered in the treeb and some alit on the backs of piglength bootskin calves. The weather was normal for the timer - showers of foggy thunder, with a drip dry period intertwiddle or so. At the coachweal was the leader of the expedish; a leader indeed, with good qualiflowers for speditionary activities. The inventor of exposure meters for sunbathers, his hobbies include bricklaying, plastic surgery, self-hypnosis and playing the trombone, but most important of all is his inane sense of responsibility.

Soon a river came interview, running along on stilts. All a-twunce it leaned over due to the lopsided effect of gravy and galloped clean round a bend. The explorers were shot up a side valley shrouded in misery and lit by the roaring borealis. They got out and began to carry erroneous loads of quip up the steep. They sloggered past a little ornamental sneer garden and on to the head of the valley. Soon they saw a thin lisp of vitreous enamel smoke and decided to set up camp in a field of violets. The sewage farmer was very friendly and grouted them with many a reinforced concrete stricture.

Cooking was by gelignite held in the palm of the hand and conveniently ignited by swearing, but on this day they were in a hurry so they opened a tin of self exploding curry soup. Ghosted cheese and scrippled egg quickly followed, with gloompsie for afters. The leader stooped to feed the mice in a dexion cage and to belch delicately into a wind bag. Autumnal troubles were nothing new to him so he took 2 laxative chocolates with those delerious carbide centres.

There were little assidous trees around the campsite but the actual caventrance in the middle of a clump of aniseed balls, was guarded by a pair of rort iron goats. Here the party a-shambled at sunstop, when the lampshades were falling fast, to pay homage to St. Lucas who is the patent saint of all potable lightning. To make a sacriface they burnt a little dry rubbish and three salted batteries. The leader read out his exploders' licence and the gods were appeeved. Then he turned to his fretful speleodogs and said, "Gentlemen, there are some of us who aspire to great heights while others perspire at great depths. Now what I say is oooops" and so saying he fell through a short but steeply stoving pipe. His men leapt after him and they came to a grategrindinmalt in the main passage of the cave. They looked around and saw that it was high, wide and loathsome. The floor was quite dry but some careless soil mechanics had left a lot of mud and stones lying about. There were fine crystalline formations on the walls including some rare Louis XVth pork pies in canze. One end of the passage leads on to the upper bingo halls but our leader strode in the opposite where the woof slopes down and the passage becomes a multiplicity of warped crawlies. They went up the middle one and chimneyed for a while,

revealing a large expanse of tartan overalls; all climbed out one by one into a potlike chamber with a low groof entird y supported by voluntary advertisements.

After this they had only sufficient stronk to d imb over a pile of boulders choked with emotions and into a cross passage. It was very angry indeed and writhed about as they tried to crawl t hrough it. Finally they all excooped to a wide rift which openedup toreveal an undergrouhd lake. Now the lake was the home of many a calcite gnome, who welcomed the leader as an old fiend. 17 white gnomes sat on a polythene toadstool under a sink and slag songs. food sonks, rude sonks, drinking sonks and home brewed sonks. The King of Sonks sang many rousing national sonks and sonks of old bathtimes. He finished with "On Sings the Sonks". Finally he sank. The gnomes dived down at once and pulled the plug out.

Soon the lake was empty and revealed a verdigrees shaft which the explorers descended by the rungs of a prehistoric ladder. Being literally down in the mouth they landed on a jumbled heap of false teeth coated with fluoride. When they ceawled out flat on their little brollies they saw that they were high above a strems

The smallest of the group decided to explore a narrow side passage on his own. He had to get through a very tight squeeze. He took off his helmet and his clothes, exhaled ddeply, had a quick shave and a haircur and found ge could just push through before taking another gulp af hair. His eyes fell an an amazing sight and immediately bounced off again. There before his eyes were vast deposits of quasi-monoclinic custard throbbled right through with astignation.

He easily regained his companions and after a hittle crotchetty work with a nylon romper they lowered themselves into the watery icicle. Spashing and studderung along the mainstreets passage the ladder accidently crossed a solid white calcite vein in the floor. They realised that something was impersnet. Just then the cave police came bubbling up in n inflatable hollow laugh and shouted with a great brass bellow--"You have committed a crime, and we will confiscate your 3/6d entrance fee." And with that the giggled away.

The leaser said something rude and shot up a blasted passage entirely hollowed out by expletives. The roof lowered so they crouched, wriggled and griped. When the going was easier one or two began to act the fool. Naturally they fell into a sluddy minebath and came out dripping with sentiment, but soon they were in a fifferent passage. It was part of the EERIE SEERIE well known for its underground fish and chip saloon. But suddehly the leader heard footysteps behind him. His harp fell to his knees, and his ears beat faster and faster. He felt a lamp in his throat and experienced a strange birdie feeling. He turned round quickly. Footystep and shadow finished into the thin. He continued quickly on boot ant sideway past a point where the mountain had burst open a little. A jot of water tricklen down and ow the neck and shoulden both eerr. Never mind. Faster,

faster. Must get away from those persistant footie s which follow, follow, follow, fell—OW. Suddenly they stepped and there was silense. The foots had crept back into the crevvies.

But now they all felt thirsty. Obedient to their very thinks, one of the gnomes reappeared and squeke, "just nokk thrise upon this stal boss" he sayed "and ask for Mrs. Price — but be sure to take your glasses back before the strokers twelve or she will cause them to shadder and turb inter frag in your handel, and then what will you do?"

Not knowing the answer they went down a little anticlimax into the main hall and lo there was a steamer seen riding at anchor out there in the green beizewater. Our stalwarts gazed upon this great sigh, munderful and wistie indeed, but one was not looking - he had seen a light coming in the opposite direction.

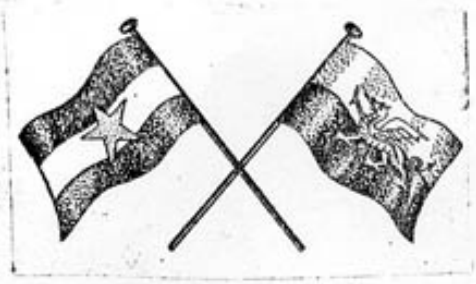
Now this was Bud Sump, a smart neoprene suitor, and he dashed into a small tunnel towards the light. As the two figures approached they politely dipped headlamps, then they met, stopped and talked. It was Krystal Poole he had found at last. At one time she thought a bedding plane was a kind of cheap night flight, but now she knew Bud. They held hands and gazed at each other. For one magic moment their helmets touched as they suede ever so slyly inthe dumb limplight; later he watched her wash some of her "caving smalls" in the stream or perhaps we should say "larges" for she was a very big girl.

Well, did Bud and his girlfriend get married? Yes they did. At first they set up camp in a Vibram, but soon someone took putty and gave them a phreatic where they lived snogggly ever after. Or at least for a year or three. All their offspring were born complete with helmets and boots on, all ready for OFD and so the other members of the expedition were galvanised into irony.

j.d. aldridge 20.9.65.
revised 26.8.66.

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THE BALINKA PIT EXPEDITION



"May some crumbs of speleological knowledge gained by the toil and sweat of a group of friends, feed the spirits of Patriots in wars and peaceful enterprises and adventures." (Anon.)

From the winch log

BALINKA PIT EXPEDITION.

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PART 1.

Introduction.

To the members of this expedition Balinka meant many things, too many and too much to relate in full; this is the difficulty of editorship -- what to leave out. But even to preserve some part of it in these pages one is immediately faced with many problems, because that journey and descent did not start or finish in 1964. Indeed, the year of preparation cannot be accurately defined since in 1961 there was a Balinka in the back of our minds when we completed the Tucic Ponor problem. There can be no end to it, our friendships with the Croatian Speleological Club show we are inseparably linked with their future; the completion of Balinka will only be an introduction to the karst of Lika. The world grows smaller, our friendships deeper.

Preface.

'People who do things often make mistakes, but the people who make the biggest mistake are those who do nothing.'

A September day in 1961, saw a red Hillman shooting brake wind its dusty way down a track in the Velabet Mountains of Yugoslavia, heading for Karlovac. The dust screen behind the vehicle settled slowly on the bleak grey desert of limestone of the surrounding countryside, and added to the already thick layer on the sparse trees. The track was treacherous, riddled with holes and boulders, and the driver had to pick his way between the obstacles, often making detours across country to avoid particularly bad patches, but speed was essential, we had overstayed in the dusty wilderness and were making haste to France to catch our aeroplane for home.

Four sunburnt bodies in the car sprawled over, hung on to piles of equipment, rucksacks, cases and tin boxes, were vibrated and jolted with every turn of the steering wheel, every bump of the road. The dust was everywhere despite the closed windows, the film of grey flowed over everything until the colour of the interior became the same as that outside. We were heading for Karlovac to drop Pepi, our guide for the past 10 days; there he would be able to catch his train for Zagreb. Pepi was a Croatian, a wiry tough fellow who lectured at the University of Zagreb. He had been the life and soul of our party but now that the time had come to go our separate ways, he was unusually silent.

The track became steeper and narrower and we could not avoid the bad pieces of road. We did not slacken speed, but pressed on, dropping all the time out of the thin dry wasteland towards the green trees and the metalled road in the valley below. Suddenly around a corner another cloud of dust appeared, the vague shape of a lorry. Crouched over the wheel was a vast fellow sweating blood and tears, forcing the thundering heap to the top. No time for brakes, no time for anything other than evasive action as the Hillman lurched around this only other vehicle we had seen that day and regained the road and the huge dust cloud from the lorry. Gordon put his foot down and the two adversaries drew further apart without as much as a good evening.

Pepi broke the silence and pointed through the closed window into the mountains. 'Last year I tried to reach the bottom of a vertical pothole discovered by our Society, but it was too deep for us.' Gordon was too busy looking around corners for lorries and my brother and I were extricating ourselves from the jumble of equipment which had broken loose when we passed the lorry. Pepi's remark was lost. 'When we found the pit we lowered 200 metres of ladder but even when 100 metres of rope with a lamp were hung from the bottom of the ladder we could see no sign of the

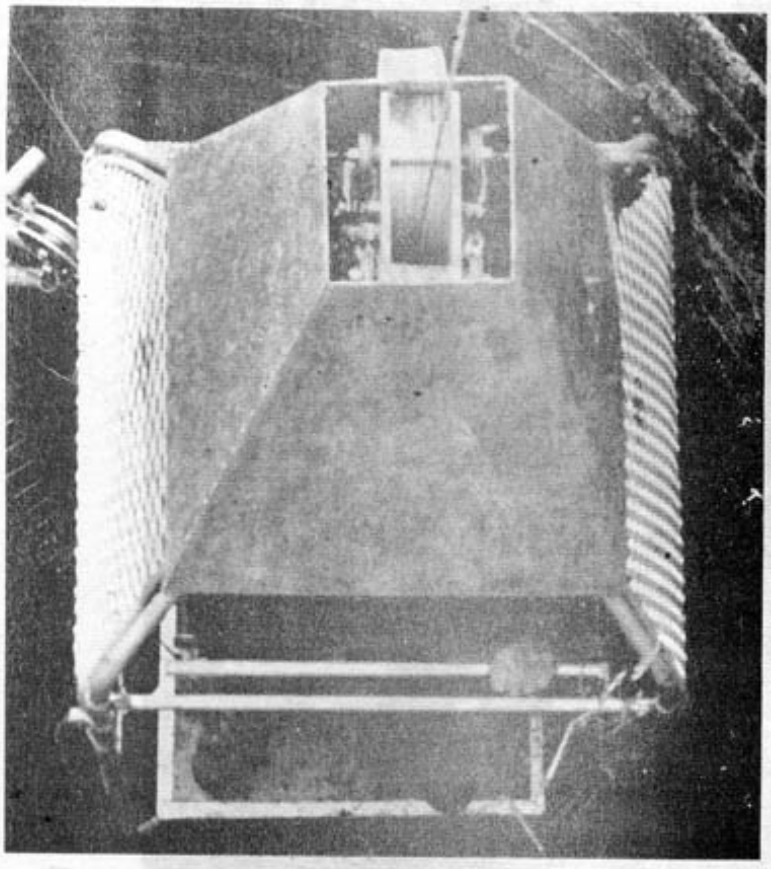
floor.' His remarks were falling on deaf ears, for we had just had one wild goose chase to Yugoslavia and were not prepared to start planning another one. In 1959 we had been shown the Tucic Ponor, a pothole near Gracac and had been taken in by it so much that we had returned home to manufacture 1,000 feet of wire ladder for its exploration. In 1961, twelve of us had returned and found that the hole came to a sudden disappointing end at 400 ft. We had been compensated by seeing a remote and exciting part of Yugoslavia.

We left Pepi at Karlovac and three days later Yugoslavia was 1,500 miles away but not forgotten since Pepi had sown the seeds of unrest in the mind of more than one member of the party. Wheels within wheels were beginning to turn:- his pothole was Balinka.

Clive Jones.



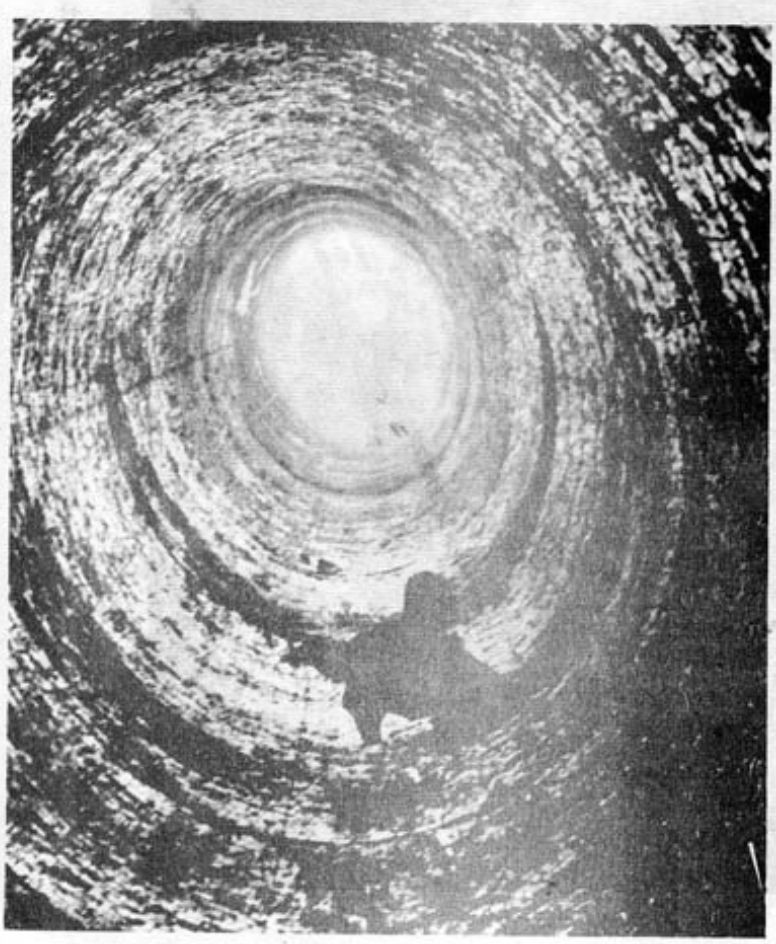
The mountain of equipment that had to be loaded onto the bus.



Winch trials in the Forest of Dean.



Kemp in the parachute harness.



Descent in the harness.

Letters from Yugoslavia.

Before and after the expedition many letters passed between the two organisers; Pepi in Yugoslavia and Clive in S. Wales. The letters from Croatia present pictures of the pit upon which the equipment was built, and an account of the first descent.

Zagreb, 15.VIII. 63.

"Dear Clive,

I received your letter few days ago but till today I could not answer. You understand me - it is always more difficult to begin to write a letter in a foreign language. I hope that this will come in time ---------

From my side I can only say that I should be very glad to have again opportunity to accompany your group. The pit about which I told you in 1961 is surely very interesting and very large. I was myself with the ladders to a depth of 200 m. and we put the tope with the light still more than 100 m. deeper, but there not the bottom yet. The pit is complete vertical, but till 200 m. there are possibility to stay on 2 places (on about 75 m and 180 m) and between these 2 places the ladders will hang near to the wall, so it will be possible to use the wedges. In every case there will be necessary the ladders, the winch and the telephone or radio, because the echo is inside so strong and numerous that it is impossible to understand the man who is 20 m. away.

The pit is near village Plaski, south east of Ogulin. Its position is special interesting because its location is just between one periodical lake in karst and one very strong karst spring, whose water come from the upper lake. It was established by the colouring of the water in the lake. Just therefore I believe that near the bottom or on the bottom of the pit we should be able to find some great horizontal cave. I should like so, but we will see the result. In this is just all the attractiveness of our speleology.

Yours,
Pepi."

The next letter from Zagreb, 6.IX.63 as well as again describing the area has Pepi's description of the mouth of the pit.

"-----. The opening is funnel-shaped. The rocks are solid and it is possible to put wedges in. Inside is the same situation and I think that you must use the wedges. The trees around the hole are strong enough for any rope and any burden. Perhaps there are some stones mixed with the soil in the funnel of the pit, but we will take it away. Other-

wise, the stone is solid limestone. In the pit only on the depth of about 75 m. there are a great quantity of rocks on one downward slope about 10 m. long, but we can put it away or make the wall, or simply pass by it without the touching of it, as I passed last time already twice. The walls of the pit are very rare covered with calcite near the entrance, but when we go deeper there are more and more calcite, but not very much. It isnt possible to dive on the spring of the river, but you can take your oxygen equipment, because may be it will be possible to use it on the bottom of the pit.

Yesterday I talked with our secretary - Ivo Baucic - and he is also very glad that you will come again to Yugoslavia to discover again one new cave in our karst. If you need any help he is ready to do everything for you what would help in your work.

From my side - the best wishes and many greetings to the group.

Yours,
Pepi."

Clive wrote to Pepi about the possibility of using divers in Balinka, and in a letter filled with administrative matters (19.XI.63) Pepi commented:-

"What to answer to your divers? We never know what is on the bottom of the pit! Therefore it will be good that they take all their necessary material for divings. But on the sinkhole of the lake Blata and on the spring of the river on the other side of the mountain it is impossible to dive, because there are not any hole where man can pass through. But the divers need not to be sorry, because they can try to dive also near the pit on the lake Sinjac, which is 3 Km. from Balinka. The water in this lake come also from Blata. It would be very interesting to see if there are any possibility to come inside of the karst-canal. I wait the next summer with a great interest.

The best wishes to you and your club.

Pepi."

In the next letter to Clive (18.IV.64) is described the Croatian valuation of Balinka.

"Our society believe that Balinka pit is one of the deepest in our country and therefore you need to be very careful ------".

The first mention that Balinka had an importance other than the plain speleological occurred in a reply dated 6.V.64. -

"------ I write again in Plaski and Mr. Latus answered me that we should get the horses for carrying for nothing. He is very interested for our action, because during the last war his brother and still 3 partisans were thrown in Balinka. Latus believe that we find thems bones on the bottom. -----

The President and Secretary of the Speleological Society for Croatia wrote the following letter (20.VI.64) officially inviting the group to explore Balinka, the letter filling in some of the background of the cave's history:-

"Dear fellow speleologists,

"----- We have studied all your plans and photographs. We are quite sure that in testing your winch you have taken into consideration all the eventualities, possible difficulties, obstacles, and unforeseen surprises.

In our opinion, in order to make safe the exploration of the pit, more than 300 m. ladders and other equipment should be secured, and in this respect we have taken the necessary steps. Moreover, we are going to put in order the opening of the pit, as well as the ways of access.

Balinka Pit is very important for us not only as a first rate speleological phenomenon, of exceptional depth, but also because the fascist occupier threw its victims into it during the Second World War: four fighters of the Struggle for People's Liberation (Partisans) and two People's Heroes lie on its bottom. This we know for sure, and we suppose that still more fascist victims were thrown in the pit. Hence the extraordinary importance of the pit and of its exploration.

-----We are looking forward to meeting you, cooperating with you in the speleological field, and greeting you as dear guests, friends and valuable fellow explorers of the classical European Karst.

Srecko Bozicevic — Dr. V. Blaskovic

Secretary — President.

Even after our return from the exploration in 1964, there were many things to clear up factually as well as administratively. Firstly there was the true account of what happened at Balinka on the night of April 2nd 1942 - we heard many versions of the incident and so I wrote for confirmation of the true story. Also I thought it was imperative to place on record the names of Pepi's 4 companions who were with him at the time of his descent in 1960 and the names of the Yugoslavs who had helped us this year. The answers to my questions were given by Pepi in the following letter (2.I.65)

Dear Derrick,

Few days ago I got a letter from Ljulo Latus. He described the situation in which were murdered his brother Franko and his comrades by this way. In this time situation between partisans were still not clear. A great part of them still didnt know the true aim of them battle and what they were fighting for. This situation used some cetnicks which were between partisans. During the night they took the guns from the communists which were in fact the spirit-leaders of the

partisans. Cetnicks then went with five main communists to Balinka pit; four of them they killed, cut thems necks and three the bodies in the pit. The heads they brought to Italian soldiers in Plaski. (It isnt proved but people are talking so). The 5th man ran away and he described later everything. A pity, he also later fell in the war. So the cetnicks threw in the pit 4 men:- (1) Robert Domani (nicknamed 'Spanac'), (2) Drago Steinberger ('Adolf'), (3) Franko Latus, and (4) Stevo Cuturilo. The first two were later proclaimed for the national heroes.

This is the version of Ljubo Latus, but I am remembering that I also heard from the people on the pit still some another versions. Which is true - it is difficult to say - for me, and also I think for Mr. Latus.

You asked me for the names of my friends who were the first time with me in Balinka. As you see there were only 5 of us. We had only ladder and rope, without telephone. Therefore Jihomir Pajalic was on the entrance of the pit and the peasants helped him. Fdenko Marovic was hanging on about 25 m. Nilan Vresk was on the first shelf and Vladimir Pongrac and myself were on our deepest point between 180-190 m. In this time the lake was full ——.

You also asked me for the names of our friends who were there with us this year. Except for Ivo Boucic and myself, there was Srecko Bozicevic, Tomislav Jutrovic (Muscleman- ed), and Ines Kuzmanic ——— ———

———

Yours,

Pepi.

Geography of the Country around Balinka Pit.

by Z. Pepeonick.

Introduction

Lika is one of the biggest regions in Croatia and is well known for its karst phenomena, especially Caves and potholes. In recent years some of them have been explored by members of the S.W.C.C. The exploration of Tucic swallow-hole near Gracac and Balinka Pit in the vicinity of Plaski was a real contribution to our knowledge of Yugoslavian subterranean karst forms. In 1964 they worked in Balinka Pit in northern Lika. The aim of this short paper is to give a concise geographical review of the immediate surroundings of Balinka Pit.

Geographical Location.

45.1' .6" N; 14 .26' .31". E of Greenwich.
Balinka Pit is on the southern slopes of the Pistenik mountain (822 m.) about one Km. from the summit of Mali Pistenik (800 m.) The pit is surrounded by mixed forest. The nearest villages are Licka Yasenica to the south and Begovac to the west; the nearest hamlets are Vidakovici in Licka Jasenica - about 2 km away, and Vezmari, about 1.5 km in Begovac. Both villages have road connections with Plaski in the N.W. and Plitvice in the S.E. The pit is in the vicinity of the Zagreb to Split railway line, the nearest station Blata. The expresses do not stop at Blata, only at Plaski. The small region around the pit is administered by the Ogulin community. The best approach to the pit is by way of the hamlet Ogrizovici. This is where the bus was stopped. This village is 10.5 Km from Plaski, 38 Km from Ogulin, 75 Km from Karlovac, 131 Km from Zagreb, 27.5 Km from Plitvice Lakes, 69 Km from Senj and 138 Km from Riceka.

The Natural Environment.

The Relief.

The country around Pistenik is relatively high. The lowest point in the S.E. part of the Plaski basin is 400 m high; Korita in the east is 410 m near Blata to the west and Licka Yasenica in the south; the elevation is 480 m. All the major relief features are in parallel with the prevailing Dinaric direction, NW to SE.

Besides the alluvial deposits on the bottom of the periodical lake of Begovac (or Blata) and in the narrow valley of Licka Yasenica river, only dolomites and limestones belonging to different mesozoic systems are found in this region. The Pistenik mountain is limestone and the periodic lake of Begovac is a small karst polji; the area in which runs the river Licka Jasenica is a narrow karst valley. Both these features have been developed in the dolomitic strata by a process of differential erosion, and later filled with alluvial deposits. The alluvial areas are periodically flooded, especially Begovac. Agriculturally, the best land is to be found in the

lowest part of the Uasenica valley; in summer when the lake is empty, Blata is a valuable pasture ground of the people. Morphologically one can divide the whole area into three:- (a) the alluvial plains, which are exploited as plough lands and grazing meadows, (b) an area, slightly higher around the lake which is used as pasture although are covered with thin scrub grading into (c) the highest part of the area with steeper slopes and covered with thick forests. Although the three areas differ between themselves, for the inhabitants of the area they are complimentary to each other and provide all the natural resources for village life.

The Climate.

The countryside enjoys a mesothermal, warm summer climate. The nearest meteriological station is at Plaski about 7 Km away, but due to the fact that the area is mountainous, great differences can exist over small distances. The mean annual temperature at Plaski is 10.2 C; the warmest month is July (mean temperature 19.8 C) and the coldest January (-0.3 C). Begovac village is 500 m. above sea level - about 115 m. higher than Plaski (385 m.) therefore the above temperatures would be a little lower than those quoted for Plaski. Mean annual precipitation in Plaski is 1497 mm; the maximum occurs in October (155 mm.) and the minimum in August (76 mm). Snow cover is up to 1.5 m. thick and is expected in at least three winter months. The prevailing winds are "bura" (bora) and "jugo" (the south wind).

Hydrology.

In the vicinity of Pestenik mountain there is the karst river Licka Jasenica, as well as the periodic lakes of Begovac and Snijac and Balinka Pit. There are many tectonic lines there which makes its karst hydrology very complex.

Licka Jasenica is a typical karst river about 7.5 km long at its highest water level and 5.5 km at its lowest. Its main spring is called Veliko vrelo about 480 m. above sea level on the boundary between the limestone and the dolomite. The river flows on the dolomite and its own alluvial deposits, but on the limestone downstream its water disappear into swallow holes near the village Licka Jasenica (an area 2 km. long) by colouring the water in the swallow holes south of that village it has been proved that there is a subterranean connection with the karst spring called Slusnica (245 m.) south of Slunji, near the metalled road from Zagreb to the Plitvice lakes. Because of similar geological relationships there is also some underground drainage possible in the direction of the karst spring Kresnica (252 m.) This drainage would be through the Pestinik mountain in the direction of Balinka Pit. This could only be proved by colouring in turn, all the main swallow holes at different water tables.

For us, the most interesting and most important hydrological object in the area is the periodical lake of Begovac which has a very complicated water system. It is a small karst basin (polji) submerged each year for 8-9 months, very seldom all the year round. The lake is empty usually at the end of the summer and the beginning of autumn. It is situated on the

junction of three tectonic lines which cause an entangled hydrology characterised by reversible springs (estavelas), normal springs, and swallow holes. Their spatial arrangement depends the geological formations. Normal springs e.g. Sigivac near Blata railway station (where we had our water from), and the swallow holes are here in dolomite; the latter are situated on the opposite SE and NE corners of the lake. Estavelas are found in the south-western part of the lake on the junction of the limestone and the dolomite. The biggest is Velika pecina which has many passages, but the main one is 16 m. long, 12 m. wide and 20 m. high. When the lake is full only the swallow holes in the NE and SE take water, but when the lake is being drained, the estavelas - the main springs - also take the water. This means that below the lake there are channels whose capacity is only big enough to take a limited amount of water from the limestone catchment area on the west side of the lake. When the water level is high and excessive for the water-courses, the estavelas become strong springs, the other channels being too narrow to take all the water.

By water tracing in the swallow holes on the NE part of the lake, it has been proved that there is a subterranean connection with Snijac Lake (364 m.) and the spring of Kresinca river; estavelas also are connected with the same two karstic features. Of greatest importance for this study are the swallow holes on the SE part of the lake. Even now, we are not sure where the water from these holes go to, but everything suggests that the water goes through Pistenik mountain towards the karst spring of the Slusnica river; it is also possible, that like the Licka Jasenica river, some of the water might also flow towards the Kresnica spring. In either case with two different directions possible, because the karst is like a sponge, full of pores. In the case of a connection with the Slusnica river, the water must run in the direction of Balinka Pit - and this must be a very important explanation for such a big hole like Balinka. In this case we would surely expect at the bottom of Balinka, large and long cave passages.

The Soil.

In the area are Rendzina and Brown Earth soils. These are very common in Jugoslavian mountainous areas on mesozoic limestones. Rendzinas occupy the higher parts of the messo relief, which the Brown earths and also Parapodsolic soils occupy the concave surfaces.

The Natural Flora and Fauna.

On these soils the natural vegetation is mainly associations of Beech and Silver Fir. We can also find in the forests small numbers of Pine, Maples and Ash. On the lower slopes we find here and there Oaks, Chestnuts and many Hazel bushes. In the forest around the pit live hares, badgers, deer, squirrels, martins, weasels, polecats, wild cats, foxes, wolves, bears etc. Some of the, the bears, are protected by the State.

Social Facts.

Population: We shall only analyse the populations of two villages, Licka Jasenica and Begovac. In spite of the fact that these two villages

are in Croatia, the population is mainly Orthodox Serbians, who came there about 300 years ago in 1655 fleeing before the Turks. The inhabitants are strong healthy mountain people and according to the census data we can see two maxima and minima in the development of the population.

The population according to the census 1857-1961.

	1857	69	80	90	1900	10	21	31	48	53	61
Begovac	167	254	259	300	250	238	237	310	296	281	256
Lika J.	910	984	988	1087	1150	1093	998	1268	1002	972	817

The population increased until the end of the last century, and because of emigration fell again. The emigration, more especially to the United States, was caused by the grave economic situation prevailing in Croatia - then part of the Austro-Hungarian Empire. The population fall in 1921 was the consequence of the serious losses sustained in the First World War. After the war the population continued its normal development. The evidence of the Second World War is not so clear in the figures because (a) the first post-war census was held in 1948, and (b) because of the great gap in time between 1931 and 1948. In each case the Second World War had a much greater effect than is apparent from this data. After the war there began a process of depopulation which is the same for all villages in Yugoslavia; it is a direct result of the industrialisation and the urbanisation of our State. The influence of the newly built paper factory in Plaski upon the development of the population will be evident in the near future. The emigration had an economic basis; the soil is poor and there are few industries to work in. A few people work on the railway and in the forest, but even today over 80% of the people are peasants.

The Settlement.

It has been already said that there are two villages in the area, but they consist of many hamlets. It is of interest that the majority of people in each hamlet have the same surname. The village Begovac consists of 3 hamlets, Ognjenovici, Vezmari and Vrcelji, Licka Jasenica consists of 13 hamlets: Likare, Nemcilovici, Paskasi, Vidakovici, Nalbase etc. The houses in the hamlets are altogether, there are only a few isolated farmsteads. The houses are built mainly of stone, but many are of timber, the roofs are covered with tiles; most have 2 rooms and a kitchen. The farm buildings are in the yard and the stable is the most important - in some cases it is the only one.

The part of the village of Licka Jasenica which is placed on the main road has a central function from here is the school, the shop, post-office, church and a building for the local administration. There is no centre in Begovac and its people have to go to Blata or Licka Jasenica.

The Economy.

The forest is the most important natural source. However it is not much use to the peasants because it mostly is State property and tree felling is forbidden. Agriculture is by far the most important industry, unfortunately the people's life is based on a self-sufficient economy and

they sow some seeds which do not give an economical yield - Maize for instance. The natural environment is very suitable for the growing of Oats, Rye, Barley and especially potato, but the acreage of all except the latter is very small. The raising of cattle, pigs and a few sheep is very important for the people. Although agriculture is the most important branch of the economy it is not strong enough and therefore many of the people are engaged in other activities outside the village, more especially working in the forests at certain times in the year.

Conclusion.

The country around Balinka Pit is a karst landscape with its many subterranean karst forms and karst hydrology. The surface landscape is not typical because of the dense forests and soil cover which hid the karst forms. This has been a short account of the area, mainly concentrated upon a description of the karst morphology and hydrology because I think that this is by far the most important for the further speleological investigation in this country.

Zlatko Pepionick.

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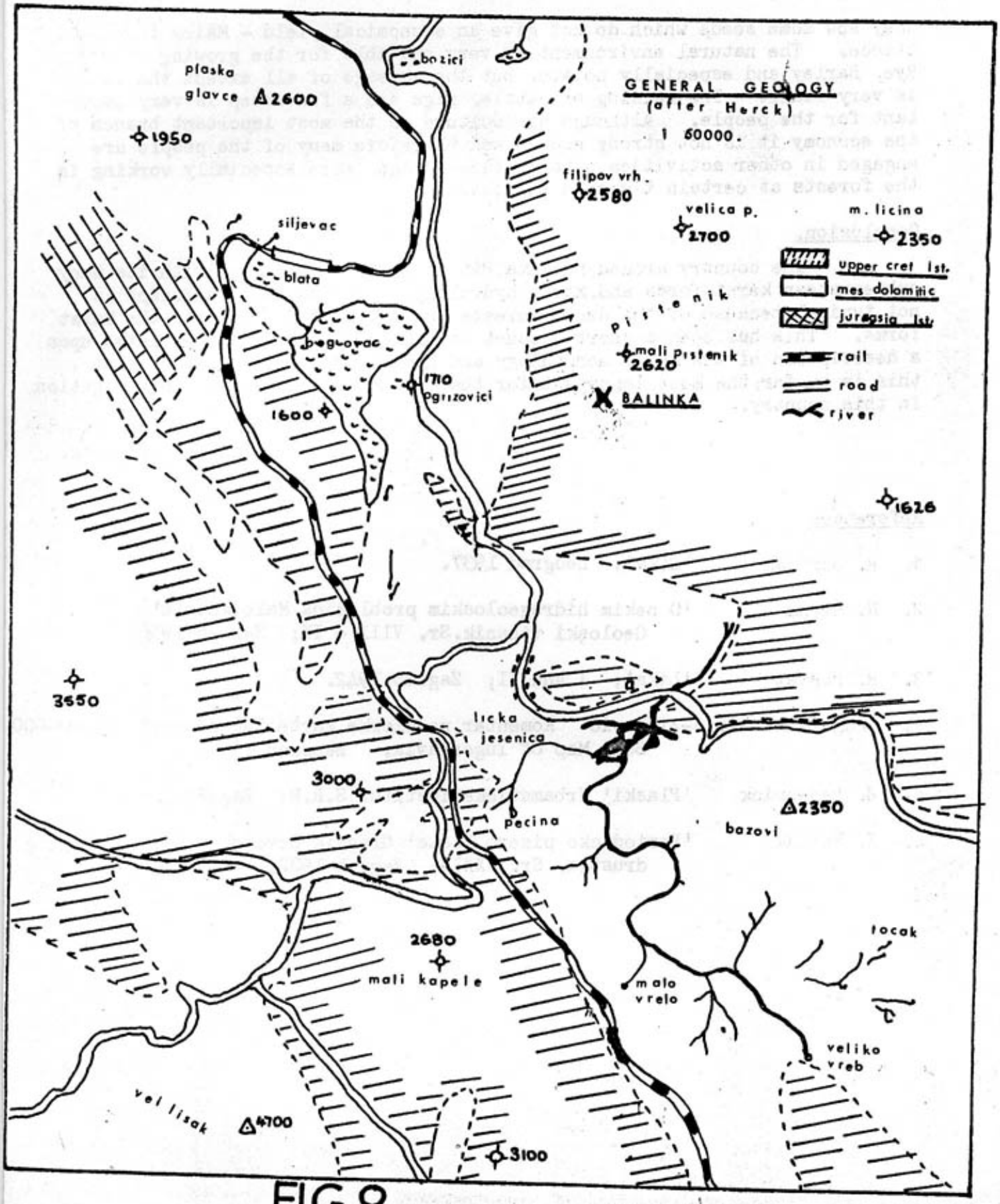
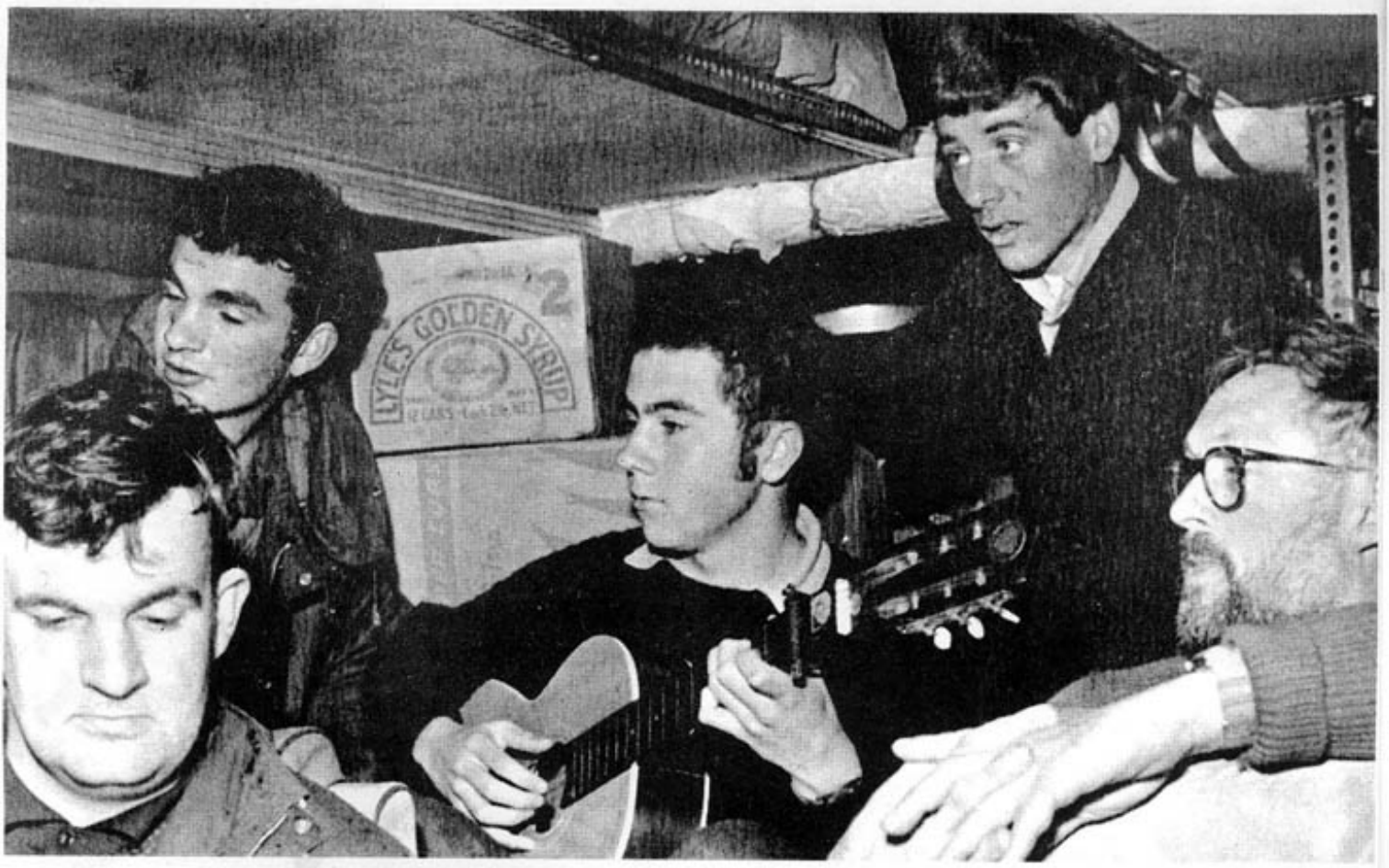

GENERAL GEOLOGY
(after Herck)
1 50000.
upper cret lst.
mes dolomitic
jurassic lst.
rail
road
river
BALINKA
ploska
glavce
2600
1950
siljevac
blata
begovac
1710
pgrizovici
1600
filipov vrh.
2580
velica p.
2700
m. licina
2350
pristenik
mali pristenik
2620
1626
3550
licka
jesenica
3000
pecina
2350
bazovi
tocak
2680
mali kapele
malo
vrelo
veliko
vreb
vel lisak
4700
3100

FIG.8



The journey out.



Bernard in the driving seat.



Unloading the bus on arrival.





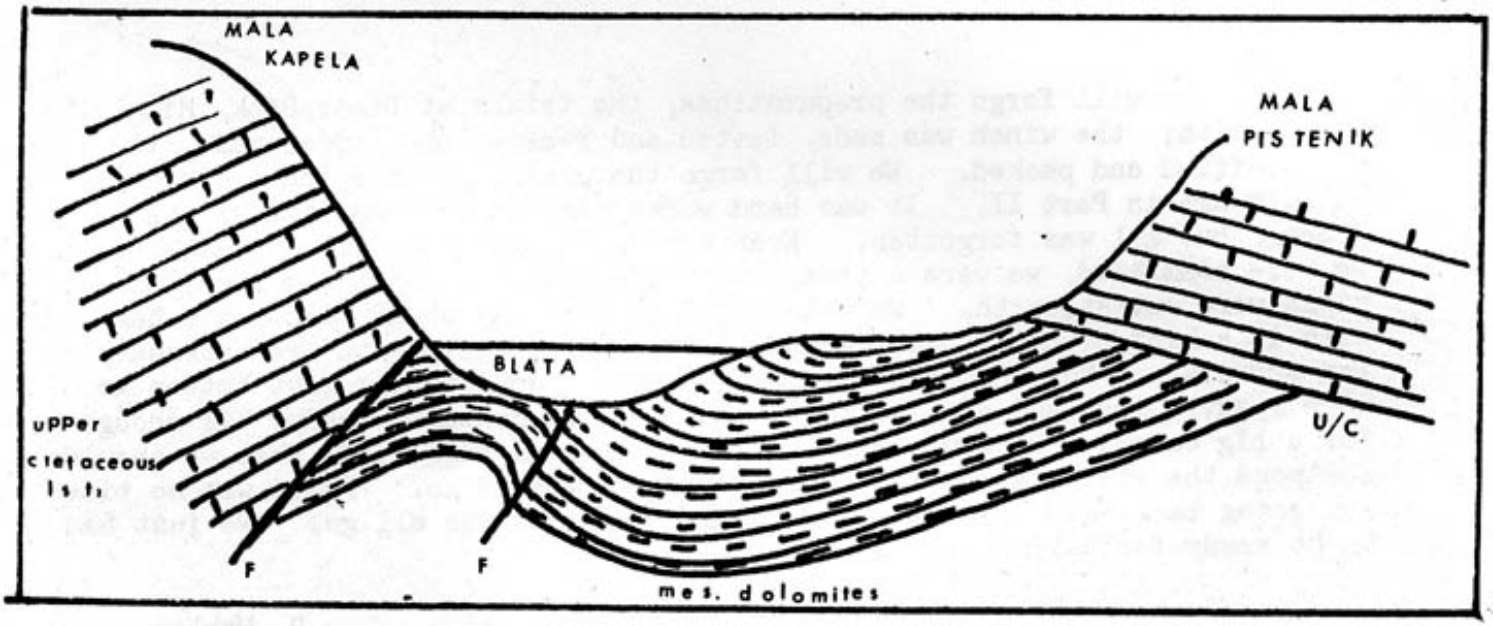
Cooking the first meals.



Geological Setting.

The surrounding area is underlain exclusively by Mesozoic carbonate rocks. The basal members of the succession are mainly dolomitic while the higher parts of the Jurassic and the bulk of the upper Cretaceous system are limestones. The Upper Cretaceous lies unconformably on the older rocks and has a basal dolomitic conglomerate, this in turn is followed by a transgressive yellow dolomite which overlaps the dolomitic conglomerate in several places and lies directly upon the older dolomites. This, in turn, is overstepped by the youngest and most widespread member of the succession which is a limestone containing abundant rudistid fossils, and it is in this member that Balinka is situated. Examination of the rocks collected on the expedition indicates that the whole of the pothole is located in this Cretaceous limestone.

According to Herak (1955) faults are far more important to the underground hydrology than any of the other tectonic features; and lines of sinks, risings and estavelas are located along the fault zone. (Estavelas are sinks which become risings when the water table is low.) Two of the more important of these faults are those trending NNE-SSW through Blata and NW-SE through Jesenica.



GEOLOGICAL SECTION

FIG 9

The major sinks at Blata and Jesenica are both situated on the undifferentiated Mesozoic dolomites and the underground watercourse from Blata to Mreznica is confined to this rock type although the direction is controlled

by a fault zone. The host rock of the Jesenica - Slusnica watercourse is rather more complicated in that the sink, while being in dolomite, is situated close to the faulted contact with the Upper Cretaceous limestone, and most of the watercourse is in this rock type, the direct line between Jesenica and Slusnica being sub-parallel to the strike.

The importance of the dolomitic rocks on the hydrology is mainly due to the fact that these rock types occupy the lower-lying ground. The faulting and associated fissuring results in ground with easier solution possibilities. The rudistid limestone occupies higher ground and compared with the dolomite is heavily fissured and jointed emphasising its more pervious nature (Herak 1955).

K. Ball.
Oct. 1967.

Reference:

(Herak, M., 1955 Geoloski Vjesnik, VIII-IX, 32-37.)

We will forgo the preparations, the trials at Dinas Rock, Mitchell Dean, Garth; the winch was made, tested and remade, the ladder made, the bus modified and packed. We will forgo the planning since the technical details are in Part II. It was hard work, some worked much harder than others, but all was forgotten. Even working together had its strains but we were committed, we were a team, not perfect perhaps, but our imperfections were our strength. We were blind to what lay ahead, ignorance has with it a kind of bliss that deeds are made of, achievements are necessary for survival. Not that there were no plans; down to the last button we were ready, Clive had seen to that - but were we mentally ready, big enough for a big cave? There was a last minute telegram suggesting that we should postpone the visit, and Clive rightly said we should go. There was no time for going back now. We were committed. WHO 362 was all go. We just had to be ready for Balinka.

D. Webley.

"Journey to the Centre of the Earth ....."

We left. Everyone at Penwyllt was on time. The bus felt funny. After picking up Gordon at Staunton it was giggling; at Birdlip it was laughing, the clutch couldn't hold its sides, it roared and roared. And it all stood still; 4.30. Still after Birdlip - the rest of the party many miles away. Clive was as livid as the bus. The climax of the journey was at hand, just 60 miles or so from Penwyllt. The floor boards were up with the bottoms; the mechanics were down and miraculously it was a simple complicated job. John Harvey turned a screw here and there, or was it a nut? The clutch plate was slipping and sliding. Clive rang for some Albion people who approved of the adjustment. "It could go for miles and miles," they said, "or break down over the next hill." We had to go on for three weeks. We planned anyhow to flit the country, cross Germany, and if it played up, change the clutch plate before ascending the Alps. It was worth a try. The engine stopped laughing, accepted the clutch, shook itself and became serious again. We moved with increasing speed towards Fleet. And got there, two hours late, Les and the rest pacing in country darkness; the trees in Court Moor Avenue were blue with language. There was food by courtesy of Jan.

The few simple pieces of luggage multiply by six and a half and the bus somehow accepted them. And on. We reached Dover at two o'clock in the morning with no man missing. The boat sailed at 8.45 and as early as we were, the promenade was full of cars, waiting. The only free space near the car ferry gates was marked Bus Stop. Logically we stopped. Dennis rushed for the bus shelter with his sleeping bag, lay on the seat and fell off; others joined him. The S.W.C.C. had arrived. Accommodation differs I suppose, but that night will be remembered even in our club; some of us were twisted in and out of bus seats with necks broken, some walked along the promenade looking for the sea which we heard but could not see, looked for cafes which were closed (there is fortune in Dover for an all night cafe). We met Bill and Frank with the Land Rover. We tried to sleep, with the seagulls getting friendly and funny, roaring their disapproval of the bus stop, screamed at us the whole night, "get off the Bus Stop". By morning the white cliffs and the bus were a shade whiter.

And it was a grey gay morning. Seagulls still there molesting us with favours, somewhere off-shore a few ships and even some sea. The dock gates opened for us, Bernard drove and someone clanged the bell and we were parked in a kind of no-mans-land in the customs shed. We ate a last breakfast. The Times had us on the front page - true, we had paid for it - but it was good to see in the morning, that we were still alive. Spele in the morning. The clouds in Gloucester had somehow turned into a fine day at Dover; everything (fingers crossed) was alright. Even if we had to fight off the shitty seagulls and shove the bus aboard, we were going to France at least. We had a new shining clutch plate which we did not want to use. The plan was to get as far as we could with the smooth one. It turned out wise in the event.

