South Wales Caving Club
Clwb Ogofeydd Deheudir Cymru

Newsletter No 120

1998

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Contents

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Front Cover photo: Julian Carter placing a spit in order to explore SVA 37, by Tony Baker

Back Cover photo: Martin Hoff afloat on the lakes in Coventosa, by Tony Baker.

Editorial

Welcome to issue 120 of the Newsletter. It has unfortunately taken a long time, but this has been down to numerous factors. Within these pages are numerous accounts from the Cantabria 1997 expedition, covering both the sport caving and preliminary exploration. This was a successful three weeks and has already been followed by Easter visits and Cantabria 1998. Also enclosed are a range of other articles covering nightmare caving experiences to living in a protest tunnel! I found the whole content of this Newsletter absorbing to put together, and I hope you enjoy its content even more. On a final note - I picked up the editorship of this N/L from Martin Hoff. There will be mistakes for which I apologise now! However I thought it important to get the N/L out as quickly as I could. I would like to thank all those who contributed and ask the membership to keep writing - the next N/L is already being compiled!

Cheers, Jules

The South Wales Caving Club and expeditions - an introduction

by ***Gary Vaughan***

The South Wales Caving Club has led a somewhat varied life when it comes to caving overseas. From bold ground-breaking expeditions in the 1960s to Yugoslavia, and in particular Balinka Pit, the drive to continue the trend appears to have faltered. Through the 1970s and early 1980s SWCC members seem to have taken the role of 'also rans' on expeditions substantially run by external bodies and groups. Even in the case of the Berger 75 expedition, an expedition led by an SWCC member, the club only seemed able to muster enough enthusiasm to produce 6 of the 25 participants. The general trend in the club was for small groups of members to participate in an 'annual vacation to an interesting part of the world' type trip or, for even smaller groups of members to participate in a 'really great groundbreaking world class expedition organised by the thingybob society'.

To all intents and purposes, the club seemed to possess the equipment and the manpower resource but for some reason things did not seem to fall into place.

There were exceptions of course. In 1979 what now reads as a very interesting expedition was run to Astraka in Northern Greece. Although the numbers were relatively small, the duration of the trip was an impressive six weeks. Some serious exploratory work seems to have taken place with encouraging results but mysteriously the leads were not followed up in 80 or even 81. Things again fell quiet on the expedition front.

In 1983 Simon Edwards, Julian Walker and Rob Parker embarked on a reconnaissance-come-caving-come-diving excursion to Tresviso, a small village in the Picos de Europa. This trip appears to have rekindled expedition enthusiasm in the club during the 1980's and in 1986 the first Agua expedition ran with some 19 participants, the majority of whom were club members. The flame was burning brightly again with a good cross-section of the club motivated to participate. The following year the club returned, this time with 16 participants and again, as with Astraka 79, the flame seemed to suddenly dwindle.

To a new member of the club in the late 1980s the expeditions could appear modest to say the least. Although extremely popular with the more mature members of the club, the general trend of these excursions was along the lines of holidays with a little bit of caving. They appeared to lack a direction, a purpose around which a team spirit could be focused. More importantly they appeared not to be popular with the more active members of the club who seemed to be exercising their skills and thirst for challenge on expeditions organised by other clubs and bodies.

The general level of skill and experience of overseas caving appeared to be in decline. The club was very inward looking with a small number of members taking an active interest in SRT, and other associated skills. A notable attempt to organise a series of weekends to Yorkshire died away due to lack of interest.

In 1991 a small excursion was made to the Piaggia Bella system in the North East corner of Italy. The trip was extensively proposed to be a run of the mill caving holiday to the Maritime Alps but due to one or two oversights the organisation became more expedition-like day by day. A horrific two hour 'dice with death' track to reach the cave enforced a base camp, top camp set up. Then, complicated route finding and poor information on rope lengths delayed the eventual bottoming of the system till almost the very last possible day. Days spent scouring the mountains for entrances to caves and ferrying water and food between base and camp required planning and organisation. The outcome however was a surge in spirits and enthusiasm and the formation of an embryonic team who could work well with each other and get the job done.

The Piaggia Bella spurred on demand for some sort of follow-up trip, something sporting, a bit of a challenge that club members could get their teeth into. Early in 1992, the club secured a booking to visit the Gouffre Berger in the summer of 1993. Almost overnight the thirty places were snapped up. Suddenly it seemed like everyone wanted to go caving again. Through the second half of 1992 and into 1993, training meets were organised in an attempt to weld together a team and blow the cobwebs out of a few people's SRT techniques.