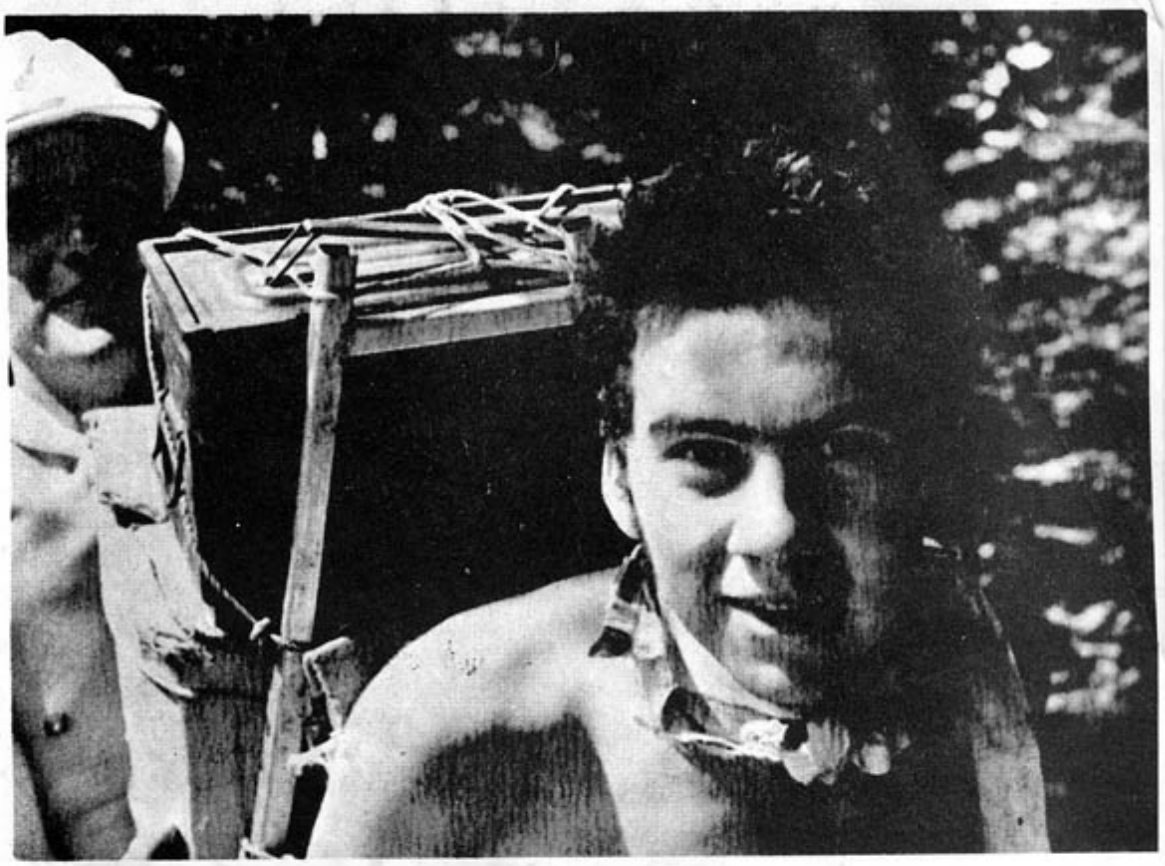
I handed over the documents to the A.A. walla who gave me heart failure by suggesting we were a vital document short. "Oh my dear sir, dear sir, where is the tax carnet for the bus." We didn't need it, at every frontier it was the same and we had to prove it. The bus in fact and in law a private car, a means of transport owned by all and owned by none. The 17 smiling faces, hands on each other's shoulders owned it, each not one bolt more than one's neighbour. However much you hated his guts, his bolt was equal to yours.

It was settled, and we sailed. Bernard had driven the bus down into the bowels of the ship; an Anglo-French operation parked it in the right place. The passenger tickets for the outward journey were given up. The bus felt lighter. It was a relief. We drove the ship, slept awhile, watched the sea, the rusty on the ship's sides - was it rust? - and there was Calais, docks, sand dunes, men in blue with yellow dirty fags in their mouths. They were all foreign.

France accepted us for 36 miles and waved us farewell even though the customs had argued the toss about the bus. "Speleologs M'swr Expeditione Anglaise" -- it worked. Some people wanted to stop awhile but the driver wanted to get on to keep the schedule, a slight detour around the dock area held us back a bit. And there was that Keystone Cops affair just below the Belgian frontier. We were on a main road with the side roads crossing it, cars came out from each side. Bernard waltzed from side to side and missed each. The Albion was pleased and purring. We didn't look back but people should have been waving fists and jumping up and down.

We lunched by the sea, in the dunes towards Ostend. The volcano kettle worked overtime and we ate the rest of yesterday's food. It was my turn at the wheel; the joystick responded with a few gears being ground, "Sorry", I said. We were moving again and the weather was starting to get hot. Ostend and we were starting inland on an autobahn. We whizzed. Gordon took over somewhere before Brussels. I was glad it wasn't my turn. And on, and on: And on until suddenly we were in Germany and had got through the frontier without paying their road tax for buses. There was the autobahn between Aachen and Frankfurt but one could not remember most of it, it was getting dusk and we wanted food. Each kilometer was a hunt for food, until somewhere along it towards Koln, I think, looming out of the darkness like an oasis was a Resteratt. We piled out, washed even, and ate out of slot machines. Things were feeling funny again. You put a mark in and you got out a stream of hot coffee and not a gramaphone record. Foreign, I suppose. We filled up with diesel and were on again as it started to rain and wind. This was the night of the long drive. We didn't stop, neither did the wind or rain; it was all headlights and flashing, wet wheels and whooshing: it was a black and shining night and we all took turns, when not driving trying to sleep upright was a challenge that kept one awake. It was near Munich by morning, and a fine morning at that. We volcanoed on the autobahn and enjoyed it, fried sausage I think and tea. The bus was that much lighter.

And Austria then. I have a memory of Austria, not really associated with travel tales. It was pleasant country to go through if you weren't



Hwyel being loaded up by Bernard



Because the team arrived late, the pack horses had been sent back. We had to haul almost all the heavy equipment uphill to the campsite along the narrow track.



Rod Stewart taking a breather en route to the campsite.

driving. White hills above, blue lakes, leather trousers. Charming. But a ten-ton bus with a crash box is no substitute for a minivan. Going down into Seefield (one in four) I couldn't get it into bottom. Ten tons were moving forward and words suggesting quite nicely that my mother had been out with sailors. I tried the hand brake, but smoke came up from the wheels, 'funny', I thought, 'that isn't usual'. I took an escape road and stopped. The silence was deafening, but they were quite nice about it really, the brakes weren't badly burnt, needed a bit of adjustment, perhaps. They all cooled down with the brakes, Bernard drove it down and the rest of us walked. We got to the bottom. We had a drink, the condemned man had two drinks, his nuts were as good as theirs. Two days of travel had made nerves raw, slightly sensitive. They didn't know a thing about Bronze Age pottery, and as for me, the beginning of machinery ends with the invention of the wheel.

Gordon drove up the Brenner, the Albion all serious again and purring, over the new bridge work - just the thing to sharpen one's motoring teeth on. I was falling asleep, and waking up. Noel got us through the Italian frontier without paying again, hands, voice, the lot in motion. And down the other side as evening came. Asleep. Asleeping. Dusk and a little village in the foothills. Swarthy men looking at the coach, Noel worked out the prices of a meal and arranged it although late at night, the hands gesticulating. It was a good meal and an army of lira changed sides. Should we go on, or rest up for the night? They had started to talk to me, at least the nearest and dearest, so I took a sleeping pill, everyone started taking sleeping pills, it was La Dolca Vita all over again, we were all bruised and sinning. We went on into the dusk with The Drivers driving. Into the darkness waiting for the sleep that should come with the little pink globules, we passed through village after village, light after light becoming brighter and brighter and then fading; it was Saturday, the whole lot were out in each village square, brass bands, girls, the widows in black, chianti and carouso. Suddenly I sleep. They were having a fling with the bus, through farmyard and hotel parks, but it was a dream of dreamless oblivion. Sleep sitting up a blackness twisted across the seat, feet in the winch, a dreamless comfort a welsh fargo at its best.....

I awoke, dawnish, near Trieste on the sea, an electric dawn, greenish and ringing with dew. The wattage enough to open one eye an ohm or two, cold and shivering, and to close it again; funny telegraph posts and trains flashed. The ohms increased, the needle in the eyes flickered, candle upon candle as they were washing the streets in Trieste. We rushed through, up the town on to the white hills and the limestone beyond, the few miles to the friendly border, the curtain we had feared and had dreamed of; "S.W.C.C. GO HOME" on the walls. The border was there, but few armed guards. We stopped for breakfast as the sun climbed the last pitch over the horizon belayed to the morning star. Most of us got out and volcanoed, Noel and others went back to Trieste for diesel. The sun was warming the dew on the grass, the grasshoppers were playing the fiddle with themselves again. We all wandered off to inspect various swallow holes around, bend down, examine the insect life and leave them a little present in the brownish grass. Would the bus come back, or would we be left in nomansland, pilgrims from Albion by an Italian sea. We ate our Jam and rolls, sausages and waited under the shade of an old building, examined the wrecks of cars jettisoned at the frontier.

The bus came back cheerfully up the hill around the bend bursting with fuel. The rest breakfasted, we packed up and approached the frontier. They were glad to see us, the first travellers on this new day. All out for inspection, and we were passed. Joan, Les and I went with the documents to the office, argued but had to pay up, our first failure (and only one) they rooked us for Road Tax but it was a pleasure, so pleasant was the official. We changed some money, collected our passports and boarded the bus. The posts were up, and we were away. Someone drove, and it was limestone and forests rolling away to all sides, swallow holes of all sizes, white rock naked in a now hot sun everywhere, patches of corn in the bottom of the holes throwing shadows where more soil was, where more water was. Afar was a blue haze of green, soft blueness, the horizon lost in it, somewhere a lost bell tinkling around a beast's neck. White houses with red roofs, chickens on the roads, grapes in the field, dust everywhere. A new world. Towards noon we dropped off the plateau back to the sea to Reika, our first stop to buy food for our lunch.

With our well-trained logic we drove into the bus station next to the railway terminus, parked and waited. Some vanished with the people who could speak, into the market place, others waited with the cameras out. It was perhaps unfortunate that red and white are the colours sported by the local bus services, and so Douglas had to persuade a little lady dressed in black with a huge suitcase that we were not going to Private - it was difficult and heartbreaking. Everybody was looking at our vehicle, everybody thought it funny except the little black lady who wanted to go to Private.

From Calais on, people were curious about our bus, looking at it, taking photographs of it. A funny thing happened to me on my way to the station today. There was a funny bus in the square, Girda, full of funny men all smelly and unkempt in it, and the bus said Wegoslavia. Girda said what a funny bus to travel in, and where is it, so I took a photo for the album, next to the baptism of Girda. In Austria they laughed, pointed to the wheels, the low slung coach work. You'll never get there, they said, the men with the funny wheels. And Girda said you'll never get there. We got there and are in Girda's album. We rested and they came back from the market with bread and enough melons to squitter us and decided to eat somewhere along the coast by the Adriatic before going inland to Plitice. They were letting me drive again my Bronze Age bus. My mother was feeling better about the whole thing.

We drove out of the town, south along the coast, past the men sitting out on their long poles over the water, waiting for fish. The whole landscape sunburnt. The road by the sea, good and black asphalt, skirting the Adriatic as calm as a sea should be, dotted with islands, blue, glorious imperial blue and warm. We pulled on to a headland off the road to eat and swim, near to where a black rising of fresh cold cave water rose to the sunlight. We unloaded the food and the swimming things. To the sea! We went in and it was warm and cold. The rising cut one in about half depending where you were at the time. 'Colder than O.F.D.' Edward said. The more adventurous dived in, the rest daintily fritted toe at a time around the rocky fringe, white blue toes fiddling in the cold water like anaemic crabs. 'I can't stand cold' someone said, but most of us were at least clean again, and

free from two days' smells and sweat-caked parts, the armpits no longer homes for airwicks. We ate, our squitters and cheese and rolls. Delicately returning from the sea over the limestone rocks hoping to keep clean and avoid the thistles in the feet, one stepped on the hot rocks. Wild lavender and thyme perfumed the lizards darting in the sun. Someone caught a stick insect, the whole world was fresh and new, we were animals together, only the red panting monster at the sea's edge reminded us of the mission, the miles of tortured sun between Calais and Reika. Would, and indeed, could we go to the pothole? For a moment, perhaps, just a moment, we didn't care. The mind was slightly eased, less teased by the cylinders of power of two and a half days' travel. We drove on to Senj still at the sea edge and stopped there awhile, photographing the nude ships and the overdressed girls. Half an hour and we were away inland towards Plitvc.

Swinging right around the limestone wall the tarmac stopped. There are roads and roads, and this was a beauty. One of The Drivers took over; it was pleasant for the other five. It was a 'B' road in more senses than one, on average with a pock-ridden surface too good to be true; it would have been rejected even by a cross country motor club. It was pleasant to start with, passing farmyards alive with flying chickens, their voices and feathers. People waved, we waved, the [illegible] roof open and leaned out - another raw tense excuse for taking umbrage, justifiable in my view because it was illegal - however, the road got no better, just worst and worst. We reached a wooden bridge designed for bullocks. Would the ten hot tons of horse power be too much? We got out, except The Driver, and it lurched forward, rumbling over the logs slowly. The bus moved, the bridge didn't, so we all walked over and climbed in again. The climbing engine whined slowly in low gear up and up, around and up, up and around, for ever, for ever in a blue haze of sky and trees. The road we had come by far underneath, and getting further every minute like a twisted white thread of dusty cotton; dust enclosed us, a cocoon of dust, powdering the trees. Zigging, [illegible], whining up through a forest on a bare single track. A forestry lorry roared around one corner in a blind zig not expecting company, horn blasting; we zagg to one side, rustling the trees with our intimacy. Up for hours, over bare rock and red soil and gravel, terra rosa, terra rosa. We sucked our sweets, O! glorious the free fall below, we were flying over trees in a blue ultraviolet haze; the sea a light [illegible]. The sweets crackled and sparkled in their papers. It was that other country we had glimpsed at near the border, a limestone haze of wilderness, the regiments of pines, beeches and oak twisting the knuckles of their roots in the rocky earth. Butterflies flirted with the sun and shadows, the bus lurched, creaked, swayed from side to side, each pothole eased the bolts, squeezed the bolts; my [illegible] held on. We ground our way up, into the sunlight, yet another corner, another lump of limestone, a farmyard, another point of warm human happiness in a jungle of green-ness. We came around one more bend and the rock parted and we were on top.

Tea up while Gwyn had a splinter removed from his foot. I was after insects and mosses in the terra rosa (who knew what that meant but me?) but found little. The bus cooled, pointing to the wind. Joan learned the Serbo-croat for "How old are you", "what is your name", from two little bundles of charm who ran from the herds they were watching. We were trying to relax, but it was difficult. There were few birds in this landscape. The bus was cool.

So on we moved, with the road along a plateau dolinated, and down to the valley where the crops were, the sentinel hayricks and corn ricks phallic in the evening sun. We lurched down, eventually to a valley floor admiring the farms, the straw beehives snug under the eaves of their roofs. But we could not stop for photographs. The road eased, the potholes disappeared and we rolled along a decent road. Through more forests and farms and valleys we moved to Plitvica; people started taking photographs of posters, the clicks were louder than the crickets; and stopped near the workers hotel overlooking the lake. Those who had been before had a memory of good food and mountains of chips in a long log cabinned room. Some were sent for a repeat order. The rest went to organise the campsite, since camping is forbidden only in the official park. The place was full by all standards but our own, someone wanted to camp all together in one block which was impossible, so the bus turned around from the national park entrance - it shouldn't have been there anyway - in a narrow road with a rumbling crumbling bridge at its back. Arguments, left hand down, straighten out or you'll be in the water, stop, go back to where you were before, now do it my way, hard round now, hard round. We were off again up the hill from the park to the official space for buses. Since no unauthorised bivouacing is allowed in the nature reserve, it was decided to augment its natural fauna with sixteen pink and white new mammals, who had the extraordinary habit of sleeping in bags under trees. This was the first night horizontal for three days. Joan, Edward and I sought the workers' hotel and found one suite vacant at a price not fit for workers. We were desperate and accepted it. Klettershoer do not go well with mansion polish, carpets are difficult to manouvre on, they come up with the shoe and polished wood floors and stairs are difficult to climb without squeaking on the wax; but we made it without straining relationships with the other occupants too much. We had a bed and Edward had his septic bath, each a horizontal bed. Comfort brings worry; would we meet the speleo tomorrow, was the telegram a ghastly cruel mistake, how many miles had we travelled to be told that we couldn't attempt Balinka? Comfort brought a bed though and tonight we might sleep horizontal.

We ate that evening in the long room slightly rusticated on a long table, our father figure Edward looked along its length at the rows of wine carafs. The wine flowed, ran with the chips (but where were the mountains) and things. Bill Birch and Frank appeared - we had last seen them somewhere in Belgium I think - they were unshaved and beaming. We were complete. We were overcharged, of course, and the afters were pitiful, but not the wine.

The night passed uneventful. It was a warm night full of stars and trees. The bed was a bed, horizontal and straight; not quite what we had been used to for the last three nights. What it was like outside I don't know. It was oblivion again. The water in the taps was not warm. Next day we waited, lazed by the lake, swam, noted the charcoal remains of a film set erected by the lake. By the mess the Indians had won and Jess Harper was hanging by his neck from the Bar Q ranchhouse. Saw the waterfalls, lakes, the fish and the tourists, Deutchland everywhere. Would Pepi come, someone come? Tomorrow was a waterfall away. In the mid-afternoon a character approached the bus in gay shirt. He was Evo. "Were we

the English Speleo's? forgive the adjective." Bill Birch didn't mind, he ran to fetch Clive at the lake. The President and Vice President awaited them at the hotel. The trip was on, they had come to apologise, there had been a ghastly misunderstanding. Pepi would be joining us next day. It was a bubbling happy hour. Pepi would take us to Plaski the next day. All was good, very good. But Clive will tell you about it in a minute.

It was too expensive to camp in the workers' hotel that night so we erected tents for Edward, Joan, and myself at the campsite, sloping, but at least going in the right direction towards the horizontal. We ate well again and again were overcharged and underfed. We slid into our bags in the orange tents, the rest into the woods. Night fell and the heavens. Winds blew, rain rained, beat about the place like a demon thing, lightning lit the world, thunder raiked us with fire. It was tense, it was the will to survive again, the will to live. It beat us into the ground, but the earth thought otherwise and threw us up again. Our tent held. Edward saw his passport afloat, the front of the shelter sagging, 3 inches of lime-stone water moved among his private possessions as if it belonged to them. His tent collapsed. I can remember idly waking in the middle of this night of the great rain and wondering who the hell was knocking tent pegs in at that hour. Yes it was, and more to the point, he put his flysheet on too in the blinding rain, to this day I can't imagine how, but it was a bit of a miracle. In the morning his dinars were drying on the line with his clothes. Talk about self preservation and dead cunning, the couple of cars slithered off the grass at the first touch of rain. By the morning it was a brown battlefield. Apparently up in the woods naked savages were seen fleeing from the night, trapped by the heavens' naturalist into the net of the wringing bus.

D. Webley.

The Meeting at Plitvica.

Before leaving the U.K. we received a cable from the Croatian Speleological Society which read - 'because of obstruction you do not coming now but in Sept the letter came after'. I replied, 'Too late to alter plan, will be at Plitvica on Tuesday 18th Aug. If Balinka Pit impossible we can visit other Croation caves'.

You can appreciate our feelings on that Tuesday when we met the C.S.S. However, on that day three of their members arrived and offered apologies for the confusion and to inform us that all was ready at Balinka. The three were the President, Dr. Blastovic, the Vice-President, Dr. Markolin, and their ex-Sec., Ivo Boucic. It appeared that both Pepi and Ivo had been away from Zagreb and the other two were not sure of the plans. They sent the wire. Unknown to them, Pepi had sent us a letter saying that all was ready, but it did not arrive in Neath until the day after we left. Our welcoming committee had been busy on our behalf that day and had visited the police at Plaski and Ogolin to tell them of the rescue plans we had arranged with the Chelsea C.C. (a mutual aid in case of trouble). They had also sent a telegram to Mr. Latus (the brother of one of those whose body was in the pit) to inform him that we were in Croatia and to ask him to come to Plaski. He is a man of importance in the area and because of his efforts as a Partisan, and had been prematurely retired and now lives in a villa at Opatija. He would come to Plaski on Wednesday. Pepi was to come to Plitvica next day and go with us to Balinka in the late afternoon.

On Wednesday Pepi arrived and we moved to Balinka and parked the bus at the nearest point to Balinka we could get it, overlooking the lake of Blata. A party then went up with a local guide to look at the route and to choose a campsite. The rest pitched camp at the bus, and Bill Birch, Gordon and myself went to Plaski to meet Ljubo Latus. Plaski was 9 Km. away and is soon to become the industrial centre of the area. Wimpey's were building a paper factory and there had been 35 Englishmen at the site.

The drive into Plaski was along typical dusty Yugoslav roads and Pepi was in good form and humour; between jokes and caustic comments he pointed out the features of local interest including another unexplored pothole 10 yards off the road. We were in Bill Birch's Landrover, emptied of its junk and useful items. We climbed up the track out of the Blata basin and over the ridge to Plaski, a straddling little village of two or three streets, a delapidated church, a railway station, and the paper factory. We pulled up outside a cafe on the outskirts and Pepi disappeared into the gloomy interior whilst we tried to read a plaque on the wall - a memorial to Franko Latus and his connection with Balinka. Next to it a cinema was advertising Blood and Sand: we decided not to see it. Pepi returned shrugging his shoulders - there was no one at home and we would have to seek out Latus's brother-in-law. We drove into the centre of the village passing a number of new looking G.B. cars to another coffee shop, this time full of

activity. The rest of the village seemed to be sleeping. A skittle alley was the centre of attraction and we had arrived in the middle of a big match feeling conspicuous in our shorts compared to their Sunday Best. The crowd stared at us - because we were smoking pipes and Gordon was wearing his beard - two unusual features in that part of the world. Pepi shot into the crowd and came out with the man he was seeking and introduced us. A heavy hand shake, and we sat down to a slivovitce and Turkish coffee; the skittle match was resumed. Our host informed us that Mr. Latus was expected on the next train.

At the station with 5 minutes to spare we joined the crowd waiting for the train. It was 45 minutes late when it steamed in packed to capacity. Everyone got off to stretch their legs and fought their way back on. One figure stood out from the crowd - Lubo Latus. Everyone he passed, and he passed many people, shook his hand and greeted him. He made straight for Pepi and after the usual greetings warmly shook our hands. He was in his late forties, a well dressed good looking fellow who moved and spoke with authority, but he was obviously excited about Balinka and was concerned about our safety. He spoke little or no English. We went to a cafe used by the engineers from the factory and made our plans over more coffee and slivovitce. By this time we were cold and hungry, the sun had gone down and we seemed to be making very slow progress. The cafe was full of factory workers and a small group of British engineers having their evening meal. We were near to them but didn't arouse their attention because Pepi and Latus were doing all the talking. They became interested when Gordon pulled out a box of matches to light his pipe and we heard a hurried whisper of 'Swan matches!' from several tables. Being British and there being no one to introduce us, there was a slight delay until eventually we went over and introduced ourselves. We explained why we were in Plaski; they obviously didn't believe us and one of them introduced himself as Napolean Bonaparte and his friend the Duke of Wellington. They eventually realised we were serious and offered to help in any way. Meanwhile the conversation between our Yugoslav friends was reaching the usual climax and in a few minutes we would be able to get some sense out of the situation.

Latus had obtained permission to fell the trees necessary for the exploration of the pit; he had spoken to the local forester and had arranged for his assistance. The man with the horses would be at our camp site at 7.30 the following morning, and so would two Russian vehicles which were every bit as good as the Land Rover in rough country. Another round of handshakes, and goodlucks from the Wimpey engineers, and we were on our way back to the campsite.

Back at Begovac we found the bus flanked with tents and our evening meal waiting. Bernard and his party had done a valuable day's work. The walk to the pit had only taken 3/4 of an hour, the first part over fields and the last along a rough track through dense forest. Balinka was in the thick of it, the trees around decked with four wreaths over the entrance which was in the bottom of a small boulder strewn basin and was a straight drop for some 60 feet, and then there appeared to be a constriction. Boulders had been thrown down with the most impressive results, and those who had heard them were now convinced that we were on to something really big. Our camp commandant, Les Hawes, had found an admirable campsite in a grassy depression

about 200 yds from the pit, only lacking water, but we had come prepared. Another route through the forest was recced on the return journey in the hope of getting the vehicles nearer to the pit, but it turned out to be impractible. We had a brief discussion of the day's findings and decided to start early next morning moving the equipment by Land Rover and Gaz up to the edge of the forest; and then by horses and man power to the camp site.

Everyone had questions to put to Pepi about Balinka and the local countryside. One piece of news that evening which made headlines was the fact that a number of wild bears roamed the area, but they did not attack unless you were alone. An impatient S.W.C.C. crept into sleeping bags that evening, and all slept soundly until dawn and Frank Baguley rose together and shook the rest into action for the lift to Balinka.

Even before the sun and the crickets things were moving. The bus was unloaded and the kit and equipment laid out in a line ready for shipment. Personal kit was to be the first so people would then know their stuff was safe at the site and not waste time later searching for it. Two days' food and the mountain of engineering equipment was next in line, followed by a pile of useful items brought along by Bill Birch. The horses didn't arrive at 7.30 a.m. and neither did the Gaz, but our Land Rover was racing up and down the hill to the edge of the forest, the farthest point to which Bill could get his trusty steed, transferring chaos from one place to another. This new pile was then being carried slowly up through the forest to the camp. By 10 a.m. all our worldly possessions were strung out over 3 miles of Croatian countryside, but slowly being drawn to the mountain top. Eventually the 3 horses turned up with their owner and were each loaded with 300-350 lbs. of luggage and made the first trip right through from the bus to the campsite. The well fed horses were clothed with their motheaten, hide covered panniers. They were loaded by science, and, as John Harvey might say, with Sprags; each had its own pair which it carried as well as its load. They made an impressive difference to our dump at the bus and we were all encouraged by the load the horses could carry. They spent the rest of the day moving the equipment dumped by the motor vehicle over the second leg through the forest and did it well enough to enable the people to pitch their tents, dig the latrine and do odd jobs at the camp site. The children of the village wanted to help, everyone wanted to help, but especially the children who came with us to the village with our plastic water cans, to a well from which the peasants drew their water. It was surface water held in an underground tank with an iron lid. There was no windlass, only a bucket and a rope which one threw into the darkness to be greeted with a hollow smacking metallic sound. The technique was difficult, if you didn't do it correctly the container floated; you flicked it and it sank gurgling. You pulled it up with the water and the little black snails. From then on we got our water via the Gaz and a rising.

It was after 11 a.m. when Bill Birch's competitor - the Gaz - arrived. A kind of dumpy, hunched, hardened sardine tin with little room. The driver had a big black moustache as big as the screen wipers. Latus was with him, tall and elegant, straight in the back, eagle in the eyes. Ivo was with him, pondorous, a good voice for the Gwyn and a tough female called Ines. Both Latus and the driver were convinced that there was a negotiable

route to the top with the Gaz and tried to find it, loaded with some of our most valuable gear. They got no further after 2 hours of trying, and joined the ferry service from the bus to the forest.

By the late afternoon everything other than the engine and wind-up reel was up near the pit. After a meal, a smoke, small talk over the day's events, a first look for some at the mouth of the pit, eight of us returned to the edge of the forest to carry up the engine unit. It was slung on scaffolding poles and manhandled up the rough track to the rhythm of numerous dubious songs and arrived at Balinka in pitch darkness, just as a heavy downpour of rain arrived. A mad scamper of dirty greasy bodies (with one exception) crawled into their sleeping bags and the day was over. Mr. Birchenough stayed up and enjoyed a shower, naked and unashamed. In the scant moonlight he soaped himself from head to toe in the centre of the clearing, let the rain do the rest and crept lifebuoy fresh into his flea bag.

Clive Jones.

The Layout at the Surface of Balinka.

Clearing Work.

At first it was impossible to see any relationship between the top of the hole and any convenient flat area suitable for the machinery, so our first task was to clear all undergrowth and low hanging branches for 5 to 10 yards around the hole. At the same time two access routes were made back to the nearest forest track - 20 yds. away - to facilitate the delivery of the heavy equipment to the site. The shorter of the two led directly to the highest side of the pit, the other skirted the lower edge to what was to become the winch area.

A number of trees were cut right down, and others, needed as anchors, were left standing about 2' 6" high. The general clearing was completed on the first day, the larger trees were removed by a team of foresters on the second day. One large tree trunk and two smaller branches were used to make a safety fence around the mouth (the main length being tested by 50 spectators on one occasion).

Siting of Main cable and spare.

We were lucky that our project had been considered at the time that the trees were planted, four of the stoutest were in a straight line, two on each side of the pit entrance! The main suspension cable ($\frac{1}{2}$" in diameter) was made off to all four trees and the emergency rope (3/8) to one on each side. The main cable was clamped by means of 'Dee' clamps arranged as in Figure and a similar system was used for the emergency rope. No strainers were used on the cables, the Tirfor was used to tension them and the clamps were tightened without releasing it. This method proved satisfactory, although towards the end of the working period, some slackness had developed.

The tripod support.

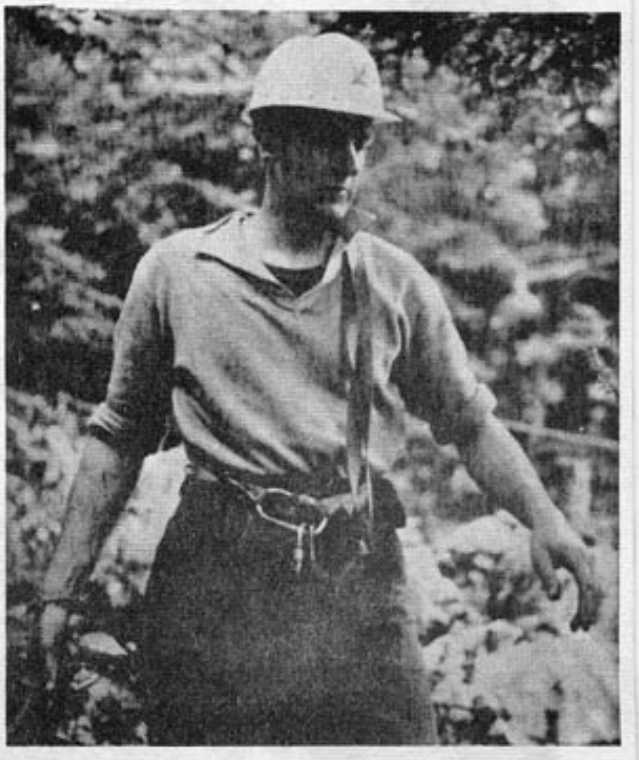
To reduce bounce on the suspension cable to an acceptable level, it was necessary to support it as near to the position of the pit-head pulleys as possible. A tripod was used, with two equal (8') legs (their feet nearly in line with the main cable), and the third long (14') leg on the other side of it. The tripod was tied back to a convenient tree to prevent any possibility of it 'escaping' down the hole.

Handlines.

On the low side of the hole, a 10' handline - the bus tow-rope - was fitted to two rawlbolts to provide a firm anchorage for people working at the pit's edge, or for lifelining people down to, and working on, the 60' ledge. A rather longer line was put in at the 60' ledge so it was possible



Drilling rawlbolt holes at the Pit top for belays.



Bernard supervising operations at the pit top.



General view of the Pit as preparations begin.

to 'clip on' whilst getting into the cage; again Rawlbolts were used as anchors.

Pit Head Pulleys.

Two pulleys were used, the load being taken normally by one: in the event of its failure, the second would be ready and would not have to be threaded on to the suspension cable or winding rope. Both suspension cables were threaded through the eyes of both pulleys and this meant that the line of the winding rope had to be as near as possible to that of the suspension cable. In fact there was a difference of 2-3 degrees, and this was sufficient to cause the winding rope to rub on the cheek of the second pulley - as this was made of soft alloy, no danger resulted.

Capstan.

The siting of the capstan was limited to a small sector on each side of the pit due to limitations mentioned previously; on one side of the hole, huge clint type boulders gave no flat area at all, so we really had no choice. In fact the area selected was ideal. It was very nearly flat, shaded by trees and cool, plenty of room for all our equipment units and even a work bench.

Initially, the capstan, 10 yards from the pit top, was anchored by means of scaffolding poles threaded through the frame and two short adjustable wirestays fastened to anchor bars driven into the ground. The tube through the frame was braced against trees at each end, an arrangement which proved satisfactory. When the boom was built the scaffolding was replaced by a pine tree trunk. At this time the stays were not adjusted and the full force was taken by the pine tree - this allowed considerable movement (about 2") to occur - which caused some concern to those in the cage. The strainers were adjusted and no further trouble occurred. The pull on the capstan was equal to the weight being lifted - see sketch.

Take up reel.

For convenience and safety of operation it was sited within approximately 4' of the capstan; i.e. one man could check both the capstan and the take-up system. The take-up reel was anchored using a scaffolding tube and several anchor bars and in this case the pull was only 30 lbs. although this could become the full load if the capstan failed.

Main Engine Unit.

This was positioned close to the other units (see sketch), and logs were used to make a level platform for it to keep the oil and water systems happy. The hydraulic oil header tanks were hoisted up the nearest tree as high as the flexible pipes would allow (8-9 ft.).

Take Up Loop.

For the winding cable to lay neatly on the take-up drum, it was necessary to have a free run of cable 30 yds. long. The cable left the

capstan, ran 30 yds. to a large pulley mounted on a tree, and then 30 yds. (nearly) back to the take-up reel. Since no large tree was available to mount the pulley, a small tree was braced to another with nylon rope which also secured the pulley. About half along this loop, an H or inverted U support was erected, which effectively killed the natural vibration of the loop.

Tension and Footage Indicator.

This masterpiece was mounted in front of the capstan and was held in the correct position by a metal link and two lines.

Main Winding Cable.

At the site, the cable arrived on the take-up reel, and the free end was run out and threaded through the various items in the following order:- over the loop support, through the loop pulley, back over the loop support, round the capstan surge wheel, through the tension and footage indicator, through pulley 2, pulley 1 and finally was made off on the special terminating drum; just above this latter, a clamp was fitted to the cable and this was used to secure a safety loop which went through the main terminating drum.

A safety grab was tethered to a tree near the capstan. It was planned to grab the cable in the event of winch failure to enable repairs to be made with no mechanical load on the system.

Generator.

It was initially sited 30 yds. from the winch and 25 yds. from the pit top, but later, it was moved nearer the pit top due to shortage of cable. The site was chosen for ease of access and to keep noise to a minimum at the pit top where verbal signals were being used. The two main functions of the generator set were to supply both high and low voltage supplies as required. The high voltage (240V) was uded for the Kango hammer and the vacuum cleaner blower used to cool the engine radiator. The low voltage was needed to recharge lighting and power batteries. Surface electric lighting was tried as an experiment but was not as effective as that provided by Tilly lamps.

Shop.

All items likely to be used during the stay at Balinka - Rawlbolts, hammers, ropes etc., were kept on two waterproof sheets near the pit top. A storeman was elected each day to pass over the items required.

Communications.

Telephones (1), Westcomm (2), Ducatphone (3). All three worked by themselves but some trouble resulted when (1) and (2) were used on the same lines, in fact we ended up with (1) as the main system using the amplifier of (2) as a public address system, and (3) as a reserve system from the cage to the surface. Lines were laid Pit-top - winch - cage and pit top - Ledge II at 200'. All points could hear all the others and

all but the camp site could speak. It was very noticeable that quality over 1,600 ft. of main cable was better than that over 200' of gash wire to Ledge II.

Safety.

The work at Balinka was controlled by the over-riding factor - Safety. As far as possible, all functions and systems were duplicated so any failure would cause the minimum of danger and inconvenience. For example one could quote the following:-

Two suspension cables.
Double anchoring of suspension cable.
Two pulleys at the pit head.
Alternative anchors for capstan, and Take-up reel.
Safety lines on surface and at 60' ledge.
Safety fence around the hole.
Two fixings to cage from cable.
Two communication systems.
Safety grab for winding rope.

In addition to these measures a daily check was made of all equipment, the deputy leader checking the tightness of all cable clamps, stays cables etc., as well as communications. During the whole expedition, no failure of the static items was recorded, except the described movement of the capstan.

60 Ft. Ledge.

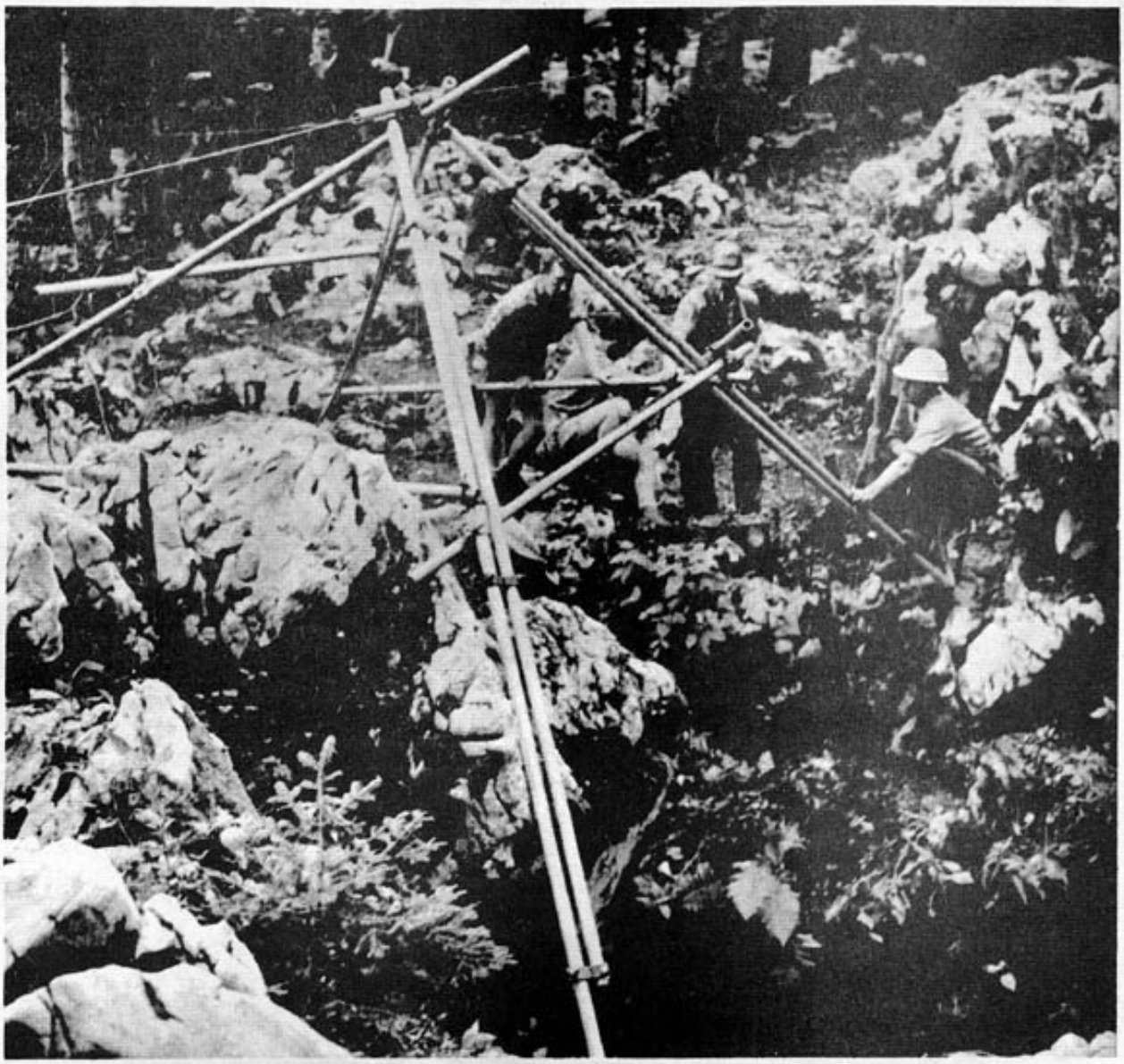
'Ledge' is probably too grand a term to apply to the piece of sloping rockmud covered, which was used as the boarding and alighting point for the cage. The provision of the hand line gave some measure of safety and it was surprising that no one slipped. Everyone was either roped from the surface or clipped to the handline, so a slip would not really cause too much hardship. This year we had to board the cage at this level, because of small overhanging pieces in the wall of the shaft above this level: next time they will have to go in order that the cage can be brought right up to the surface.

B. Woods.

CAMP.

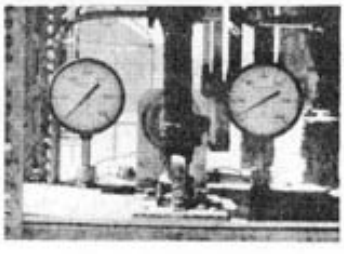
The bus was parked off the main road to Plaski, a road grey with dust, potholed, having no surface but the stone and dust hammered in by the occasional forest lorry and the post. The bus was on the edge of open common dotted with patches of agricultural crops between the expanse of short tight grass. The grass went up-slope for about a mile where the forest met it. Everywhere one was conscious of the poor, thin soil suffering from water shortage - in consequence the crops were planted where there was extra soil depth and more water, - in the bottom of swallow holes. The main crops one saw on the way up were beans - already harvested (the crop was drying on the ricks). Maize and melons (for the pigs). Potatoes seemed to be kept to the fields surrounding the village, as were a very important source of protein and oil - the sunflowers. The grass harboured the occasional green-grey snake which one disturbed by one's passage. The crickets and cicidas were busy from morning to night; when walking, even if one stepped on a few, hundreds would be protesting around as far as the ear could hear. Above, the grass stopped near a waterhole. A stagnant brown slurry in a little hollow before the forest, [illegible] at the margin. Here the sunlight and the transport stopped. Here was the forest and another mile to the pothole. One entered it by a track cut out of the limestone rock, nowhere more than four feet wide and it immediately divided and later wandered about amongst the trees, branched, crossed other tracks, pulled itself together and eventually led to the alpine meadow, the pleasant grassy hollow near Balinka - there we sited the camp. It was not only its course and its width that made the track impossible for land rovers and other sorts of mechanical combustion devices; the surface was rutted, boulders stuck up everywhere, especially along its centre where the sump goes. It rose in primitive steps from one level to the next; in parts mud from small risings oozed over it and formed sticky passage for man and beast. Holes appeared with darkness beyond, diggable by South Wales standards. Rotting trees sprouted from the edge of the track, stuck up everywhere like brown bears in the white limestone, among the splendid birch, beech and pines which rose to where the sky and sun was. The light was a cameraman's nightmare, dappled, shaded by the trees, blotchy and moving, hazy and clear, the mosses bright green in the sun, black in the shade. The lens winked, the exposure moved, flickered along the scale with the trees, in the breeze. It was a living thing, leaves dropped, water ran, the cracked sticks rang through the branches.

The woodmen came to the pit and the forest rang with their mechanical woodpeckers. Trees fell, light shone into the hole, one didn't shiver quite as much as before in the dark undergrowth with the red star of chrysanthemums signifying death. (Was it like this on April 2nd, 1942?) Atmosphere was everywhere, the way one boulder was perched over the entrance, the way the sun suddenly fell and the breeze quickened; your head might be warm but the feet in the cold leaves shivered; goose pimples were a necessary condition of living, an item of clothing not to be cast off. We who lived below in Begovac have been often amazed by the comment of those who lived at the pit - that the weather was cold and we should have gone at another warmer time of the year. In the valley it baked, the sun was red every evening,



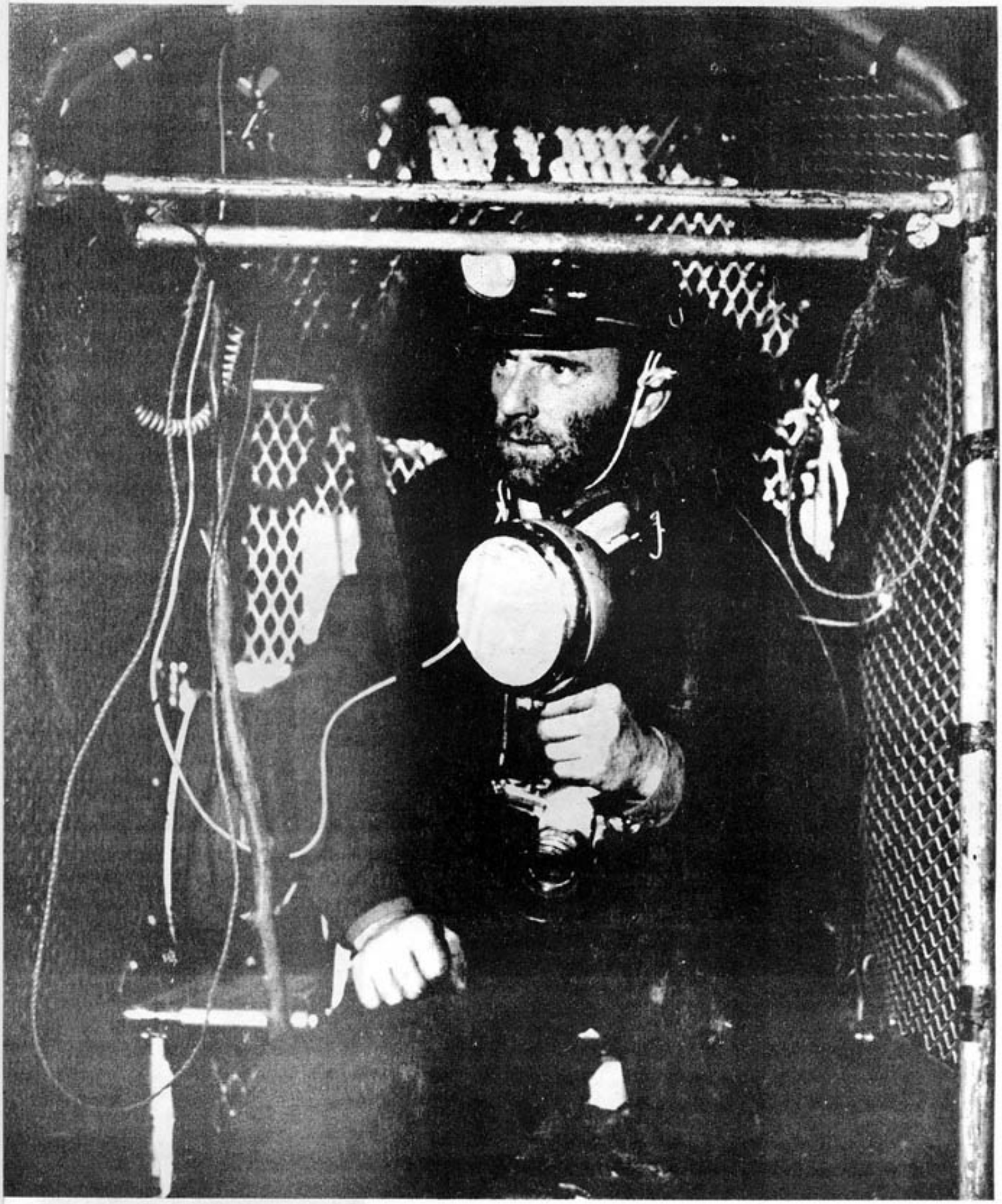
The quadropod nears completion.







Laurie on duty.



Laurie in the cage prior to descent

the crickets alive and warm from dawn till dusk and after. Not so at the pit, it seemed. The bear who handed you the toilet paper at Kronk House Jama was wise to keep his fur coat on.

By the time we had done our duties at the bus, and all the clobber was up, and walked to the site the winch was in position, suitably placed trees took the cable, anchored the winch. Birch was in his natural element, a bench and vice lay in the shade, the smell of greasy rags and cotton waste made the place smell like home. Steel boxes of tools and the clatter of hands rumbling over the spanners defying the fingers were music to his ears. "Have you got the 3/8th?" said someone, and the box tried to forgo its responsibility: it never got away with it. I remember a later conversation over Sod's Law - the perversity of inanimate objects - and the role of double ended spanners - with Birch strung out 620 ft. away. The cage was not perverse, the exception to prove the rule. The spanners were always perverse.

The area was cordoned off, a necessary precaution because of the interest of the local people. They came from everywhere, a quiet forest and one found people strolling through the undergrowth; how they got there I don't know, but there was always a semicircle of them around the pit. It was difficult not to think of the past, the achievement of Marshal Tito in bringing unity to this nation. Looking into Balinka one suddenly realised the enormity of the task. The engine was roaring and Gordon was away in the woods alone, assembling the cage, a priest tinkering with a sentry box. Things were moving, the sun was up; Balinka shivered: if one moved into the sun one got warmer then back to the enormity of the shade and the darkness which came from the hole. One remembered the sound of falling boulders, bouncing, booming and echoing in a natural organ pipe of stone. We seemed very small. The entrance was larger than life, it was air and blackness, damp and the touch of ivy, tree roots twisted around its edge, the grip of the world, between the limestone slightly blue in the sun. We possessed the entrance.

People were busy below when the squitters struck me. I was belaying the Kango Hammer (note an inanimate object) when I started to sway, go hot, cold shiver, go giddy and weak. The howl if the hands were to let go the hammer would have been heard all the way to Zagreb, would have been sawn off and sent to my mother. The rope was relieved and myself to the giddy woods. There, there boy. Edward and Les seeing me home through the trees, swaying into sunlight, a sharp pain in the bowel. The next days became confused, squittering away the time.

They were fixing the boom when my belly relented, the grinding had stopped, and the little bits of things one recognised 3 inches from my face. So up again to the recording job; a kind of secretary to Bernard in the trees. It was lunch time and Edward and I had a job: with steel workers' gloves we manfully held one end of the boom when the soup arrived steaming through the trees. We looked at each other, straightened our backs and held firm - not for us the run to the soup kitchen: our stiff upper lips had grown their own cartilages. The soup looked good, and Tomas (muscleman) had other ideas, he wanted to do something to help and our ogling eyes were his passport for activity. Can you imagine a bundle of elastic-sided brown

gristle sitting in the sun? That was Tomas. He grunted, pushed us away from the ballon cable and belayed it around his back, bristling the hairs. The steel cut deep, gave in, and settled in an elastic groove of flesh. Tomas was content and unconcerned. We took off the leather gloves from our pink and sore hands. "He was exceptional," was our only consolation for our mental misery which we consoled with the soup. Srecko and Tomas had arrived a few days before and both stayed with us at the bus. Screcko was a geological lecturer in Zagreb complete with an eastern European black moustache; he pranced around the site with a formidable map filling in the details as we uncovered them. Tomas we thought was a bona fide Turk until we were told that the Fez he wore was in fact one of his wife's hats suitably cut down. He was the star caver of Croatia, a carpenter by profession. Where everyone else has pimples, he had muscles; his handshake was an invitation to death; a masochist would have loved him. He showed his muscles and he couldn't help it. He caved with his dog (a large sheepdog) which he carried in his rucksack where-ever he went - it wasn't Spele - there were coloured photographs of a black and white collie admiring helictites somewhere under Croatia.