The atmosphere was infectious, with people almost competing to carry this and de-rig that in their enthusiasm to get fit and prepare for the challenge. The team grew stronger. In August

1993 we were as ready as we could be to face this, one of the worlds most renowned caves. Renowned not only for its size, depth and beauty but also for claiming lives, with its ability to become a watery nightmare and the potential to trap people underground for weeks at a time.

Fortunately the weather was impeccable, and minimal water levels provided ideal conditions to bottom the cave. The system was rigged in just two days and some twenty members of the now thirty-eight strong team bottomed the cave. The de-rigging was accomplished with the same level of oiled efficiency, rope was raised from the depths and returned to camp with the speed of a typical Yorkshire meet. It all seemed too simple, the Gouffre Berger had hardly put up much in the way of resistance.

Upon reflection my singular regret of the 93 Berger expedition was that the full potential of the team had not been pushed. I will never regret the opportunity to have been able to visit such a fine cave under such perfect conditions but I still find myself postulating on the possibilities of 'what if this' and 'could we have done that' if the weather or equipment had been less optimal.

However, the club's current ability to undertake major expeditions was now beyond doubt. The manpower existed, the technology existed, the organisation existed and at last the enthusiasm existed also.

The follow up to the Gouffre Berger expedition was the 1995 expedition to the Pierre St Martin system. Again another world class cave system, but this time offering a variety of through trips as opposed to a distinct bottom target or objective. The cave offered to test the skill and endurance of the participants but again with hindsight it failed to offer the same level of challenge to the assembled team. There was not the same sense of isolation with increasing depth, the sense of remoteness or reliance upon other team members. It could be considered a distant cousin to our own Ffynnon Ddu, where one can happily venture alone, bumping into passing parties undertaking through trips or taking photographs.

As an expedition it was well supported with some thirty participants. Spirits were generally high but the level of drive towards a clear team objective was very much reduced. Individual or sub-group agendas came to the fore, rigging and de-rigging would grind to a halt due to lack of resources and the direction of the team became diffused. In short the task was too indeterminate and too easy. Here was a system potentially every bit the equal of the Gouffre Berger but now destroyed by the opening of a man-made entrance directly into the lower reaches of the system. Without the same level of challenge, the motivation and direction faltered and the expedition took on that weekend in Yorkshire feeling.

Enthusiasm within SWCC for foreign caving however was at what seemed to be an all time high. The Dent de Crolles trip in 1996 bore testament to members' needs to be 'lost in something big'. Again the expedition was extremely popular and enjoyed by all those taking part. The trend in world class caving continued but as with the PSM the team lacked a clearly defined challenge. By 1996 the number of foreign trips was starting to increase. The word 'exploration' was undergoing a revival. Inspired by finds at Ogof Draenen and elsewhere in South Wales there was renewed interest in finding new caves either at home or overseas. Numerous members were talking about exploratory expeditions as opposed to sporting expeditions, and many were suggesting that the time was right to change the emphasis from the established formula, to divert the current levels of experience and enthusiasm into a more speleologically credible venture. Groundwork had also started on studies into hand- held GPS receivers. Early results looked most encouraging and a full overseas expedition test was warranted.

The club appeared to stand at a crossroads, one route would continue along the sporting caving path, the other along the road to true scientific exploration. The former had a proven track record of popularity, it would continue to offer enough of a challenge to those members who wished to participate, and if correctly managed could take the club's team spirit from strength to strength. The latter a dark horse, an unknown quantity. On the one hand it could be the next step in the club's development, consolidating the success of the earlier expeditions and blending the enthusiasm for foreign caving with the revived enthusiasm in exploration, or it could be a red herring, a proposition that due to lack of support by those feigning interest would never become a reality.

Of course simply sticking to the same formula is not a recipe for success, rather it is a recipe for stagnation. I for one have always wanted to be involved with an exploratory expedition but due to circumstances was never afforded the right opportunity.

The setting up of an exploratory expedition would face other, different problems to those facing a sporting expedition. It would not simply be a matter of arranging access to a known system, obtaining a set of dates, finding a camp site and off

we go. It would face a whole new set of problems involving a huge diversity of factors. The first problem of course would be where could one go to find the potential for exploration, and yet stay within the budget of the majority of those who might wish to go?