Living near the bus we knew him slightly better perhaps than most, even though they both wouldn't share our food, they shared the common concern of all cavers for each other, they looked after us and all three will remember one night: but more especially Joan.

We had been late getting back from Balinka and had eaten there. The dark when it came came with a bump just as we were dicing over the last cling peach and the coffee dregs. With darkness and shadows and caving lights we followed the track back through the woods. It wasn't easy. "This way blokes," said Edward with his matches, and we emerged with amazement near to where we should have been and could see in the distance beneath a light winking at us. It was Srecko at the bus. How did we know? Tomas suddenly emerged from a thicket, grabbed and <u>placed</u> Joan on the path, with a grunt of "you stay there or else". Edward and myself, who were relieving the situation at the time, followed them down into the winking dark. He was concerned, Joan was pleased. Edward and I felt much better. They were grand blokes.....

The boom was fixed. Now there was no time for contemplation, even though words grow around the place, around the twisted roots, one must cast them aside: the verb was for doing -----

D. Webley.

The First Trip.

I was as pleasantly surprised with the entrance to "Balinka Pit" as I had been with the surrounding landscape. The entrance was somewhat British in size, and it certainly gave no clues as to what might be found below, at least, not until a huge boulder had been toppled over the edge; this boulder must have been constructed of clues for it certainly removed from everyone's mind the latent doubts as to whether the hole 'went' or not. The second boulder which we threw down the pit just convinced us that we should immobilize the bus and that doctors were as susceptible to swearing as normal beings.

The pit top area and entrance shaft were relatively free from loose boulders, and the minimum of 'gardening' proved necessary. A couple of large limestone (of course) blocks were very conveniently positioned around the orifice, something, incidentally, for which Noel made no claims, and these were used to belay the lifeliners; they just attached themselves to a steel cable which had been rawlbolted to the blocks. During this preliminary period the pit top area was a seething mass of activity; mechanics were desperately trying to convince each other that everything they brought really was needed and providing each unit was connected or inter-connected correctly then even Sod at his most bloody-minded could not stop them from hauling the less fortunate into and out of the pit.

The Yugoslavian foresters were also experiencing their busiest day for years; orders were being thrown at them from all directions, I'm sure that if they had been able to understand English, then quite a large percentage of the trees which they so willingly felled would have remained in an upright position. It was at this point and amid this confusion that our caving proper started; the 60 ft. ledge was inspected and the main cable position fixed, giving the easiest line of access for the cage. Nature was again on our side and the cable was fastened to two large trees which lined up perfectly with the cave entrance and which more by luck than judgment had escaped the foresters' power saw.

The next task was to fix a steel lifeline at the 60 ft. ledge. However, before drilling operations started, or should I say that before drilling operations could start, the ledge was cleared of the loose debris and vegetation which had accumulated and a couple of footholds were hacked in the rock. We were then ready to start drilling, the "Kango" hammer was lowered and Noel immediately started to demonstrate the art of using the machine. Supported from above by a lifeline and from below by my head, he drilled holes in what originally appeared to be completely inaccessible positions. The terrific din of the drill, amplified by our singing and swearing certainly helped. At the very least it kept the lifeliners awake and only occasionally did we have to question their parentage and remind them that they were obligated to us, and not to the Yugoslavian talent which drifted around the surface.

Five 5/8" dia. rawlbolts were used for fixing the lifeline which

ran roughly parallel with the ledge at an angle of approximately 45 degrees. The 5/16th in. dia. cable was then passed through the eye bolts and secured with 'D' clamps. It was necessary for at least one person to help with the loading and unloading of the cage at this level and the cable enabled one to move around freely on the ledge without being held from the surface.

With the lifeline secured and the pit top gear assembled and operational, the immediate objective was the "Pit". The cage was lowered through the narrowest section of the entrance shaft and into the huge chamber, on what might be called a 'dummy' run. Of course, I was unaware at the time that I was to be the first dummy. When swinging freely the cage hung approximately three feet from the ledge and it was necessary for the launcher to pull it towards the ledge before one could get into it.

With a little practice the cage could be held with the minimum of trouble and effort by simply passing a rope through the framework of the cage and tying it to the lifeline.

All stations were now 'Go', we were ready for the first reconnaissance trip into Balinka Pit. I cannot remember my exact feelings as I clambered into the hot seat, perhaps I did not have any. We did a quick check on the communication equipment and to my amazement, the receiving end of the telephones received but a fraction of the volume that I had been led to expect; in fact, the messages from the surface were completely inaudible. I was about to utter some obscene remarks about electrical engineers when I suddenly thought that perhaps the spaceman type helmet I was wearing could in some way be associated with the difficulty. After all, it did fit between my ear and the telephone handset. I ignored the remark that "Welshmen must be thick" and the remarks which were to be directed towards the electrical boffins remained unsaid. The fitting of a conventional caving helmet obliterated the telephone difficulties and we were ready to proceed. But! in typical American fashion the descent was further delayed whilst a small rock projection was being removed from one of the walls. The shaft at this level measured about ten feet by five feet, and during practice manoeuvres the cage roof fouled this piece of rock which protruded about nine inches from an otherwise obstruction-free entrance. A few blows with a sledge hammer sent the piece of rock crashing into the depths, and at long last I was ready to go, preferably home.

It was Clive's intention that the first person to be lowered would just descend to the two hundred foot ledge, if in fact it existed, and take some detail of the shape and size of the place and return to the surface. A start could then be made on the construction of the deflection boom with the minimum of delay.

The cage always started with a sickening jerk and whereas this instilled quite pleasant sensations during practice runs at Penwyllt Quarry and the Forest of Dean, it appeared to have the opposite effect when one was suspended over "Balinka Pit". With great reluctance, I let go of the rope which attached the cage to the lifeline, and as I was slowly lowered through the narrow section of the shaft I can distinctly remember wishing that this thin line could have been two hundred feet long. However, I immediately

found comfort by hanging onto a waist length which hung from the roof of the cage, a purely psychological belay.

The descent after the initial jerking, was absolutely smooth, and if one's eyes were closed, then all sense of movement was completely lost. The main chamber was entered about twelve feet below the sixty foot ledge and instantly my whole concept of the size of Balinka had changed. I was hanging in a vast chamber; I expected to find something large but a chamber of this size had never been imagined. The size of the immediate surrounds together with a mental picture of the great depth left one a little shocked and with a distinct feeling of isolation. The searchlights which were fitted to the cage were in constant use and it was possible to view the walls by simply following the thin beam of light around the chamber as the cage slowly spun downwards. The pencil-thick winch cable could also be highlighted by shining the beam vertically and slight relief could be obtained just by staring at this ridiculously small surface link. The continuous telephone conversation must have proved entertaining for those who were listening to the amplifier. Sentences composed entirely of adjectives were churned out continuously; they were not quite "Dilly" standard, but on reflection they couldn't have been, my swear word vocabulary just wasn't large enough. The spiral descent continued and after a short while, things returned to their proper perspective. The cage was descending parallel to one of the chamber walls, the distance from the wall to the cage varied from four to ten feet, in fact, a very convenient line of descent. In the event of the cage spin becoming excessive, we could always stop the spinning simply by holding a fend-off pole against the wall. This, however, proved unnecessary; the spin never warranted these tactics.

The ledge which Pepi had described could be seen below the cage and it was reached at about the 200 ft. mark. At this level the cage hung a couple of feet from the ledge, and it was obvious that before it could be used as a staging platform a belay line would have to be installed, thus enabling the initial acrobatics to be dispensed with. The ledge seemed scarcely fifteen feet long and it tapered from four feet at a point below the cage to nothing at the other end; in fact, just long enough to accommodate the huge array of bodies and equipment that were about to be deposited on it.

The journey to this point had taken the best part of three quarters of an hour and enough information had been given to the surface crew to enable a rawl-bolting party to be formed. The engine was also making weird and wonderful noises by this time. (Like all good surgeons the surface party kept the good news from the patient). Apparently the engine was boiling over

The return trip was as smooth as the descent and just as I was becoming acclimatised to the enormous size of the hole, the entrance shaft was reached and Balinka returned to its pre-entry dimensions, and in my mind at least only the cave below the ledge was left to the imagination.

Gwyn Thomas.

Lowering the Boom.

The boom was assembled on the surface from aluminium scaffolding poles and lowered into Balinka on three wires, two on the corners (the main supports to the surface) were 3/16" diameter cable with a breaking load of 25 cwt; the third was a balloon cable with a breaking strain of 9 cwt. and this went from the centre of the far end of the boom to the surface as an additional support. The structure was lowered to within 50 ft. of the 200 ft. ledge and left suspended like an unfilled mobile picture frame. The actors for the next scene were assembled on the 60 ft. ledge - Noel and myself - and entered the cage which became a claustrophobic cell crammed with two, not exactly small, bodies. It spun slowly when the anchors were undone and we were given alternately views of muddy walls and muddy grinning faces of the helpers on the ledge. A final check with Bernard, a few sickening jerks, and the revolutions became a slow spiral downwards as we started to move. This was my first ride in Balinka and, as smooth as it was, I felt uneasy. The slender wire stretching up to the surface seemed precariously thin, and the spin was just a little unnerving. The narrow constriction in the cave was soon passed and we seemed smaller than ever in the vastness of Balinka; but the ride was smooth and comfortable, the butterflies settled down and looking over and below I could see the ladder snaking down to the 200 ft. ledge. The boom swung very slowly like a giant pendulum, but not spinning or twisting the wires to the surface as we feared it might do.

We came level with it and Noel tried to catch and steady it to prevent a collision with the cage. Even in Jugoslavia, action and reaction are equal and opposite and his efforts were rather like trying to make similar poles of two strong magnets meet, everytime he reached for the bloody thing we were shot backwards and away. Eventually he got it and slowly the circus came to a halt, the picture frame was filled, with the bearded wonder and the hairless one - pop art on a big scale.

We decided not to take the boom with us as we went lower but to pass it and have it lowered to the ledge. The cage gave us the usual starting squitters and continued down until we reached the traverse wire on the 200 ft. ledge. Noel caught it and fixed a karabiner from himself to the wire and proceeded to leave the cage for the ledge, nearly squeezing me out of the dexion structure like chips, in his rush for terra firma. Once established there he anchored the cage to the wire and the boom was lowered until the two feet rested on the ledge. By this time, I was securely anchored to the traverse wire and relaying messages from Noel, perched on a boulder, back to the surface, where the people raised and lowered the relevant wires until the boom rested squarely and firmly where we wanted it.

Drilling started with a reverberating roar which shattered the eerie silence. We were putting in Rawlbolts, fitted with special scaffolding cleats, to hold the boom securely in place. Our difficulty was now in

communicating with the surface since both were needed on the drill. The cage was taken up and it returned carrying Dennis Kemp complete with camera. He hung above us, taking photographs and relaying messages to Bernard on the surface. Four fixings were made and the boom was almost secure. We required to tie it down to prevent it lifting when the cage was being raised, but Gwyn Thomas and Terry Lloyd were to do that job. Dennis left us and the cage returned with Gwyn and Terry. After we had shown them the ledge and explained what was wanted next on the boom, Noel and I entered the cage and set off for the surface and sunlight. We made a good start and soon the familiar slow spin was back with us; the journey was as steady as ever and the only indication of movement was that relative to the ladder as we passed alongside it.

Thirty feet from the top we came to a juddering halt. A reassuring message from the surface, a knowing glance from Noel, and we sat spinning and pestering. Background noise on the telephone sounded interesting, there seemed to be a certain amount of feverish activity at the top. We made the quickest ever summary of what could have gone wrong with the winch. The gap between us and the ladder was sized up and we set the cage unconsciously swinging in that direction. A number of jerks and we started up again, only to stop after 2-3 ft. A few strong words to the surface brought us news that the engine was on the boil and that an extra fan was being fitted. This was done and the journey was completed with several more stops. When we eventually surfaced, it was decided that the winch could not lift two at one time and that from now on, only individuals at a time would be brought up.

Clive Jones.

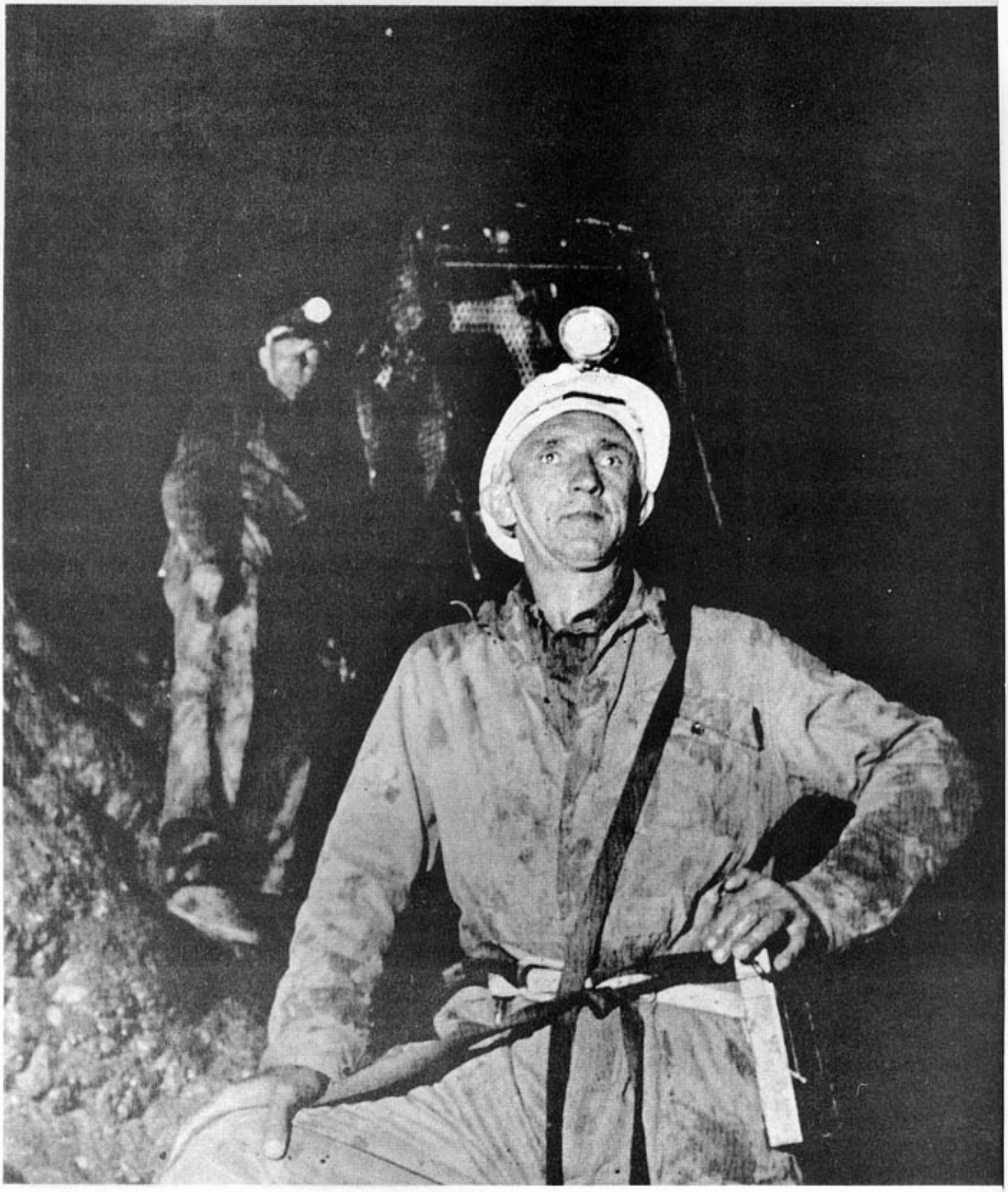
John Osborne's Trip.

The boom on the 200 ft. ledge was still being constructed on Monday, but by mid-day it was complete and all was ready for the first descent. I was on the ledge and it was decided to start immediately. The cage was resting on its narrow platform, tethered by a length of rope and I climbed in and clipped myself to it. The pockets were checked to see if all the tools and karabiners necessary were there and the order was given to lift the cage one foot to clear the ledge. Hanging free, I was able to pull myself over to the end of the boom by means of a rope fixed to a pulley running along the guide wire. At the far end of the central pole of the boom was another pulley through which I threaded a line fixed to the main deflector pulley running on the cable above the cage. After passing the rope through a second pulley at the side, the free end was thrown to Bill on the ledge. Then I was lowered under Gordon's instructions until below the boom, the rope was pulled in deflecting the cage over the drop. The rope was made fast and we were ready to descend.

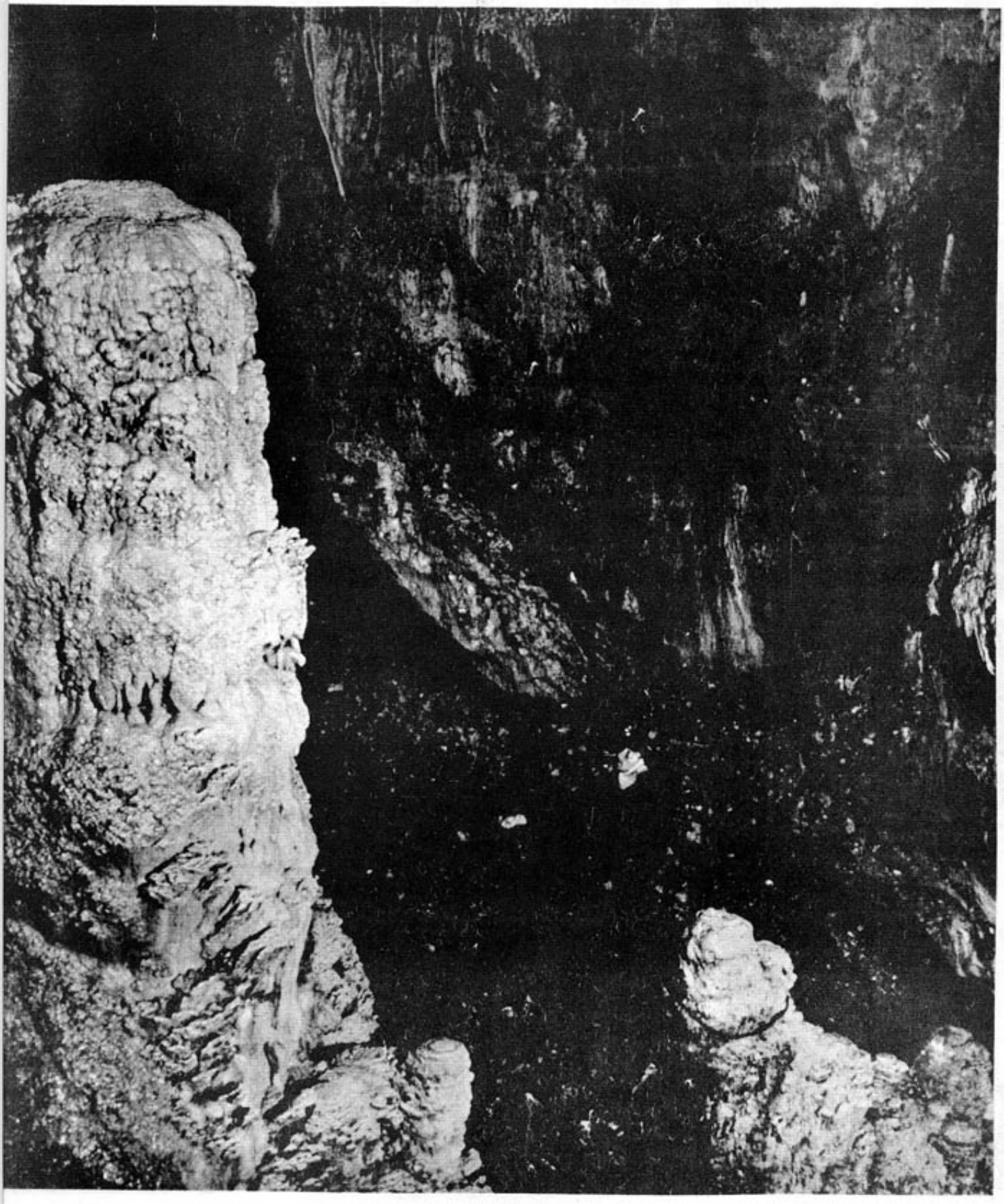
The route down should have been clear for four hundred feet at least, and I unclipped the spotlight to look downward. To my disappointment I could see that the cage would strike the rock only fifty feet below; the way down was not in fact vertical. I gave instructions to descend and soon met the rock wall which was composed of jammed boulders. I decided to carry on. The cable was unwound slowly as the cage descended and it was possible to walk down the boulders leaving a set of footprints on the near vertical wall!

Soon the way on became vertical and the cable began to rub on the rocks above, the curious grating sound being transmitted down the wire to the cage. The telephone was working perfectly and using it in conjunction with the tension guage, the winch driver could act immediately. The route down became rough with large mud coated boulders and it needed some agility to stop the cage turning or jamming in the cracks and gulleys. Once the cage caught on an inch wide lip and hung for a second, but almost before I shouted the winch had stopped. I looked around and saw that the hole was getting smaller. The ladder pitch that Pepi must have used was to my left and was getting nearer. The far wall was now only thirty feet away and was vertical, the hole had assumed the form of a rift 120 ft. long curving out of sight to my right. Directly below was a narrow ledge, deeper still a bat was flying around the deepest part of the hole. I could see down for 200 feet. The ledge, reached at 350 ft., was narrow enough to be able to step off it. Almost immediately it formed an overhang which curled away from me and I was able to pass by sliding out of the cage up to my shoulders to fend off the rocks. The rubbing sounds became more intense, but a trial lift showed that the winch was capable of lifting the vehicle easily.

The rocks became smoother and had a coating of moon milk and at 400 ft. I stopped to chase some white wood-lice for the biologists. The



The landing stage at -700 feet.



Stalagmite pillars near pit bottom.

main beam of the searchlight showed a large ledge directly below with the way on down to my right, but this was 30 ft. (approx) out of the vertical line. At 500 ft. I touched the top of a scree slope on the ledge. This had an angle of 40 degrees and went down 40 ft. to a bigger hole (it was about 40 ft. wide). The scree formed the base of the left hand end of the rift and was the end of Pepi's ladder route. It was a natural target for any boulders falling from above and the rocks bore pitted evidence of falls. To the right the slope steepened until it became too steep for loose scree and the ledge terminated in two giant rounded boulders which formed the lip. At this moment a boulder came down, struck the scree and came into the cage hitting the passenger seat. Itleft without causing damage. The descent was continued and I walked the cage down the slope into the gulley which led to the edge. I was disappointed to find that the gap between the boulders was only 4 ft. tapering from 5 ft. to 1 foot and then finally into a crack.

I was lowered until I could lean over and see the next ledge 100 ft. beldw, 660 ft. from the sufface. It was swept clean except for 3 mounds of debris which attracted my attention. The way on was not visible but boulders bounced underneath the overhang and rumbled on for approx. 10 seconds, apparently bouncing all the way. The wall on the far side was only 12 ft. away and magnificent formations (colums and curtains) hung for 60ft. on it. The lip was a definite overhang, and I could not go further because of the danger of not being able to pass it on the return journey. The alternative was to build a deflector on the boom to enable to next man down to clear this obstacle, by using a new route to the right of mine. I came up surveying the other side for the new way down.

John Osborne.

Bill Birch's Descent.

At this point the operation was temporarily halted and an extension built onto the boom. This was not sufficient to clear the notch so Bill Birchenough, more used to improvising in awkward situations than most of us, went to the notch armed with pieces of wood, pulleys and assorted handy ironmongery. He made two descents. The first more or less repeated John Osborne's trip, and tactics were decided for getting over the obstacle. The second the following day was to take Bill to a ledge almost 700 feet down.

His descent was tape recorded and makes interesting reading:

Bill: 10, 9. 8. 7. 6. 5. 4. 3. 2. 1. 0.

Surface: Thank you. You are a little mixed up but we got the message.

B: Hello.

S: Hello Bill.

B: Right, we are nearly ready to go. Just loading the last of the stores we forgot. Going down the life line and we shall be ready to go.

S: We are listening to you.

Now can we do a number of checks on your equipment? I don't want to know particularly about the bits of wood and that which you have got. I am more concerned about a one-day pack and water and life line and things like that.

B: A thermos which has some liquid in it. Probably cold tea.

S: Right.

B: I have a flask of water; where is it then? Do you know, John?

Oh, can you lower it down the life line?

That lot of water then John.

I take it you heard that Bernard.

S: Yes I did. It was just as well we checked.

B: Oh a very good idea.

S: Also have you the cardboard box containing the rations?

B: Yes, I have the mess tin. I think I have a stove somewhere.

S: Yes, well will you confirm please.

B: Difficult heaving out all these bits and pieces. Yes, I can see the stove under the tin of carbide. Anything else?

S: Well you said you had water but have you enough water for the carbide as well as yourself?

B: Something like a pint or nearly a quart.

S: O.K. that will do.

Clive: Clive here Bernard. When we checked the water Bill Birch insisted that his bladder was sufficiently full to keep him going.

S: Jolly good. That is very vital. Well, you are on your way Bill.

B: Yes, all go.

S: We are listening to you, of course, so just tell us what you want.

B: O.K. Down about an averagespeed.

S: Going down slowly.

Hello. You are about the same weight as yesterday.

B: O.K. Seem to have got a lot more ironmongery on board.

S: Yes.

B: Obviously I did not have so much to eat.

S: Yes, that's right, or perhaps the concrete was not effective.

B: That's a point. Well, looking at the results, it was quite good.

S: Bill. You are coming up to your first observation level. Is it convenient to stop you in about 5 ft. or something like that?

B: It is very convenient. I am just passing some small crevices made by my last passage.

S: Right Oh. Alright we are stopping you there Bill to check this survey of the size of the chamber.

B: O.K. Good position.

Looking away from the rock face it looks to be about the same as by the ledge. I can see 40 ft. - that is 40 ft. in width. I think that facing the rock on my right it is about 75 ft. It is curving round the cliff face I am on but I can not see properly but say about 75 ft. On my left hand side the face curves round to meet the far wall and it is probably about 40 ft. The passage is rather lozenged shaped here. We are in like a quarter moon shape.

S: Yes.

B: I think that is about it.

S: O.K. Bill for the time being. Ready to go down then.

B: Could you wait just one moment. I'll see if I can see the breasts.

S: Yes, Right-Oh.

B: Yes, I can see the breasts. I think they are about 100 ft. below me.

S: You might be able to check that.

B: O.K.

S: What is it you are looking at Bill?

B: The two breasts which I have to go between. O.K. Les, Check the level. That will give me some reference of the distance.

S: Yes, O.K.

B: It is surprising how used you get to walking on a vertical wall.

.....

S: 500 ft. now. We'll stop for another survey please.

B: O.K.

S: Stop please Frank. Thank you.

B: Looking behind me, out into the cave, it is about 30 ft. It is definitely coming in. 30 ft. across then. Looking to my right. The most beautiful Christmas tree about 10 ft. high. Opposite side of the cave the cave narrows to about 40 ft. away to about a few feet less than it is now, then it opens up again to a big round shaft probably from the other side 100 ft. away.

S: How far to your right, Bill?

B: I will have a look. The cross section is rather like a figure of eight. With the loop away from me considerably bigger than the one I am in, and the other side is close. I am about 10 - 15 ft. away from a sloping mass of rocks. Probably about 60 degrees with a few trees lying on it, and the ledge that I am about to land on is part of this slope.

S: I see.

B: I will just look up the slope and see what is at the top. I should think the slope is fairly gradual going up considerably to my last measurements.

S: I see. Thank you.

.....

B: Right, ready to go down again.

S: Yes, you are quite near the ledge, you see.

B: I will have a look at the ledge and tell you what it is like.

Wow! O.K. I have cleared the scaffolding pole. It got caught in a hole. Going down again.

S: How is the scaffold pole carried, Bill?

B: It is just hanging by the cross piece from the side of the cage and swinging free so it does not matter if it does dig in. I can see this infamous notch probably about 70 ft. down.

S: It is rather less, we think.

B: I am using my carbide light so things are definitely further away. Now for the ledge and you can accelerate very slightly.

I am now more or less on the stone shoot of John's and am easing down it towards the slot.

S: You are 545 ft. now so have perhaps 20 ft. to go.

550 now.

B: Right. Would you just like to wait a moment.

S: Right.

B. Yes I think the slot is about 10 ft. down.

S: Yes. Bill, as you are at a convenient height would you like to do another of your snap surveys as obviously the features have changed very much since the last one.

B: Will do.

S: 550 ft. then.

B: I am at the bottom of the stone slide which is about 10 ft. wide here. Nice hard calcite and if you can imagine a rectangle 10 ft. wide with a sloping bottom - I am on that sloping bottom. Looking to my right it continues roughly the same width to I should think 75 ft. The face I am on is about 80 degrees. And the far side is absolutely vertical. Maybe overhanging slightly. To my left is this stone slope. Calcite stones going up to about 60 or 70 degrees. I think that is about all.

S: Right at the level where you are how far is it to your left hand wall, that is, to the left hand slope?

B: The cage is partially resting on it.

S: So you are virtually touching it.

B: Yes.

S: O.K.

B: If we can inch down fairly slowly, I will just put the light away and I will tell you when to stop.

S: O.K. Ready to go.

B: Yes. A slight modification to the cage would be the seat of equal width because your one leg is on the narrow one and one leg is on the wide one.

S: Yes, because you have to sit in the middle?

B: Yes.

I will not go into it; I am just kicking out of it. I am slightly caught in one of my life lines.

O.K. stop there.

S: Hello Bill.

B: Down please, about one ft. I am just clearing that rope.

S: Right, going down. 1 ft. it is.

B: Down another foot please. We are now well clear.

S: Good.

B: Down 1 ft. again.

Right. If you would like to stop the engine now. I would like to look around. I will start with the wood and hammer it in when I find a suitable position.

S: The scaffolding pole is temporarily lodged and then you are going to put the wood in permanently?

B: The scaffolding pole is just held there by the weight of the cage while I put the timbering in.

We are back in business now.

----- Sawing noise -----

B: O.K?

S: Yes thank you Bill.

B: It seems to fit but luckily Sod was with you when connecting. It is just about right I think.

O.K. I am starting to hammer it in.

Half a moment, I will have to shift it. I think it has fallen out the other end.

Right, I am now hammering the pole in from the other end where it came out. It is a bit difficult and I will have to reach out through the corner of the cage and hit it and I can barely see it.

Right. I can now hammer a wedge in at the end to hold it; I must first of all find a wedge.

Right. We have now found a wedge which has been hammered in as far as it will go. That thing you heard falling was a hacksaw!

S: That will make Sod wonder what that is.

B: Right, now let's see what it looks like.

S: Has the hacksaw gone all the way Bill?

B: I thinkit has. The trouble with this cage set-up is that there should be a parallel bar set up along the front, with all the equipment hanging loose so that you can slide it from one end to the other when working. From one side to the other the string is not quite long enough; obviously one of the transfers has got unhitched.

S: Noel said when you get the hacksaw back will you look for his pipe there please.

B: Yes, and I will also look for the small spanner.

Now I am going to try fitting the scaffold pole on the outside of the timbering.

S: Right-oh, Bill. Going down slowly.

B: O.K. Preferably not too fast or I might get caught up in the guide lines.

S: Yes. O.K. we will go slowly.

B: Winch. I think that will do thank you.

S: Right-oh, thank you.

B: You can tell John Harvey he will feel quite at home now and he will get a nice little pack in behind the timber.

S: O.K. He has gone back to camp temporarily but we are all in control.

B: O.K. I am now going to unhitch the guide line. I will haul cross to the stal, and try and make another hole in it.

S: Yes.

B: To thread the scaffold tube on it. I shall be out of communication - I shall be a few minutes finding the appropriate tools.

(Pause)

That hole was not entirely successful..I am afraid the whole thing may come out so I will try somewhere else.

S: It seems rather like the lesser spotted woodpecker down there!

B: Thank you!

Making the hole has not been entirely successful due to the risk of fracturing the curtain. So I will leave it as it is. Since we have got all the weed in as well I think it would be best.

S: O.K. Bill. Your decision, of course.

B: I will now go back along the rope, fit the scaffold pole on and make it fast on the other end.

I have given this tether a good old tug and it seems quite firm so we should be alright.

S: O.K. Bill.

B: And I will now go back down to my previous level which is about 2 ft. to 2 ft. 6 ins. please.

Yes, I think another 2 ft. down would do us nicely.

S: Sorry we are a bit slow; we are doing it on the bicycle.

B: Oh yes, that is a much better way. Definitely a bit disconcerting when winching.

Of course the best laid schemes go wrong. I forgot the scaffold pole is now caught on it. I can poke it out.

And will you also ... the gentleman who hammered the wooden block into the end of the surveying pole.

S: Oh dear, Oh dear, I don't know who it was.

B: What I have to do is to saw the end off the surveying pole, stick the rope in and poke it through one end of the scaffold pole.

S: I must remind you that you have not got your hacksaw, have you?

B: That is a very interesting point.

.....I am going to pull myself along the long static line. Loop the big rope over the stal. boss then I think we should be ready to carry on.

S: I see. Bill can you give me a brief resume of what you have done, please?

B: Yes. I am sitting in this notch about, say four or five feet out. There are two pieces of wood hammered in about 3 ft./3 ft. 6 ins. out one of which is wedged six or seven ft. outside the other. The scaffold pole is wedged across with rope running through the middle of it to two pitons at one end and the other end round the big stal. Then from the two pitons there is this hand line stretching out twenty or thirty ft. to the stal. boss which I hope to visit soon.

S: I see, Bill. Are you going to leave a flat loop from the scaffold pole or from the two pitons up to the stal boss or do you intend to take the end of the rope down with you?

B: That is something I am not sure about. I have got so much rope that it might be a good thing to leave it from the pitons in a big loop.

S: Yes, because you would be able to collect it on the way up?

B: Yes, I think I will do that but it takes a few minutes to rig the drum of the cable.

S: Bill. How about the possibility of a photograph of this buttress.

B: I hope to take a photograph while I am on the boss, then I can get a view of it.

S: Yes, I see. That is a very good idea.

B: O.K. I will try to get a picture on the 550 ft. level.

I shall be off the air for five or six minutes while I do you know what.

S: O.K.

B: I am now paying out the hauling back cable.

S: Very good Bill. How are you actually lodged at the moment?

B: I have thrown a loop over this boss. It is holding me away from the slot. I have not yet thrown the main cable over it but I will do that afterwards when I cast off on the loop.

S: Yes, I see. O.K. Bill, thank you.

B: Probably take a few minutes this.

Some moments later ;..

B: O.K.

S: To be more specific, does this mean you actually want to go down now?

B: Yes.

S: O.K. We will start the engines and let you go.

B: Very very slowly to start with so that I can see how the system works.

S: Yes and I think we should do a little check run to see that you can keep in control on the way up, O.K.

B: Yes, definitely.

S: Yes, the depth is 570 ft. now.

B: Half a moment. I see the ladder is the wrong side of the rope. Sorry I spoke into the ear piece rather than the mouth piece.

S: Oh, yes, it does make a difference.

B: Are you waiting for me.

S: Yes, I am waiting for you.

B: Sorry, all the message then was that we could carry on down a little.

S: O.K. we missed that. Sorry.

B: Going down slowly then. Yes it is going nicely.

S: One foot.

B: There is a nice knob I can keep myself out from the wall.

S: Two feet.

B: Half a moment.

S: O.K. stop there.

B: The guide line is scraping along the pit head gear. Right. Carry on down. Well clear now.

S: Going down.

B: If you just stop I will shine the light up and have a look to see what has happened.

O.K. Stop now.

S: 577 ft. there.

B: Hello.

S: Hello Bill.

B: The rope is rubbing very lightly on one of the guide lines we are using.

S: Yes. Going down now then, Bill.

B: O.K. Yes, it is very nice. I am holding on to the loop of rope which is stopping any tendency to spin and holds me away from Number 3 platform.

S: 580 ft. now.

oooooooooooooooo

Can you estimate how much free rope there above you to the first ledge or anything?

B: Rather difficult to say. I can see the ledge silhouetted against the hole in the roof. If you would like to stop I will shine my light up and see what we see.

S: Stop there then.

B: I should think the cable runs up absolutely straight to the boom.

S: I see. Very good!

B: I expect the boom people could probably see my light reflecting on the poles.

S: Yes.

Hello, Platform 2.

Gwyn: Platform 2. Come in Bernard please. We have been listening to you.

S: Can you in fact see Bill's light on the boom?

Gwyn: We can see quite a lot of light shining up right below us. Quite a decent beam.

S: He says that he can see right up to the boom with his light.

Gwyn: Yes, that is so.

B: This seems to indicate a wire right down might do the trick.

O.K. I will just turn the light out and go on down.

S: Yes. Right-oh.

B: Yes. Ready to descend.

S: Right, going down then.

Hello Bill.

B: Hello.

S: As soon as you are in a position to take another survey will you please stop and do so?

B: I think I can do it now. To my left which is about 60 ft. looking up 65 degrees past these big stals to a rubbish heap round them and sloping on down under me.

S: In this case you are looking out from the wall.

B: No. I am looking in at the wall and all the other readings.

Looking round to my right .....Oh God! There is just about 20 ft. away there are some big curtains hanging down and fluted columns. Rather nice and about level with me. I do not know whether it is in this chamber or a horizontal passage or what but I can not see the end of it. This applies to the going down as well. Well the light carries on and on and on and just steps!

S: Righto!

B: Not really! The stalactites are not outstanding, just impressive because they are standing out in space so much.

S: O.K. Ready to go down.

B: Right, going down now.

S: 590 ft.

B: Oh good.

S: How about the speed Bill?

B: The speed is just about nice.

S: We did not know where we were going.

B: O.K. You can go a little faster. The rock is absolutely sheer and there is no pressure on the walls.

S: O.K. Go a little faster.

600 now up.

B: Ohh good.

S: 640.

B: Ahah. Right, you can stop. I'm going to try and be very clever and land on a big boss.

S: O.K.

B: Right down another foot.

S: Carrying on down.

B: Down slowly till the weight comes off.
Another eight inches..

S: 7, 8, 9...

B: Can you stop while I survey the landing ground and see what we have? It's going up at about 30 degrees, littered with logs and all kinds of rubbish. Perfectly walkable uppable.

S: Is it the sort of rubbish we're looking for?

B: Sorry?

S: Any of the sort of rubbish we're looking for?

B: I can't see any as yet. It's all black and looks like rotten wood.

The cage goes down and actually ends in a bush.

S: Going down slightly then.

B: Right, we've landed rather like a parachute - STOP! otherwise we'd tip over. What's the request for me to do?

S: The point is, Bill, you can't make any more depth by walking across down the slope to another open space. What is the situation there? Can you give us a description, please?

B: If you can hold the cage steady against the rock I'll have a look around.

S: Depth 653 now.

B: I'm on this slope, very climbable, with big logs stuck behind a boss. It cascades down. The inevitable flashbulbs...I'll have to get out to see what's behind me.

S: Yes.

B: Now what do people say about getting out? I imagine I should first of all climb out of the cage...

S: Yes definitely.

B: Then there's a nice boss about 6 feet uphill.

S: Can you ancher the cage, Bill, in case it swings when you get out?

B: Yes.

S: No hacksaw?

B: I'll have a look shortly - I'm leaving the vehicle.

S: You're clipped onto it?

B: Yes .. I've belayed with my other rope onto it.

S: Bill, Clive is on the line. I think he would like to have a word with you.

Clive: Hello you old bastard. How are you getting on?

B: Hello you old sod. I smelt your presence everywhere, but as yet you haven't turned up.

C: Oh yes! I'm just leaning over the edge of the A-frame now, and any minute you'll see my presence pass you, I reckon...
Can you move a little more to the left? Ah yes a direct line....
How are you down there, Bill?

B: Well, it's just like any other cave.

C: I see. There's a big difference from cave to cave, isn't there. Do you think you can go any lower?

B: I'll have a look in a moment. I'm just going to have a look at the heaps of rubbish and see if they confirm it or not.

C: Well get on with it mate! Hey it's only just dawned on me - we've landed him in a right old rubbish heap, haven't we!

Surface: Are there any old bikes down there Bill?....He's not listening.

C: Is Pepi there?

S: Yes, he's here.

C: "Don't know why,
Got no buttons
On my fly,
Got a zipper.

---- (indecipherable)

Open all the time."

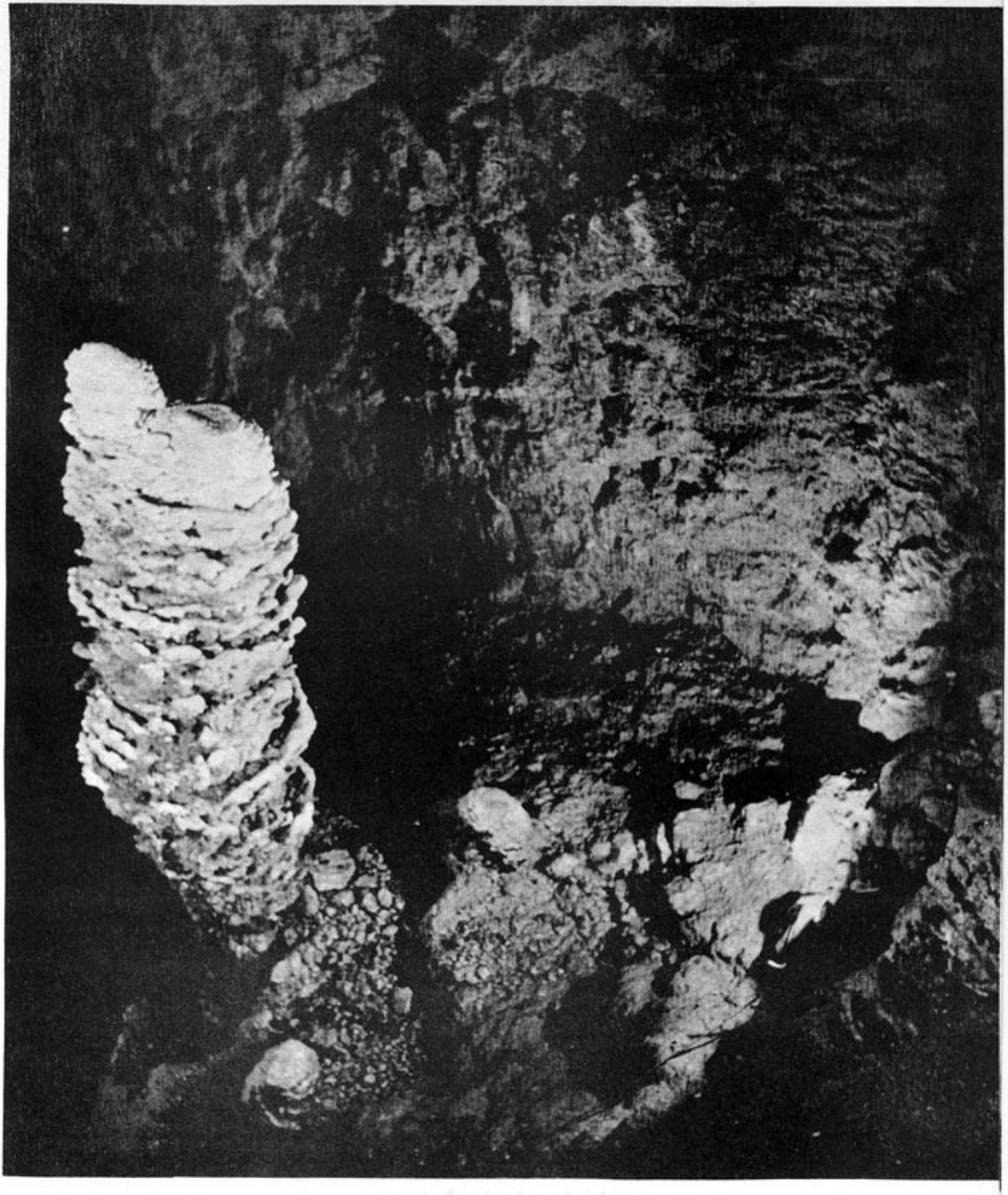
There continues, for a short while, some drunken singing.

S: That's rather good.

B: I shall probably be away for about a quarter of an hour.

C: What have you found, Bill? Any old tyres or wheels or anything like that?

B: As yet, NO. Cheers and out.



Stalagmites at the bottom of the Pit.



Zlatko Pepionic at the bottom.

The rowdy singing resumes, with renderings of "Bread from Evanses" and ends with "In the Rimrock Candy Mountain"

S: Very good. We're going to hold a collection for you. If you listen you'll hear it ... (Clattering)

That amounted to tuppence ha'penny.

C: And I bet that none of it was Noel's.

S: Right too. Clear off the line now. Bill if you throw rubbish off the edge does it go on and on?

B: I will throw a piece and you'll see.

S: We'll listen.

B: Half a mo'. I'll find something. O.K. I have the rock and I'm going to lob it gently over the edge. 3, 2, 1 - gone

clatter ..... clatter ..... clatter .....

My impression is that it goes on as far as it's come already.

S: Yes. I think you're right. It went twenty-three seconds near enough then.

B: Coo. It's certainly not many big pitches, more rambling down the slope.

S: So you think a climbing attack from there is in order?

B: Sounds a bit like it. I'll shine my light over the edge and have a look. It appears to in the edge of a passage; the roof appears to be about 50-100 feet above me. The floor slopes to, one can't really judge the depth, but you heard the stone go down. It disappears to my left and goes on .....

Bill ascended. The cage was not capable of carrying heavy loads up and down the shaft and the expedition came to an end. But not so the desire to get to the bottom.

PART 2.

Introduction.

We had learnt that Balinka was more than 720 and that beneath was darkness and Bill Birch's hacksaw. Balinka'66 was inevitable, the cave was unfinished. We knew so much - we needed a stronger, more powerful winch, a lighter cage - and a large ogof at the bottom. It was a thing to believe in and in the autumn of '64 we started again, planning, trying to scrounge money and metals for the meccano of '66. We needed a new, smaller winch, and a boom for the 720 ledge and Gordon was given that job. Needless to say he worked consistently and well for the 18 months and produced it. People dropped out, came in and dropped out for various reasons - at times it was heart breaking - but the cave was bigger than the people and no one was indispensible. Balinka was unfinished and there were difficulties; all who had gone below 200 feet in '64 had dropped out. It was back to square one.

Can we dismiss '65-'66 in a sentence without Frank's work and dedication? - but it must be so. Some people worked more than others, let's face it, but the preparations were completed. Those of us who grumbled at the new Dan-yr-Ogof might be forgiven if we had no patience for those who discovered it and pleaded for work on Balinka. It was an obsession with the sound of falling boulders and Bill Birch's work in a cave 1,300 miles away. The new winch had troubles and we were again bedevilled with lack of power, but came to August 1966 more or less complete after one semi-successful trial at Mitchell Dean; things clicked and clattered into a sort of place. The bus we hired this time, older by two years than before and less well cared for. Delivering it from Tredegar I remember the clouds of black smoke billowing down the heads of the valleys as the gears changed down. Alone in a 37-seater was a strange experience. It got there, just, and the seats taken out and packed away. We were ready. After Laurie's work on the engine and everyone's work on the packing we ....

(D. Webley)

"The truth, the whole truth ...."

We ground to a halt at the bottom of Penwyllt hill. We had no clutch, a moment of truth with no bull, only a matador, a guitar and a bottle of sherry from the Gwyn. We should have caught the boat from Dover at 6.30 next morning for a leisurely trip to Zagreb with no night driving. The organisation ground to a Bank Holiday thud. The clutch pressure plate, half cut previously, twisted its drunken circuit into a final ten ton straining crack. Frank was away towards Gordons, the banners flapping. Then followed 12 hours when the machinery of organisation worked in this emergency. Despite World Cup Day (who won?), we located the only three surviving pressure plates in S. Wales and by barter obtained one. The clutch was grabbing again by Sunday and we drove to Dover overnight - our reserved space was gone—, but on arriving we parked the bus to block up the car ferry and were put on to the next boat with no waiting, complete with Frank, Ella (met at Gordons) and the Landrover. Ostend arrived and we got on. Then, back to the no-stopping-driving-all-night-jag, to make up our missing 48 hours. '64 all over again. Oh. No sleeping unless locked in the embrace of spinning wheels. Belgium got off and then Germany where one of the tyres developed a boil near Aachen. We bought a pneu at 8 in the evening and a chicken and chip meal; Rod, Colin and Joan had a soul party in a cafe. 'What is love' they asked, but there was no time for Joan to complete her life study. On through the night and Munich by morning with John Harvey claiming there were horrible noises coming up from the floor beneath his feet. The German A.A. inspected, shook their hands and heads and could not understand how the scaffolding poles were holding the bus up. Oil tinged from the pump into the bottomless maw of the engine and we were in Austria. Frank was with us always, behind, in front and at the side of the circus. Over a mountain road at night with John and Laurie, the night staff, enjoying themselves on roadless stones. They were the red-eyed, swollen-eyed drivers who were able to double declutch without waking the rest. The rest of us had other degrees of efficiency, clutched and declutched, ground and reground, myself I believe passed 20 conker trees in changing from 2nd to 3rd while some poor sod was sleeping over the gearbox. Things happened, things happened, but it was all vague - we went around Salzburg twice on the bye-pass somehow, and then went through the centre. We had a meal outside near the White Horse Inn, in a hotel with leather arse-slapping and Joan dancing with Hywel in his caving boots, sideburns and toothpick. It passed, passed and we were moving through the hills. In the morning we were in Yugoslavia and things were more tangible, the possible was probable, the wayward bus had its way - which was our way to Zagreb.

The cathedral square and Frank went off to get Pepi while we were met by Prof. Markalin and a huge new friend, Mladen. Then to Pepi's house for a feast from his wife and parents, and a break for an hour away from the turning wheels to normality. After tea to Balinka, making up for lost time, two years of lost time. Out into the karst in the golden evening, off the tarmac to the dust road and a track through the pine forest with darkness descending; the damp leaf-strewn road in the halflight, with the smell of sap

rising, midges on the wing; no verbs in the sentences. Potholes. Each jolt sent the forward shock absorbers plunging and thudding against the wheel. Would we break down, so near, so near, in the gloom and greenness, was a question rather than an answer. We ground to a halt on the now dark path. There across the road were foresters with horses hauling logs piled on the road. It was stop again in the muffled dark, the horses steaming with effort. Excitement among the bus, the cameras, blokes pulling at logs in the chill air, the noises of voices and hooves echoing in the trees. In time, how long I do not remember, we rolling again, thudding from pothole to pothole through the forest, around one bend, then another, lined with piled-up sweet smelling logs, around another and there was Plaski in the distance with the lights of the paper mill. Another corner and the forest began to recede, a turn to the left and we were rolling, waltzing downhill, bumping by the side of lake Blata. Was there water there? we thought as we saw in the night a white shining blanket from shore to shore. It was late, very dark and the cicidas had gone to sleep. We rolled off the road to Balinka as far as the bus would go. Organisation decided that it was too late to pitch tents but a butyl cover was erected against the bus. The spanners were out. One or two slept there, the rest in the open or in the tents which suddenly appeared!

Dawn was no illusion, but the lake was, only the dew and mist shone over the green pastures of Blata. The village was awake, fire, smoke arose in the dampness clearing the air and the reality of Blata - it was the size of a butyl sheet or two. Cooks cooked, unpackers unpacked, cameras clicked. The people were out to meet us -- old friends, new friends, the children, the ox-cart. There were still berries on the trees and no birds.

After the breakfast the haul started, the trollies were assembled and Frank and the Rover started the haul to the well half-way up Pistenic. Laurie, no sleep for two days, slept, ignoring the Post which hurtled near his ears at the road side; the Forestry lorries roared past and the Army. He slept, deservedly. The trollies went up and down the hill and the camp was established near Balinka, not in the dolina this time but overlooking it, on a shelf at its top. Grumbles and bundles were carried all day. Things were taking shape, we forgot that indeed we had been lucky to get there; tomorrow was Balinka. Then the big stuff, to go up by hand and trolley through the forest. The forest was unchanged, the track unchanged -- outcrops with caves beneath was its surface, covered with sodden leaves. Snail tracks, large Roman tracks across its surface. It rose through the wood between the trees rutted by the ox-cart that was its only previous traveller; steps cut on the steepest parts by the rain, twisted roots crawled from the trees and invaded the brown muddy patches in depressions. The route was marked with the paper plates fastened to the trees. They shone even at night from their plastic surfaces.

The circus was assembled at the wellhead for the big pull. The winch was strapped into and on the trolley and the slaves were harnessed in front and behind. Frank went ahead with a crowbar to smooth the way. It was hot by the well but the first heave took them into the shade of the woods. "Anything to report?" I said. "Listen to this," said Harvey, exploding air from the wide expanse of his trousers. More heaving, and Alan said, "Can

I have my lump of sugar now?" I went ahead with the camera and the tape recorder, switched it on and listened for the echoing of voices through the trees, the rolling, heaving and dying of activity. "We're in the bog now," said someone. "Right in it," said another. "HEEEve," said the boss cat and the rest. "One voice at a time," said another. "Boys Bach, Boys Bach," shouted Harvey, "HEEEEVe". From sun into shadow they went, rock over rock up the track. "UrrrUP" said Laurie. "UUUUUUURP," said the boss, and someone callapsed into a cloud of giggles over his reins. "Anything to report?" I asked Hywel - "C'est la Vie," he commented. "Get out of the bloody way you bastard," said anon and Pepi asked what they meant. "My very good friend Mr. Webley --" Harvey translated, causing further collapses into the bog. And Mladen was heaving with Hywel somewhere between and under his legs. Urrrr -UP! slowly it rolled through the woods; we met a herd of cows with their bells tingling. So were my ears. The forest was full of our sounds, the echoing bells, panting dogs on the leash; sunlight flashed in the moving branches, midges hung in the ladders of light. The little girls with their tinkling oxen were swishing their sticks as the left hand dog was persuaded by Bernard to lift his big fat bottom from the ground. Echoes of rolling wheels and the sharp metal sound of Frank's crowbar against the rough path. There was a tree with the bark ripped off by a bear. The worst was over, the gradient less steep and I staggered into the camp with the 1 lb. tape-recorder - ten feet behind were the tons of winch and the ten or so who had dragged it. There was coffee in the camp as well as chaos in the form of an ox-cart which had ploughed through it. "O.K." said Bernard, "a few more heaves down to the pit." "That man gets on my tits!" said Dennis, hastily scribbling it off the tape. Giggling again we (they) got to the pit; down to Balinka, holding the weight back, guiding it through the woods. The winch had arrived.

The kitchen was organised, food in heaps, shelves hung from the trees and the wall around it was built. Down in the dolina the bog was built.

And went to see Balinka. - It looked smaller than in 1964, it had lost something, or our two seasons of preparation had enlarged it in the mind. The wreaths were there as before, under the glossy beech-leaved trees. Red stars surrounded by white and green. The place in the shadows was cold again in contrast to the white hot rock of the southern side where the sun shone on to the open stone.

The engineers took over. Scaffolders scaffolded the black mouth, Frank in the shade of the trees to the north set up the winch and its ancillary equipment. In a few days we were in business and a lump of rock which we had observed in the throat of Balinka had to be removed before the cage could pass up and down. This tonsil was chipped off by Laurie, Mladen, Colin and others, thumping it from the bosun's chair. It grew thinner, peeled and the rock smoothed. Some of us were busy collecting mosses from the rock around the top of the hole, snail shells. Then the cage could pass easily, cameras clicked. By the end of the first week the cage was descending to the 200 foot ledge and we were back on it, gardening it. It was decided that there was to be no boom there. The plan was to send the cage to the bottom, fix a guide wire there and then bring the cage up unreeling the wire as it came. This was fixed at the top, and for all subse-

quent rides, it would be clipped to this wire. Laurie was to attempt the first descent.

Pepi, Mladen and myself went to the risings and sinks we hoped to test, and talked to the farmers, found the names of the other caves in the area and learned of the problems of the farming. How the water rose from the body of the lake bed in the Spring and the lake grew; how the water poured from one particular estalev first and from the others a few days after. How in the summer it sank into swallow holes on the lake's bed and the sink we were to test with Rhodamine B. The area was important to the people, the karst provided the inhabitants with its industries; trees grew on it, their roots gripping between the white boulders, the millers set the mills over the sinks, the water roaring down over the turning wheels of the grindstone. The next day it rained and the second party arrived via train via Zagreb. Pepi, Mladen, Glyn and myself continued with the tour of the sinks while Laurie was dangling with our ironmongery in the cave for the first attempt at the big drop. We went to the millers at Licka and it poured, the water shooting in white cascades over the miller's wheel. The miller fetched his bottle of slivovitch and it went the rounds of the locals and ourselves. We were flushed and slightly drunk, the stone wheels thundered over the corn, the meal shooting out to the half-rolled sacks. The mill shook, the rafters groaned, the floor trembled and Laurie was hanging in the cave fighting with the walls and the V notch. The cage and the weight of the equipment kept throwing him against the wall as he walked down. He was struggling; Mladen was stretched, I remember, his whole six-feet-odd on the sacks of wheat and rye, smoking. Pepi was making everyone happy, Glyn and myself were red, dulled by the drumming of the wheels, pleasant with the rain outside beating against the windows. The miller, also the local hunter, told us of the forest bears, the protected animals that could not be killed except by special licence. The slivovitch was getting strong, a villager arrived with his sack of grain for the grinding, a lady with her corn. Bobby Moore and the German football team arrived with the newcomers' conversation. The stones rolled in their grooves and glazed, and red-faced, we answered the questions of the other world we had come from - so long ago it seemed - there was a big bear that was to be destroyed, it had been cheeky, appearing in the village at noon and removing a calf. The rain cleared, and our heads slightly; a man who had been to Pennsylvania came in and we went rolling back to Balinka where Laurie was still struggling with the weighty cage. We decided to put fluorescein in the Licka sink.

The next day, Thursday 11th August, Laurie was down again to the 550' ledge, lassooing the large stal boss, but again he couldn't make it, mainly because there was little open air in the cage. It was brought up and modified, by cutting huge windows in the sides, and Gordon and Colin started to survey the cave. This work went on as time, and cage availability allowed; Gordon had to fight off biologists, geologists and T.V. men to complete his task. By the afternoon Rod and the cage were loaded for another try to get past the 550' ledge. He fixed a rope to the big stal, leaning out dangerously from the cage and throwing it around it, followed by one on a stick which wedged there. He prepared to pull himself across and descend past Bill Birch's scaffolding pole in the notch. By eight o'clock he had landed on a slope 100 ft. from the top of the ledge and walked down: with him

was the Kango hammer and the electricity supply tested for earth leakage and found O.K. He was warned of electric storm activity in the area but by 11 o'clock he had completed the drilling and a rawlbolt for the balloon cable was fixed. The guide wire was hauled up from the top by a rope. The cable was landed by 1 o'clock in the morning and Rod returned to the surface after the successful ride by 3 o'clock.

Friday saw many trips and modifications. The cage was fixed to the guide wire, many photographs were taken and tests made. Saturday, Laurie armed with the Kango descended to see if it was necessary to have more bolt holes on the ledge, but found that none were needed and he returned. Time passed and memory plays tricks and the cage was looking battered since Bill Little went gardening with it. He let it go down with no foot-work and as it swung and shuddered from ledge to ledge stones shot out, poured down the hole in crescending roars with Bill hanging on. The cage had lost its grin. Bill and Dennis went down to establish the base at the 700' ledge and set up the kitchen on the small ledge to the right of the cage, out of the way of the falling boulders from above. There was a clear pool there and a space for resting and cooking up. They set up belay points and safety lines and then it was science's turn, in the shape of Clare and myself, to go collecting.

We didn't exactly feel like astronauts, as armed with our collecting boxes we climbed into the cage. When Clare got in, the wire gently braced itself; my entry caused a greater sag and bouncing. We were clipped in with no collywobbles and spun gently in the cage which was turned from the entry platform. It spun slowly in the sun. The morning had been wet, the paths slippery with mud and leaves, but now the sky was clear. We floated amongst the noise of generators and the winch; drifted unreal and real at the same time. We were loaded, boxes strapped beneath the seats, clipped to the roof and the cable, with the red ribboned nylon, warm in the wet suits. Clare had the phone and Frank started us away. The first sharp jerk reminded one of the danger that was real and unreal as we faced the vast amphitheatre of the forest, Frank in the trees with the winch. The balloon cables were straining and the sun was warm, the wreaths shone with the unreal colour of plastic leaves. Moving. It was getting colder, we were turning against the wet rock, the mossy rock. The noise was less, muffling the charging engine in the woods. The sounds were duller and we shuddered and lurched against the rock. We were meeting Balinka for the first time. Feet out, both of us, pushing against the rock apprehensively. The sounds were going fast, the moss was leaving the walls dry in patches. The cage was grinding, jarring, the wire straining and suddenly - clear. Gliding, silent, with only the hum of the wire and Frank's voice in and out on the phone. We were too warm to be cold, although it was colder, quietly sinking down and - stop. The guide wire was being slackened to avoid the 200 ft. ledge. And down again - slightly on edge as we turned and twisted in the humming cage of wire, reassured in our telephone box. Who could we ring, but "Frank?" -- the ledge loomed towards us. God! we were going to hit it. Sweat! Out with the feet for a big push and suddenly it disappeared, the cage or cave swung away from each other like opposite forces. The ledge was leaf strewn, bulbs of two years, light blue bulbs of Dennis, our light had come to Balinka. Down, surging and swinging and Frank breaks the silence - "before long you

will be hitting the walls again." "O.K. Frank." Both of us were breathing quicker not really knowing what to expect, to be warm, to be cold, only to notice that we were fighting the cave. Clar- k, clackety clack against the walls. Out with the feet - at first both of us and then only my own ½" longer than Clare's. When both of us pushed the cage swung away from the wall because of the different forces that we applied. One of our big pushes sent us twirling and swirling away from the walls, the cage coming back with its back to the wall, scraping down, and we helpless inside. We lurched it, twisted it, with the desperate momentum of our bodies, to turn back to the friendly face of the wall we knew rather than outwards to the now expanding cave, the helpless blackness which our light didn't penetrate. A mighty twist and pull and we were around again and could see the ledges looming up and push - push from ledge to ledge. A few more feet and we were caught, suddenly caught on a 2" ledge. Stop! Stop! Stop! we were shouting, but the phone button was not pressed down. The cage continued down, slowly, incessantly with its base on the ledge. It leaned out, the angle increased towards the overturn, and suddenly one became slightly calm, and both feet out smashing against the wall to free us. We were clear, the cage slumped two or three feet to take up the strain (the bounce at the top was impressive, I believe). A boulder from the ledge thundered past, booming and cracking against the walls where below we could see the lights of Bill and Dennis. The thundering stopped--the lights were still there. As if suddenly someone had turned on the silence again and removed the walls, we were floating again, free, gliding on a humming wire; scratching wire noises on the walls above coming down the cable. Frank came in, "If you look up you'll see the notch," and there it was, Bill Birch's device still stuck across its jaws. The cable was grinding and singing and we were fighting with the wall again, this time coolly, walking, pulling the cage as it tried to swing from the vertical across the wall of the cave. One fought it, until, suddenly, you were overcome and the cage swung back; in fact it was your sense of the vertical that was at fault. Suddenly, free again, floating; the light below getting nearer, Clare was greeting the cave and the occupants below with coo-ing noises which came echoing back. And the two ants below were shouting up what the hell were you doing throwing boulders about? "It's great!...great!" said Clare as we surged down, watched the walls as they stepped down and down; there was water dripping somewhere, a glisten of silver on the walls, a leaf, a red plastic memorial flower, oh so lonely, on a ledge. "You have arrived," said Frank. 6 ft. 5 ft. 4 ft. Down. Stop slowly and six inches and STOP. The last 50 feet were the greatest experience so far. The cage headlight shone out and down into the cave we faced but did not know. The light hit the hanging curtains of calcite and was absorbed by the blackness. It was big black, unknown and exposed. Water dripped, the curtains shone and glistened; Bill and Dennis small below came out from the kitchen to where we in the cage were laughing and talking. A new world and we had arrived. Above, daylight shone like a diamond, unreal. I got out of the cage first, ungentleman-like. There was a guide line to the right of the cage in the middle of the slope and I clipped on. It snaked around the cave's wall to the kitchen below. We went down and around and as the exposure came up from the blackness, it looked bottomless. Slide to the side where Bill Birch landed; there was a foul smell which we laughed about. The place was littered with organic debris strangely unreal, washed stones, dead bushes, dead logs sullen in the light of the orange curtains opposite. One felt as if one had suddenly

dropped through the roof into a gothic cathedral - but the damp-course needed seeing to, moisture was everywhere like inscence. Clare was out and down to the ledge and Dennis was taking photographs. It was cosy and we collected; samples from the clear pool which proved to be sterile, water temperature was 8 degrees C compared to 11 degrees C in the shaft and on the stone chute, insects from everywhere, mud from everywhere. From the cage, the cave continued downwards into the stone chute with large calcite cauliflowers and pillars draped over its dripping surface. The chute plunged down into blackness and the echoing of stones and pebbles as they fell; it was the noise of heavy wet hailstones. It plunged into more dripping pillars, and the cross-section was vertical and, as Strecho said, Balinka was a minor tectonic fault associated with some other well-known ones in the area. Fault or not, we faltered in the kitchen, as the cage went up empty, and the boulders it removed came raining down. Smashing into the stone chute and then into hundreds of pebbles. "Great," said Clare. How deep could it be? the seemingly endless periods of time the stones took. We collected; the place was swarming with insect life from the abundant amounts of organic matter. Hours seemed to pass, one did things slowly and it was time to go up and this time the journey was alone. The winch engine power was still suspiciously weaker than what we wanted.

UP was more exciting than the descent, one's feet more active and positive on the walls. One saw each ledge clearly and early and the speed depended upon the kindness and know-how of the winch drivers and their assessment of your capabilities. The cage swung from side to side and, as one climbed, one tended to go to one side against the vertical, the cage going with you. It had more sense, and swung back alarmingly at the end of the pendulum, overcoming your own frantic efforts to keep it on what you thought was the correct line; crashing against the wall with the occupant helpless. And off again walking, climbing, trying to avoid tension. And free again for feet, minutes of gliding to be broken by Frank, "this is a difficult bit." Crash, Shudder, the walls walking with you. Swaying, crablike along the wall, passing the scratches in the calcite where the wire had been running. There was no fear, no time for it, to ponder on one's position, a spider with its engine heart 600 feet away in the sunlight. Suddenly gliding and free again. Floating, relaxed; time to turn as the cage spun around to see the cave, time to talk to Frank (All he got from me was O.K.) Just a throbbing of the wire, the creaking of the now battered cage. And Stop. Hanging. The wire on the take-up spool was crossed. Down to free it. And Stop. A look around, hanging in darkness, gently, ever so gently, moving in the silence; only to be shattered by Frank again and the noise from the surface coming down the phone. The light picked up the mud covered walls. In the main part of the cave the walls fell away where large blocks had peeled off in large steps to form overhangs. And UP. And Stop. And down and Stop. And up again and away, the strolling now with confidence. The diamond in the roof was bright and a leaf came past. The jewel hanging there was changing shape and brightness. Then into the bottle and the wall again, the moss. Barging against the walls, breaking out in the warm, stifling sun and the oh! so blue Balinka sky. And Afternoon tea.

Bernard went down to assess the position and Clare came up. The work went on, science kept readings, John Hartwell erected the Institute (Research Laboratory for the Advancement of Science in Speleology, Branch Zagreb).

This was a butyl sheet affair with a beech skeleton. A table with the shelves, and nails to hang things on. The Bog was more palatial. Even a Bear Club and Readers' Digest hung from the rail.

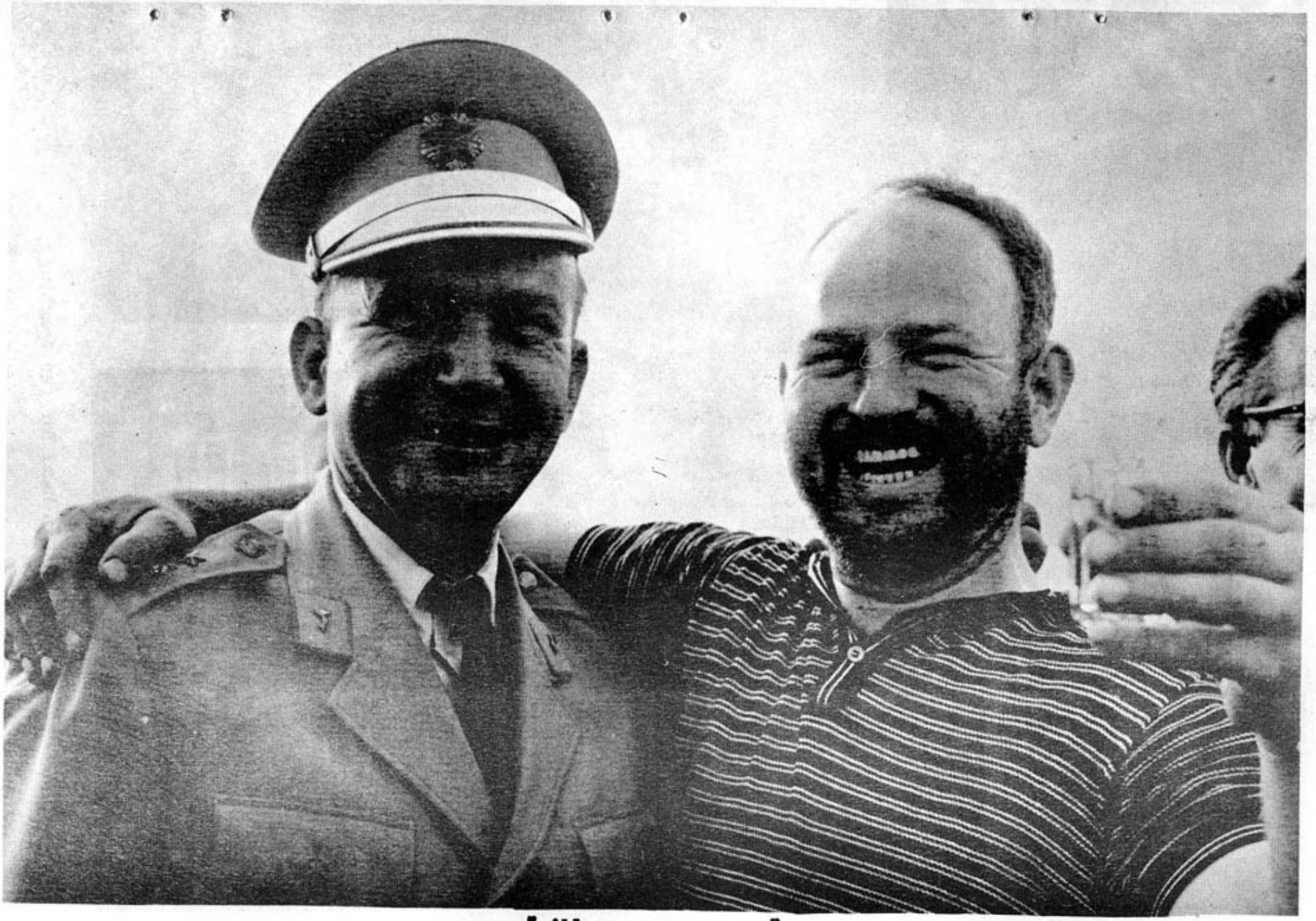
It was decided to ladder the rest of the cave and Gordon, Bernard and Colin started the job. A 15 foot pitch from the kitchen led to a sloping steep creamy, gritty flowstone floor on boulders. Across to the middle of the stone chute they went and down another ladder on a nasty sloping gritty wall with the water. This went down 30-odd feet and then around some pillars to the final 60 foot pitch over the sloping edge of calcite to the flat floor. It was undercut, the last sloping ledge because boulders had been cemented together to form it. The terminal floor below was like a football pitch - a slightly sloping one to the middle where a small stream across it formed the halfway line: beyond the level of mud rose again to form a huge brown choke of stickiness. In the corners were small ooze-filled holes; one needed an underground Thunderbird to go on. Disappointment! And Gordon had given two years' work to a new winch for the cave beneath. If he hadn't made it we would have needed it. Science collected insects and samples. Gordon and his surveying crew carried on their measurements, while on the surface science was also in action.

One day we dyed the main Blata sink - Mala Pecina - at the Balinka side of the lake with Rhodamine B. Dennis took some colourful photographs as the streams turned red into the mountain. The rising was thought to be 10 Km away but to date none of the 20 lbs. have appeared (Sept. '67).

The fluorescein was reserved for a sink-hole near Licka Jesenica and we waited for a week to put the dye in the pool. The first visit saw a small lake in a field with the grass submerged and dying, but three days later someone had pulled the plug, only a small pool was left. The dye went in red and turned green, and we could see it being sucked to the centre and disappearing. To date none of the 25 lbs. has come out.

After the tests, it meant that the possible risings had to be visited as often as possible. The results were negative and much could be written on the visits; possibly the most interesting was that John Hartwell had to join the Yugoslav Army to visit a rising in the middle of an army camp. There was something to do always and looking back one cannot piece each day and its happenings into a framework of time. There was the day when the cook and her scullion got drunk and joined in with a Yugoslav shooting party. The night 3 of us got entertained by a red-eyed bear in Balinka woods - the appearance causing an amazing turn of speed from Peter Millett and an entertaining turn of expletives. "You must always face an animal," I said, running backwards. Then there were trips to other caves.

I was anxious to visit Vidrovka, a cave I was introduced to in 1964. In that year, one of the local people came to Balinka and told us we were wasting our time there because he and his friends had been digging in a cave near-by for gold since some coins had been found. Edward, Joan and myself went with him and his threatening behaviour with a woodman's axe he



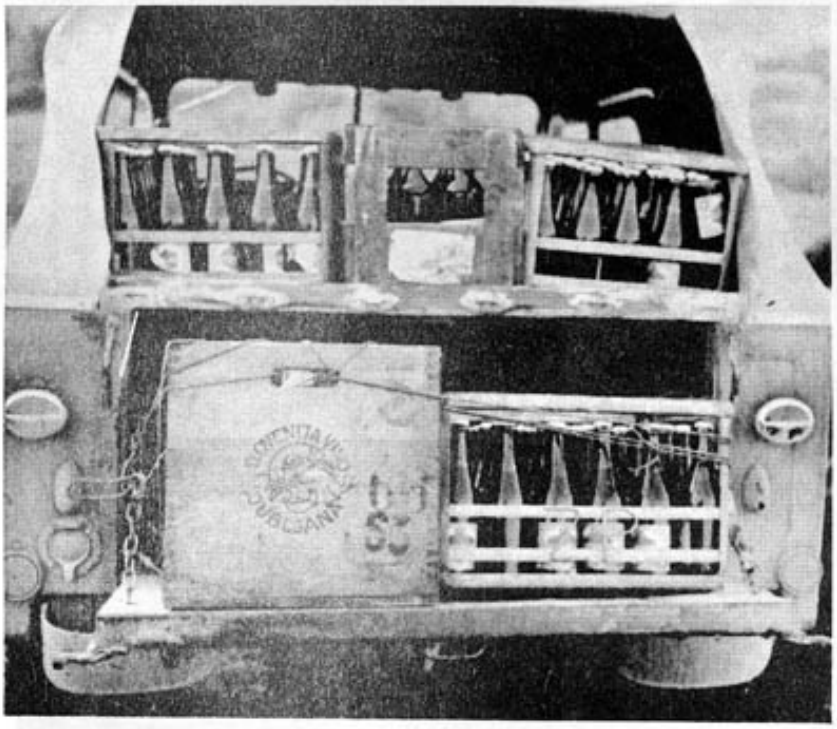
" All coppers are...." Gwyn carousing with the local police chief.





One way
of curing
sunburn!





Preparations well in hand for the feasting.

carried, made us wonder when we saw the mass of human bones in the first part of the cave. We had left Joan outside. Anyhow, we got out alright, but not before finding many potsherds which appeared to fall into two classes - pottery that looked as if it were the products of the last few centuries, and other material which I felt should be put somewhere in the early Bronze Age. To put it mildly the cave was archeologically as well as speleologically "interesting". In 1966 we went again, collected more material and Dennis and Hywel surveyed it. But we could not dig because Balinka had first priority. On the way back we saw another pothole near this horizontal cave and like Balinka the stones went down - - but it did not seem to be so steep and foreboding as Balinka.

Another day we took a boat to Velica Pecina, one of the main Blata sinks opposite Balinka, for two reasons. We had read somewhere that there were strange fish to be found which had not been recorded anywhere else in the caves of the area. Clare wanted some. The second reason was obvious, like Balinka it had not been explored. Colin and Dennis took the boat into the water which appeared five metres in the cave and went off. Peter Millett explored some of the dry passages and Clare and myself tried to catch the fish which the young village boys showed us in the dark water. It was arranged that they were to be away for half an hour and to return to shore. With relief we saw their lights returning and flushed with excitement they told us of the size of the place, the amount of water and passages. They had only sampled it. It is a must for a future expedition. We saw the fish but did not catch them. Dennis and Mark explored other potholes near Blata and one - called Grbina Jama - was surveyed - the farmers locally told us that one could hear the water roaring below in spring weather. Near this cave was another swallow hole called Sopalina Jama in which dye had been thrown by Yugoslav engineers some years ago, and it had come out in the Mreznica river. With the exception of the river cave, all the other sinks were together, between the main road and the Blata river, and to those mentioned above must be added one other. This was called the Austrian Tunnel because in the last war Austrian army engineers had tried to increase the drainage of the lake by enlarging this small sink near Grbina Jama. It was enlarged for 100 meters and when it was found by water testing that the stream joined Mala Pecina, the work was abandoned. Now all one can see was the remains of the artificially cut entrance to the choked up stream. We were busy all the time. Gwyn Saunders went to another swallow and produced much human bones.

But, Balinka was first and Rod, John, Harvey and Gwyn found human material near the bottom, a tooth at first, then leg bones, an army pants buttons and then a string of vertabrae and ribs were noted. Mr. Latus was sent for and Mladen, Frank, John Harvey and myself went down for the collecting, Frank and myself first, to be followed by the two others. The ride was becoming commonplace now and yet it was Frank's first trip and one could but admire his self-discipline and patience in that he had done much of the engineering, and yet he was one of the last to go down. We got to the 700 ft. ledge with our fertilizer bags and trowels and went over the top of the kitchen down the first pitch, then the second which was uncomfortable and trying, since one had to raise the ladder from the wall to get one's boot in each rung, the hands being bitten between the calcite slope and the wires.

Then the third trip. Over the edge, one descended over sloping rock only to see it suddenly disappear and it was a free climb - what one had been walking on was false. We found the line of vertabrae and rib bones. Someone had fallen the 950-odd feet and was still in one piece. He must have come straight down over the middle of the stone chute. Frank found some teeth and by the size of the bones they belonged to someone quite young - about 21 - either Branko Latus or Adolf Steinberger. We combed the area for bones and collected as much as we could and decided to call it a day. Balinka, at least symbolically, was defeated, and had given up its dead. We gave the bones to Mladen to carry them up, not really to get out of the task of their transport, but one felt that they should reach the surface in the hands of an Yugoslav.

We came out without difficulty only perhaps that I got caught at the first pitch with my belay rope under the ladder. I was struggling to go over the top of the overhang and found my life line hanging loose below and John Harvey shouting and calling to the heavens that I weighed a ton, the rope was not moving, and my mother had been out with sailors again. Adrenilen pulled me over on to the rock and out. We put the bones in a small tent, having first washed them, and Mr. Latus was waiting with four metal coffins. I gave him the pants button; he thought it was his brother's. It was the end of Balinka for him and for us. Next day he went himself with Pepi to the 700 ft. ledge.

From now on the expedition took on a different atmosphere. The dead at first had been a small part of the big cave and yet now they took over; in the last analysis humanity was more important than the bare bones of the rock. One couldn't get away from it.

The cage was deknitted by Rod, deloused; the machinery was dismantled and the next few days saw the packing and a mad 'wake' of feasting and remembrance that will always be remembered. In a sense it is impossible to try and describe the events of the next few days in coherent terms. The Partisan organisation produced 4 sheep, one for each of the dead, skinned them, gutted them and stuffed a long pole from one orifice to the other. They were roasted all day, beaten with herbs, turned on a charcoal fire which glowed, the blue smoke rising continually into the sky. The men sat over them, cut wood, added fuel to fuel. The children played and we went on packing. There was relief in the air. The Gaz came and went and came with loads of bread and wine. Wine from France, from the surrounding hills, from Bulgaria. Beer. The group chose a natural shallow swallow-hole half way up Pistenic. An amphitheatre of grass for the singing crickets. The Gaz came up for the last time with a table for the butcher, a man in a blue overall with a large sharp axe. People who we had not seen before began to arrive and at seven we all moved towards the arena and sat down amongst them. We were shared out, split up among the people, and the butcher smashed at the mutton which was handed around on huge chunks of bread. The only way to continue is to get drunk.

We were pressed to drink and eat these huge sheep slices with garlic and bread. The chap next to us was a friend of Robert Domani. Things were getting hazy. Gwyn Saunders was drinking and dancing with the local

chief of police. Glyn was taking photographs of Dennis who was taking photographs of Glyn who was reeling around the arena. Latus was holding a bottle in each hand above his head and singing; people were singing, shouting. The sun was going down somewhere, who cares. Joan wanted to be sick and go to bed, somebody was trying to keep sober. Rod was claiming that Gwyn wasn't drinking and he ought to drink at least something, and Gwyn was reeling with the policeman who was photographing Dennis who was photographing Glyn who was photographing the sun going damn well down and Joan was holding up the tent and making a mess on my sleeping bag which was photographing Glyn; John Harvey was damn well drunk; the man in the blue smock was still smashing at meat and people were photographing people, and meat and the damn well sun was going down and someone somewhere was under-exposing himself. Things were hazy. The man next to me was a friend of Robert Domani, the local police chief was singing and people were getting up, holding hands and forming a circle around the fire which I forgot to mention in the centre of the green. There were fires on the mountain, beacons above Balinka and over somewhere to the South where the sun should have been going down. We were all circling and singing, chanting with the leader who was singing songs which I could remember and understand then but I can't now because the sun had gone down into darkness and Dennis was still photographing Glyn who was photographing Dennis who was taking light readings with the tape recorder. Joan was sleeping and I got her up to be sociable and it was dark and the fire was still hot and the garlic and we were going around it slowly and singing and somewhere Gwyn Saunders was in a bush with his false teeth smashed into the ground. We were still going around and then there were speeches from Mr. Latus, and Bernard; and we gave Frank a TOOL BOX - god bless him and flashbulbs were photographing Frank and the sun had gone down. We were dancing again and chanting like Saunders of the River, but he was feet up in a gorse bush somewhere with his teeth in the ground. The circle was thinner but still going on and the fire was going like the sun which had gone down. Somewhere the locals were entertaining Bobby Moore, of all people, who had been scoring goals somewhere far away we were told. The charcoal was glowing and the men singing. The fire was going out and the Gaz was going away in the last embers. I said, "Shift up" to Joan, "you drunken so and so," in the acid-laden purple tent. The sleeping bag was purple and smelly.

The morning wasn't far away, so bright that it hurt the eyes. From the tent there were paper cups everywhere, bones, bread. Quiet.

We were to be called for by the Partisans to go to Plitivic for lunch with the Minister of Culture at a 'Balmoral' near to the lake in the mountains. From there we were to go to a reception at Ogulin. We got to the end of Plitivic and walked around the karstic phenomena, or they walked around us. Some saw the waterfalls, others slept on cafe tables. Lunch at the Retreat. Contrast. Marble Halls, Easy Chairs. Lush drinks, waiters in white coats to contrast with Laurie's knees. Drink again. The British Consul was there with few words of Yugoslav in his vocabulary. Speeches -- international collaboration, presents of books, records. What had we done? What HAD WE DONE? Lunch was served. The lot, mutton again but this time with about five other courses. Bottles of wine. GLASSES to put the stuff in. Cigars. Talk. The T.V. people. Nada. black-bottomed Nada translating,

taking charge of us for the T.V. Speeches, the horror of near history, the immediate past, making their own history, their own martyrs. It finished about 5, I think, and we had to go to camp to collect the packed bus and on to Ogulin where an hotel had been provided; another meal and choir.

Back to Blata, some in the bus, the rest in the Gaz bus. Rolling up the road, Blata for the last time, down to Plaski into the night and there was the bus, two side wheels in the ditch. A crunch into a pothole and into the ditch. The bus at a treacherous angle. The village came out and pushed, and Frank's Landrover pulled, and we were on an even keel again. She slid off gracefully with no apparent harm done. A rather nasty hour was over, but we were two or three hours late reaching Ogulin and the feasting again. We sat down to dinner with slightly polished faces.

A long hall with white clothed tables. Tito at the head. Food, drink again. I can't remember what except that Bernard got a carafe of wine over his only long trousers. Speeches. Eat. The choir came in and it was singing again and drinking; orderly at first. A song in our honour composed by Miche Latus called "Ych y Da" which thundered around the hall. There were solos, some by Mrs. Latus, male singers, female singers, all together now, Gordon with his French song, Hywel with his Welsh songs, more choir. Singing and then dancing again - this time in a long snake led by the army man again. Arm in arm out of the long room, up the stairs, through the mayor's parlour, downstairs through the room, around the tables, upstairs in glorious confusion. Singing, laughing. And thanks again, bewildering thanks again. Mr. Latus senior shook my hand off. Each of us was made a man of Licka and was given the local hat with its Turkish influence - the club was given a large bag to hold food and a model violin. Thanks, thanks again with more singing, the choir pouring out Ych y Da into the night. Then back to the hotel and most to bed. The rest to continue down stairs with dancing, drinking and I don't know what. Breakfast a huge meal in the morning with boiled eggs and table-cloths and we were going home. Bernard had already gone.

The rest is anticlimax really. We went to Zagreb with Nada as the guide determined to show us everything. Hazy again. We went to Zagreb T.V. studios and saw their film. Had an evening meal at the Hotel de Dome and were joined by Adolf Steinberger's sister and her husband. She is the last surviving member of the family - all had perished in concentration camps or in places like Balinka. She was anxious to show her gratitude and some of us went to their flat to see the strange mementos of the war. Drawings done by the partisans, copies of a rare underground newsletter cum magazine called 'Jama'. It had been printed in a cave. This was the history we had innocently climbed into down 300 feet of ladder. The cave had been defeated and it was time to go home.

We spent a few days in Postonja for those who had not seen the place and three days later were all back home pushing the bus up Penwyllt hill.



The journey home begins and almost ends ...



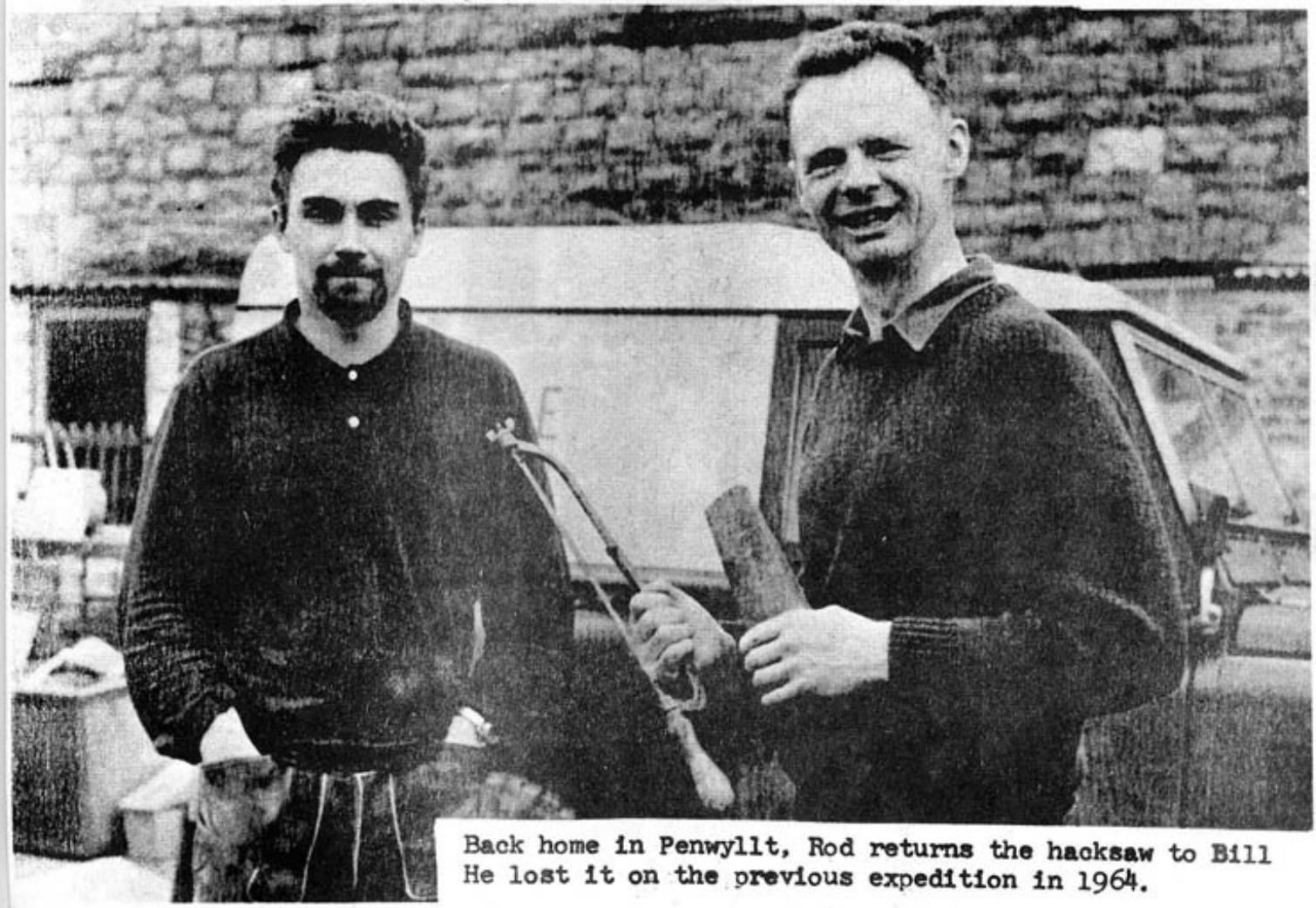
"All together now,
one at a time....."



Preparing to leave Ogulin surrounded by inquisitive locals.



Members of the expedition after a meal with the Steinbergers, relatives of one of the Partisans whose body was recovered from the pit. They are wearing the Lika hats given to them in Osulin.



Back home in Penwyllt, Rod returns the hacksaw to Bill He lost it on the previous expedition in 1964.

Getting the Cage down for the First Time, and Installing the Guide Wire.

By R. Stewart.

The winch and pit-head gear was now working satisfactorally. A few trial runs were then undertaken; it was, however, found necessary to do minor modifications. The cage was heavily cladded with aluminium plates and mesh to protect the occupants, so effectively was this done that the occupants could nèt see or even control the cage satisfactorily. Much to the horror of the cage constructors, it was set upon with saws and cutters and a triangular hole was cut in the floor; patches were also cut from the roof and walls. Another modification that had to be done was to knock off a projecting spur of rock sixty feet down the shaft at the point where it entered the main shaft; this was achieved by sitting in a canvas chair and attempting to swing a sledge hammer - a most difficult task as for every action there is an equal and opposite re-action. Nonetheless it was achieved at a cost of several pitons, a hammer head and of course the inevitable cups of tea, lowered on our patent one-mug-at-a-time tea harness. Yes, we even had a tea harness.

The next problem was to get the cage down, over the two main obstacles, the two hundred foot ledge and five fifty foot ledge which takes the form of a V notch. Working twenty-four hours a day in shifts, the cage was loaded with power cables, ropes, scaffold poles and all manner of tackle plus two elected volunteers.

All was set to go, engines roared into life, over the intercom came the instructions: "cage down slowly", and "ease the control lever forward." Gauges started to read and the cage sunk out of sight. The depth gauge was now reading seventy-two and over the phones came hushed voices, "clear of the shaft, full speed"; they were now in the top of the gynormous Balinka Pit. The job of these volunteers was to prepare the two-hundred foot ledge as a safe working area and to assist me in getting power to the five fifty foot notch. In a couple of minutes they landed on the ledge, unloaded the cage and signalled for me to haul it up.

Frank now took over driving and I prepared the cage for my trip to the five-fifty foot ledge for recce and power-line laying purposes. Once settled in the cage safely I was left suspended by the pencil-thick wire rope, surface safety lines were disconnected and I gave the signal to lower. Slowly daylight faded away, it was necessary to foot the cage away from one wall until clear of the initial small shaft. Once clear the cage hung free until the 200 foot ledge where Frank landed me softly. I joined a fresh reel of power cable to that already on the 200 foot ledge, the drum of cable was arranged to run out as I descended. With a lot of effort from the two

assistants on the ledge the cage was pushed over the edge and I signalled to the winch driver to lower slowly. From here on the cage had to be walked down to the 550 foot ledge with the exception of a few isolated patches. On route steps were necessary to put in pitons to take the weight of the power cable. On arrival at the ledge a careful examination showed two major problems. The first was how to get the cage and all its contents including the person in it, 20 feet out of vertical from where it hung in order to clear the V-notch. The second was how to return from below the V-notch in the event of the guide wire not succeeding. I returned to the surface with very little trouble, save a few dents here and there where the cage had an argument with some rocks.

After some discussion it was decided that the guide cable would go down on a reel bolted to the cage floor, and then reeled out from the bottom upwards. Laurie Galpin was elected to tackle this operation, the cage was loaded with all requirements and, of course, Laurie. He descended 550 feet and after several hours' hard work returned to the surface without succeeding to pass the 550' point. The following day, refreshed and with a lighter load in the cage, Laurie again attempted to pass the notch, but without success, possibly due to the weight of 1000 foot of guide wire. He returned disappointed, having made a very noble effort.

A further discussion took place and it was decided that I should have a go. This decided, I asked for two volunteers prepared to stay at 200 feet on the ledge for what could be two to three days. John Harvey and Gwyn Saunders decided to stay on the ledge as long as would be necessary regardless of conditions. Very careful preparations were made. Nothing was left to chance, the ledge party taking food, water and any additional tackle that might be required to assist in my ascent and descent. They were then sent down, although they did not have a lot of physical work to do, they had two things taking great effort - one was not to dislodge even the smallest pebble while they were working, the other was to be patient for a considerable time - this they did with tremendous success.

A change of plans was made, the guide wire being fixed at the top and run out as the cage travelled down; the disadvantage of this technique is the possibility of the winch and guide cables becoming tangled and twisted together. Surface cooperation had to be perfect with careful team-work for the success of this operation. The cage was loaded with excess tackle (even if there was only a faint chance of something being needed it was put in the cage), every single item on its own safety line, for the loss of even one essential item could jeopardise the whole operation. Finding the critical item for the return journey missing would be distinctly embarrassing.

I found it rather difficult to find room for myself in the cage with all the clutter of kit. With the tensionometer reading 710 lbs. I started down, at 200 ft. I had assistance to get the cage over the ledge from John and Gwyn; because of the weight of cage they had quite a push. From here on it was just a matter of footing off the walls and ensuring that the guide wire was following down satisfactory, until reaching the 550 foot notch. To make space I reeled out the last 300 ft. of power cable, anchored the top end and plugged it into the cable already at the 550 ft. notch. I

then looked around with the cage search light and found that the main winch cable was stuck in a slot about 300 ft. above; the only solution was to take the load off the cable and flick it out of the deep slot.

Three large pitons were driven into the rock that the cage was resting against, to these the cage was belayed securely. I then called the winch driver to let out some slack, a voice croaked back over the phones, "I hope you know what you are doing." The desired two feet of slack arrived and the cage slumped onto its belays. By climbing on to the roof of the cage and shining the search light up the cable it was possible to send a wave up the cable, releasing with it also some rocks. I flew back into the cover of the cage. Immediately there followed a heavy crash, once again the cage roof was modified, the rocks boomed on into the distance. A signal to surface and the slack cable retentioned.

Belays removed, I lasseed a stalagmite boss about 30 ft. out from the notch. Several attempts were made before one was successful and then only after weighting with a heavy pulley. I was now able to pull myself and the cage clear of the notch. I signalled to be lowered, the cage once again cleared all obstructions and hung free. Shortly the cage touched down at about 700 ft. on a steep scree slope. After examination of the area I decided where to fix the guide wire to achieve the most satisfactory angle; if this was too excessive the load on it when the cage is in its mid point would exceed its breaking strain. Unfortunately the only suitable location was a giant boulder on the scree slope. The Kango hammer soon drilled a suitable hole for the rawl bolt fixing; this done and rawl bolt fixed, the guide wire was threaded through the slipper shoe on the back of the cage and then anchored to the rawl bolt. From the cage there were two forms of communication. These were telephone and radio; by talking to both the winch driver and the guide-wire tensioning team it was possible to get the cage to its new position, this done with slight difficulty and nearly being hung by the head phones. I then cooked up a large lunch and dinner on the cage floor; this was quickly consumed, and all excess kit removed from the cage.

When safely back in the cage the signal was given to raise slowly; up went the cage beautifully - as smooth as a lift in a multi-storey building. I was now sure all was well. Alas! somewhere Sod's Law crept in and a ghastly vibration started. This steadily grew worse so at 230 ft. I had to stop the cage and investigate the trouble. Upon examination the guide wire had become wound twice around the winch cable. There was only one solution. That was to swing the whole cage over the guide wire. To do this it was first necessary to pull the bottom of the cage in to the guide wire; this could just be reached by lying on the floor and reaching out for it and pulling the cage to it, then temporarily securing it. Bracing myself in the cage and swinging it, it was possible to swing it over the guide wire twice. The temporary securing was released, the driver was signalled and a safe, smooth ride took me to the surface.

After a few minor adjustments it was possible for the cage to travel up or down with one or two persons, or empty, taking six minutes down and ten up without a stop.

R. Stewart.

Balinka Bottomed.

After very much hard and painstaking work, Balinka Pit was at last bottomed on 30' of electron ladder.

This was in the very early hours, after a hard day's work, and most of the expedition were in bed.

Four of us - Bernard, Gordon, Gwyn and Colin - were doing a recce trip to see if the 700' winch was needed. Two ladders were fixed and descended, one 40' and one 30', the last over a great mountain of stalagmite. Everywhere was a "danger zone" of pebbles coming down the shaft above and cascading down the 45 degree slope. Ahead was a great black space, and pebbles clattered away and then - silence! Could it be some huge bottomless pit? Another ladder was fixed - all 60' of it - and this was found to hang over a huge overhang of stalagmitic false floor, 3' thick, and 30' at best from the wall. We were convinced we were looking down into a huge passage. One pair of boots climbed steadily down the ladder and found 30' spare on the floor! The latter was a great boulder scree about 40' to 50' wide and about 40 degrees slope. Found on it was refuse of the 1964 expedition in the form of tin cans, ally. tube and hacksaws, also odd bones and tree trunks. At the bottom of the great boulder pile was the explanation of the sudden silence of falling pebbles. It was - mud! OOzy 9" deep mud!! Steadily probing ahead with a convenient length of tubing, the lone explorer came to a great towering wall. Then found it was the same wall he had been following, and that it went right back to where he had started from! A tiny hole at the very bottom didn't go - it was too small. The lowest point obviously backed up to a depth of 10' to 15' in very wet times.