Albania was one suggestion which did not progress too well. Norway maybe held potential, but the most favourable possibility stemmed from a conversation I had with Mike Hasildon one afternoon soon after the PSM trip. Mike had been describing a classic through trip which he had undertaken many years previously and was keen to repeat. He also mentioned that there was the potential for exploration in the same area. The whole thing sounded too good to be true, the possibility of running a sporting expedition alongside an exploratory reconnaissance would be just the ticket, allowing people to pick and choose precisely which aspect they were most interested in. A chance to hedge our bets, and run a serious exploratory expedition but at the same time cling to the formula of recent expeditions to produce a known attraction. The through-trip sounded intriguing, a technical 15 hour traverse which involved huge fossil galleries, large river canyons, deep lakes and a 300m entrance shaft. Purely by chance I had recently overheard a student in the Dragon Caving Gear shop complaining bitterly at having spent the first 10 hours of the trip into the system dangling in his SRT harness!

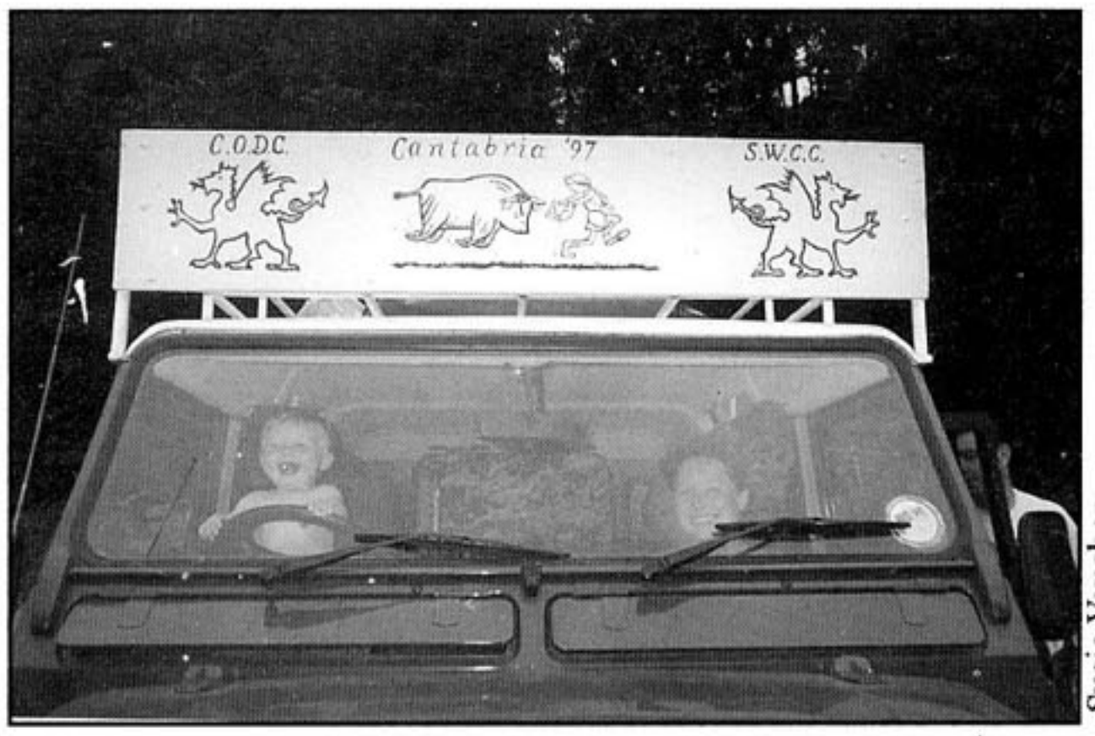
The exploration potential also sounded good, a large upland area of limestone, deeply dissected by rifts and covered in a formidable layer of bramble and bushes, enough to inhibit all but the most determined of expeditions. I pressed Mike for more details on the area, local maps, reports and contact names. I contacted everyone I could think of who might know something about the area but most leads produced little information. Progress was slow, and letters to Spain seemed to take ages to elicit any response but eventually the pieces began to fall into place. Contact was made with the Agrupacion Espeleologica Rameles, 'AER' the local caving club. They were currently exploring the area in question and seemed guarded against the intervention of a foreign club. Local tourist guides and information were not producing much data.

A reconnaissance was needed. In August 1996 a trip was made to further assess the potential of the area, look into access problems and try to open up a working dialogue with the AER. Rafael Zorrilla, an old acquaintance of Mike's offered to translate at a meeting with the club secretary, Martin Gonzalez Hiero. The meeting went well although Martin seemed surprised that we were asking only for access to do some reconnaissance work. He offered to put our proposal to the members of his club but he was not optimistic as to the outcome. It seemed that there had been some breaches of trust in the past with foreign clubs, and now the AER were generally sceptical with regards the value of involving foreign clubs in the exploration of the area.