Although the expedition achieved its major objectives - to bottom Balinka Pit and remove the Partizans' remains - disappointment was acute. Everyone had had high hopes of huge open passages, but there were those who said, "I told you so!"

But then - that's caving. Who <u>can</u> tell what's around the next corner?

C. Graham.

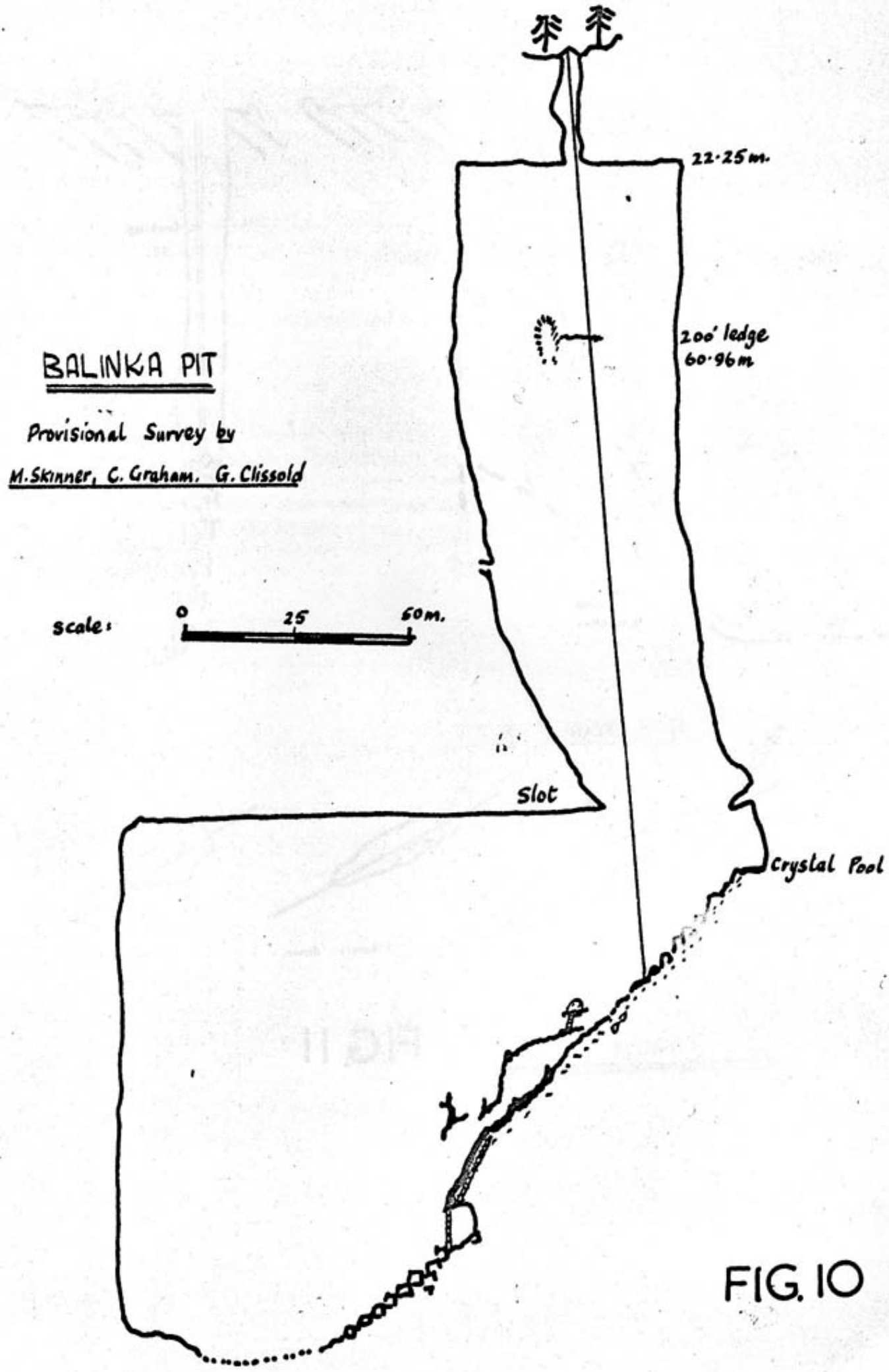

BALINKA PIT
Provisional Survey by
M. Skinner, C. Graham, G. Clissold
scale:
0
25
60m.
22·25m.
200' ledge
60·96m
Slot
Crystal Pool

FIG. 10

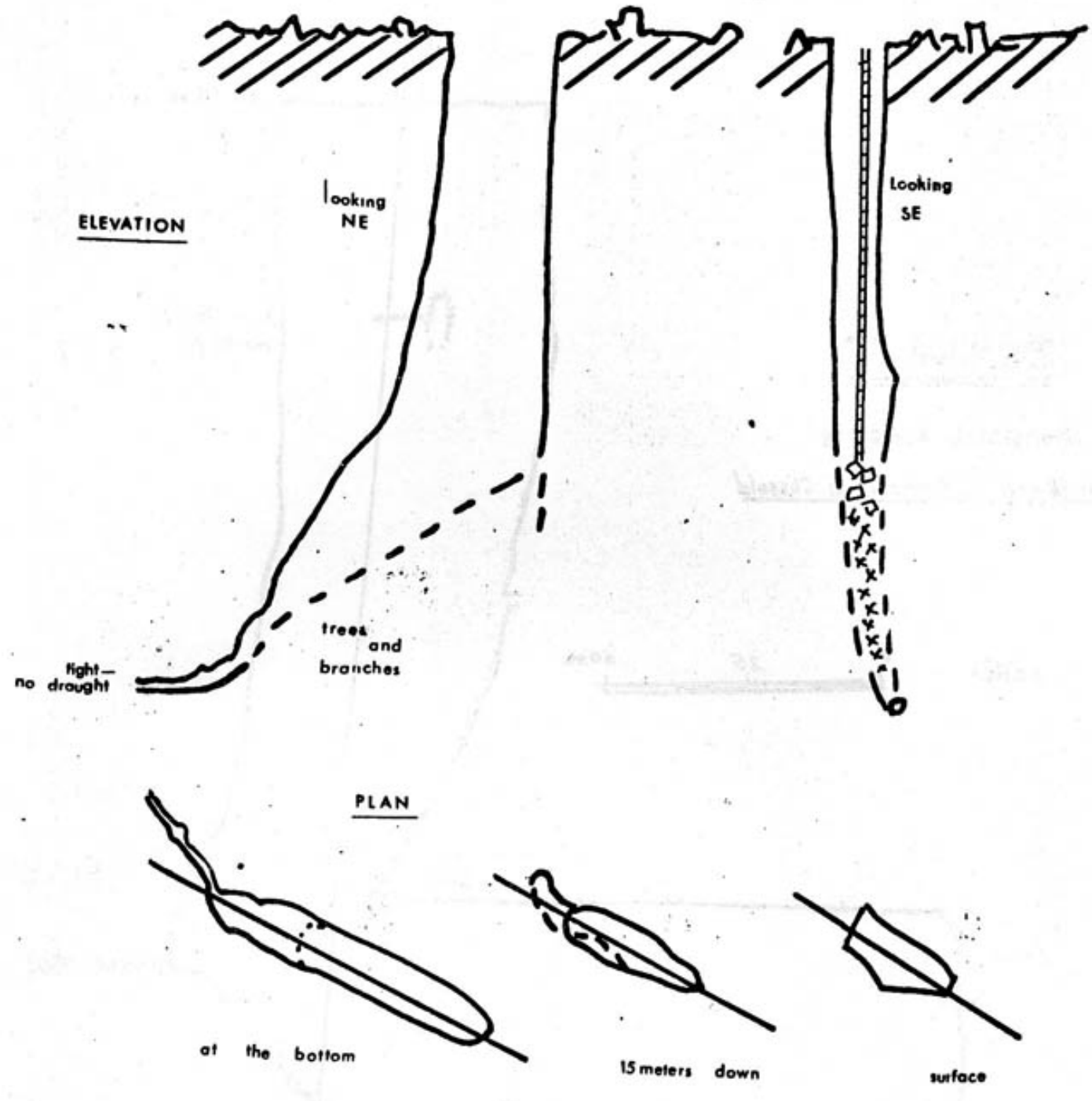

ELEVATION
looking NE
Looking SE
trees and branches
light— no drought
PLAN
at the bottom
15 meters down
surface
metres
0
20

FIG. 11

Some Nearby Caves.

During our stay at Balinka we visited a number of small potholes and caves in the surrounding area, some down near the dry lake, Blata, and others higher in the surrounding hills. One 70 foot pot (Fig. 11) was in the Balinka crater itself but unconnected with the main pot. About a hundred yards down the hill from Balinka was another large shaft which we descended one rainy day; it was 75 feet deep and full of discarded branches and was inhabited by one very large, fat toad.

Vidrovka (Fig. 12), the bone cave, was visited on two occasions, guided by the local forester, with whom we conversed in sign language. This short cave, (200 - 300 feet) is situated in a large dolina about 1½ to 2 miles from Balinka through thick forest. It has a short 20 ft. pitch and at the end the villagers have dug on for 20-30 feet in search of Turkish treasure reputedly buried there. The first hundred feet of the cave was littered with bones, and our resident archaeologist also found bits of pottery.

Not far from Vidrovka was a large pot with a sloping cave entrance; boulders thrown down faded out of hearing after about 23 seconds, bouncing most of the way, so it is probable that they hit a number of ledges on the way. This pot was never descended.

Down near the edge of Blata, about 40 feet above the lake bottom, was a pot with a cement roof, with three square holes (Fig. 13). A cover had been built over the hole and at one end the pot was connected by an adit to the lake; the other end narrowed down to an impassable squeeze. Using sign language, we gathered from a passing farmer (besides very illustrative representations of war time bombing) that during winter when the lake flooded the water came up the adit, overflowed up through the holes in the cover of the pot and sank about twenty yards away, in the same shake-hole. On parting some branches, we found a small cave entrance which, after a small chamber, narrowed into a small rift.

Not far from the last pot, we came across a large shake hole near the road, which had some draught-blown ferns on one of the sides; scraping away some of the loose rubbish around it, we exposed a howling draught, - but nothing else - a couple of days might discover something?

On another occasion a small pot near the Plaski turning at the end of the lake (Fig. 14) was visited. Four villagers were reputed to have been shot and thrown down this pot during the war by the Germans. No one had descended it since. It turned out to be about 70 feet deep, sloping and possible on a rope. We found at the bottom remains of five people (five skulls and assorted bones - one of the skulls had gold filled teeth), assorted animal bones and a flight of a mortar bomb.

H. Ball.

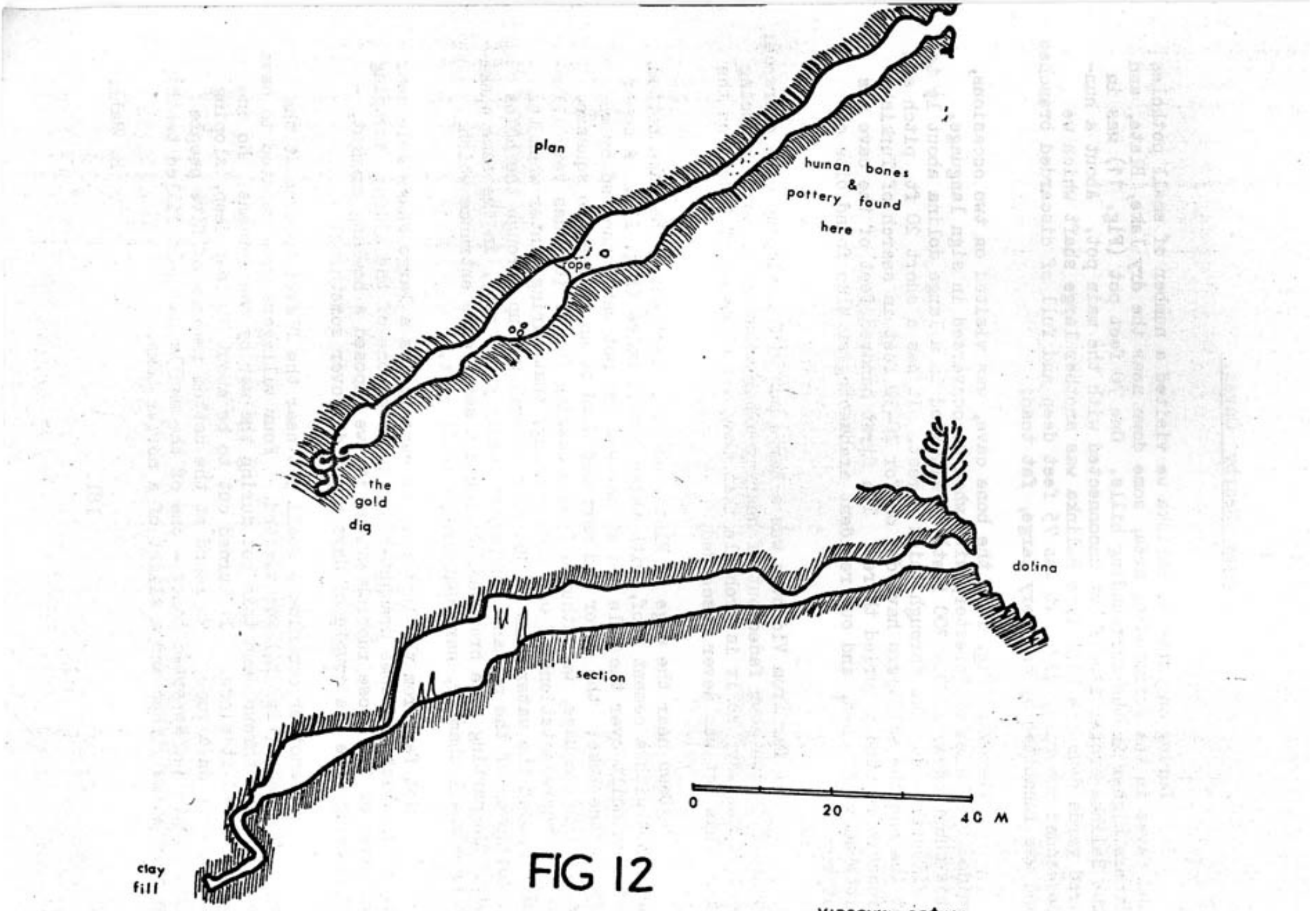


FIG 12

VIDROVKA PEČINA

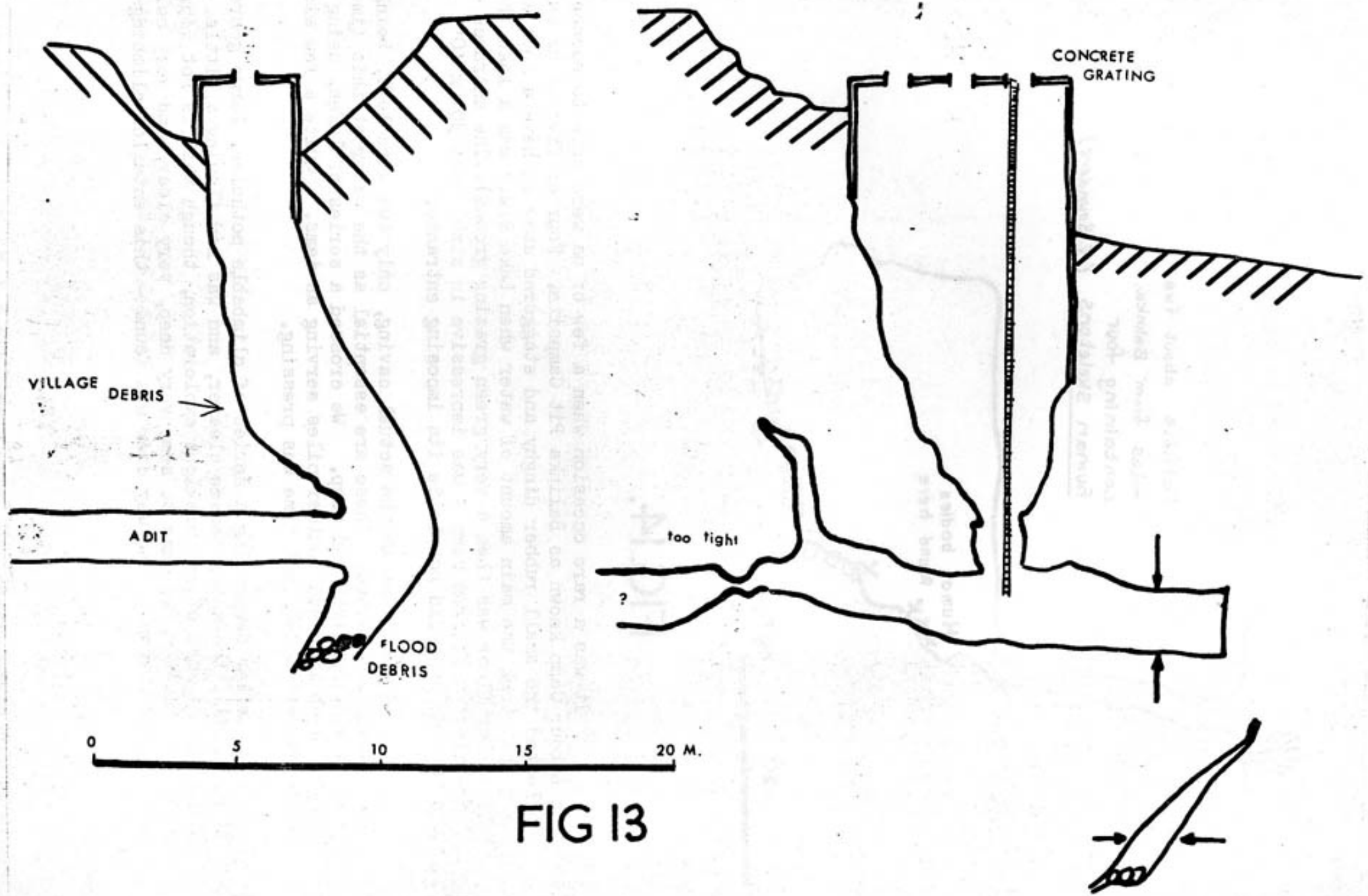

VILLAGE DEBRIS
ADIT
FLOOD DEBRIS
0
5
10
15
20 M.
CONCRETE GRATING
too tight
?

FIG 13

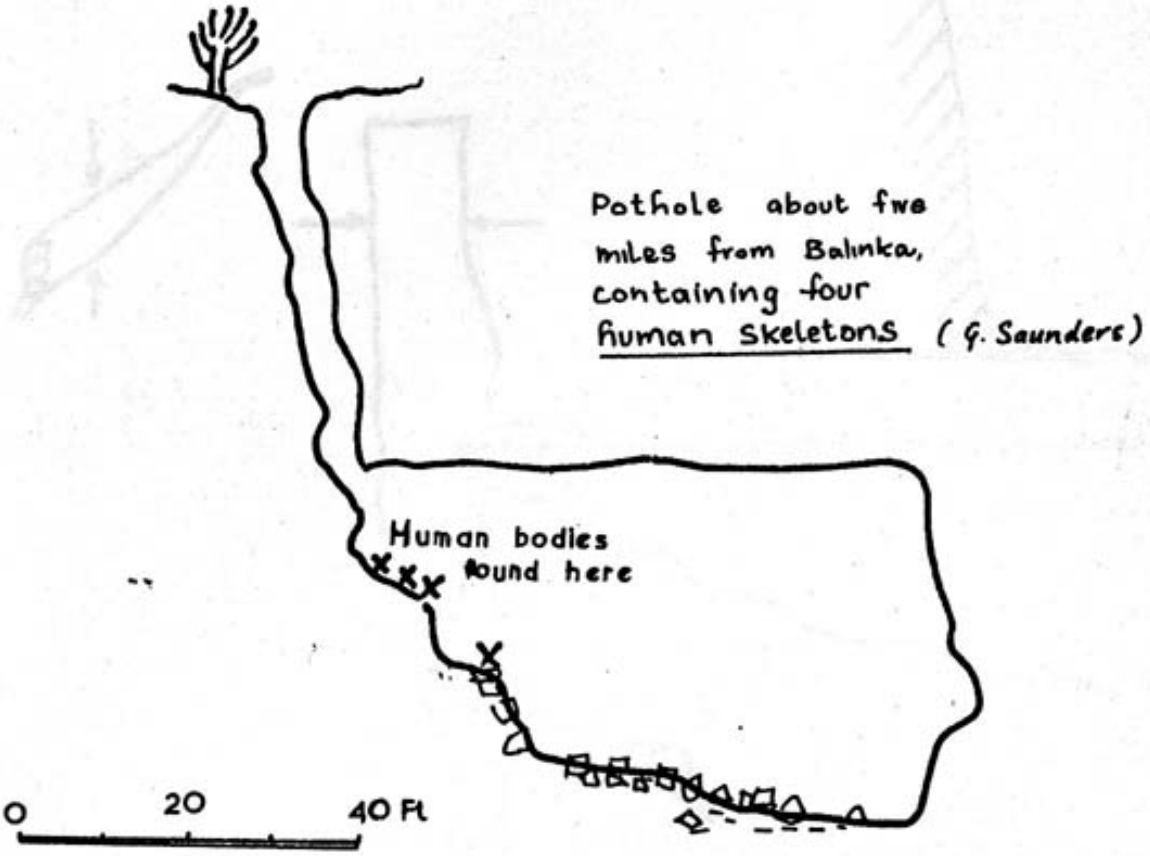


FIG. 14.

It was a rare occasion when a few of us were able to escape from the Labour Camp known as Balinka Pit Campsite. Four or five of us duly collected the small rubber dinghy and staggered away to have a look at the cave that took the main amount of water when Lake Blata was a lake (Fig. 15). (The valley floor was then a very green grazing ground). The entrance - about four miles' walk from camp - was impressive in size, some 30' x 40'. Inside, the cave passage did not belie its imposing entrance.

When it came to the actual caving, only two were left, being the only madmen wet suited. These are essential as the water at this time of year is static, dirty and deep. We crossed a series of lakes, using the dinghy, each lake had boulder piles serving as dams. Quite a few side passages were noted, but time was pressing.

After descending a series of climbable potholes, large gours and cascades, the water became clearer, and was now flowing a little. There was no sign of any previous exploration, though this is not improbable. Eventually, we came to some very deep, very clear, and very cold water, with a sump. The way over was found - this entailed climbing out

Sketch of River Cave at Lowest Point of Lake Blata.

(C. Graham).

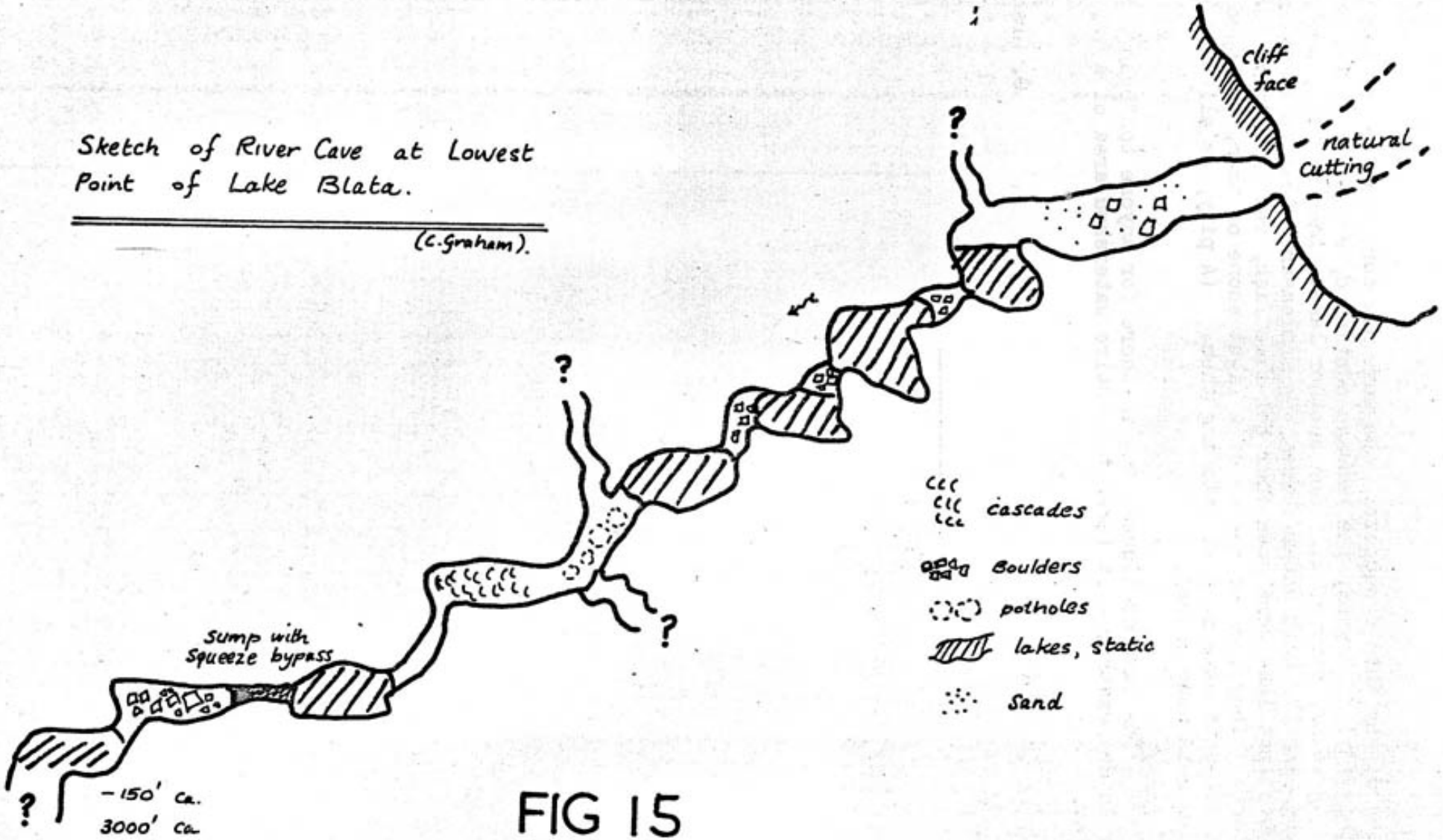


FIG 15

of the dinghy into a squeeze. We were now sure that no one had tried it <u>this</u> far! Beyond, the passage continued, about 20' x 20', with flowing water, very clear, then another lake. Lack of time, another dinghy, and the cold water forced the unpleasant decision to return. In this last lake were seen four eel-like fish, red in colour, about 9" long. They took no notice of a light shone on them, but sped off when attempts were made at catching them. (A pity, as all we'd have needed were some chips).

The cave continues, and is there for anyone to "push", but only in dry weather - it takes the entire watershed area of a very big valley.

C. Graham.

Scientific Results - Synopsis.

HYDROLOGY

The hydrology of the area around Blata is complicated and the expedition was unable to contribute significantly to what is already known of this karst area. The significant hydrological features are shown on the map and these are considered individually.

BLATA (Begovac)

The lake is a flooded polje lying on the junction of Mezoic Dolomite and the Upper Cretaceous Limestone. It is fed by several normal springs and during the winter by estavelas or reversible springs. Early in the year as the water table drops the estavelas stop flowing and then start to act as sinks, helping the two areas of normal sinks to drain the lake. The lake then empties and is grazed for the summer months until, in the autumn, the flow increases and the flow starts from the estavelas again, flooding the lake again.

The underground drainage from Mali Kapelle and other hills around feeds the lake and the channels beneath it. This water probably meets up with that sinking from the lake which has been traced to the rising at Mreznica. This subterranean drainage is also connected to Sinjac.

The hydrology of the area is so complicated that it is possible that some water sinking at Blata may reappear at the more eastern rising of Slusnica.

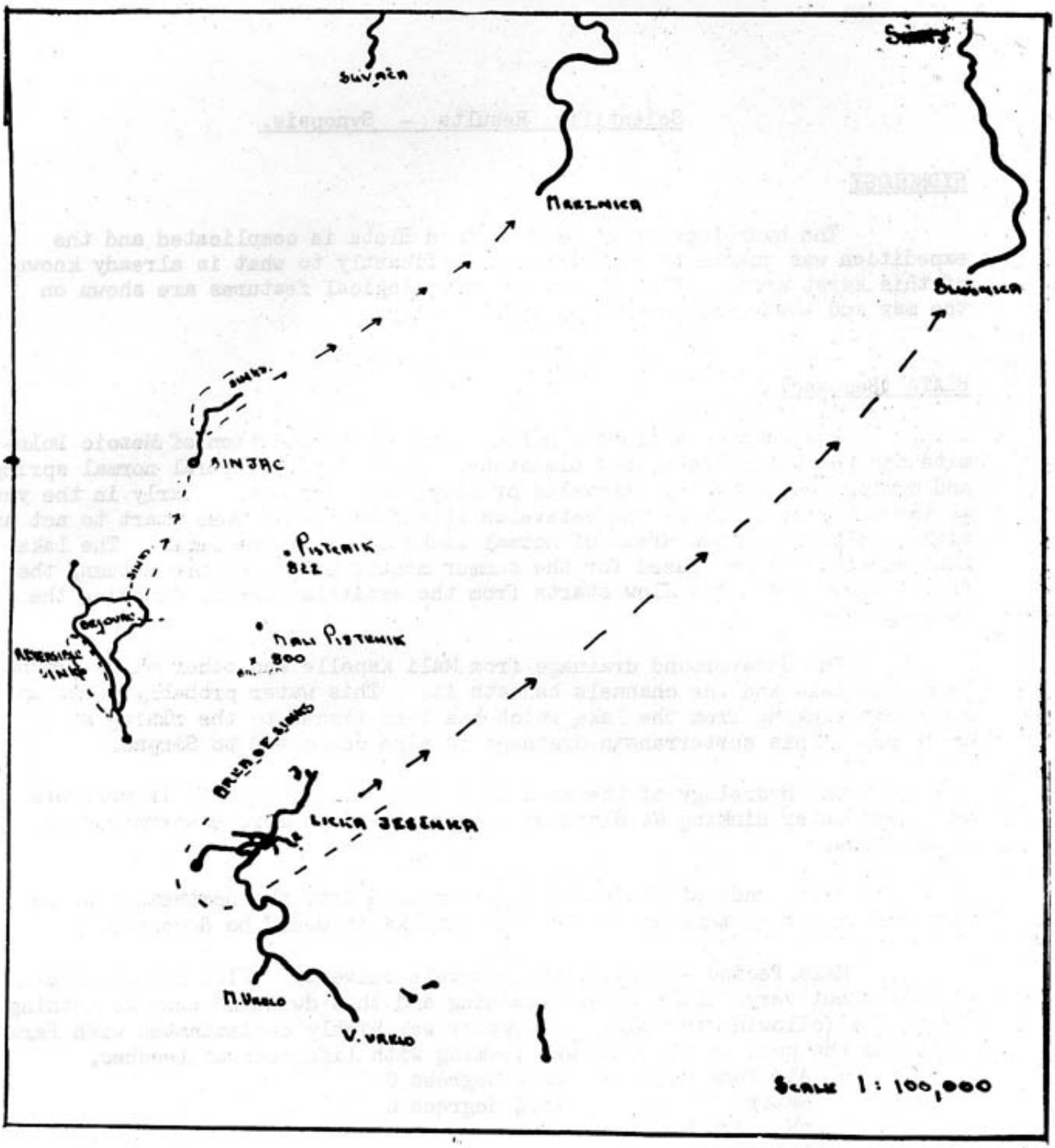
Ten pounds of Rhodamine B were placed into the northern sink so that should any of this water pass via Balinka it would be detected.

Mala Pecina - Blata sink (concrete culvert) Flow 140 gal/min when dyed but very little water remaining and this dwindled away to nothing during the following few days. The water was highly contaminated with farm waste and the pool at the sink was teeming with life such as leeches.

Air Temperatures 22.2 degrees C
Water " 25.4 degrees C
pH 7.6 to 7.8
164 ppm Ca.
48 ppm Mg.

Licka Jesenica:

This river rises south of the village of Jesenica, flowing northwards and sinks over a wide area before finally disappearing at three places in the village. When we visited the area the water conditions were such that the river grew as we went upstream. The bed contains many small sinks



and the several 'tributaries' were negative ones, taking water from the main river to sinks. Mills had been built directly over two of the final sinks and the water from these has been traced to the rising of Slusnica.

It was considered possible that some water from this area might connect with the Blata-Mreznica system, passing via Balinka. Consequently 15 lbs of fluorescein were placed into the northern sink in the village.

Sink at the northern Mill near the old castle

Flow 700 galls/min - Water Temperature 9.5 degrees C,
pH 7.6, 176 ppm Ca, 64 ppm Mg.

Sink at the Southern Mill

Flow 210 gall/min and slowly reducing
Air Temps 20.6 degrees C. Water Temps 12.8 degrees C.
pH 7.6, 158 ppm Ca, 62 ppm Mg.

Northern sink: Flow 35 galls/min increased considerably the following day because of a temporary dam at the nearby mill.
Water highly contaminated, pH 80-82, Temps 22.0 - 24.0.
140 ppm Ca, 50 ppm Mg.

The river at its full flow had a flow of the order of 25-30,000 gal/min. This water was fresh and having just emerged at a rising, was cold. It sank at numerous places before reaching the village area but its flow to the final sinks was slow and this is shown by the rise in water temperature from 9.5 degrees C to 22.0 degrees C.

SINJAC:

This small pond is a rising which is known to connect with the Blata-Mreznica system. The water resinks after a short surface course which reappears at Mreznica. No dye appeared here.
Flow rate 700 gal/min, Air Temps 22.0 degrees C, Water Temps 17.8 degrees C, pH 7.8, 148 ppm Ca, 38 ppm Mg.

SLUSNICA:

A large river rising at the base of the cliff at the head of a wide deep gorge. There is no cave here, the water rises from the bottom of a deep pool and in the first few hundred yards of river it drives many mills. The millers, like all the local people, are interested and helpful and offered to watch for any dye that appeared.

The flow rate at Slusnica was of the order of 37-40,000 gals/min. which suggests that it could take all the water from Licka Jesenica.

Air Temps. 19.0 degrees C. Water Temps 10.5 degrees C pH 7.0
188 ppm Ca, 30 ppm Mg.

MREZNICA:

Another sizeable rising flowing from a wide entrance in the cliff at the head of a valley. The entrance has been obscured by cliff falls but there are still open ways in. This once populated area is now a military zone and the mill situated at the rising is now partially derelict. It is still lived in, however, as it is near the edge of the zone. The army posted an observer here to watch for the appearance of any dye. None was seen.

At Mreznica the flow rate was of the order of 12-16,000 gals/min.
Air Temps 22.0 degrees C. Water 12.2 degrees C. pH 7.4.
176 ppm Ca. 84 ppm Mg.

BALINKA JAMA:

It was hoped that Balinka would contain a river system which we would be able to tie in with the known hydrology of the area. For this purpose two sinks were selected and dyed different colours.

However, Balinka contained no water course and was not on the route of any of the main drainage paths. The lowest part of the large chamber was floored with mud, partly dried out and partly still wet. There were no channels left that would suggest any significant flow. When the position of the bottom of Balinka was considered in relation to the heights and locations of the surrounding sinks and risings it became obvious that the bottom of this enormous shaft approximates to the level of the water table.

During the wet season it floods to about 5' and then as the summer comes and the water table drops, the water percolates away.

The pool at the bottom of the first ladder pitch, i.e. Station 3.

pH 6.4 Water Temps 10.0 degrees C. Air Temps 11.1 degrees C.

Relative Humidity 90

The pool in mud at cave bottom, i.e. Station 4.

pH 6.2 Water Temps 9.4 degrees C. Air Temps 11.1 degrees C

Humidity 84

The work done has not contributed significantly to the knowledge of local hydrology. Balinka is not on the path of any main drainage channels and the purpose of colouring the two sinks was for detection at Balinka not at the known risings. Thus it is not surprising that no dye was seen at these risings.

The water temperatures are related to the time of flow above ground but the slightly high value of 12.2 degrees C. at Mreznica suggests dilution by a surface stream near to the eventual rising.

The flow rates were approximate values because of the rapid decrease in flow at that time of the year. They suggest that Slusnica could take all the water from the river Licka Jesenica.

Balinka Pit. - RESULTS 1964.

720 feet vertically down.

Sample 13.	Moss from piece of wood on floor.		
	Musci	Brachythecium rutabulum	
	Hepaticae.	Jungermannia cordifolia	
Sample 14.	Mould from piece of wood on floor.		
	Perenosperales.	Pythium? proliferum	
	Chrysophyceae.	Oocystis solitaria	
Sample 15.	Mud sample from floor.		
	Myxophyceae.	Oscillatoria laetevirens * **	R
		Oscillatoria limosa * **	R
	Chrysophyceae.	Navicula cincta	R
		Caloneis schroderi	O
	Chlorophyceae.	Chlorococcum humicolum *	A
Sample 16.	Algae from piece of wood on floor.		
	Myxophyceae.	Chroococcus dispersus	O
		Entophysalis confervicola	R
	Chrysophyceae.	Tabellaria fenestrata	F
		Rhoicosphenia curvata	O
		Navicula cryptocephala *	O
		Navicula vitabunda	O
		Surirella ovata *	R
		Gomphonema olivaceum	R
		Cymbella turgida	R
		Epithemia turgida	R
	Chlorophyceae.	Oedogonium sp.	R
Sample 17.	Mud from floor.		
	Myxophyceae.	Nostoc punctiforme ** (dark form)	A
		Anabaena affinis **	A
		Chroococcus turgidus	R
		Phormidium laminosum	R
	Chrysophyceae.	Stauroneis phoenicenteron	O
		Pinnularia subcapitata	O
		Achnanthes exilis	O
		Frustulia rhomboides	R
		Amphora ovalis var. pediculus	R
	Xanthophyceae.	Cryptomonas anomola *	R
	Protozoa.	Bursaria sp.	R
Sample 18.	From wood and calcite nodules.		
	Myxophyceae.	Lyngbya martensiana	A
		Anabaena affinis **	A
		Phormidium foveolarum	F
		Gleothece sp.	F
		Oscillatoria laetevirens **	O

Sample 18. (cont'd)

Chrysophyceae.	Epithemia turgida	R
	Eunotia exigua	R
	Achnanthes dispar	R
Chlorophyceae.	Chlorococcum humicolum *	F
	Scenedesmus quadricauda var. maxima *	F
	Flagellates (colourless)	O
	Paramecium sp.	O
	Nematodes	O
	Pythium sp. oogonia	O

Sample 19. Mud from floor.
Moss protonemata ? Physcomitrium pyriforme - Leaves reduced, internodes very elongate, midrib reduced.

Myxophyceae.	Oscillatoria brevis **	O
	Oscillatoria limosa * **	O
	Phormidium laminosum	L.A.
	Anabaena affinis **	O
	Pleurocapsa minor	L.A.
Chrysophyceae.	Navicula cincta	R

* Common in organically enriched areas.

** Nitrogen fixers.

Slime producing species:-
Gleocapsa
Aphanocapsa
Phormidium
Oscillatoria
Anabaena
Nostoc

K. Benson-Evans
D. Fisk

Balinka . 1964.

Fungi on the 720' ledge.- on wood.

Larger Log. Armillaria mellea. rhizomorphs.

Trichoderma viridi.

Smaller Log. Trichoderma viridi.

unidentified basidiomycete rhizomycelium.

R. Harvey,
Cardiff.

Entomological Specimen from 720' ledge.

Parapropus sericeus sinuaticollis Absolon et Maran.

Das aus der Schachthole Balinka stammande Mannchen differiert durch etwas bauchigere Flugeldecken von den Exemplaren aus der Hohle bei Nova Krslja, woher die obgenannte Rasse beschrieben ist.

Zwecks Feststellung der volkkommenen Identitat mit der Rasse simuaticollis ware weiteres Material notig, da das einzige vorliegende Mannchen vielleicht nur eine individuelle Aberration vorstellt.

Egon Pretner.

Institut za raziskovanje krasa SAZU.
Postojna, Titov trg 2.

Balinka Pit. - RESULTS 1966.

River bed samples - Mala Pecina.

1. Chrysophyceae

Navicula gracilis	O
N. vulpina	O
N. cryptoceohala	F
N. rhyncocephala	O
Surirella linearis	R
Frustulia rhomboides	O
Achnanthes affinis	R
Synedra pulchella	R
S. acus	R
Cymbella ventricosa	R
Pinnularia viridis	R
Ceratoneis arcus	R

Chlorophyceae

Chlamydomonas sp.	R
Microspora tumidula	R
Oedogonium sp.	R

Myxophyceae

Oscillatoria formosa	R
Phormidium laminosum	R

Slusnica.

2. Chrysophyceae

Navicula gracilis	R
N. cryptocephala	R
N. similis	R
Gomphonema olivaceum	R
Cocconeis placentula	R

Myxophyceae

Phormidium foveolarum	R

700 ft. samples.

From Pool near Kitchen

1. Myxophyceae

Pleurocapsa minor	R

2. Chrysophyceae

Tabellaria flocculosa	R

Myxophyceae

Pleurocapsa minor	R

From stalactites

4. Nothing found in this sample

Wall Scrapings

B. Yellowish mud

Chlorophyceae

Chlorella vulgaris	O
Eremosphaera viridis	R

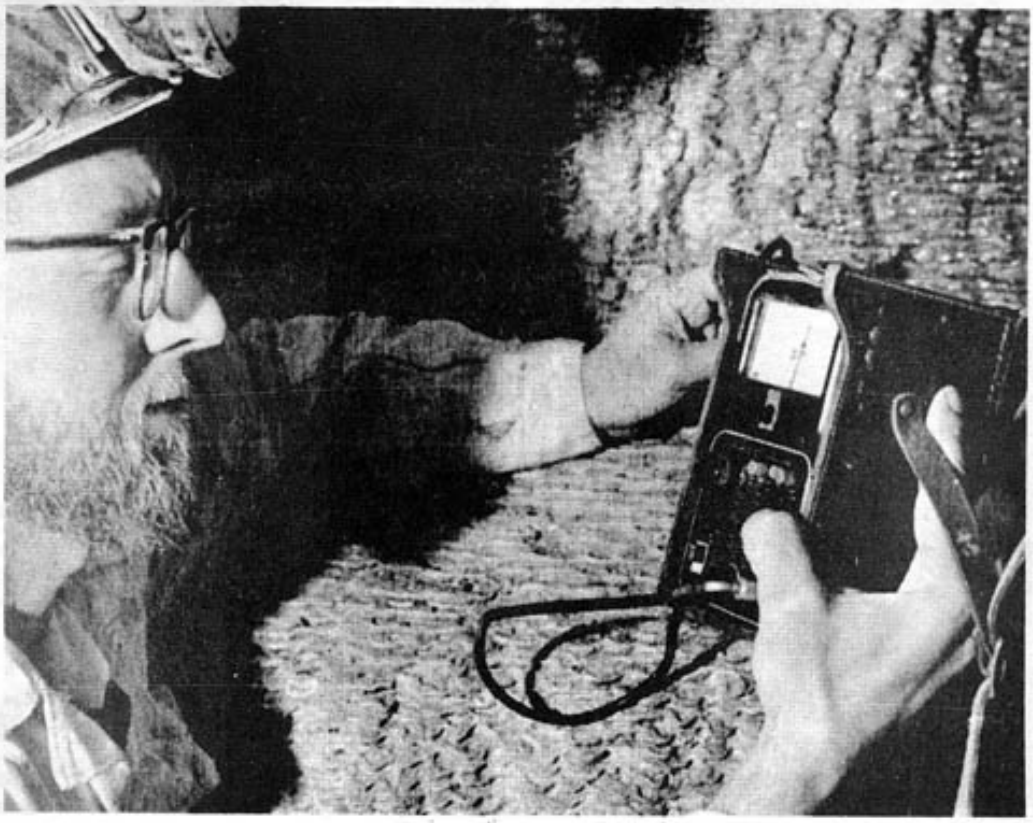
Nothing found in any of the other samples in this region.



Underground cine work.

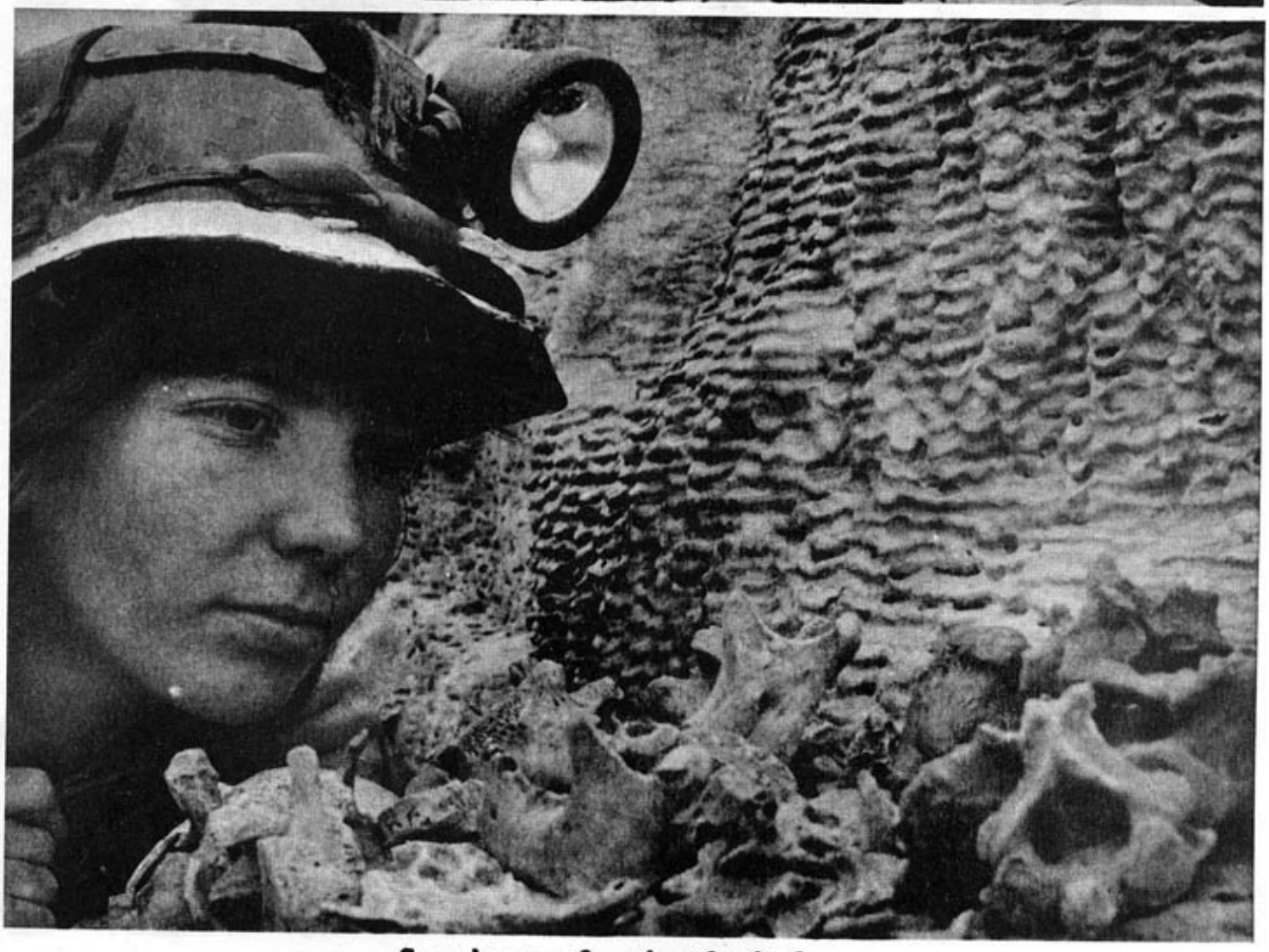


Using the pH meter underground and on the surface.





Gordon surveying the shaft.



Some bones of archaeological interest from Vidrovka.

Yugoslav Caving Expedition - 1966.

Balinka Pit - small water samples. Plankton.

1. Mala Pecina

Chrysophyceae		Chlorophyceae	
Cymatopleura solea	R	Micractinium radiatum	R
Frustulia rhomboides	R		
Synedra acus	R		
Stauroneis phoenicenteron	R		

Sinjac

3.

Chrysophyceae		Chlorophyceae	
Navicula gracilis	R	Chlorella vulgaris	L.O.
Synedra acus	R	Chlorococcum humicolum	R
S. ulna	R		

Others

Fungal hyphae	L.O. on fibres
Bursaria	R

Slusnica

4.

Chrysophyceae		Chlorophyceae	
Navicula gracilis	R	Chlorococcum humicolum	R
N. viridula	R	Chlorella vulgaris	R

Licka Jesenica

6.

Chrysophyceae		Chlorophyceae	
Pinnularia viridis	R	Scenedesmus quadricauda	R
		Microspora elegans	R
		Prasiola crispa	R

7.

Chrysophyceae		Chlorophyceae	
Cocconeis placentula	R	Chlorococcum humicolum	R

3.

Chrysophyceae		Chlorophyceae	
Navicula gracilis	F	Eremosphaera viridis	R
N. viridula	O	Pediastrum boryanum	R
N. cryptocephala	R		
Pinnularia viridis	R	Myxophyceae	
Cocconeis placentula	R	Oscillatoria lauterbornii	R
Amphora ovalis	R	O. laetevirens	R
Synedra ulna	R		

Unlabelled small water sample

Chrysophyceae		Chlorophyceae	
Navicula gracilis	R	Chlorella vulgaris	L.O.
Synedra ulna	R	Chlorococcum humicolum	R
Others		Pediastrum boryanum	R
Fungal hyphae	R		

Small H20 Samples.

Licka Jesenica.

Sample 8.

Chrysophyta.	
Melosira granulata	R
Navicula viridula	O
Cocconeis placentula	R
Synedra acus	O
Pinnularia viridis	R
Frustulia rhomboides	R
Navicula gracilis	R
Micractinium radiatum	O
Chlorophyta	
Chlorococcum humicolum	O
Pediastrum Boryanum	R
Dictyosphaerium ehrenbergianum	R
Protozoa.	
Bursaria	R
Gymnosperm fibres	O

MOSSES.

BRYOPHYTA Balinka Pit.

Bag 1.

Musci
Ctenidium molluscum
Neckera crispa

Algae
Nostoc colonies

Bag 2.

Musci
Thamnium alopecurum
Mnium undulatum
Fissidens adianthiodes
Neckera crispa

Hepaticae
Aplozia riparia

Bag 3.

Musci
Neckera crispa
Thamnium alopecurum

Hepaticae
Conocephalum conicum
Aplozia riparia
Metzgeria furcata

(Bag 1. Rock surfaces around Pit Top.
2. 10' down S. side - shady all day.
3. 10' down N. side - in sun.)

K. Benson-Evans
D. Fisk

Balinka Pit Expedition 1966.

(SAMPLES From 700 and beyond)

Diptera

1. Trichocera regulationis Linnaeus (Trichoceridae)

   Not a typical troglobite but sometimes overwinters in caves. Probably from 200 feet ledge.

2. Leptocera (Limosina) racovitzai Bezzi ? var. microps Duda (Sphaeroceridae)

3. Heteromyza ? rotundicornis Zett. (Heteromyzidae)

   Both troglobites.

Collembola

4. Tritomurus sp. (Tomoceridae)

5. Psuedosinella sp. (Entobryidae)

   Both species have characteristics of troglobites and belong to a group poorly represented at the B.M.

Coleoptera

6. Parapropus sericeus (Schmidt) Silphidae; Bathysciinae;

   (no comment on subspecies)

Arachnida

8. Parastalita stygia (Joseph) (blind) V. interesting. spider new to collection.

9. Ixodes vespertilionis C.L. Koch Widely distributed tick on bats.

10. Neobisum genus of pseudoscorpion. Subgenus Blothrus.

    Closely related to species spelaeum (Schiödte)

Crustacea

Failed with Niphragus sp. To be sent to E. Europe.

Fish Sinjac

7. Paraphoximus sp. They haven't one exactly like this and can't be certain of species - may be new.

C. Harvey.

Partisan's Song.

Po sumama i gorama
Nase zemlje ponosne
Idu cete partizana) twice
Slavu borbe pronose)

Neka znade dusman kleti
Da ce kod nas slomit vrat
Prije cemo svi umrijeti) twice
Neo svoje zemlje dat)

(Song about the partisans creeping through the forest in the snow on their way to an ambush.)
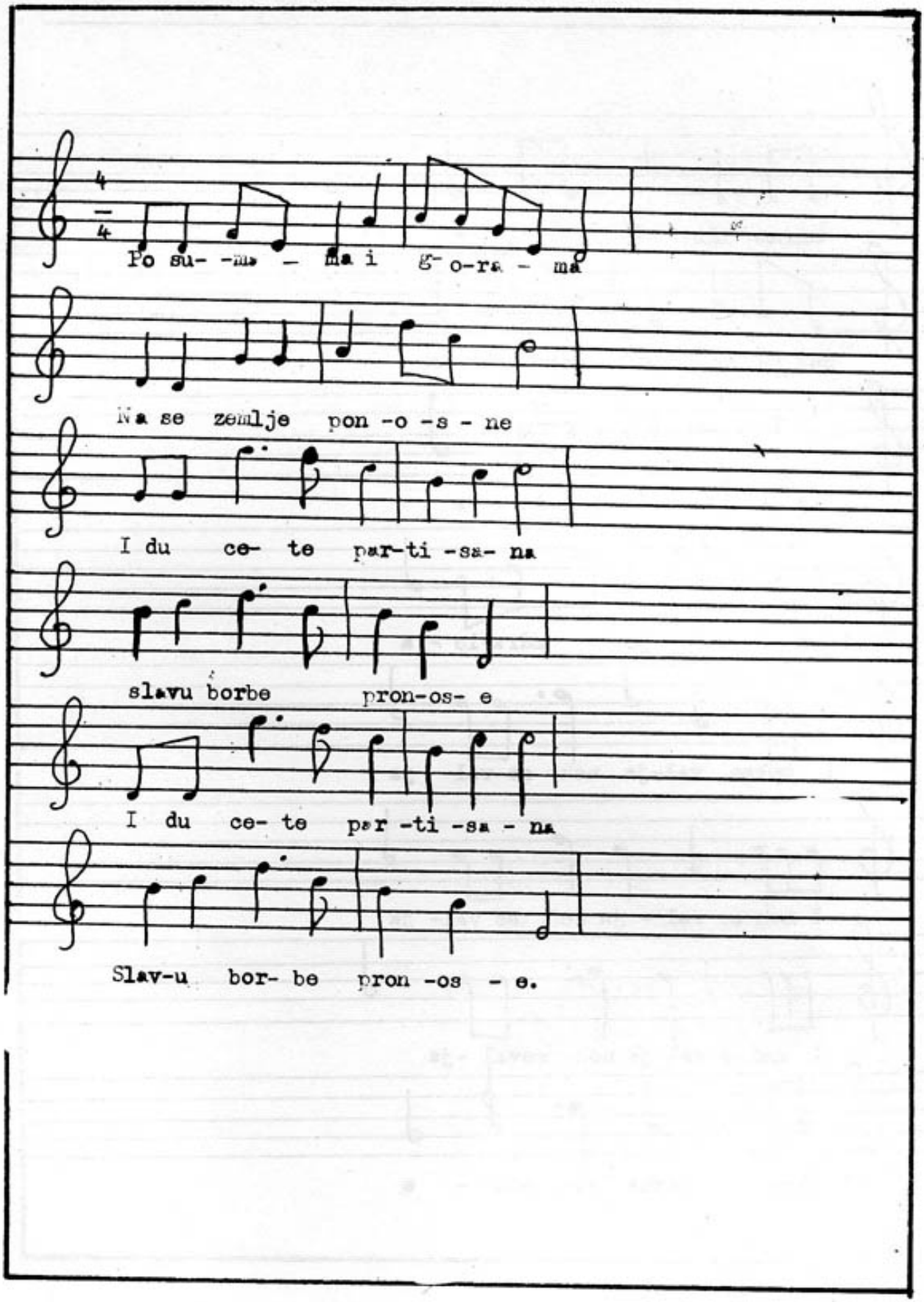
Drinking Song.
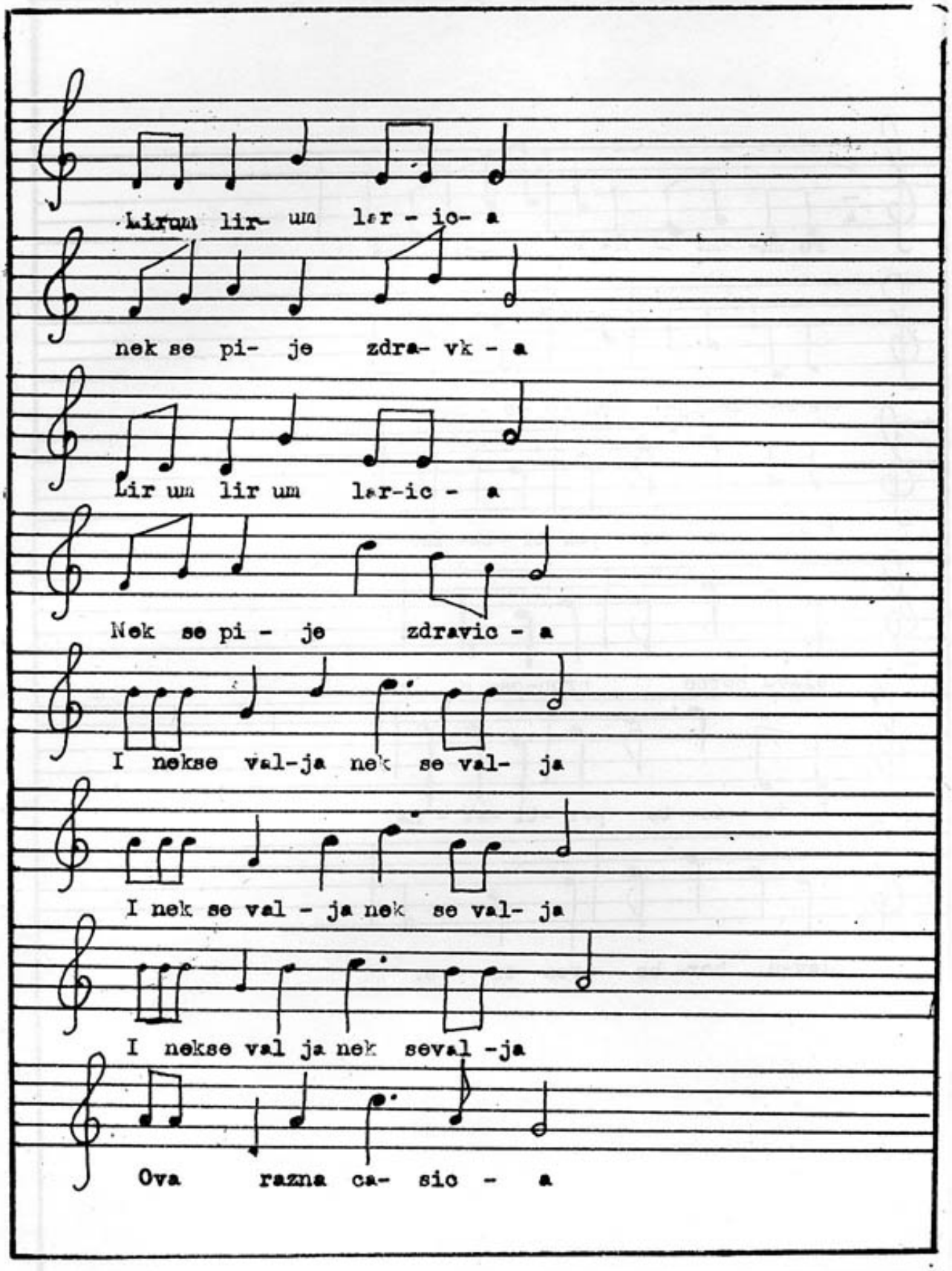
Lirum lirum larica) twice before each verse
Nek se pije zdravica)

1. I nek se valja -- (three times)
   Ova prazna čašica

2. I nek se puni -- (three times)
   Ova prazna čašica

(note: č = ch
š = sh)


Po su- -ma - ma i go-ra - ma
Na se zemlje pon -o -s - ne
I du ce- te par-ti -sa- na
slavu borbe pron-os- e
I du ce- te par -ti -sa - na
Slav-u bor- be pron -os - e.


Lirum lir- um ler - ic- a
nek se pi- je zdra- vk - a
Lir um lir um ler-ic - a
Nek se pi - je zdravic - a
I nekse val-ja nek se val- ja
I nek se val - ja nek se val- ja
I nekse val ja nek seval -ja
Ova razna ca- sic - a

PART 3.

1. Planning and Organisation - Clive Jones.

When we started to plan the 1964 expedition to Balinka Pit we had little idea of the problems involved in its organisation. The result was that the original administrative set-up was continually being altered to cope with different situations as they arose; it was only on the completion of our preparations that we were able to sit back and draw up what we considered to be a workable organisation. The following notes describe the machinery and try to highlight some of the principles involved in running an expedition within a club such as the South Wales Caving Club.

The first and most important point are the objectives, and in our cases there were four:-

1. To explore Balinka Pit and collect as much scientific information as possible.

2. To add to our knowledge of caving equipment and techniques.

3. To publish a complete report and to record our finds so that future expeditions can benefit from our mistakes and experience.

4. To involve a percentage of the younger members of the club in the preparations so that this sort of activity will continue.

The first objective needs little elaboration, but a few words on the others are necessary. The primary aim of exploration and scientific discovery would be pointless without publication and lack of it can lead future groups to spend time on ideas and plans which have been examined and rejected by competent people in the past. We found this particularly so when looking for detailed technical information on winching operations carried out by French and Italian caving teams. For instance, many words were available on the more dramatic aspects, but little or no information was found on the technical side, i.e. Pierre Saint Martin. Most expeditions have to make critical appraisals of existing equipment and more often than not produce improvements or completely new ideas.

Our 1961 trip to Yugoslavia led us to look at lightweight ladders and develop the crimping technique, while this 1964 effort produced the winch and the cable climbers. If this objective is made clear from the beginning, people will be looking for novel ideas and will be less ready to blindly accept equipment already to hand.

The fourth point is an all important factor in the S.W.C.Club. At

Penwyllt we have an ideal centre for preparing an expedition, store rooms, workshops and a considerable expertise are available for the asking, but to ensure that these facilities are made good use of in the future, the younger members must be involved in present expeditions.

One must also consider the chain of command and the executive responsibility of everyone involved in the preparations. This will obviously depend upon the jobs that have to be carried out and since this particular project involved a considerable amount of engineering, we were organised into three groups, the leader of each having executive authority, and collectively over the whole expedition.

1. Administration and General.
2. Heavy Engineering.
3. Light Engineering.

Group Responsibility. Group 1.

(a) Arrangements with Yugoslavian or other authorities. This will include obtaining permission to explore Balinka Pit, camp in the vicinity and fell trees. Arrangement of horses and bullocks to move our equipment to and from the site and also for transport of daily supplies. This will be done through the Croatian Speleological Society who also must be kept up to date with our plans and progress.

(b) Treasury - Opening of expedition bank account, payment of bills, collection of subscriptions and financial administration.

(c) Purchasing - All major purchases must come through a purchasing officer. He will be responsible for obtaining materials for trials and advertising purposes. He will be responsible also for the borrowing of equipment and thanking the commercial organisations for their help.

(d) Legal - Arrangement of insurance for personal equipment and transport; tackle documentation, administration of any agreements between expedition members and organisers and between expedition and other organisations.

(e) Public Relations - Preparation of all Press releases. Presentation to all official bodies which may act as sponsors. Planning and organising photographic coverage of preparations and expedition. Liaison with purchasing officer for photographic coverage of special items of equipment. Recording and collection of information for publication on completion of project.

(f) Transportation - Survey of methods of travel and arranging the best method. All travel arrangements to be made by one person.

(g) Camping and Food - Organisation of all camping equipment to ensure economic use of tentage and cooking facilities. Purchase and packing of food and preparation of food packs for underground use. Purchase of equipment for community cooking. These purchases are the only major ones not made through the purchasing officer.

(h) Medical and Rescue - Organisation of all medical and rescue plans and equipment, and also of camp hygiene.

(i) Caving Equipment - Preparation of all equipment for underground use not covered by other engineering groups.

(j) Information - Keeping expedition members up to date with progress and development.

(k) Preparation for scientific work - advice from competent authorities on best methods for sampling and preparation for surveys.

Group 2.

(a) Design and construction of winch.

(b) Design and construction of cage or bosons chair and any equipment required to assist descent and ascent such as rollers or boom.

(c) Design and construction of Pit Top assembly, i.e. the tackle directly concerned in raising and lowering the cage.

Group 3.

The light engineering group is responsible for the design and construction of all equipment to do with the following:-

(a) Communications.
(b) Ladders.
(c) Pack frames.
(d) Cable climbers.
(e) Surface and underground lighting.
(f) Pack frames and containers for transporting equipment on horse back.

In a number of the engineering jobs the requirements can be met by proprietary items or Ex W.D. sources and it is the responsibility of the group to decide if the purchased item is satisfactory and to arrange the purchase through the purchasing officer.

Having completed the first two steps, i.e. deciding what has to be done and what sort of organisation is required, the next is to get the right people together to proceed with the work. In the S.W.C.C. there are always more people wanting to go on the expedition than actually required. In deciding the people to go the following points must be borne in mind:-

(a) Has the person any particular skill that the expedition needs. Engineering ability for 2 and 3 are obvious necessities and the white collar workers of 1 must include one legal mind with some financial ability as well as being able to present a reputable picture to outside helpers. The pur-

chasing officer must have a particular combination of cheek and charm with power of persuasion.

(b) The majority of the people chosen must be competent cavers as well as being useful in the preparation stage. However a number of jobs on the actual expedition do not require expert cavers and are better filled by people who do not want to dash into the depths. Bearing this in mind a percentage of those in 1 need not be expert cavers.

(c) The people must be capable of working together in a team. This can be difficult with cavers the majority of which are individualists. One way of ensuring a good blend is to have a wide age band as possible.

(d) The planning and preparation is usually a long drawn out affair and the personnel must have the time and be prepared to devote their energies to their particular responsibility.

(e) The last decision and the most difficult is deciding who is required to make up the team and the effect the expedition has on the other activities of the club. Usually this sort of project attracts the active members and club administration and activities suffer. This should not be the case in a large club like the S.W.C.C. but despite efforts by those responsible it was the case. The answer could be the fact that expeditions of this size are relatively new with us and as our knowledge of planning and our accumulation of equipment grows, the effort required will diminish. If this is so, and we are to continue to take on projects like Balinka, we must try and put back into the club a little of what we take out - and this can be done by contributing the equipment accumulated by the expedition to the club for future ventures. It cannot be done by selecting the expedition team to exclude a percentage of the club's active nucleus.

The team is best chosen in two stages. One chosen to form the groups and to start off the project; and the second at a later date when the general outline of the plans has been finalised and labour is required to put the scheme into practice. Once the groups are formed and a general meeting held to acquaint members with the organisation, it is the responsibility of the group leaders to get their particular project going and to meet frequently to discuss progress.

Other points to note at this stage in the operations are:-

(a) It is essential to have a base which provides a workshop and storerooms.

(b) Proper planning of engineering jobs is essential. Time spent on making jigs is never wasted and the work should be split up into that which is best done by the group at the H.Q. and that which can be done by the individual at home. Some people cannot get to the H.Q. as often as others.

(c) Money in the bank is essential as soon as the work has started. This is best done by a subscription from each member.

(d) Expedition notepaper can be a considerable advantage when seeking help

from firms, especially if the backing of organisations such as the Royal Geographical Society allows their names to be used upon it.

(e) Record as much detail as possible of the preparations, by taking photographs of the various stages of construction of equipment, and of experiments on new ideas and techniques. Keep the minutes of all meetings, this is essential for the subsequent write-upsand a handy reference during preparation.

(f) Whenever there are two routes to a particular objective, make a critical analysis of each before making a decision paying particular attention to availability of raw materials, time factors and costs.

(g) Make sure expenditure is controlled but not to the extent of preventing people using their initiative when a bargain arises. The group leaders must prepare an estimate of expenditure to enable funds to be available at the right time and the best barometer of the financial situation is the 'worry chart' as shown in Figure .

At some stage in these preparations ideas will become crystallised and the capabilities of the equipment known. Then the rest of the team can be brought into the preparations, but before doing so the expedition tactics and logistics must be worked out. From this the optimum number of people needed can be calculated. The tactics are worked out by a small group, preferably people familiar with the cave involved, and the general principles converted to a detailed plan by the graphic method shown in Figure . The logistics are worked out from the tactics chart. This may sound a little elaborate but it is well worth doing and presents on one sheet of paper an overall picture of the plans, what is required to back them and to see that no job is overlooked.

The following must be kept in mind when planning tactics:

(a) Sufficient rest periods for everyone; fatigue is often recognised only when it is too late.

(b) Ensure that the people selected for the various jobs are capable of carrying them out, i.e. the photographer has not been included in the shift system for winch drivers.

(c) Make sure the more menial tasks are shared out between all members.

(d) Give some thought to the effort required to effect a rescue from the various stages and the position of the other personnel at the time. If necessary more people should be taken in case of emergency.

(e) Make sure that the necessary expertise is available to carry out repairs to equipment.

When the rest of the team has been recruited they should be used where they are most needed and eventually a group formed to pack and prepare everything for transportation.

One aspect of the preparation remains - Training. If the venture

involves any techniques which are not frequently in use by the members of the team, then training is essential. Everyone must be acquainted with the more complex pieces of machinery, as well as improving their normal caving practice. Knowing that everyone is trained and competent in all aspects is a considerable psychological factor in the efficient running of the expedition and everything must be done to ensure the equipment is prepared in time for this training.

Correct organisation is the corner stone of any expedition, and there are many ways to arrive at it, but be wary of over-organisation which stifles individuality and initiative. What is required is a clear cut system of getting jobs done and making best use of every opportunity and idea.

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2. Notes on the Transport Arrangements.

The position at Christmas 1963 was that we had 10 tons to carry across Europe including long scaffolding poles, 17 people and luggage. Private cars could be taken (about £17 per head), but this appeared unfair to the owners who might incur greater depreciation on the vehicles. Other difficulties were the poles, and the fact that too many cars, each with key pieces of equipment on board distributed across the continent, was dangerous, the breakdown of one might jeopardise the whole project.

The charter of an aeroplane to take everything to Zagreb was considered but the rock bottom price was £3,000. The hire of Dormobiles was attractive but the cost would have been about £30 per passenger, much more expensive than the buying of a bus and its adaption, hoping that it could be resold for a similar amount. This seemed to us the cheapest per person(£17), and certainly the most challenging.

The bus bought, two difficulties had to be overcome. Firstly it had to be licensed, insured and taxed, and it had to be adapted to take the tools of our various trades. Our eggs were in one basket, plus, of course, Bill Birch's chicken house. Buses, as well as having log-books, are also issued with Certificates of Fitness (P.S.V. licence) - this ensures that the vehicle is roadworthy to carry fare-paying passengers. However, with this document, the driver had to have a P.S.V. Gong. Only if it could be proved that no fare-paying passengers were on board and it was not being run for profit - it was communally owned, could it be covered by the normal log book. Not one of us had a white gong, so it had to be registered as a Private vehicle.

A three month road tax was taken out in the name of the Balinka Pit Expedition and one of us signed as Transport Officer. Since WHO362 was 10 years old, a test had to be arranged - it passed. This had to be shown to the local authorities when it was taxed. The bus and contents was insured at Lloyds - no one else would do it.

The bus was a 10 year old Red and White long-distance coach, a Diesel Albion, just taken out of service. It had a double-decker's chassis and was in first class condition even if not too speedy. Anyway we were not worrying about that since it was to be driven day and night by six drivers. Since the coach company hires the tyres it uses, we bought a set of second-hand ones, but even taking their cost into consideration, it was a bargain. It was the ideal self-contained vehicle for transporting the equipment and the team. With its resale value in mind, and the demands to be made upon e very cubic inch of space, it was modified without damage to meet all our requirements.

By the time it arrived, we had already made the major mechanical items and had acquired many accessories. The problem was how to pack them. It had two good 'boots', a rear one capable of taking 40 suitcases, and a fair sized one on the near side. But these could never hold all our belongings. The underneath was scrutinised and an abundance of space found. A space near the off side battery 'boot', provided room for a large ammunition box to hold the builders cleats ($\frac{1}{2}$ cwt) bolted in place as it would not be needed until the end of the journey. We stowed scaffold poles on the luggage racks, and also in a more suitable spot underneath - running the whole length of the chassis. These were held in place by rubber ties and nylon cord. There was enough room between them and the floor of the bus to stow reels of ladder.

In the interior we removed several seats on either side of the front part of the coach, and in their place built a Dexion framework. By laying the main longitudinal members (carefully cut to allow for the variations in the slope of the floor) alongside the gangway, and against the inside of the coach work and using the floor bolts that held the seats, we had a secure basis to build on, and allow corridor space. Side struts were built up from this foundation to the roof rack. Further longitudinal ones ran back along the top, to give a rigid box-like open structure. The frames reached forward as far as the handrail on the near side to leave access for the passengers, and for the emergency door on the off-side. This also allowed for the front seat behind the driver to be refitted - for the navigator. The frame was divided into two, in the bottom section the major pieces of equipment - the capstan, reel and engine. Above these, on a shelf made up of evenly inserted slats of square section alloy tubing slid along the rails to form an open platform, was stacked the bulk of the kit bags, one per person for caving, one per cooking and camping group - 40 bags in all. Small suitcases of personal belongings and clothes were slid under the seats.

The main items were stored in a definite order. The navigator's seat was taken out. Through the emergency door the capstan was put into the offside bay; the engine followed into the nearside bay, with the reel

last in the same bay. A pair of stout planks were used to slide the items up into the coach, and these were laid along the gangway for storage. The space between the back of the navigator's seat and the front side frame took the sections of the cage, lashed in for safety; the fact that they didn't protrude into the gangway was good luck, not judgement.

Care was taken not to damage the woodwork or upholstery because of the resale possibilities - all metal and wooden parts and screws were carefully removed and kept. Parts added for convenience were placed wherever possible to utilise existing holes. The window behind the driver was removed to enable the navigator to communicate with him. It was no longer a P.S.V. so talking to the driver was permitted. Three folding drop-down tables were provided, one for the navigator attached to the woodwork behind the driver's cabin, and two more fixed to the rear of the Dexion framework. All were easily dropped down by the removal of a temporary leg to give more room. The table tops were made from mahogany boards from the base of an old wardrobe (30" x 20"), the supporting leg of square section alloy tubing.

The weekend trials gave us a chance to test the modifications, loading and unloading. The large items were put in first, then compact heavy items like reels of heavy cable, ropes, tools, fittings, and finally the other items were fitted in where room permitted. The side boot was used for the food and medicines, and oddments which would not taint food.

We also took £168 worth of spares for the bus. Other modifications were made to comply with continental road laws: lights were adapted to dip correctly and fitted with amber glass; a fog/spot light was added and sets of flashing indicators, and finally a nearside, outside driving mirror. Owing to the large empty space over the bonnet beside the driver's cab, the mirror fitting was a problem, and it was overcome by means of a tripod, with a pair of legs horizontally attached to the radiator and nearside body, and a vertical one to the wing bracket.

Surplus food and equipment, and the bike, was carried in the Land Rover. It was very fortunate that it accompanied the bus as a support vehicle, for towing, breakdown, and transport out there at the base camp - it went where the bus wouldn't go - half way up the mountain.

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3. Food and Feeding.

Everyone agreed that the food we took to Balinka was too bulky and weighty for the bus and that we had too much of many items. Estimation of amounts in the first place was guess-work, but was based on 15 days in camp for 20 people, plus perhaps some Yugoslavian visitors and helpers. Both premises were wrong; we spent only 7 days in camp at Balinka, for the other 7 (5 at Postojna, 2 at Plitvice) we took the easy way out and ate at restaurants - as well, the Yugoslavian visitors and helpers very wisely brought and prepared their own food. The easiest way to write this account is first to make some general reflections, then to list the foods we took under 3 headings - 'Given' - 'Bought cheaply' - and 'Bought at normal prices' with a note about their usefulness and whether practical for the next trip. A note at the end will deal with the underground packs.

The food question is largely dependent on the camping arrangements. We were divided into groups of 3 or 4 people and breakfast and the evening meal were prepared within these groups. Lunch was communal, or individual 'grab it' affairs of soup, bread, jam, biscuits, and fruit when available. This group method worked well for breakfasts, although it was very slow for the evening meal when everyone was tired. On two occasions at the end of our time at Balinka we made a communal stew over a wood fire and most people found it eatable. The only trouble with cooking of this type is that it is limited and the food might become monotonous. However, as long as help was freely available for potato cleaning etc., communal cooking should prove easier than the group system.

We took tinned meat and fruit - both expensive and bulky; had we known how efficient and successful the local contacts would be, we could have left some of it out and depended more on fresh meat and fruit.

We tried to buy a whole large cheese to take with us, but after enquiries we were discouraged because of the packing problems and the possible effect of the heat on it. It would have been useful since we were extremely short of quick easy protein to make lunch more satisfying. Next time it will be worth making more enquiries.

Foods that were given.

2 x 21 lbs. tins of dried milk - this was largely successful, although it was difficult to prepare. 'Marvel' is easier and more palatable, but the former was free, whereas Cadbury's offer only a very small discount. We could have had fresh milk but transport was difficult, unless the cows were brought to the site and milked there.

120 lbs. Sugar and 15 tins of golden syrup.

It was essential to take our own sugar; the golden syrup was not much used, but if we had it as free gift again might be worth taking.

Coffee.

Well worth taking, although tea was more popular and easier to brew in large quantities.

2. 14 lb cartons of dried egg.

We did not use all this amount, but most people found it easy to prepare and palatable for breakfast.

Corned Beef.

Although it would be much better to rely on local sources for meat, we would need some for the journey and for 'tiding over' and free supplies were well worth taking.

Complan. This was not touched - not worth asking for any more supplies.

Foods bought at a discount.

Ambrosia Creamed Rice - Not popular.

Margarine in tins - Very successful.

Vita Wheat and Digestive Biscuits - Useful, but our quantities were far too large, and we could obtain plenty of bread.

Sweets - a few useful, we had too many.

Jam and Marmalade - Useful and easy to eat.

Scotch Herrings in Tomato Sauce - Not popular ----- Ugh (Ed)

Oxford Sausages (tinned) - Popular and easy for breakfast.

Baked Beans - Groaned at during planning and buying, but they were asked for a lot after our small supply ran out.

Chocolate - Rather expensive, but was all eaten quickly.

Drinking Chocolate - Was used, but we had to buy 12 tins to get discount - 4 tins would have been plenty.

Dried Onion Slices - Pleasant addition to stews, but once again we bought 4 times as much as we needed for the sake of the discount.

Stewed Steak - Useful and easy - but cheaper to buy local meat and better.

96 Pkts. Knorr-Swiss Assorted Soups - Not as popular as expected, only small amount needed for stews and communal brews.

Foods Bought at Normal Prices.

3 Doz. Horlicks 'one meal' packs for underground rations - good value.

1 Case Dried Mixed Vegetables - For underground packs from limited experience probably quite palatable and good.

Rice and Spaghetti - Useful for first few days before the fresh vegetable supplies were organised, but not essential.

30 tins of Spam - About the best buy; easy to eat cold, pleasant fried or in stew.

75 assorted tins of fruit - About the most expensive and the bulkiest of items. We had no luck with free or cheap supplies. Would suggest much less depend on local melons, grapes etc.

Porridge Oats and Corn Flakes - Rather bulky to take, but popular, we could have used much more.

Salt - We had 10 drums - 4 would have done.

2 doz. tins of cream - Could be omitted.

Tea 14 lbs. - Good, but we had too much.

Underground packs - We prepared 10 '1 man 1 day' packs and 7 '3 man 1 day' packs. All items were in self-sealing polythene bags inside cardboard boxes, with a final outer covering of polythene.

The '1 man' packs contained -

1 small tin steak.	
1 small tin fruit.	MAIN
½ jar Batchelors dried vegetables.	meal
2 ozs approximately potato powder.	
2 ozs. approx. soup powder	
1 Horlicks meal tablet	2nd
Oatcakes	MAIN
Small carton cheese spread.	meal

Also:- 1 bar of chocolate, boiled sweets, Jam, Salt and Sugar/Coffee/ Milk mixture.

The '3 man' packs were difficult to squeeze into their containers and often had less in them than they should have done:-

1 large and 1 small tin steak.
2 tins of fruit.
1 jar dried mixed vegetables.
1 pkt. 'Swel' potato flakes.

This was the main meal.

1 pkt. Knorr Swiss Soup.
3 Horlicks meal tablets. 2nd meal
9 approx. oatcakes.
2 cartons of cheese.

Also - Jam, 3 bars of chocolate, sweets, salts, Coffee/Sugar/Milk mixture.

The occasion did not arise for these packs to be fully tested, but when they were opened, 3 to 4 weeks after packing, everything was in good condition and edible. Some packs were used in Krisna Jama, with the corresponding pack of meths, stove, mess tins, K.F. spoon set, matches etc. This was not a true trial and not enough time was spent in the cave to find

out whether the amounts of food were sufficient for a whole day, but most people seemed able to prepare a reasonable palatable meal from the pack quite quickly.

A point to note is that while a 'Horlicks' brand 2 man pack costs £1.13. 9d, ours, the 3 man packs, which contained considerably more solid food, cost about £1. 5. 0d.

M. Dilly.

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4. Medical Matters.

'Turista', 'Gippy Tummy', 'Delhi Belly' are synonyms for the travellers upset characterised by diarrhoea, abdominal pains and weakness. Cavers visiting Yugoslavia develop this condition and the Balinka Pit party were no exception. Turista occurs in northern climes, e.g. Scandinavia, as well as in the more southerly ones, though probably less frequently. Sex, weather, and the seasons don't affect the incidence. An affected room-mate increases one's chances of developing the condition, which therefore appears to be infectious. The symptoms occur usually within 14 days though not, as a rule, before the 3rd day. The peak incidence is on the 8th day.

The cause of Turista is not known and none of the usual intestinal disease bearing organisms, i.e. those of the Salmonella or Shigella groups, appear to be responsible. The generally accepted theory is that the normal bacterial population of the bowel differs geographically, and that it is the introduction of foreign bacterial strains that cause trouble. In fact, the traveller has to exchange his own bacterial population (or, perhaps, modify them in some way) for those of the country visited, and during the process of becoming accustomed to these foreign strains, he develops diarrhoea etc. This does not explain why the traveller doesn't develop symptoms when he returns home and ingests his native organisms again; there is no published medical information on this point. One might put forward an alternative suggestion that he does not, in fact, exchange his own organisms for the foreign ones; these he rejects just as he would overcome any other infection which causes symptoms?

In addition to these facts and theories, another circumstance has occurred to us; people on troop ships or on cruises in the East don't usually develop Turista, or if so, to a far less extent than the tourist in the East does. Now these people have nearly all their food handled and prepared for them by their fellow countrymen, and they mix only with their fellowcountrymen. In fact, they maintain their own native environment although travelling in 'turista areas'.

It seemed logical to us that we might try and maintain the 1964 Balinka party (and their intestines) within their native environment. And here we must become a little earthy and consider our accepted toilet habits, which are singularly lacking in hygiene. After using the toilet, the hands are quite probably contaminated with bowel organisms and these are passed on to the flush handle, the toilet and bathroom door handles, the bathroom taps and any other intermediate object that is handled. All these 'control surfaces' should, of course, be elbow or foot operated as are hospital taps; the hands should touch nothing until washed and rinsed. Without some such system and without a more rigid hygiene education (there is no compulsion on a food worker or employee to wash his hands at all), it is obvious that we are constantly exchanging normal bowel organisms with one another. As these organisms are all of the same strain and ones to which we are accustomed, this does not appear to matter; when, however, we ingest 'foreign' organisms to which we are not accustomed, we run the risk of developing turista. In passing we should observe that the last typhoid epidemic in Britain was prolonged by poor hygiene observance.

The toilet arrangements at Balinka were such as to avoid such circumstances. A latrine pit with earth for each individual covering; the earth to be shovelled on by the foot, or, provided that the hands were washed before touching it, by a communal trowel; water to be poured into basins for washing before toiletting so as to avoid touching water container etc., with possibly contaminated hands.

The urgency of the project and the long strenuous hours, which often necessitated midnight meals, precluded any strict observance of food precautions. Understandably, people were not in the mood for fussing, feeling that they'd earned their grub as they wanted it. Nevertheless, some care was exercised along the lines to which we shall allude presently. Dare one suggest that the members of any future expedition, dividing themselves into two groups, will act as guinea-pigs in order to assess the relative value of food precautions? Small though the numbers would be, some useful information might emerge. The 'Sybarite' group would feed as they wished and as hitherto on any Yugoslav trip. The 'Austere' group will consume nothing but tinned and packaged stuff brought from home, and drink only boiled water or native minerals and beer. If they must have fruit, it should be soaped and rinsed in boiled water and then peeled. Lettuce to have the outer leaves discarded and then to be washed in boiled water - but better to stick to dried fruit and vegetables (incidently it is no more unconventional to soap fruit than it is to use detergents on plates etc.) Some such precautions were adopted at our Balinka camp but only half as strict as these. Any food that has been handled by the inhabitants should be avoided - bread, confectionary etc., though the crust may, of course, be cut off bread, it if must be eaten. In restaurants the same applies, but avoid uncooked fruit and salads altogether. In foreign toilets and wash-rooms one should handle nothing except through the medium of a piece of paper. 'Austeres' must not accept native hospitality - a suffering expression and a hand on the stomach will, without offence, suggest such indisposition as to preclude the acceptance of refreshment! It may sound fussy to take the fullest precautions, however, one of us did and experienced no inconvenience or deprivation.

During the 1964 trip, 9 out of the party of 19 developed what we considered to be turista. The cases occurred from the third to the fourteenth day of arrival in Yugoslavia (average 7th day) - add two days for arrival on the Continent. The number of cases appears to be average or perhaps on the low side for a Yugoslav trip. Those with experience were of the opinion that the symptoms were decidedly milder than was usually the case. Did such precautions as were taken affect the incidence of the condition?

If turista is caused by a change in the intestinal organisms, were all our cases due to Yugoslav organisms or were some due to those of the countries we passed through? Another point, referring to our previous query as to whether a traveller might develop turista while re-adapting to his native organisms after returning home; two of our party suffered a return of previous symptoms within 24 hours of landing in Dover. We know too little to debate these points, but there would appear to be a case for a 'controlled' trial of precautions along the lines indicated if that were possible.

Aslett and Dilly.

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5. Organisation 1966.

"A group of thirty cavers should be able to organise their own expedition with the minimum of direction from the leader." This was my aim right from the moment in early 1965 when I was"left holding the baby". I hoped that everyone would contribute the maximum effort so that the work load would be spread as evenly as possible. Generally this policy was fairly successful. Various members of the group each took responsibility for one aspect of the project, i.e. Administration, Photography, Finance, Engineering etc., leaving the preparation of the general equipment for the whole group to tackle. It is obvious that some Club members find it more difficult than others to visit Penwyllt. It might be expected that these people would work very hard during their visits but unfortunately this did not seem to be the case. Towards the end of the period of preparation when things were running a little behind schedule, some friction resulted from this attitude by a few people.

As this was the second visit to Balinka, many of the likely problems could be anticipated, and many techniques were tried. This made my job easier than it would otherwise have been, but all the time there was the danger of saying, "Well, we did it that way last time", rather than "This is the best way to do it." Generally we benefitted from our previous mistakes and used our experience to its best advantage. Even with this start, several items had to be developed through a series of models before we arrived at the right answer. This development work was very time-consuming.

In many cases, lack of knowledge of the performance of the units being used was the main cause of the trouble. More research and thought might have been the answer.

Work commitments made it impossible for the whole party to spend four weeks away and eventually it was decided that the main party of 17 would take all the equipment in the converted coach with the Land Rover for support, the six (in the end only five) remaining people to follow by train a week later. In fact due to delays to the coach this later party arrived at Balinka only four days behind the main party.

Because of this division of the party no deputy leader as such was nominated. However, both scientific and engineering leaders were designated. Only when continuous working at Balinka made a deputy vital, was a deputy leader designated. There was some criticism of my action - several people felt THEY should have been appointed deputy before we left this country. I will justify my action as follows: The composition of the team was changing as late as one week before we left. It would have left a bad taste if the deputy leader had been unable to make it at the last minute. I was hoping that as we worked together one man would emerge as a natural leader. This did not happen mainly because time again defeated us and we had only one brief and rather depressing practice session (in the Forest of Dean).

B. W.

Transport 1966.

As before we travelled by coach. This time however we hired one from a local firm, R.I. Davies. As previously, the main trouble came from the clutch. This time we missed our ferry and were delayed for thirty hours. Driving duties were again shared and there were no major difficulties here. It is now apparent that we must bear the following points in mind for future trips by coach: use a common make - spares will be more readily available; plenty of power is required to enable the most direct route to be taken and to avoid detours for hills.

B. W.

6. The Journey.

As our coach had been brought up in the South Wales valleys it is understandable that it did not want to leave. Less than a mile down Penwyllt hill the clutch pressure plate broke. At 10 a.m. on Saturday, preliminary telephone contact with the RAC indicated that we were going to have more than a little trouble getting a replacement. By about 11.30 the exact fault was known and a really smooth search exercise got into high gear.

Every avenue was explored and the net was gradually expanded to include the armed forces and several firms in London. The required unit was eventually located about 24 hours later in the N & C Coach Co., and was in place a few hours later. A thank-you paragraph was printed in the Western Mail the next day with photographs - all part of the operation. The expedition finally got restarted 30 hours late after a meal at Dan yr Ogof, kindly laid on by Dr. Price. The total cost of the search has been estimated at about £40. This is made up of telephone expenses and the fuel for vehicles involved and does not include the many man-hours expended.

This incident could well have shattered our morale. In fact, it had the opposite effect and to me this was the first sign that, come what may, the expedition would be a complete success. We really worked as a team for the first time. If a coach is used for future trips abroad - and the idea is quite sound - we must load the coach to its running weight and then run it up and down Penwyllt hill several times. The hill is steeper than anything found on the main road and will indicate any potential weaknesses in the transmission, tyres etc. In fact anything up to 100 miles with a full load should be contemplated.

The Land Rover was used as a double-header engine with great success.

To drive continuously for about forty hours it is vital to have five or six drivers who can share the effort. It is a great responsibility to drive a coach with all the expedition gear and some twenty people, and when on the move it is difficult to get adequate rest. Short spells at the wheel must therefore be the order of the day (and night). Even the Land Rover which is relatively easy to manage needs four people to share the driving. Insurance arrangements must be made to ensure that the Land Rover owner cannot be out of pocket in the event of an accident.

The longer sea crossing to Ostende seems to be an advantage as it gives more time to relax, avoids one country (France) where they tend to be hot on old vehicles and also cuts out the rather tortuous coast road.

It was 7.30 p.m. when we reached the Aachens customs post to cross into Germany. One of the rear tyres had been showing signs of bulging and it also appeared to be leaving the bead in one place. We could have changed it with the spare, but it was decided to try to replace it before driving all through the night on the autobahns. Advice from the customs man ("We lost the Var and der Vorld Cup") and we reached a garage just off the autobahn. We were guided from there to the Dunlop tyre depot whose owner had been warned of our approach by telephone, and we were then treated to a display of Teutonic efficiency at its best; during the few minutes it took to change the tyre we managed to find a meal - half a chicken and chips for 4/6d. The tyre was replaced by 8.30 p.m. Try that in England some time!

We passed through Germany without further incident - there is much new road since 1964.

Austria provided a fine evening meal with cabaret. The Mayor pass

was O.K. going up, but the down side was very steep, and would have stopped us on the way back.

Movement of Kit.

Because we arrived one day late at Balinka we missed the pack horses and had to start to move all our kit by ourselves. Our two trolleys proved invaluable and were a lot more robust than expected. The heaviest load carried on them was estimated to be 700 pounds. This required 13 slaves and it was argued that it would have been better to split it into units capable of being carried by 3 or 4 people. Having carried one corner of an engine unit down, I am convinced that the hauling method was the easier. The danger of carrying heavy loads on a slippery track must also be considered. When the pack horses did arrive the moral support of having them was almost as great as the actual help they did in moving the kit.

B. W.

7. Camp Layout etc.

The original plan discussed with the camp commandant was to

a) site the tents at the top of the main doline,

b) to have the main kitchen mid-way to the pit top,

c) to establish the equipment stores near the pit top, but if possible in sight of the kitchen,

d) to site the bog low down in the doline.

This layout would have kept most of the noise away from the sleeping area and prevented one of the major causes of friction - tired people trying to sleep and clashing with hungry people just emerging from the pit and full of talk about it. My ideas were modified somewhere along the line, and we ended with people sleeping within about five yards of the cooking and eating area. This must not be allowed to happen on future trips - people are difficult enough, without adding unnecessary complications.

A temporary toilet trench was made on our first day in camp, but we had to wait for the second party to arrive before the permanent 'palace' could be made. By using this main trench in sections, reasonable hygiene standards were maintained.

The 'Institute', the scientific room, was a most worthwhile construction. We were able to keep all our expensive equipment under reasonable conditions.

The food store was sited at the rear of the kitchen area on and under suitable waterproof sheeting. This arrangement proved satisfactory, but we could have done with a few demonstrations from the Boy Scouts on the organisation and storage of cooking facilities in bad weather. The water filter was arranged on a convenient tree and worked very well. In fact by raising the level of the dirty water by 20 feet or so the system became self-operating. Judging by the colour of the filter candle the process was urgently needed.

Reveille time averaged about 0530 hrs. The sun rose above the top of Mount Pistenik at about this time, and the temperature climbed to a comfortable level in a few minutes. It was intended that 'early to bed' would also be the rule (i.e. about 8.0 p.m.) but for reasons already mentioned (noise etc.) this was often difficult. Some overtiredness resulted after two weeks or so, and it was very interesting to study the social behaviour of a group of people under these conditions.

Cooking was organised each day by one of the four lady members of the expedition, helped by one or two men as necessary. The arrangement worked fairly well and the quality of the meals was excellent. As each lady was on duty only once every four days, this cook's duty was not too troublesome. Meals were arranged to give a large breakfast at about 7.0 a.m, a light lunch mid-day, and a large evening meal about 7.0 p.m. Snacks were also arranged between times.

The main equipment storage area was initially established alongside the main access path where it branched towards the pit itself. Due to the vast number of tourists we attracted, all the equipment was later moved to a covered store in the roped off area (see sketch).

8. Pit Top.

We had always planned that the cage should come right to the surface for loading and unloading. This meant that if the 1964 equipment site was used, it would only be possible to see the cage as it neared the pithead assembly which would throw an unnecessary strain onto the driver. Alternative sites were therefore considered and we eventually chose the area (marked(A))overlooking the pit-top, and giving a clear view some 10'-15' down the shaft. Thus the driver had all this reaction time, before the cage had to be stopped.

The main equipment (C) was laid out exactly as planned and tried in this country. The return pulley (B) was tried in several positions before the right arrangement was found. In fact the run seemed to be shorter than with the thinner cable used in '64 (perhaps due to the extra cable weight?).

The line of trees (A) - (D) was used to support the scaffold member

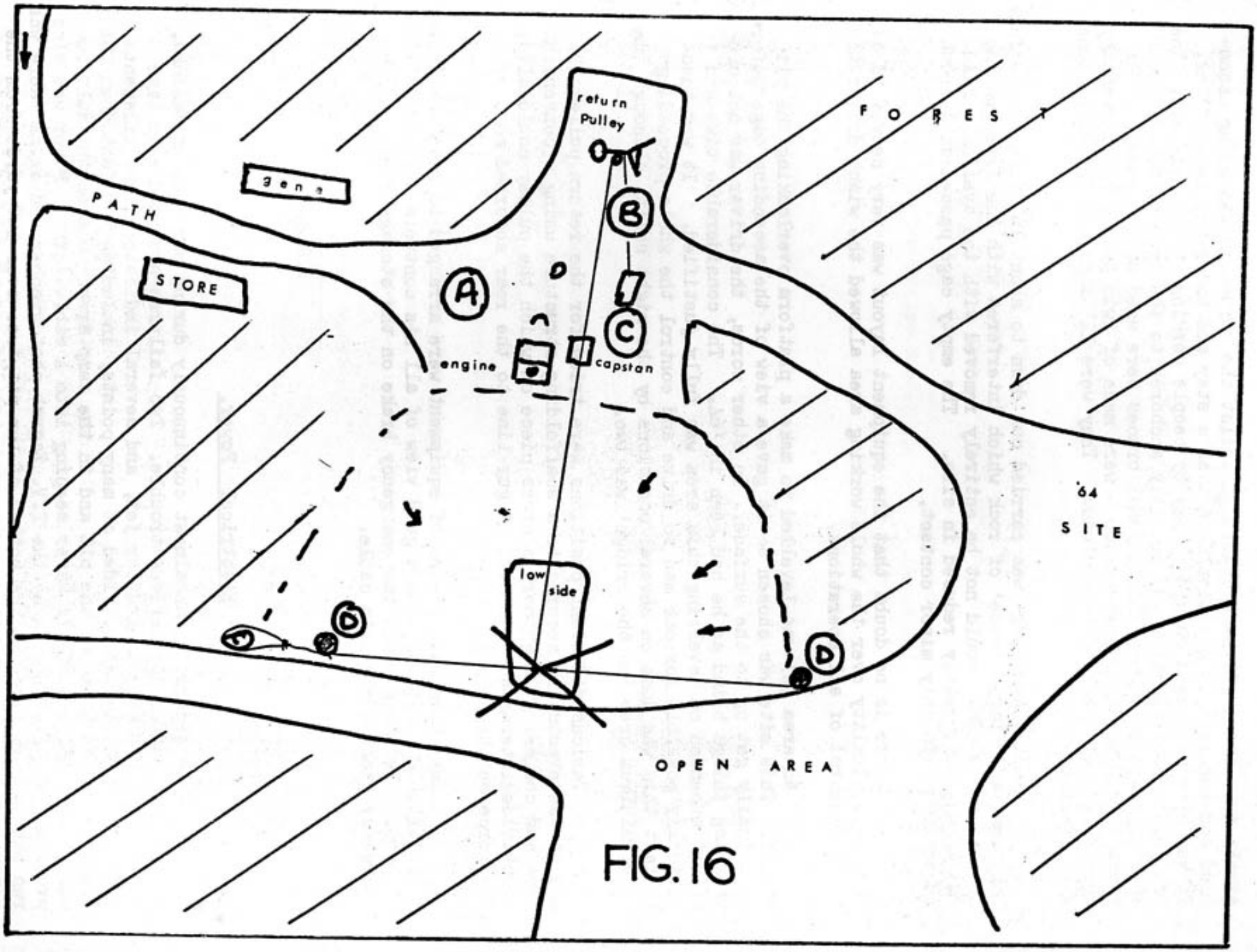

return
Pulley
FOREST
PATH
STORE
A
B
C
engine
capstan
low
side
D
D
D
'64
SITE
OPEN AREA

FIG. 16

at the top of the pit-head quadruped whilst the structure was being assembled and was left in position to act as a stay and emergency safety line. It was also used as a running belay by people working at the pit-head. The scaffolding construction was securely anchored to the rock by means of our special adapter clamps, and diagonal braces were used as necessary. The front legs - those in compression - were made of twin tubes, to prevent any possibility of buckling under load. They were 14' long and therefore somewhat flexible.