It has to be said that Rafael did an excellent job of putting a case forward for the expedition to be accepted. His interest in seeing the two clubs work together was all the more remarkable when you consider that Rafael has little or no interest in caving itself. Martin was receptive to Rafael's arguments and his disposition towards the proposals became more favourable, such that at the subsequent club meeting it would appear that Martin very much swung the day in favour of permission being granted.

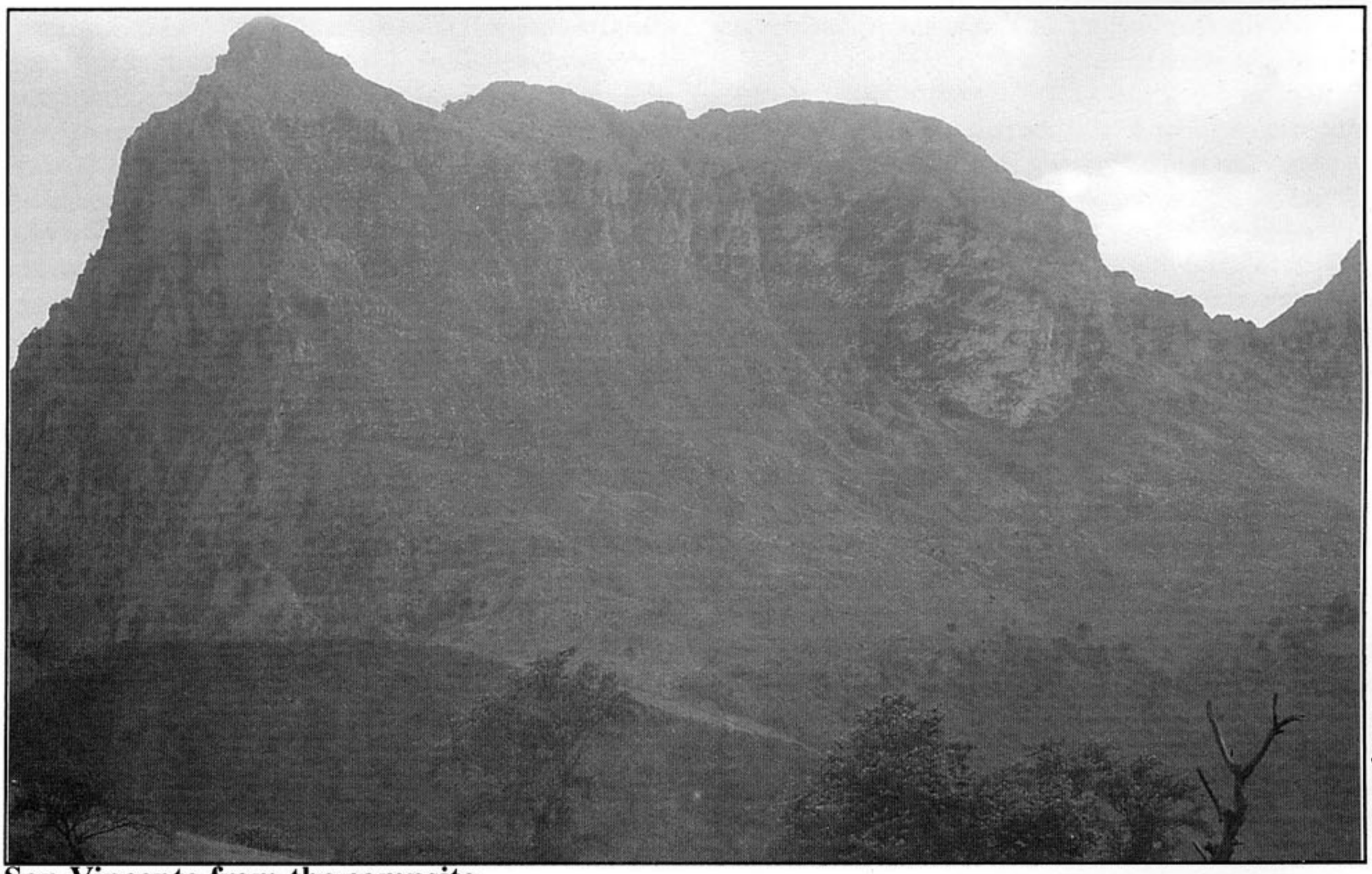
On 19th of November 1996 a permit granting permission to explore the Pico San Vicente was issued by the AER Committee and the Cantabria 97 Expedition became a reality.