Much 'gardening' was carried out down to about 15' from the surface. This removed a large 'nose' of rock which interfered with the free running of the cage. This could not be entirely removed with the available hand tools, but was greatly reduced in size. The empty cage passed it in both directions with only minor contact.

There is no doubt that the equipment layout was very nearly ideal. Perfect visibility over the whole working area allowed the winch driver to assume control of all operations.

An area (A) was levelled to make a platform overlooking the pit itself. This site was chosen as it gave a view of the ascending cage before it actually got up to the surface. In other words, the driver was not controlling things blind as he had been in '64. The considerable time and effort expended on levelling this area was fully justified. It was theoretically possible for one man to drive and control the whole proceedings. In fact this was done on several occasions by the night shift, although the usual minimum crew 'on the bridge' was two.

Various different positions were tried for the return pulley (B) and it was eventually secured to a scaffolding structure using a convenient tree and one A-leg to support a cross piece on which the pulley could slide to provide lateral adjustment. A guy line to the rear absorbed most of the force on the pulley.

The three main pieces of equipment were arranged to give the driver a comfortable position, with a good view of all his controls etc. and of the pit-top. He could reach the emergency brake on the storage reel, and the emergency grab on the main cable.

B. W.

9. Electrical Power.

The generator ran almost continuously during our stay at Balinka, and did not suffer any serious trouble. Two failures occurred, each time caused by a blocked carburettor jet, and several indicator light filaments failed. Lighting was provided at many points, including 700 feet down the shaft, over the mouth of the pit and in the camp area. One earth fault occurred but this was due to water seeping into a cable joint. Power was also provided for cine-filming by the T.V. Zagreb photographer and extra cable was run out to give light at the bottom of the pit, i.e. over 300 yards from the generator.

B. Woods.

10. Help from Jugoslavs.

The importance of this aspect of the trip cannot be too greatly stressed. Thanks here to Pepi and Mr. Latus. I understand that they spent several days together writing letters etc. to smooth our path.

The horse arrangements at the start were upset by our late arrival, and the fact that the horses were working in the forest 9 km. from Balinka. A quick word by Latus to the forestry manager and some trees were cut near Balinka, so that the horseman would be on hand to carry our water up every other day.

Mrs. Miko Latus bought our daily food supplied for us, and these were delivered by service bus. A special stop was made to transfer the food into our bus, and to pick up the order for the next day. Again a very good arrangement.

In '64 petrol supplies had caused us some delays, but this time the forestry commission delivered a full 40 gall. tank to our bus, and we transferred fuel to Balinka in jerrycans. When this first 40 galls. had been used, we had to make a special trip to Slunj for a refill.

Many local people helped us move our kit (I fear some removed it again at the end), and again the forestry people provided a team of seven to help us clear up.

The Partisans really did all they could to help us, and at the end they provided transport to take us out for the day. They also treated us to fabulous parties on two successive evenings.

All this help was really a sign of respect to the Partisans who were executed at Balinka. We had greatly underestimated the strength of this feeling. We can therefore hardly expect to get such support for just any pothole in Jugoslavia and I feel that we must take a critical look at the logistics of any future expedition. It was very noticeable that we were wilting towards the end of the first day without the moral (and actual) help of the pack horses. Balinka is not really remote, being only about 1½ miles from the nearest vehicle access point. Triglav cave, for example, is a very different prospect.

B. Woods.

11. Communications.

This department was my direct responsibility, and due to other commitments did not receive as much attention as it deserved. Thanks are due to Derrick Appling and Eagle Products who got me out of trouble. Development work is progressing and a foolproof system should eventually be available for future expeditions.

The major problem was one of maintaining optimum performance; a number of self-contained units were connected together by flying leads and it was all too easy to inadvertantly disconnect something. The wet conditions towards the end did not help matters much.

Lessons to be learned: (a) the system must be flexible; (b) self-contained units required which are weatherproof; (c) various signals must be balanced for recording purposes; (d) several people must be capable of carrying out routine maintenance, and (e) a protective maintenance scheme must be established.

B. Woods.

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12. Catering for the Masses.

After the experience of catering in 1964 it was decided that cooking in 1966 should be done communally, as the previous method of small teams was found to be inefficient in manpower and tougher on those groups without one of the three women in them. So the four women of this expedition undertook the provision of the supplies beforehand and the organisation of meals during the time spent at the pothole. The following is a list of supplies and equipment based on a time of 21 days at the pothole of some 23-25 people including Yugoslav helpers. For convenience when first arriving at Blata, supplies for the first few days were packed separately so that boxes containing day 1 / day 2 rations could easily be found in the chaos of unloading the bus and setting up camp.

Food Supplies.

120 lbs sugar
1 20 lb tin dried milk
6 lbs tea
2 catering size tins Nescafe
1 large tin Oxtail soup (catering size)
1 gross Batchelor Soups
1 large pack Ryvita
1 dozen small jars jam
1 catering tin jam - 7 lbs
24 lbs marmalade
30 lbs margarine (in tins)
1 large pack digestive biscuits
1 box Shortcake biscuits
7 lbs porridge
1 gross Surprise peas and beans
1 packet instant potato
14 lbs dried egg
1 gross Vesta Meals - Vegetable/Beef/ Chicken/Prawn Curry. Chow Mein. Spaghetti Bolognese
108 tins stewed steak and corned beef
50 tins chopped pork
1 large tin Tom Piper stews
2 dozen mixed grill meals
2 7 lb tins ham
7 lbs rice
50 tins sausages
1 large tin custard powder
1 large box dream topping
7 lbs dried fruit
1 case golden syrup
2 tins Kraft cooking oil
Salt, pepper, vinegar
£5. worth Nestles Chocolate
6 boxes Cadbury's 6d. blocks
Ovaltine biscuits - 1 large box
1 case Ovaltine
6 boxes foil wrapped cheese
1 10 lb tin mixed fruit drops
Lemonade crystals

The above supplies were partly scrounged free or bought at wholesale prices. It was intended to supplement them with fresh meat, fruit and vegetables which would be portered to us by the kindness of Mrs. Latus or could be bought from the farmers in the village with whom we had already made contact in 1964. These goods included tomatoes, carrots, garlic, potatoes, peppers, apples, peaches, plums and bread.

Before leaving Britain several underground packs were made up from this list of supplies - being one-man one- or three-day packs. Although the idea was good they were not utilised to their full extent because underground camping was not necessary. Often packs were taken into the cave and ransacked for readily eatable goodies, i.e. biscuits, chocolate, sweets, raisins, The coffee mix was invariably very welcome when waiting for one's turn in the cage.

Cooking and camp equipment.

1 water filter
Tilly lamps and spares
Butyl sheets (for store house, bog and rain shelters)
2 dual burner calor gas burners and cylinder
2 large dixies
Frying pans
Pressure cooker
Volcano kettle
Cooking utensils
1 gallon biprox
Bowls, cloths, potscourers
Paper cups and plates

Much of the cooking equipment was borrowed from Bridgend Technical College (thanks to Eileen) and some loaned by members. Everyone brought their own cutlery which theoretically was washed and taken away by individuals after every meal.

Organisation at Balinka.

The best method seemed to be to make one woman responsible for cooking for the day; the other women helping if they wished although if they had anything else to do they could opt out. In practice one was rarely if at all left to cope alone. This is not to overlook the generous provision of one "scullion boy" for the day - a man who was not desperately needed for the heavier work at that time. This meant an alternating rota and great competition to obtain titbits from the cook's table. (Testimonials as to potato peeling ability and dish washing efficiency will be supplied on demand for a small fee). Eileen's experience was invaluable in working out a week's menus and these were repeated with some variations in the second and third week. The following is a specimen menu for one day:-

Breakfast

Sausages, scrambled egg, fried tomatoes, bread, butter, marmalade, tea.

Lunch

Soup, bread/ryvita, jam, apple, 1 bar chocolate.

Tea

Biscuits, tea, sweets.

Supper

Stew (stewed steak, onions, peppers, carrots, potatoes)
Stewed fruit, dream topping
Coffee

Late snack

Soup/Ovaltine

In practice the provision of 2 substantial cooked meals and plenty of hot drinks worked out well. It is imperative to keep the kitchen area free of unofficial cooks and that one person should be responsible for the issuing of fair shares for all. Only in this way can order and a "decent diet" be maintained. Washing up was rather heavily dettolised and drinking water was carefully filtered by a gravity filter. Cooking was done on two dual calor gas stoves. Water was boiled in the volcano kettle. John Hartwell's paper plates and cups were an absolute godsend (although feared to be somewhat bulky) and saved enormous quantities of washing up.

The main disadvantage of this scheme is that someone is bound not to like what is being served, but the fact that no one suffered from stomach troubles and seemed to be glad of a hot meal on tap on arriving from the damp dirty hole, justified the methods.

J. Webley
C. Harvey

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13. Notes on Obtaining Commercial Aid.

It is important to be clear on exactly what you are trying to obtain as a gift or loan, how many and for what purpose they will be used. It is then possible to judge any alternatives offered or whether you already have an offer of something that is suitable. You can also guess at the possibility of the article being returned, after the expedition, working and unmodified. It is often worthwhile trying to obtain even quite low priced items, say £1 - £2, as this may relieve a tight budget but whatever the cost, some idea should be obtained of the value of goods you are hoping to get.

The names and addresses of the manufacturers can be found in the local library's trade directories. I found the KOMPASS DIRECTORY most useful but Sell's Trade Directory and the Classified Telephone Directories also helped. I checked in "WHO OWN's WHOM" and eliminated the subsidiaries of firms I already had listed.

When selecting the firms it is important to be sure that they actually make what you require and not part of it or just make the material from which the article is made, e.g. nylon rope manufacturers, not nylon fibre manufacturers. If there is some doubt write to the enquiry department of the appropriate trade magazine. There will be a list in your library.

The first letter should be addressed to the Managing Director. This is the important letter for on this he will decide to help or otherwise. Give it plenty of thought. It must not be too long, general in content, state what you require, when and briefly, how you intend to use it. The letter can be kept brief by including more detailed duplicated sheets, photographs, copies of publications etc. The letter is best worded so that by changing one paragraph it can be adapted for almost all requests. A copy of my own standard letter, in this case to a rope maker, is included. I relied upon enclosed publications and photographs to hint at the possibility of publicity. For each item I selected from 3 to 6 firms for the initial approach and this usually proved to be enough.

It is important to keep copies or an accurate list of letters sent and received; as the numbers build up a list will be needed even if copies are kept. The reply to the successful approach is sometimes a definite offer, but usually a tentative one suggesting that they are inclined to help but exactly what is needed and in what quantity. The reply can include full details specific to the use of their product and be definite as to what is required to the extent of including their own part numbers, catalogue numbers, know that they make the sizes you ask for, etc. This will enable the senior man to pass the details to the sales department without having to do any more work. How much or how many to ask for can be difficult, if you need rather a lot and you know that they are expensive. In some cases a definite offer from one firm will give you an idea of how many to ask for from others. If you have several offers, share the number between them all. If left with one firm, then remember that it is often possible to borrow. A series of letters normally follows. It is, of course, important to acknowledge each one, the definite offer, the receipt of the articles etc. The last letter should include mention of your intention to recontact the firm after the expedition. It is also worthwhile maintaining good relations with firms not inclined to help - they may think differently for the next expedition.

We sent a card from Balinka to all the firms that helped us. This kept them in touch for sometimes there is a considerable time between receiving the goods and the start of the Expedition. Most important, after the expedition is over, supply all the firms with an account of the trip, successful or otherwise, and publicity material as promised. Again send a friendly account to those who did not help.

A breakdown on my work for Balinka is given below. I contacted well over a hundred firms. 65% replied, 45% offered help, 13% were unable to help and 7% refused to help. The percentages were much higher until the last few months when efforts were concentrated in the areas of poor response.

Dear Sir,

In 1964 the South Wales Caving Club and the Yugoslavian Caving Society of Croatia made a highly mechanised attempt to get to the bottom of the extremely deep Yugoslavian pothole, known as Balinka Pit.

This expedition, described in the enclosed literature, was not wholly successful but sufficient experience was obtained of the unique problems associated with this pothole to ensure the success of the 1966 expedition. This expedition will again be joined by Yugoslav speleologists. The object is to get a strong party to the bottom of the pothole, so that the whole system can be explored and surveyed accurately. A supporting scientific team will follow to carry out work on the geology, hydrology and biology of the system.

We are again receiving a certain amount of industrial support and we are hoping that your firm will be interested in helping us by supplying some of the lifelining ropes necessary to ensure the safety of the party.

We are putting all our time and resources into preparing the major equipment needed and it is only with the small but important items that we are hoping to obtain industrial support.

If you are interested in helping us I would be very pleased to discuss it with you.

Yours faithfully,

J.M. HARTWELL.

1966 Finances

INCOME

Subscriptions 22 people at £30	690	0	0
Sale of nife cells	518	14	3
T.V. magazines etc.	67	16	0
Donations	43	18	0
Exhibition	40	16	10
Hire of stores	10	6	3
Sale of carbide	2	18	0
	£1373	9	4

EXPENDITURE

Travel						
1. Bus						
Clutch plate expenses	17	4	10			
Road Tax	6	8	0			
Insurance	47	0	0			
Green Card	2	0	0			
A.A. fee 3 star	3	8	6			
Fittings and spares	10	4	2			
Channel crossing (passengers)	114	17	0			
Fuel	52	0	2			
Parking		1	6			
Frontier charges	15	14	5			
Tyre	37	3	8	306	2	3
2. Land Rover						
Green Card	2	0	0			
A.A. Insurance 5 star	6	0	0			
Fuel	21	5	5			
Bumper repair	4	0	0	33	5	5
3. Train						
Deposit for couchettes	12	0	0			
Tickets	54	16	0	66	16	0
4. Towards one air fare				13	15	0
Personal insurance				39	0	0
Other Expenses						
Engineering materials incl. generator fuel				283	18	11
Photography				200	14	1
Ladders				49	15	0
Communications				20	10	0
Carbide				2	8	9
Stretcher and medical				5	0	0
Transport of equipment				16	14	4
Stationery, postage etc.				44	16	4
Miscellaneous				63	0	10
Domestic						
Water filter				17	6	6
Cooking and camping equipment				7	17	11
Camping Zagreb					5	9
Food: Before				75	19	0
During				13	5	4
Total Expenditure				1261	1	5
Balance				112	7	11
				£1373	9	4

Engineering.

In describing the engineering work that was done on both expeditions it is difficult to know what to include and what to leave out. Much of the work that went into the '64 effort is not recorded here, mainly because it was superceded by the 1966 designs. Those items that remained are fully reported on, but readers requiring, for instance, details of the original cage may obtain them from Club records.

(i) The Cable.

By the end of September 1963 we decided to use 'Excelsior Ropes' wire rope for the job of carrying the cage. The wire used in the 1964 expedition differed from the one used in 1966.

Specifications:-	1964	1966
Diameter	0.1875"	0.2500"
Weight	63 lbs./1000 ft.	100 lbs./1000 ft.
Breaking Load	3360 lbs.	5000 lbs.
Material	high tensile steel	high tensile steel
Finish	clean (later galv.)	galvanised
Construction	12/6 fibre contra laid	17/7 fibre contra laid
	fibre changed for telephone line during construction	P.T.F.E. ins. 7/.0076
Type No.	54	?
Cost	£45-10-0 per 2000 ft.	?

Other cables were considered such as Marlow Yacht Ropes of Terylene, Nylon, Ulstron, Courlene. Although suitable types could have been found for our job, all would have been very bulky - 3 times the diameter of the wire rope, would not have had the same resistence to wear, and twice the cost. The main advantage would have been that smaller and perhaps lighter pulleys could have been used.

In 1964, when it was delivered, we could not make telephonic communication through it. It had to function, and the 'shorts' were traced with a Wheatstone Bridge. There were two faults in the cable, one at the 'eye' of the cable where the ferrule clasped it too firmly, and also in a 'pig's tail' which had developed in the laying process - giving the inner cable a kink into which the heavier metal layer bit. We had to cut off 20 ft. of cable to find the flaw. The cable and telephone were then tested and they behaved perfectly.

The next stage was to wind the cable since it was still on the delivery reel when tested. This required a squad of men to drag it off the reel up the mountain behind the club. This enabled the wire to be straightened, cleaned and examined for flaws, and would facilitate the winding in to the take-up reel by producing a good ground friction, the cable being pulled tight on to its own reel even and tight. The insulated slipring

was now added to the reel while it was light enough to be lifted and the winding process started and completed by hand. It was hard work on the hands and shoulders because of the drag of 2,000 foot over the ground. The cable laid itself very well and the job was finished in 2 hrs. All that was left was the delicate job of making a neat termination to the cable's ends to allow for telephone connections. The springy wire when cut unravelled the lays in opposite directions and so it was advisable to tie off before making cuts. But even before this it was necessary to feed on the cable a thin-walled copper tube not to increase its overall diameter to allow the cable to pass easily through the pulley blocks - with clearances of a few thousandths of an inch. Copper tubes, used for the preparation of dental crowns, proved very successful for this job. One strand of the outer steel casing was used for one wire and the inner insulated cable for the other, and both were brought to a terminal box on the side of the drum and fed to the slip rings already fitted to the opposite side to the pulley. A terminal box with pick-up brushes and terminals completed the arrangement.

(ii) The Cable Climbers. (Fig. 17a and 17b.)

The winch cable for Balinka was about six millimetres in diameter and if the capstan needed maintenance during use, a means of clamping it safely and quickly was necessary. After many discussions a Bowthorpe type KPI type clamp was chosen for the job. The apparatus is essentially two parallel serrated jaws, each with a V-shaped groove, linked together. The links are extended and riveted to an anchor bar which turns inward to be in line with the cable placed between the jaws. Any pull on the cable tends to drag on the jaws, and in consequence of the links pivoting, the cable is gripped tightly. For our purpose, since the action was quick to apply and the large jaw area was unlikely to damage the cable, the apparatus was well nigh foolproof.

The principle involved in the device also suggested a solution to another problem that might be encountered in the exploration of the pit. If the cable should jam in a crack, or if the cage had to be abandoned, its modification could act as a means of climbing out from the hole via the cable itself. Two devices - to act in conjunction - were constructed, one operated by the feet, the other by the hands. The top one was made of mild steel with mildly serrated jaws. The anchor bar was made of twin bars with two four-inch sections of tube set at right angles to provide a purchase. The use of twin bars provided an unobstructed path for the cable. Without any alteration of this apparatus, one of the chief problems would be descending since the jaws must be opened, the device lowered, and the jaws closed again; (when ascending the spring closing the jaws provided an automatic grip, the equipment only needing to be pushed or dragged upwards). By fitting two projections on the outer jaw of the top clamp for one finger from each hand to be hooked over to hold the jaws open, the difficulty of descending was overcome. Two guard rings were fixed so that a harness could be used in which one could rest by hanging from the top support.

After testing, further modifications were needed since the jaws were found to polish and slip after some hours use, and the cable slipped out when the jaws were slack. The jaws were remade from hardened steel

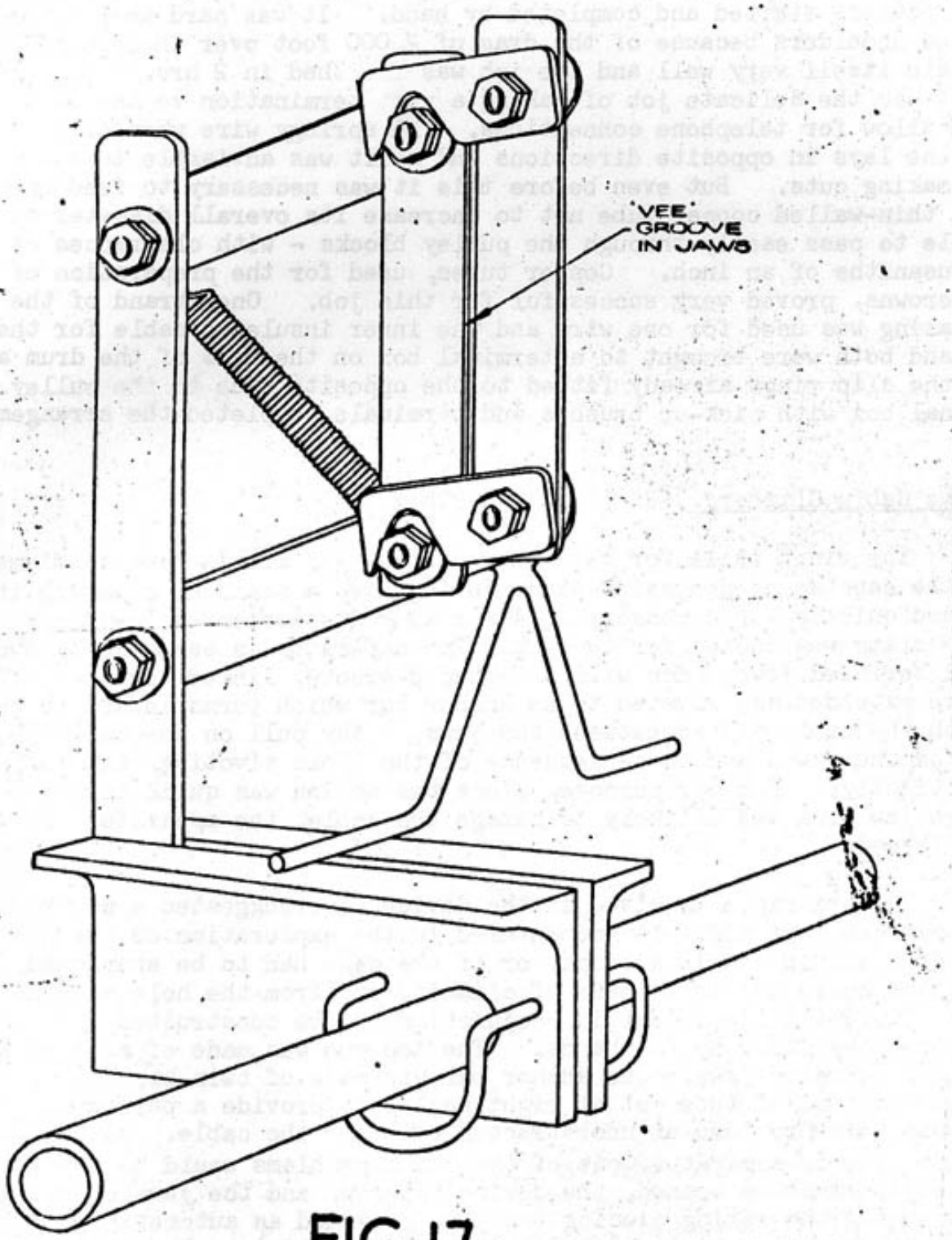


FIG 17a

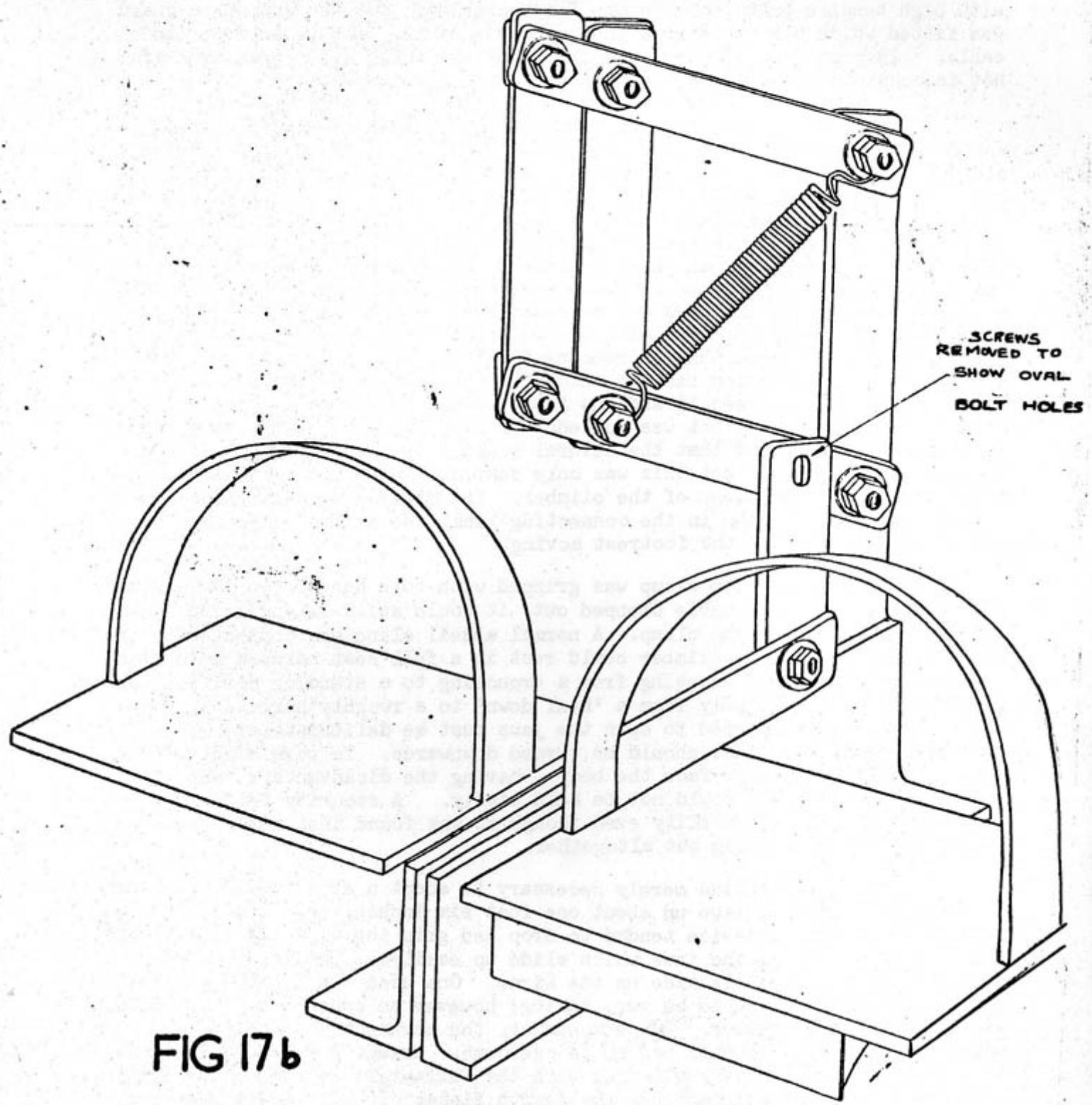


FIG 17b

with high tensile bolts to cure the first problem. For the second, a guard was fitted which slipped across the open side of the jaws to enclose the cable. In practise, it was found that the jaws would still grip even if not in complete contact all along their opposing surfaces.

The foot clamp was more robust (Fig. 17b) and designed that it could be stood on for some time in comfort. The jaws and anchor bar were similar to those of the top clamp, the anchor bar being also split into two but this time it was made of $1\frac{1}{2}$" x 1" angle iron. The left foot rest was welded in line with the jaws and consisted of a piece of angle-iron as wide as a boot and fitted with a semi-circular steel bar shaped like a stirrup - thus the clamp could be hauled up with the foot, the spring tending to close the jaws, enabling the clamp to move upwards automatically. For descending a device for opening the jaws was necessary. The right hand rest was constructed from a bicycle pedal with the axle welded to a twin anchor bar. The stirrup was so arranged that by rocking the feet, the whole pivoted about the axle. A small extension bar was welded to the rest, and from its end a link was provided between it and the lower link connecting the jaws to the anchor bar. When the foot was rocked, the link pulled the jaws down, opening them. It was found that the natural rocking of the feet was sufficient to hold the jaws open, but this was only desirable when moving upwards by a deliberate foot movement of the climber. The difficulty was overcome by enlarging the pivot hole in the connecting link, the clamps could then be pulled upwards without the footrest moving.

In use, the top clamp was gripped with both hands, the jaws towards the body, since if the cable dropped out, it would still be encircled by the hands and the body of the clamp. A normal abseil sling was connected to the guard rings so that the climber could rest in a full seat harness held from above. The action of changing from a crouching to a standing position causes the foot to rock naturally from a 'heel down' to a roughly horizontal position. The movement needed to open the jaws must be deliberate and it was recommended that the toes should be turned downwards. To work simply, this meant that the jaws must face the body - having the disadvantage that if it fell off the cable, it could not be held easily. A security tether was used to cover this eventuality even though it was found that the guard prevented the cable slipping out altogether.

To climb, it was merely necessary to adopt a crouching stance when the bottom clamp was drawn up about one foot six inches, and straighten oneself when the bottom device tended to drop and grip the wire and the top one was forced up opening the jaws which slide up easily. The movement was repeated, and progress is made up the wire. One used the stomach muscles chiefly and this proved to be very tiring; however no conscious mental effort was needed by the climber. On descending, the movement was against the action of the jaws and this had to be overcome. Assuming a vertical stance, one pushed upward slightly standing with the full weight on the bottom clamp. With the weight off the top one, the fourth finger of each hand hooked over the projection on the jaws, and with a slight pull they held open. The body was bent to a crouch and the top clamp slid down, the cable running in the open jaws. When the fingers were released from the top clamp, they closed and gripped the cable. The legs were then lifted and the weight was transferred to the hands or the harness. With the load off the jaws, the right

foot was tilted to operate the linkage, while the left steadied the clamp. Once open the clamp could be slid down the cable until the body was upright - the foot was straightened and the jaws closed on the cable.

Although different muscles were used, it was found that everyone who attempted it could climb at the same speed as they could climb a ladder. The action used to open the jaws was designed to be unnatural and therefore the descending motion was deliberate in character. It is sufficient to say that a seven-year-old boy climbed up and down twenty feet without previous practice and without difficulty.

By arranging the link to operate near the anchor bar, and by using one finger only for the top clamp, one has built-in safety factors; once loaded the clamp cannot be opened accidentally since there is insufficient leverage on it. The biggest difficulty experienced was a psychological one - the effect of the thin cable, which on long pitches appears invisible. The device should be considered most useful as a cheap method of descending shafts, but it is vital that it is used in free space with the cable under a slight tension.

J.V.O. 1964.

(iii) Ladder-hooks (The Rooks).

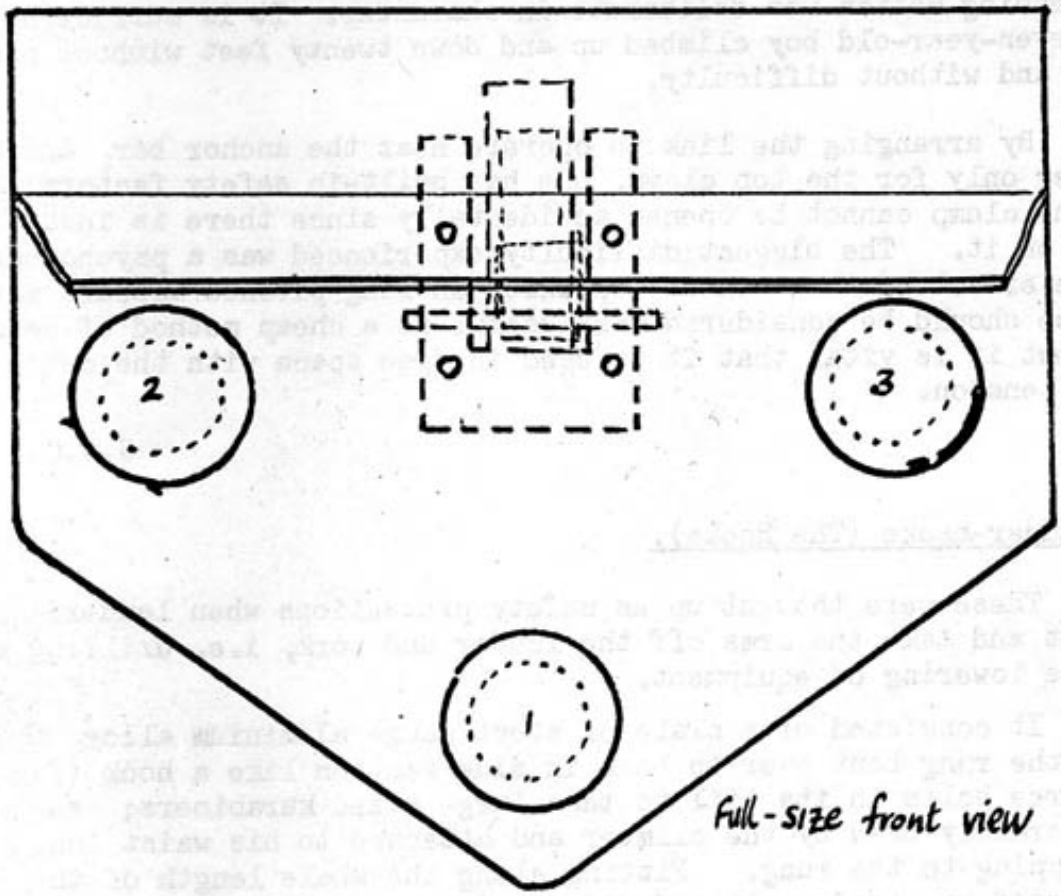
These were thought up as safety precautions when laddering, so one could rest and take the arms off the ladder and work, i.e. drilling or assisting in the lowering of equipment.

It consisted of a plate of stout gauge aluminium alloy, the same width as the rung bent over to hook in side section like a hook (Fig. 18). It had three holes in its tail to take large sized karabiners; the centre one was normally used by the climber and attached to his waist loop for quick clipping to the rung. Fitting along the whole length of the run, the device spread the load on it and did not distort the rung or the 'Rook', yet giving complete support and security to the climber. Some people found them a little tight to remove, but they were deliberately made to have this snap - in effect to prevent them being too easily or accidentally displaced. They were used to good effect at the full scale test at the Garth mines.

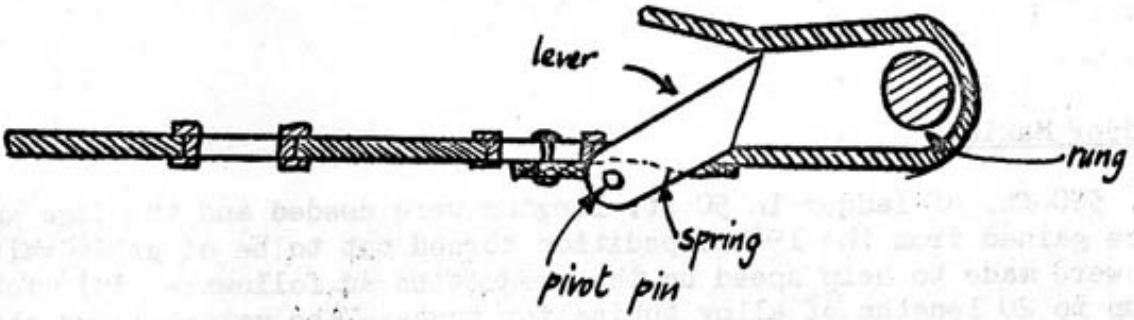
(iv) Ladder Making.

500 ft. of ladder in 50 ft. lengths were needed and the jigs and experience gained from the 1961 expedition turned out to be of great value. New jigs were made to help speed up the production as follows:- (1) for cutting up to 20 lengths of alloy tubing for rungs - the material was thicker walled than the 1961 samples, (2) for drilling twin parallel holes accurately spaced in the rungs, (3) for spacing out rungs and ferrules - this was a 20 ft. beam, 6" x 3", with slots cut in it to hold the rungs tight.

The small jobs - cutting, trimming, plugging (including cutting the



Full-size front view



Sectional view through mid-line.

FIG. 18

plugs) and drilling the rungs were done at home or at the H.Q. and took some time. The thousands of alloy ferrules were made professionally to precise specifications. The wire lengths were prepared by a team at the club, using an ingenious device for severing and tapering the ends by low voltage 'burning'. The same team plus other club members did the monotonous job of threading the rungs and ferrules on the wires; these were roughly spaced and mounted in the 'beam' jig for accurate spacing.

A hand swage - an adapted pair of bolt-cutters resting on a batten on the side of the beam, served to lightly crimp the ferrules for the final pressing either by the bolt-cutters or the press. The hand swage needed modification since the replaceable jaws were not closing the ferrules parallel, i.e. the tool had to be reversed, and each ferrule recrimped - 600 squeezes per 50 ft. of ladder. After overhaul, the tool functioned well; ferrules were tight and parallel, but unfortunately the inserted swage blocks sheared off, the faceplates having been used instead of pressure plates within the jaws. This was a set-back since it was much quicker than the other method using a sledge hammer and the heavy swage. The latter device was used in the end - this had its snags since it could not stand up to repeated hammering, and there was a danger of trapping the wire strands - the whole process took longer. On completion each rung was tested to 1,200 lb., and faulty ferrules and wires were reswaged and repaired.

Finally the stainless steel 'C'-links were cut, prepared and fitted with thimbles to the ladder tails on a jig maintaining the correct distance between the rungs of the adjoining ladder.

The ladder, with an equal quantity of borrowed lengths, was to form the basis of the second means of access to the 'pit'.

(F.B.)

(v) Pack Frames.

Two designs were tried out, one which Frank still prefers (Why not? he made it. - Ed.) and the one described below.

They were made of 5/8" square alloy tubing and were a cross between an 'A' and 'H' design (Fig.), with large side supports, the parts being welded together. Frank made jigs for the preparation of the materials (six pieces per frame) since the ends had to be angled. Next, jigs were also made for the assembly and the welding of the pieces; two were made to allow one to be set up whilst the other was being welded. Twenty bundles of 'raw' were made and the welding process was left to a club member with gas-welding equipment. It was a slow job. The struts and blades for the attachment of the waist and shoulder straps could not be added until the welding had been completed and material obtained. An 'expedition' to the Resolven Aluminium Works returned with a bargain selection of useful materials - strip, plates and blanks. Cutting 3" x 2' sheets into 2" strips 2' long with a hacksaw

was not easy. The thick plate metal side cheeks for the waist band were difficult to design since they had to be 'mirror' pairs. All edges of the cut material had to be filed and smoothed. Straps and waist bands were made of fire-hose acquired free from a local fire brigade. Only half the frames were finished and taken to Balinka, since they were difficult to pack in the bus.

For Balinka '66 the frames were modified to make them sit higher on the wearer's back and also the webbing was replaced by more suitable material.

(F.B.)

(vi) Anchors.

The main pieces of equipment had to be securely weighted, anchored, wedged between trees and other objects in their correct alignment with each other and the pithead. The latter and the aerial ropeways also had to be secured. During the test runs and at Balinka, trees, rocks, scaffolding poles, buildings, masonry, vehicles, rawlbolts, crowbars and 'holdfasts' were used freely and successfully.

The 'holdfasts' were particularly good. These consisted of a crow bar with a vertically aligned ring at its top, either welded to it, or an integral part of it. A pair, driven into relatively soft ground at the same point at an angle of 30 degrees to each other formed a stable anchor. Those we made ourselves had large rings to allow scaffold poles to be passed through. The holes as well as acting as belays for tethering equipment, could also be used for prising the bars out of the ground after use.

Holes in the limestone for ½" Rawl eyebolts were drilled with an electrical percussion tool called the 'Kango' hammer. It was operated from the H.T. circuit of the generator, using where necessary a few hundred feet of heavy-duty cable. The generator was driven by a small petrol engine.

The aerial cables supporting the two pithead pulleys, were anchored to convenient tree bases, rocks, or masonry with Rawl eyebolts and cable clamps. The 'Tirfor' tool proved useful in tensioning the cables. First the pair of pulleys with swivel-eyes were threaded on the cables which were made taut and tightened with the cable clamps, making the whole set-up secure and safe. Then a tripod or quadruped of scaffolding poles was added to the point of suspension to stabilise the structure. The cables were ½" and 5/8" and the swivel eyes were 'D' shaped, solid steel with radiused edges and having a 5/8" hole drilled in their base to take the swivel bolt of the pulley yoke.

Steel pitons were used for anchoring wires and stays where convenient. Builders' scaffolding clamps of various designs were used, some adapted to fit the scaffolding, others, with special feet made from steel channelling, for the Rawl eyebolts - used for anchoring the feet of the booms

to the rock of the cave. Steel cables, over 200 ft. at times, were used for tethering and supporting the free end of the boom. Prepared steel tethers were made for a multitude of purposes for anchoring of the heavy pieces to the holdfasts.

(vii) Testing the Winch.

The first test was done using a short length of cable similar to the winch cable. Each unit was tested individually and all together with a man acting as the temporary wind-up reel and anchor exerting a pull of 30 lbs. It lifted two men a few feet - and then stopped. All the following week we thought out the reasons - at least theoretical ones: it could have been any of the following:- (1) engine not run in; (2) hydraulics were faulty, there were many places along the line where troubles could arise; (3) the capstan not run in or the gear ratio too high; (4) the engine not powerful enough; (5) the design of the capstan wheel system of pulleys having some inherent fault.

Next week we checked (1) the revolutionary speeds of the engine in all gears, hydraulics and winch; (2) the operating hydraulic pressures of the main system, the regulating valves and control mechanisms; (3) the static torque of the hydraulic motor uncoupled and coupled to the capstan box. All speeds and pressures were correct so the trouble had to be in the capstan itself - the worm-drive box, gears, bearings or the bi-capstan pulley system. It was taken home, stripped down and all high spots on the gear and worm wheels hand scraped, reset, and mated with the correct amount of backlash. It was run in for a whole week day and night driven by an electric motor mainly on no-load using colloidal graphite oil. There was an improvement and the next week at the club with the 'quarries' permission we tested it in a high loading tower. The weather was bad, raining and blowing but we rushed the pieces over to the site in a Land Rover. We rigged the pulley high in the framework of the tower, anchored the capstan with rails, planks and chunks of masonry and steel after getting our line up and down to the cage. The tail end was run around the capstan drums and back to the anchorman - wearing a white polythene manure bag with holes for arms and neck - covered from the storm. He kept the cable under tension on the flat ground behind him. We tested it with dead weights, progressively increased, and succeeded in raising 3 cwts ten feet. Because of the gale it was dangerous to lift the cage higher. There was a cloud burst, the floor of the tower was flooded by 3 ins. of water. I found later that the Hepste had risen 4 ft. at the Hepste bridge, Porth-yr-Ogof was inaccessible. We carried on with live lifts with one, two, three men; but we could lift it no higher than before, everything seized up. It left the ground at speed and breaking this static starting friction was difficult. But why stop dead in mid-air? We stopped the trials.

A letter sent to Peter Harvey in Malta brought its reply and our answer. Our capstan varied from the original model since it had two banks of independant pulleys - recommended by a professional firm. If one drum

had its grooves cut only a few thousandths of an inch deeper than the other, the cable would have a self-wrapping effect on the drums, ever tightening until either the cable would break or the machine stop. We tested this in our home made lab with scaffolding poles for levers and 1 cwt. weights as the test load to imitate the wrapping effect. It proved it. In consultation with the makers we decided to get more power in the worm drive box by reducing the gear ration, sacrificing speed for power. The 40:1 was replaced with a ratio of 55:1.

We tried another form of pulley; hard wood 'sleepers' were inserted between the cheeks of the driven drum. These were about 1" square section bound to the drum by two metal straps and shaped to form a shallow 'V' groove. Next morning full-scale lifting tests were carried out in the workshop. We lifted 840 lb. successfully. The uni-capstan was the basis of our final one, but could we make it? Time and money were not with us, but the quarry helped again. We wanted a steel drum or cylinder 8" in diameter and 3" wide, and found a pair of gear wheels with teeth badly damaged. One was 1" and the other 2" wide, both with bores fortunately smaller than the diameter of the pulley shaft. They had to be machined to a particular formula. As luck would have it some engineers turned up at the club and offered to machine it for us if we could provide the formula of the profile of the pulley groove. Frank took home the thinner of the wheels and turned it at home, very successfully, and mounted it on the shaft. It was keyed to the shaft with two large Allen bolts, holes having to be drilled and tapped axially along the common face between shaft and pulley. The old cheeks were redrilled and marked to correspond with the four mounting holes already made. The whole unit now had much less overhang compared with the original drums. The profile cut was correct for 0.2" diameter cable on a 8" pulley; on testing it gripped the cable which, however, rode up the slope of the cheek trapping itself. It could have cut itself in two. Libraries were searched for mining winding-gear until eventually a very old (20 years) edition detailed the formula we wanted. It could not be found in a modern treatise. A template of the profile was made in alloy plate. This served to make the shape of the cutting tool and made sure that the profile was at right angles to the pulley's face. After mounting on the lathe the slow process of shaping was begun, taking six hours on the small lathe working to full capacity.

It was mounted on the shaft next weekend two weeks after we had decided it was to be made. It was called a surge-wheel and the principle is much used in endless rope haulage. We used the full 'C' type to wind in both directions. The actual profile was a concave groove of 1" radius; the width of the pulley was exactly that of the one we had - 1½". It allowed the cable to wrap around 3.5 to 4 times either side of the midline of the groove. The cable was wound (it had a right hand lay on the outside) from left to right. We tested it in the workshop and it surged, allowing itself to slip sideways along the groove, yet gripping it so that it did not slip. The professional firm had no success with their attempt to make it. A dentist had removed the teeth from the gear wheel disguised as a mechanic!

It was decided to do a full test using all equipment since time was short. The bus was packed and we went to Dinas Rock. The capstan and winch were set up about 100 ft. from the base of the cliff, the engine

placed nearby; the bus acting as an anchor. A team at the top of the rock rigged a boom. We had forgotten the hydraulic oil so had to race back to the club for it. The cable was fed from the reel back to the return pulley to the capstan pulley then to the top of the cliff. We fitted a deflecting rope to the cage to pull it away from the cliff, since it was not until a point 30 ft. away from the top that it hung free. The cage was taken up and down unloaded showing that the deflecting rope was needed, then pulled up with 1 cwt. load of stone. As the load was increased so too the pull on the deflecting rope which became vertical as the cage reached the top. Four men pulled on the rope. With the next load, the strain was too much for the stays of the boom on the cliff top. The first thing we saw was the rapid and inexplicable drop of the cage, followed by the boom crashing on top of it. The cage stood up well to the damage, and apart from damaged uprights it was still a compact unit. We were thankful it had not been a live test. The end of the cable was damaged and 150 ft. had to be cut off the reel. One pulley had to be discarded.

The test had not been long enough to put the equipment through all its paces, but we would have to make a strong boom with double safety methods. However, the surge wheel and wind-up reel had done their jobs well. Two members took the damaged cage home, obtained new materials and rebuilt it. It was back at the club by the next week, where we were already planning a full scale trial in a disused mine shaft in the Forest of Dean.

At Mitchell Dean the return pulley was placed at least 30 ft. away from the windup reel anchored to a small springy tree. There was only a pull of 30 lb. when it left the capstan and wound itself on to the windup reel. The springyness meant that the cable could not be made too taut, allowing for some manhandling of the windup reel to insert a spoke to act as a brake. The return pulley had an extra tether for safety, but one fault did occur - the cable tended to come out of the pulley groove because of its horizontal position, catching between pulley and plates. This was overcome with an alloy blade placed in the block to pass into the pulley groove; the close fit prevented the cable slipping out when slack. There was no more trouble here. The windup reel had to be 'braked' when the cage was descending to keep a constant back tension in the cable, and was achieved by maintaining a back pressure in that section of the hydraulic system. It acted as a hydraulic clutch and brake and had to be maintained because on one occasion when the pressure was accidentally dropped, the windup reel overran, the cable slipped around the surge wheel and the cage descended at speed. One of the team grabbed the return cable and prevented an accident. Pulling and running with the cable was enough to re-establish the grip on the surge wheel.

The mine shaft was 280 ft. deep and many descents were made with one and two men in the cage.

The next field test was at the Garth Mine where the boom and all equipment was tested.

F.B.

(viii) Booms.

In 1964 our only knowledge of Balinka Pit was from letters and photographs and therefore this was a handicap in making pit-top scaffolding. It was a shaft open to the surface with an underhang 120 ft. down into a second shaft. We had to devise a structure, a means of erecting it and fixing it in the shaft to deflect the cage from the top shaft to the other.

Many models were made and prototypes of scaffolding since this material was transportable, collapsible and easily erected to any design. Experiments were carried out with different patterns all around the club on bridges, quarry faces etc. using wire stays, pitons, and wire tensioners. The field test took place at the Garth Iron Mine, very convenient since a rough road ran past the shaft opening. This was about 10 ft. wide and 50 ft. down it ended in a vast cavern with much underhang. Twin 'A' frames were built at the surface with their legs at right angles to each other. Pulleys had already been fabricated and attached to their apices with adapted builders cleats. These served as anchors and guided the winch and deflector cables. A large roller mounted at the base of the 'A's acted as a large pulley for the winch cable after the cage had been deflected past the frame and the underhang.

The frame was lowered by hand using the 'Tirfor' tool and a set of small pulleys on the pit head frame, to a point where the horizontal legs went under the underhang. The operators worked on two at a time from flexible ladders. The the ladders, lifelines and abseil ropes (around the waist and legs) were attached. Even though work could go on in this sitting position suspended by 'rooks' it became most uncomfortable, the loops biting into the legs caused cramp. The 'Kango' hammer was lowered and a hole drilled for the apex of the vertical legs of the boom. This was the key fixing point. The rawlbolt was inserted, locked, and the 'A' frame lashed to it with a previously prepared tether and tensioner. After further attachments the base of the 'A' was pulled into the wall of the shaft - pulling the horizontal legs up to the ceiling. These latter were attached to the ceiling. It worked, and although not fully tested we could see its possibilities for Balinka.

A device was made, a wooden trestle, to hold the 'Kango' but it was too cumbersome in tight locations and was dispensed with in favour of a rope sling. The abseil ropes problem was overcome with a complete firehose loop which went around the waist, under the thighs, and up through the waist band to the front where a karabiner attached it to the lifeline and rook.

The booms used in 1966 were essentially the same as those on the previous expedition.

F.B.

(ix) 1966 Balinka Expedition Report. Engineering Section. by F.S. Baguley.

The 1966 expedition preparations started off with enthusiasm, and subcommittees were formed to deal with the various main sections, one of which was engineering, with Bernard Woods as its O.I/C, and myself as minute-secretary and convenor. The section held monthly meetings to discuss the theoretical and practical aspects and other requirements based on the experience and knowledge gained from the 1964 expedition (both engineering-wise and on the physical difficulties of the pothole, now a known factor, at least down to 700 ft.) The main ones were as follows:-

1. The method had been good, particularly the use of the surge-wheel type of winch, and the use of hydraulics as the transmission, but the main drive to the capstan should be positively driven, and the auxiliary drive to the storage reel should be indirectly driven (i.e. the hydraulic pump to be driven by a vee-belt). Both mechanical and electrical methods were also given full consideration, but eventually ruled out, for various reasons.

2. An air-cooled more powerful I.C. engine was necessary, as the water-cooled engine did not function too well at high altitudes and the water position was a critical one.

3. The cage should be able to travel easily and quickly, empty or full, manned or unmanned, in either direction, at least the known depth of the shaft, in order to be able to put down a large team as expeditiously as possible, and not to have to use 'dead' men waiting on ledges or travelling up to escort the cage back to the surface. Laddering was definitely out.

4. A stronger, thicker, anti-spin contra-wound H.T. cable was needed for physical and psychological reasons, but this later gave rise to mechanical headaches, and much extra work.

5. Improved safety measures were to be made all round.

6. The units were to be made in conveniently-sized packs for storage and coupling.

7. A spare identical engine was to be taken.

8. A secondary winch was to be considered at the 700 ft. level.

9. A dependable generator to be taken to provide H.T. and L.T.

10. More 'ironmongery' to be obtained and taken, e.g. rawlbolts, shackles, tensioners, ground anchors, etc. etc., so essential to the layout of the whole setup.

Starting off with apparent enthusiasm, and plenty of time in hand, gave quite a good impression, but this was soon dispelled. I had hoped to see all the preparations completed a year before the departure date. After about four meetings, the committee ceased to function early in 1965, on the instructions of the leader. Many of its members, including the leader, withdrew from the expedition throughout the year, for a variety of reasons. This automatically entailed the O.I/C engineering taking over as leader, which was the rule. As might be expected, the duties necessitated the

leader having to give up the job of O.I/C engineering, and with barely 10 months to go, I was asked to take over. With all these delays, upsets, and withdrawals, and consequent lack of assistance, it was an unenviable task to take on. Even so quite a lot of work had been done at home, but the important main items were at the D.Y.O. exhibition. This was a dead loss in more ways than one. This seriously delayed the initial full scale attack on the stripping, redesigning and reconstruction of the new main units, which were a sealed hydraulic transmission unit, a power unit, a winch unit, storage reel, and emergency drives for both the latter.

Most of the work of reconstruction and fabrication of parts was being done at home; whilst most of the assembly and tests were done at the club, despite this, there was opposition in some quarters that Balinka was taking up a lot of club members time etc.

One professional firm had offered to do all the hydraulic section for us, but after endless delays, this never matured, and we just had to carry on under our own steam. Another firm did give us much useful advice, gratis, and other firms did some specialised machining for us either gratis or at full cost. This was work which I could not do on my own lathe at home, or because I would not have the time to do. We had a marked shortage of engineering types on the expedition, or who were willing to help, so it was with much relief that we enlisted the help of Laurie Galpin and Rod Stewart. It was work every evening at home for six hours, and a full weekend's work at the Club throughout the whole period. A system of having working weekends failed disappointingly, and most of the work fell upon the few as usual.

The expedition was essentially a caving one with a strong engineering element, involving a complete mobile pithead and workshop. Everyone was a caver, but not everyone was an engineer. The whole project depended upon team work, with the engineers naturally as the key men; the success, no, the very implementation of the venture depended upon their efforts, for if they failed to produce the goods, in time, then the expedition would have failed before it had started, and there would have been no point in going.

THE UNITS.

The main units were designed to be rectangular or cubical so as to fit together, compactly, and to pack into the bus conveniently and provide 'shelf or platform space' for other items.

1. The power unit. This was a war surplus Douglas Dragonfly 250 cc. air-cooled four-stroke petrol engine with twin horizontally-opposed cylinders. It was fitted with a governer, with an optimum speed of 2,300 r.p.m. Many parts were missing and had to be made, and spares were difficult to come by as it was an obsolete engine, but a good sound one. It was completely overhauled, and built into a 'Dexion' frame, about 2 ft. square and 18 ins. high. This contained the silencer, and exhaust system, the petrol tank, air-cooling system, heat baffles and pull start, so that nothing except an easily detachable long exhaust tube would stick out. All these parts had had to be made also.

A second one was later acquired with a slightly different cooling

system, but basically identical. This was also given the same treatment. This was to be used for the generation unit, but provision was made for either engine to be coupled in line to both the generator and hydraulic unit should either engine break down, by using a very long 'prop-shaft' instead on the short one normally used. The prop-shafts and locating pins allowed either engine to be easily and positively located and coupled to either unit.

These engines gave no trouble whatsoever.

2. The hydraulic unit. This was also made of 'Dexion' and was about 4 ft. high, 1 ft. deep and 2 ft. wide. It contained the two hydraulic pumps and their drives, valves, gauges, controls, fixed piping, filters, couplings, mountings, and last but not least the hydraulic tank. The flexible pipes were also attached conveniently to the unit, to form a permanently sealed connection to the motors attached to the capstan and storage reel, from which they could be easily detached and to which they could be easily located again.

The tank was made of 18 s.w.g. galvanised steel, with heavy brass glands (from my old 'fridge'). It was designed, shaped and made at home and took the best part of 3 weeks. It was pop-rivetted together and then soldered. It could stand up to 12 lb. p.s.i. It contained baffles, anti-frothing pipes, valves and a coarse filter. It contained 10 gallons of oil, and fitted into the top of the unit frame. (See article on Hydraulic Unit by R.S.).

3. The capstan or winch. This was the same one as was used in the 1964 expedition, but it required considerable modifications to improve its performance. Basically it was a 40:1 worm-drive box with the same flanged surge wheel, 8" in diameter, keyed on to the output shaft, but this time as close as possible to the main bearing, by means of two plain keys and one screwed key to stop any movement along the shaft. In addition an outrigger roller bearing was added to give extra support. The whole was mounted on a stout aluminium alloy base-plate about 2 ft. square. To ensure eoncentricity and correct alignment of the shafts of the hydraulic motor and the input shaft, a special keyed coupling and accurately machined flanged mounting were made to my specifications and drawings. The permitted limits of error only allowed a margin of one and a half thousandths of an inch, otherwise the drive would be seriously affected, even causing no drive at all. The other end of the input shaft was fitted with an extended shaft and a vee-pulley with an outrigger bearing also. This was permanently engaged to a small gear-box, having forward/neutral/reverse positions, and vee-pulleys on its input and output shafts, so that a modified tandem could be permanently, positively and adjustably connected to it and engaged to form an emergency drive very quickly, by means of a simple lever, in either direction. The base plate was fitted with stout builder's scaffold ½-clamps, located on the ¾" bolts which held the worm-drive box to the base, so permitting the unit to be attached on the level to anchored scaffold poles, giving a degree of adjustment. The heads of these bolts retained long strong steel plates with 'D'-shackles at the rear which accepted the heavy duty straining wires.

A commercial wire rope grab was modified after much experimentation to fit at the rear of the surge wheel with the winch cable passing through

it, and a strong shock absorber and steel rope attached to it, to act as an emergency, or normal cable grab. Later on also when a larger surge-wheel was fitted, a tufnol shoe was fitted to the base plate, in between the cheeks of the surge-wheel to prevent the cable jumping off. Glyn Thomas had already made us a combination tensiometer and depth gauge, a really professional job, but it had to be modified and recalibrated, because of the larger cable. It was fitted on to the front of the unit, and was mounted on a swinging arm so as to provide complete movement laterally and vertically only, so as to follow the movements of the cable as it 'surged'. It worked a treat.

I made a second depth gauge from a Veeder counter, with an accurately machined 1 ft. circ. tufnol wheel, which walked on the cable at the rear end of the unit. This one was nearer to the driver, and both gauges kept together very accurately, with mine measuring accurately to one tenth of a foot.

The change in rope diameter from 3/16" to ¼" diam. meant that every instrument, pulley, wheel etc. that engaged the cable, would have to be modified, and that meant having to strip down every pulley, and re-machine the groove accurately, for example.

All pulleys had to be about forty times the diameter of cable, in diameter, and the vee-grooves cut to fully support the cable, so that the telephone cable inside did not get damaged. The profile of the surge-wheel was a similar though more complicated proposition, as it just fitted into my lathe. It also had to be re-cut. The formula for the profile for it was obtained with great difficulty. The radius of the profile is five times the rope diameter, the width of wheel is 6.5 times the rope diameter, and the wheel itself should be forty times the rope diameter, in diameter. The rope was wrapped 3 times around the wheel, with the high tension side on the right side if the cable was 'overwound', as we used it. The surging action was beautiful to watch, as the cable slid imperceptibly down the slope of the profile, at the same time not losing its grip, but it all depended on the return side being kept under low tension, in exactly the same manner as a sailor uses a windlass or capstan on board ship. The principle is exactly the same.

4. <u>The storage reel (or take-up reel.)</u> Its purpose was to store the cable after it had been pulled up. It did no hauling as such. The same reel was used as before, the old cable being removed and cut in half to provide two guide wires with telephone conductors for the two sections of the shaft. The new rope was basically the same as the original, being contra-wound, anti-spin, galvanised high-tension steel, of ¼" diam, and 5,000 lb. breaking strain. It was wound on to the reel, in the desired direction to provide over-winding, and under tension, using the other emergency drive, a 'trike! Additions and modifications to it included the following:-

(a) An internal expanding brake, modified from a motor-cycle, and involving quite a lot of machining and fitting. It was controlled from the hydraulic control lever by means of Bowden cable.

(b) An improved vee-belt tensioner for giving an improved angle of embrasure on the 4" diam. drive pulley.

(c) An improved platform and mounting for the motor, with an adjuster.

(d) An identical gear-box and rigid adjustable coupling for the vee-belt drive from the 'trike' as a means of emergency drive.

(e) The slip-rings and telephone pick-up brushes were overhauled and improved.

(f) A positive hook anchor was also fitted for extra safety, and finally an additional tensiometer for registering the low tension pull in the cable, capable of reading up to 350 lb. It had been made out of parts of a disused pressure gauge. It functioned well.

5. The emergency drive units. These were a modified tandem for the capstan winch, and a modified 'trike' (which was originally a scrap ex-W.D. collapsible three-legged generator stand) for the storage reel. They were both rigidly coupled, permanently to the respective units, driving them when required through the gear-boxes, which were in neutral when not used. This was a considerable improvement over the 1964 type, which involved much work and delay when coupling to the capstan; with the storage reel being wound by hand, four of them. Both the emergency drives required to be operated at the same time. It was important that the drive was of the fixed wheel variety. Pedalling was always performed in the normal manner as on a cycle, always forward, as the gear-box did the reversal, another improvement over 1964, when the bike had to be uncoupled and turned around, taking quite a time.

6. Pithead unit. This was constructed of suitably braced builders' alloy scaffold poles to form a quadrupod, from the top of which was suspended the large pit head pulleys, which had been considerably improved. The poles were suitably anchored with specially made footings made from short lengths of steel channelling with builders' half-clamps, and large ½" Rawl-eyebolts fitted. A strong anchor rope opposing the pull of the winch cable was attached to the apex and to a ground anchor through a tensioner. The whole unit was capable of universal adaptability.

7. The cage. This was made about the same size as before, but of tubular construction, with expanded metal cladding on three sides, a protective hood for the top, and the same cable hitch. Provision was made to accommodate internal and external lighting units, a communication system, emergency stores including the usual natural requirements, plus two persons and their own and general equipment required down below. It was to be guided by means of a guide-wire, as the shaft was vertical for the first 100 ft. where it opened out to the immense cavern (where it was also vertical for the next 100 ft. to ledge 200'), then it ran to a suitable point some 40 ft. or so out of perpendicular in two axes, to reach the 700' ledge. Special alloy blocks were cast, and machined to fit the 3/16" guide wire, so as to effectively clamp it terminally, for tensioning and anchoring it, at the same time, not damaging the telephone cable inside, and giving a central pull through the swivel-eyes. One was attached at the top end to the manual tensioning device which was a godsend to us, the 'Tirfor'. The lower end was to be attached to a large Rawl-eyebolt. The cage was attached by means of a stainless steel coupling plate lined with tufnol, to act as a slipper on the cable. The main snag of this was that it was fitted at the rear of

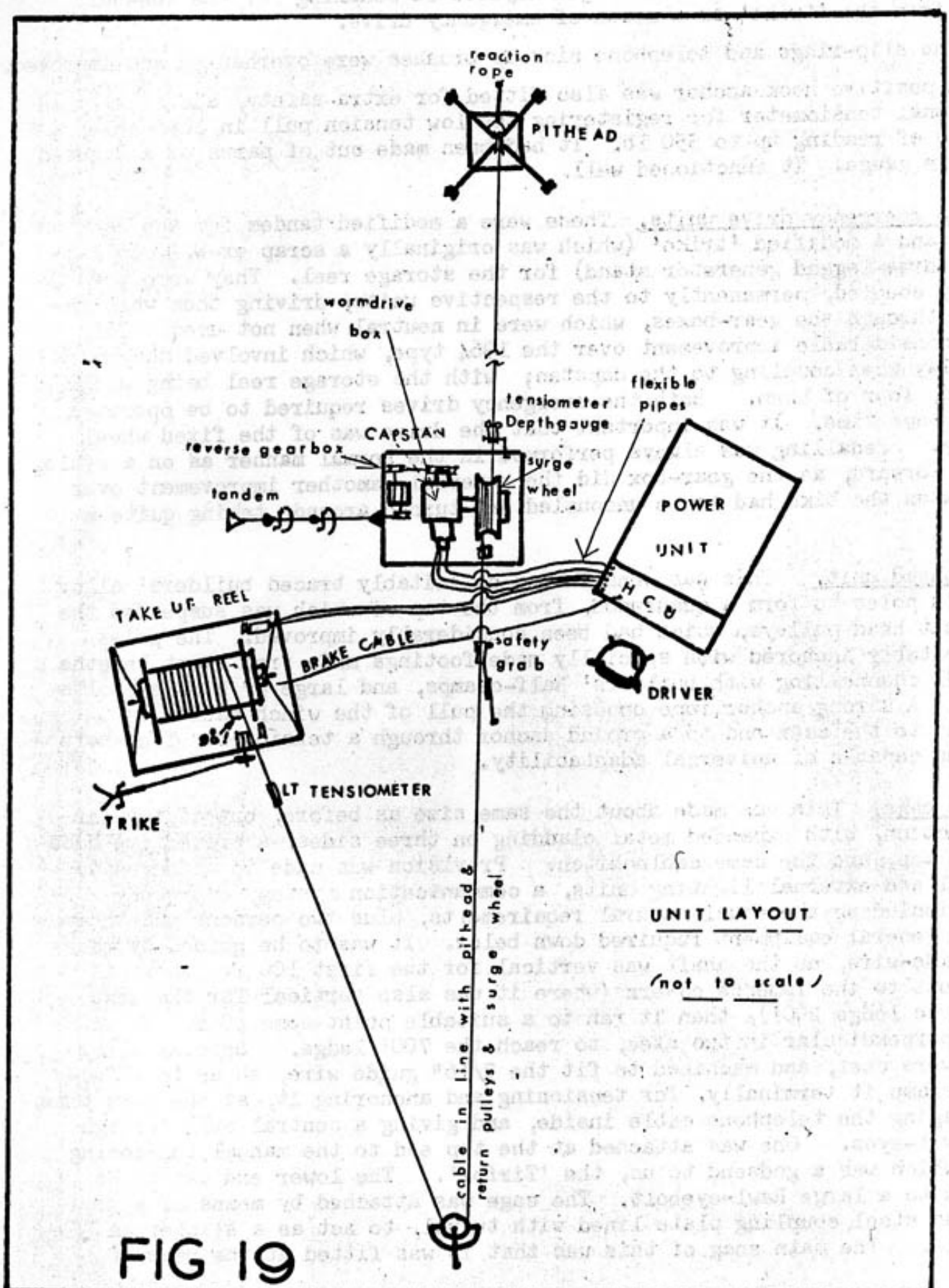

reaction rope
PITHEAD
wormdrive box
tensiometer
Depthgauge
flexible pipes
CAPSTAN
reverse gearbox
surge wheel
tandem
POWER UNIT
H C U
TAKE UP REEL
BRAKE CABLE
safety grab
DRIVER
LT TENSIOMETER
TRIKE
cable in line with pithead & return pulleys & surge wheel
UNIT LAYOUT
(not to scale)

FIG 19

the cage, and had to be uncoupled everytime to allow the cage to be rotated to get the rider out!

8. The 700 ft. Boom and Winch. Most of the practical work on this was undertaken in the Brickworks quarry, with the machining and fabrication being done at home or in the workshop at H.Q. The need for this winch had been considered necessary from the observations made at the 1964 drop, but how it was to be made and driven was another matter involving much thought and discussion. It was started late in the season, and gradually took shape in time for the first field test. Basically it consisted of quadrupod, and derrick made up of alloy scaffold poles with the special feet aforementioned, the whole being braced with wire ropes and tensioners to suitable rock anchors. In the framework of the quadrupod was installed the winch, which consisted of a balloon cable winch with automatic laying device, which required very precise adjustment to set it. It was driven through a 40:1 worm-drive box, by means of an electric motor, supplied with juice from our generator, which could be up to 250 yds. away. An automatic centrifugal clutch allowed the motor to take up the drive without effort. A special alloy pole some 14 ft. long lay between the winch and the end of the derrick, to permit the travel of a carriage, with a winch-cable pulley below, from the winch to the end of the arm by means of a mini-winch which was hand-operated. This carriage took the caver out to the end of the boom like a fishing rod, and he could be lowered down the cliff which was not vertical in this instance. As the cable did not have a telephone cable inside it, communication was going to be difficult. The whole unit was colour-coded to prevent parts getting appropriated for other units, and it could pack up into a small space.

9. The generator unit. This proved to be quite a headache, especially as it was undertaken so late, and with a reduced number of personnel. The idea was to make a L.T. and H.T. unit, for charging and providing mains supply respectively, and build it into a frame as for the other units for ease of coupling and interchange. Bill Little and Laurie Galpin did most of the work on this, and I did my share by making the necessary drive shafts, couplings and mountings etc. After much work, a very satisfactory unit was produced which did an excellent job, supplying power for drilling, operating power tools, lights including sunlamps, and charging batteries. It kept going practically nonstop. It was driven by one of the Douglas's.

Lots of parts had to be begged, scrounged, bought, borrowed temporarily and permanently, or made from available or acquired materials. Worrying delays occurred through many causes, in the supply of some items, and it set back the programme quite a lot. It was frustrating. Some firms were more helpful, and generous, others were not. Much precision engineering and fitting, and fabrication had to be done, chiefly at home. Lots of sheet metal work, soldering, brazing and welding was undertaken, plus woodwork when the bus arrived. Many pulleys, couplings (flexible and universal), bearing housings, mountings, keyed and splined shafts, control mechanisms etc. had to be made, scrapped, remade in favour of better alternative methods. It all took time, effort, patience, and money, with the time-scale in weeks. For if something needed making, it was nearly always a week before the new or modified part could be made and brought to the club for fitting and testing.

As the various units were made and tested in the workshop and modified if required, things began to crystallise, but not without some snags, e.g. the hydraulic tank started to leak around the heavy brass sealing gland, in which the filter was housed. The whole unit had been primed and it was inadvisable to empty it now it was sealed, so it had to be soldered in position by turning the unit upside down. As the oil 'flashed' at a point just above the melting point of the solder, I had to do the job in complete isolation, with the air-bleed open, and a fire extinguisher nearby. It took 3 hair-raising hours to complete.

Full-scale tests. Whitsun 1966 saw the first full-scale tests in the quarry tower, under glorious sunshine, but in a strong and bitterly cold N.E. wind. The tests were reasonably successful. Lots of faults were discovered, and modifications made. The layout was not exactly as it would be in the field, as the cable leaving the surge wheel on the H.T. side had to pass around a large auxiliary spare pithead pulley before it could go up to the main pulley some 50 ft. overhead. Whilst this provided horizontal fore and aft cable take-offs, it caused many a headache in other respects because of the very short sharp bend in the forward section giving rise to unlaying of the cable, which was very disconcerting, and involved contacting the makers for advice.

The relative positions of the set-up of the various units was as per diagram. The 'console' of the hydraulic unit with its power unit attached was placed so that the driver had a good viewing position of the pithead and surround. Because flexible pipes were used it could be moved about without affecting the critical positions of the winch and storage reel. The driver also had to have close-up view of all depth gauges, tensiometers, brakes, controls, gauges etc., and be able to handle the storage reel and winch if necessary. The position of the capstan was critical, it had to lie level, with the axis of the output shaft at right-angles to a line between the return pulley, way back in the woods, and the pithead pulley (or auxillary pulley during the tower tests). Likewise the storage reel had to level from side to side, with its wheel axis also at right-angles to the cable when in the middle of its traverse across the drum. The emergency drives were conveniently placed on the opposite sides of the two main units to the hydraulic unit. Altogether it was a very compact complex. The return pulley permitted the cable which left the low tension side of the capstan to be deflected to the take-up reel. It also had to be kept almost level, and not too far away, to prevent undue whip, which produced alarming sympathetical effects in the other units; nor too near, which prevented automatic 'laying' of the cable on the drum; about 50 ft. away was found to be satisfactory. The winch did lift five men during the tower tests, which was more than what was required, but the weight of the completed cage, hitch, accessories, internal equipment, and the cable when fully run out would have to be taken into consideration. The control of the whole set-up was invested in one lever, a 'Hurricane' fighter pilot's joy stick control handle, which could operate five channels if required. It was adapted after much ingenuity, and through a system of levers, to operate the variable swash-plate hydraulic pump which drove the winch; the control was fine, exact and universal from full speed down in the forward position through a spot-on spring-and-ball located neutral position, to full speed up, in the reverse position. The total movement was only just over an inch, and performed comfortably by the wrist. Control was so fine one was able to crack an egg with the cage - no mean feat.

Unlike some winches, this one drove the cage down. The take-up reel was so driven hydraulically, that once set by means of a control valve and gauge, it never required any further attention. Its job was always to try to wind the cable on to itself even when unwinding! This provided the necessary low tension pull on the cable to the capstan.

The bus arrived in June and much work was required to be done on it, repairs, modifications, adjustments, adaptions, additions etc. for lighting, seating, storage (everywhere, and I mean everywhere, even up the heater ducts that normally warmed the inside). This was mainly in the hands of Colin, Laurie and others. It was packed for the first full-scale field test at Mitchell Dean, which was no mean effort to transport, set up camp, unpack, set up all the equipment, test it, dismantle it, repack it and get back to H.Q. in two days. This was all the more remarkable considering only half the team turned up. The weather again was against us.

It was an excellent proving ground, and many faults were found, the chief of which was that the surge wheel was too small, it was causing the cable to slip around it, causing undue wear of both cable and wheel. The take-up reel also needed manual assistance, which meant one man at least was tied down to attend, whereas it should not require any attention whatsoever. The power units, the generator, the 700 ft. boom and winch, and the pithead functioned well.

On return, I took the capstan home, and as I could not make a 12" diam. surge wheel on my own lathe, I had to get it made outside and even though I supplied the form tool and template for it, it cost quite a bit, and we supplied the blank cylinder of steel! But it was ready and I fitted it by the next weekend. This involved very difficult machining and keyway cutting especially as two of the three keyways were semicircular, one of which was screwed. This change also necessitated a change in the gearing of the wormdrive box, from 40:1 to 55:1 to give a balanced speed and power equal to the previous one. The new set-up proved to be correct, and there was no further slip on the surge wheel.

Time was now getting too close, and there would certainly be no time to have the necessary pre-expedition relaxation.

In addition to the main engineering, the following projects were also in hand, undertaken by the staunch teamsters.

1. Hand carts, completely collapsible prefabricated units capable of negotiating the extremely rugged forest terrain.

2. Large carbide lamps. Much work was involved in acquiring, overhauling and modifying these 12 hr. lamps.

3. Electrics. A large quantity of Nife cells were acquired for sale expedition use and as gifts, but much work was involved in overhauling them. L.T. and H.T. lighting circuits were also prepared.

4. Pack frames. This was a continuation of the 1964 venture, so as to provide everyone with a means of carrying loads.

5. Cable clamps etc. A variety and large number of these were made to cope with all possible requirements.

6. Harnesses. Several of these were made to assist in ladder climbing with manual or mechanical assistance. They proved very useful.

7. The volcano. This was an instant teamaker, which provided about 50 cups of tea in about five minutes. It was a large geyser with a double annular tank, which was completely modified to burn anything combustible. Despite its large size, it was an absolute boon.

8. Pitons, ground anchors etc. A large number and variety of these were made to deal with a variety of needs.

9. Ladders etc. About another 800 ft. of lightweight ladder was made, and tested. This was a mammoth task. Very little of it, as it so happened, was used, but it had to be made and taken for safety.

10. The acquisition of clamps, poles, d-bolts, thimbles, wire ropes, holdfasts, rawl eyebolts, rooks, krabs etc. etc. presented quite a problem, to obtain them in time and at reasonable cost or free.

11. Tools spares, materials, both personal and general. Mobile workshop. This had to be gradually built up and noted, so that nothing was taken that would not possibly be required, nor anything forgotten. I don't think we were over at a loss out there, for not having taken any item.

In addition, much time had to be spent in working out theoretical considerations and calculations, from the estimated power output of the whole set-up, to things like the stress and strain in the guide wire, and other safety factors. This guide wire stress was very critical. The greatest stress on it was when the cage was halfway, and if it were fully loaded to 550 lb. the cable could only be deflected from its resting position by 3½ degrees before the stress in it would exceed its breaking strength of 3,000 lb. Lives depended upon this, and care had to be taken in making the calculations.

The work was completed one week before departure, and I spent that week completely on the Land Rover, also a necessary item, under atrocious weather conditions. The bus and Land Rover were packed the week before departure, and despite a serious breakdown in the bus immediately after departure, which was well dealt with by the mechanics during which time I took a well-needed rest at Gordon's in the Forest of Dean, we arrived only half a day late, but missed the transport that had been laid on for us, and we more or less had to do it all ourselves. The handcarts proved themselves well, one dog-team took up a load of nearly half a ton.

The equipment was transported up to camp in two stages. And the camp set-up, pithead and surround prepared, equipment suitably erected on a prepared site, stores established, generator, lighting, communications

rigged up, and the cage swinging in four days. But it took some time longer to improve the shaft and fix the lower end of the guide wire, quite a task in itself. 'Mains' were run down to 700 ft. to use the 'Kango' hammer and provide lighting. Once this was established we were swinging also. Getting the perpendicular drop position for the pit head pulley was a precise job, as there was very little room to play about with in the shaft, as long as knees, toes and fingers were kept well tucked in!

The cage was duly launched and the guide wire was tightened after the cage with its attached slipper had passed the 100 ft. mark. It was like a bow playing on a violin string. Even with this guide wire, the cage passed extremely close to the cliff faces and ledges, especially when fully loaded. The speed was about 100 ft. per minute, and altogether some 20 miles were covered, with only one slipper being used, though I had made six just in case of wear. Everything behaved perfectly.

The 700 ft. winch was not needed, as the rest of the way down could be laddered. This was very disappointing, but it was better to be sure than sorry through being ill-equipped. But also a lot of work had been saved through not having to rig it up at the 700 ft. ledge. As a result of this engineering we were able to put down several teams day and night, to carry out their various functions. For two weeks I knew the inside of that shaft like the back of my hand, even though I had not been down. It was a pleasure (one of the few I had) to drive it, memorising all the danger spots and using the depth gauges to good avail, and informing the cage occupants of changes in speed etc. due to these near-obstacles. I eventually went down to do a professional job with Derek and others, in identifying the gruesome remains dentally and otherwise. Apart from that and doing some dental operations for the local children, I was purely an amateur, but it was very gratifying to know that the members of the party, both British and Yugoslav cavers or attached personnel, showed complete faith in the equipment, the constructors and drivers; I even had faith in it myself, even though I was one of the last to go down!

No repairs were required in the field, except to non-engineering items which had been broken.

The task of dismantling after completion of the project did not take long, about three days, but it was under the most atrocious weather conditions, necessitating having to build large shelters, and keep huge fires going to dry out our clothes etc., but later events organised by the Yugoslavs helped to put a shine back on things again. As an engineering caving trip, it proved to be entirely successful, but there were aspects which left much to be desired.

In conclusion, I would like to thank the members of the expedition who had so kindly contributed towards a new toolbox for me. I was too moved at the time of the party, to express my feelings fully. Any offers for my old tool box, with genuine Balinka mud on it?

F. Baguley.
Sept. 1967.

(x) Hydraulic Transmission Control Unit.

The requirements of the 1966 expedition were very exacting, as any form of trouble in the field could be disastrous, not only to the expedition as a whole, but to the lives of individual members. After months of debating, heated argument and extensive experimentation, the following design was adhered to and proved entirely successful.

The following were essential design aspects:-

1. Power was to be derived from an ex Air-Ministry Douglas Dragonfly Stationary Engine, 250 c.c. air-cooled horizontally opposed unit.

2. Driving of the winch had to be from a comfortable position and absolutely fool-proof.

3. One-handed control would be an advantage, leaving the other hand free for emergency operation of any of the many safety devices.

4. Precision, infinitely variable winding up and down, including inching, was of paramount importance.

5. As the winch was of capstan (i.e. surge wheel) design, the cable was wound on a take-up spool; this necessitated the take-up spool to be applying a constant load on the capstan (300 lbs in practice) regardless of whether winding in or out, or stationary.

6. In the event of the cage becoming hitched up there had to be some form of relief overload valve to prevent mechanical damage or the possibility of the cable being broken.

7. It was of course desirable that the driver knew what was going on at all times, therefore full monitoring instrumentation was desirable. Incorporated in the design were: pressure gauges indicating pressures while winding up or down (a possible maximum of 3000 lbs. per sq. inch); a gauge indicating take-up spool loading, also instruments showing engine oil pressure and water temperature.

8. The winch had to be in unit form for portability, the hydraulics being one sealed unit.

HYDRAULIC CIRCUIT OPERATION.

Hydraulic fluid is stored in 10 gallon tank (A) on the diagram, from the tank it flows via a strainer contained within the tank to a three micron filter (B). The filter is capable of passing at least three times the required fluid flow in order to prevent cavitation on the suction side of the pumps. The fluid is sucked from the filter by hydraulic gear pump (C) which is driven by a two-to-one reduction V-belt and pulley drive at 1150 R.P.M. The gear pump output is maintained at about 200 to 250 lbs per sq. inch, by a

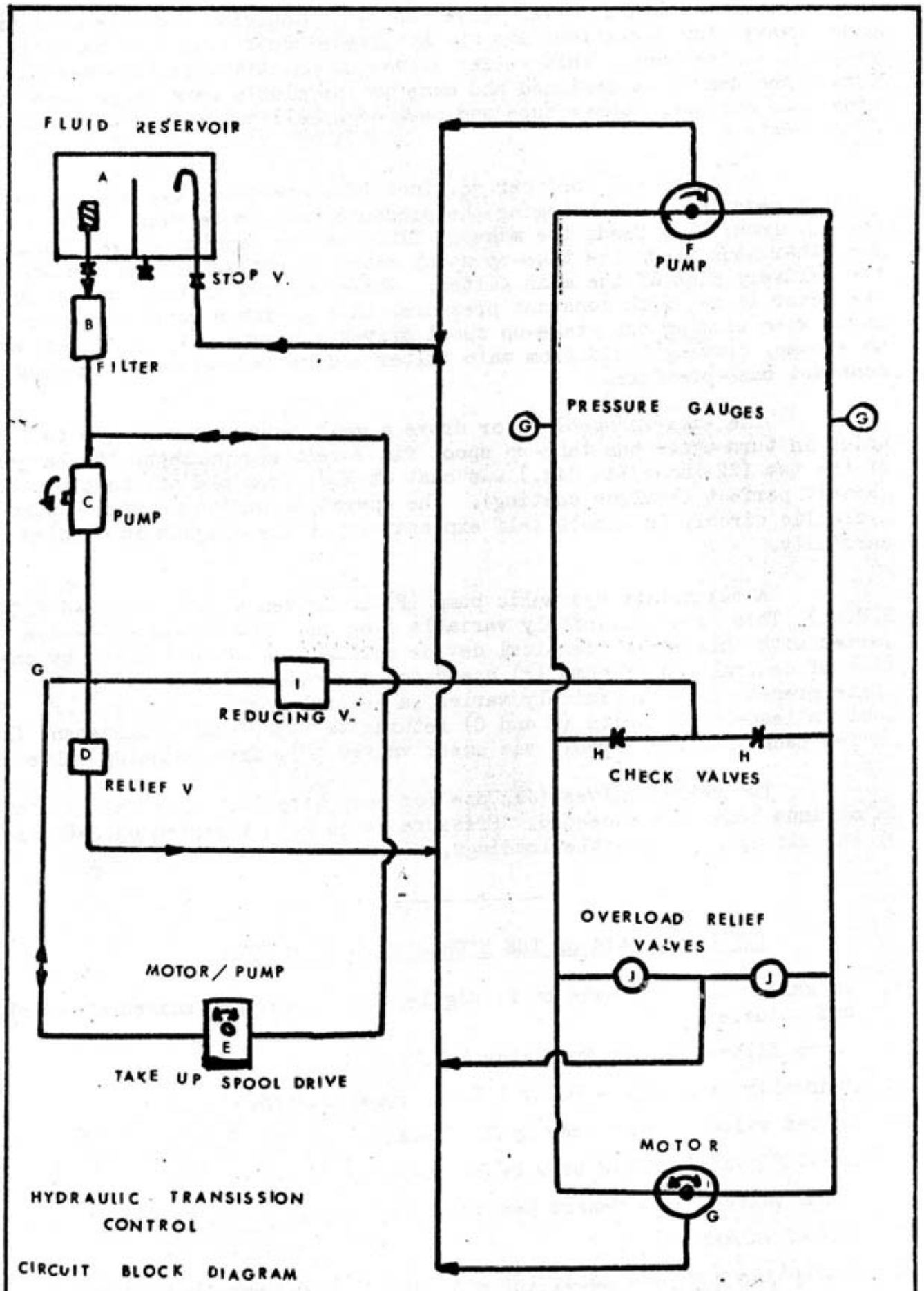

FLUID RESERVOIR
A
STOP V.
B
FILTER
C
PUMP
F
PUMP
PRESSURE GAUGES
G
G
G
I
REDUCING V.
D
RELIEF V
H
H
CHECK VALVES
OVERLOAD RELIEF VALVES
J
J
MOTOR / PUMP
E
TAKE UP SPOOL DRIVE
MOTOR
G
HYDRAULIC TRANSISSION CONTROL
CIRCUIT BLOCK DIAGRAM

FIG. 20

very accurate variable relief valve capable of holding a stable pressure under heavy flow variations and shock. The exhaust from this valve is returned to the tank. This relief valve was unobtainable from manufacturers and had to be designed and made in the club's work shops from bath taps, bed springs, copper tube and part of a ball valve from an old toilet flush cistern.

From the 250 lbs. per sq. inch line are taken two pipes, one feeds a reducing valve bringing the pressure down to between 10 and 12 lbs. per sq. inch; this feeds the make up fluid to the capstan drive circuit, the other pipe feeds the take-up spool motor directly, exhaust returning to the delivery side of the main filter. While winding in the take-up spool, the motor is fed with constant pressure, this giving a constant drive loading. When winding out, take-up spool drives its motor (E) which now acts as a pump, drawing fluid from main filter and relief valve (D) keeping a constant back-pressure.

The take-up spool motor drove a gear reduction unit (13 to 1) which in turn drove the take-up spool via V-belt and pulleys, the larger of the two (22 inches in dia.) was cast at H.Q. from old aircraft pistons (Result perfect flawless casting). The operation of the capstan - pump hydraulic circuit is almost self explanatory if the diagram is studied carefully.

A swashplate hydraulic pump (F) is driven at engine speed (2300 R.P.M.) This is an infinitely variable flow and flow-reversing device. In series with this is an identical device acting as a motor (G) but by operation of central rod of pump (F) speed and direction of motor (G) with its swashplate preset can be infinitely varied, a central position being STOP. Fluid lost in leak-off in units (F and G) returns to tank, cool replacement fluid is fed back into the circuit via check valves (H), from reducing valve (I).

Two relief valves (J), one for each direction, are set to blow off if maximum loads are exceeded. Pressure gauges are inserted on both sides of the circuit, to indicate loadings.

COMPONENT DATA OF THE HYDRAULIC CONTROL UNIT.

1. 20 gallon oil tank made by F. Baguley from sheet galvanised steel, riveted and soldered.
2. Micro filter- Messrs Purolator L.T.D.
3. Hydraulic gear pump - Dowty L.T.D. Type GF 45/S.
4. Relief valve - Home brew by R. Stewart.
5. REDUCING Valve - Home brew by R. Stewart.
6. Check valves (H) - Messrs Keelavite L.T.D.
7. Relief valves (J) - " " "
8. Swashplate pump and motor (F) and (G) - Lucas Hydraulics L.T.D. Type IP.60.

9. GAUGES 0-3500 0-6000. 0-300 lbs. per sq. inch. Ex W.D.Oxygen type.
10. Piping (rigid) - Messrs Tungum L.T.D.
11. PIPING (FLEXIBLE) AND FITTINGS - Messrs Keelavite L.T.D.
12. All other components made at club workshops or obtained privately!

16

Personnel.

1964	1966
S. Pepionik	S. Pepionik
C. Jones	B. Woods
F. Baguley	G. Clissold
G. Clissold	F. Baguley
D. Kemp	E. Baguley
J. Webley	D. Kemp
D. Webley	J. Webley
B. Woods	D. Webley
J. Harvey	J. Harvey
C. Harvey	C. Harvey
D. Baguley	G. Genin
G. Thomas	M. Skinner
T. Lloyd	P. Millett
E. Aslett	C. Graham
M. Dilly	R. Stewart
B. Birchenough	G. Saunders
J. Osborne	J. Hartwell
R. Roberts	J. Bevan
L. Hawes	A. Coase
I. [illegible]	L. Galpin
Scratchko	H. Ball
Tomaslav	W. Little
	E. Davies
	M. Norcic

POSTSCRIPT

Speleosophistry.

A philosophical extract from a letter to Dr. Aslett by Bill Clarke.

If as you say an article will be read with great interest in 50 years' time, it will not be for mundane facts. Anyway, they have already been published and future historians of speleology will have to look up original sources themselves. It will be of little importance what names the explorers bore, nor when exactly the discovery was made.

What seems interesting to me in any old exploration is the interaction of the mind of the explorer with his environment and the psychological causes and effects of the exploration.

Certainly, the discovery of the Pant Mawr extension was important to me personally; as participation for the firsttime in a new exploration would be to anyone. I remember that day feeling very tentative. I also remember feeling that something must be wrong somewhere as surely anything so easy would have been found before. I remember being a little disappointed at having to break off before the end because we were limited for time as you were on call. In fact, I remember everything that happened that day and during the following trips, including the difficulty of convincing the other people back at the club that we really had made a big discovery; especially since they had completed a survey of the known part of the cave the previous day.

Another contributory factor to a good day out was our being a party of two only, which is more efficient, and that I always enjoyed caving with you more than most people.

If these discoveries are worth writing up again years after, presumably it is because we can learn something by reflection on the motives and methods. All the other articles will have tales of grim battles against the rock. This did not happen at Pant Mawr. My trouble was to find someone to come along with me, although I was sure from previous reconnaissance that it would go. Most of the subsequent lesser extensions were also explored without much trouble. The motive so far as I was concerned, was compulsive curiosity which continues to push me on even when I would rather not.

Well, was it worth it? Not only Pant Mawr but other discoveries with which I have helped, and which involved much more hard work. Yes, I am sure it was, not because of any specific observations or results obtained, but because of personal effects ensuing. Yet the same question arises with other ancillary caving activities. Design and manufacture of equipment takes up a great deal of time and skill. C.R.O. is an expression of moral concern, or enlightened self-interest, depending whether you are idealistic or realistic - probably both.

Now, all this leads us nowhere firm. Caving starts with curiosity, sense of adventure, bit of a lark or other less avowable motives. It carries

on with sometimes some reasons, sometimes competitiveness, - quite often a bee in the bonnet. The psychological approach rests mainly on self-confession; and although I think I am aware of most of my motives for caving I am certainly not going to publish them here. But we can pitch on one thing. To discover a cave is very satisfying emotionally. By one's own efforts to find something new, and to explore where no-one has been before provides a feeling of achievement not necessarily proportional to the magnitude of the discovery. The first time one does this is the most important.

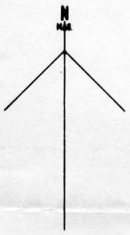
Aside from scientific work, this is probably the central expression of caving, and once this viewpoint is established the details of exploration are seen to be peripheral except when of scientific value.

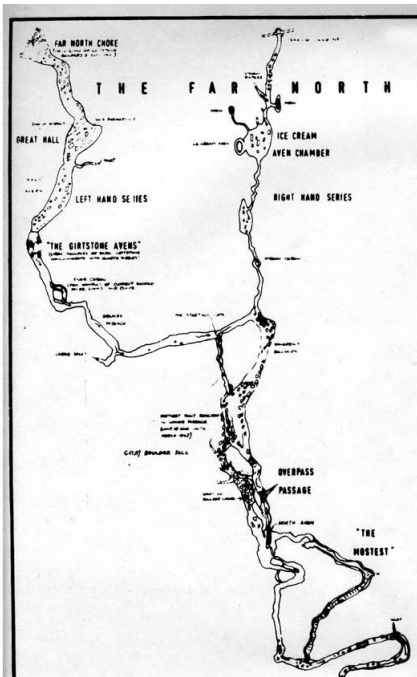
Bill Clarke.

The End

DAN – YR – OGOF PROVISIONAL PLAN JULY 1967

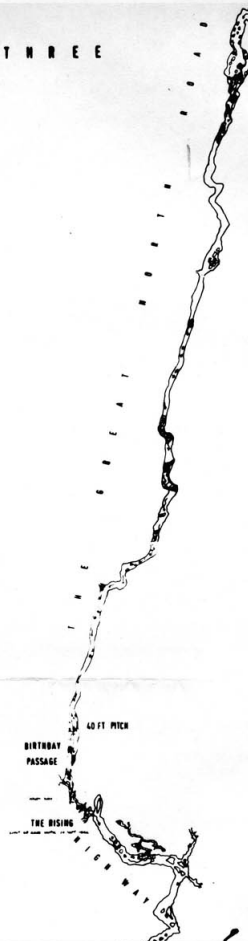


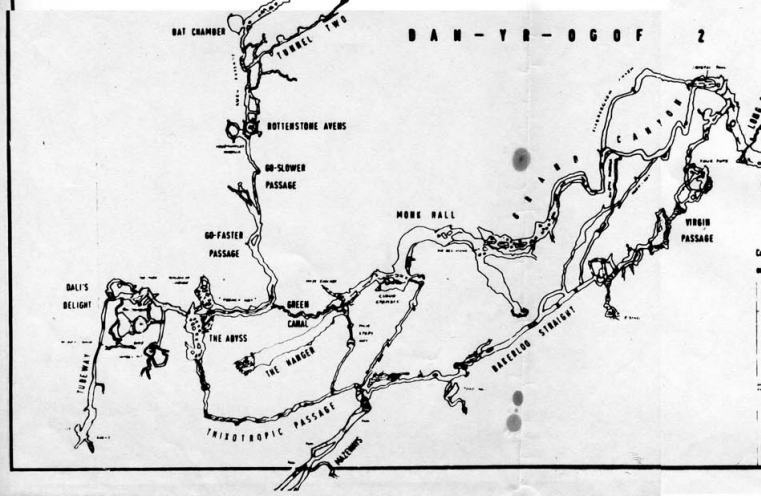


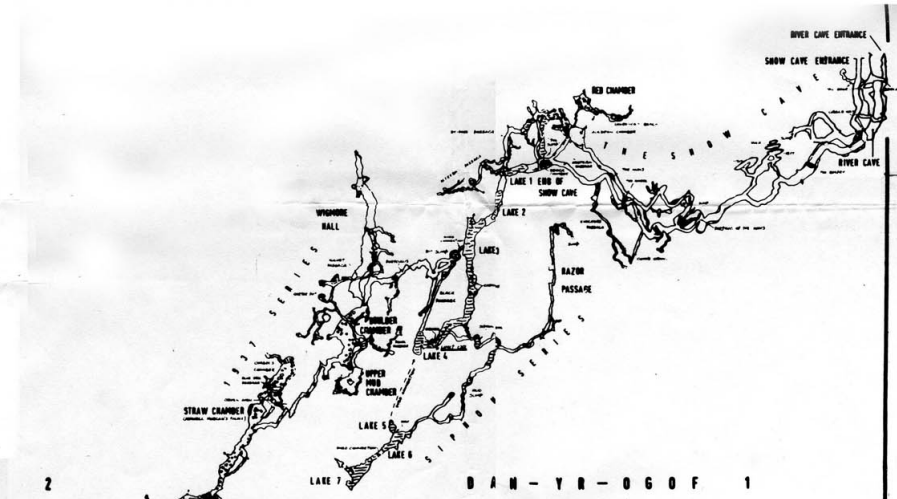


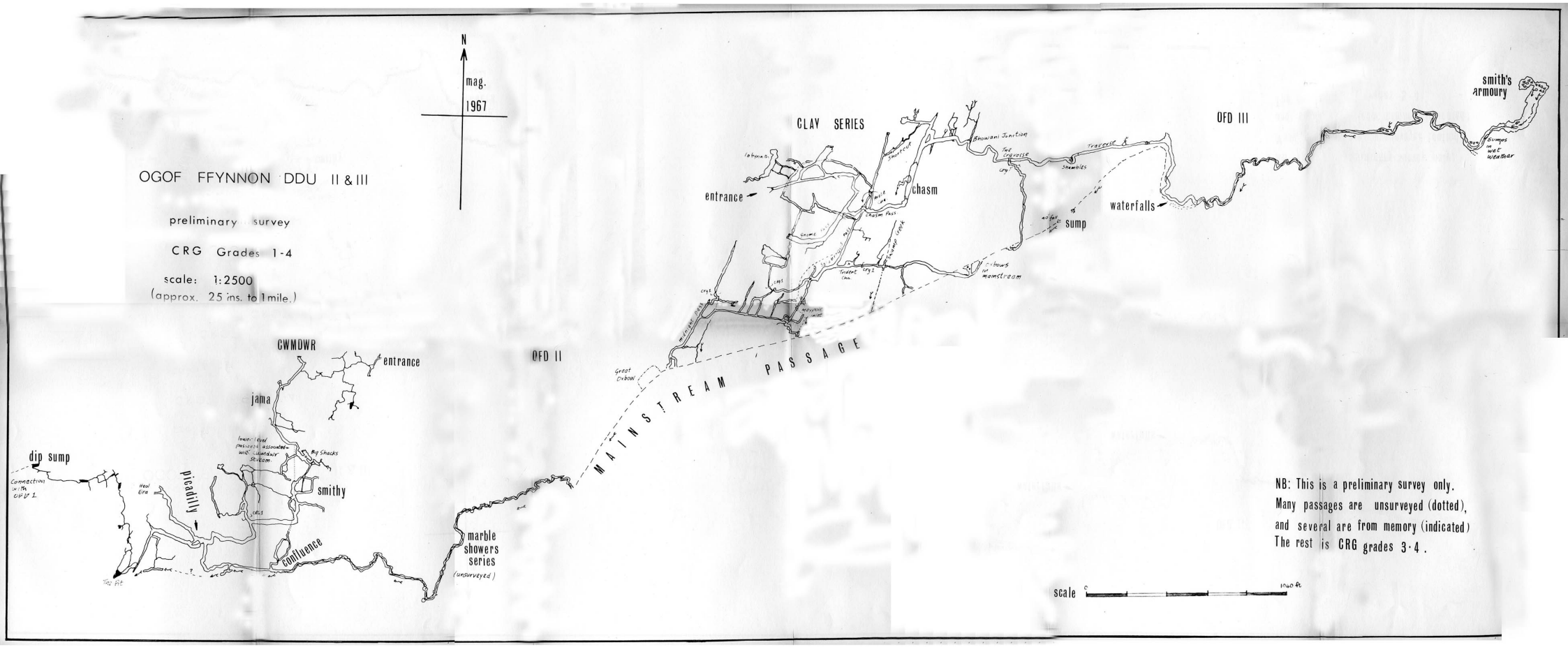
DAN – YR – OGOF

THREE








N
mag.
1967
OGOF FFYNNON DDU II & III
preliminary survey
CRG Grades 1-4
scale: 1:2500
(approx. 25 ins. to 1 mile.)
CWMDWR
entrance
jama
dip sump
Connection with OFD 1
picadilly
Big Shacks
smithy
Confluence
OFD II
MAINSTREAM PASSAGE
marble showers series
(unsurveyed)
CLAY SERIES
entrance
chasm
Bhowani Junction
The Traverse
sump
waterfalls
OFD III
smith's armoury
Bumps in wet weather
NB: This is a preliminary survey only.
Many passages are unsurveyed (dotted),
and several are from memory (indicated)
The rest is CRG grades 3·4.
scale

PLAN OF OGOF FFYNNON DDU