Within the pages that follow are the stories and plans, observations and results of that expedition.



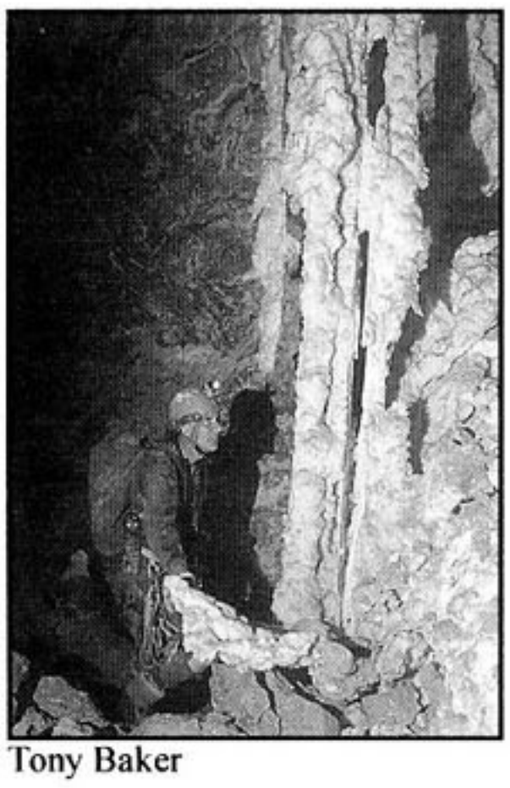
Susie Vaughan

Cantabria 1997

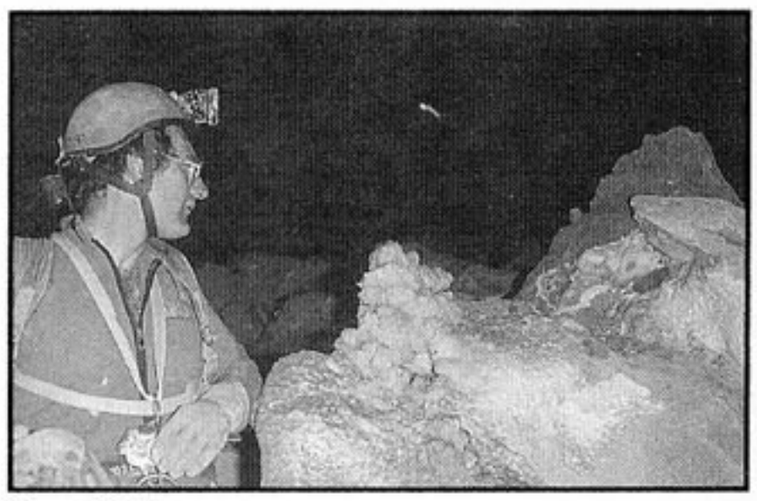


Tony Baker

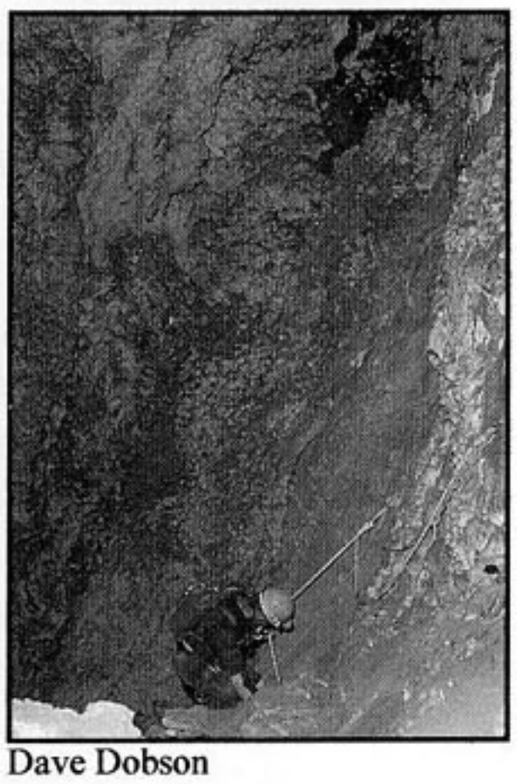
San Vincente from the campsite



Tony Baker



Dave Dobson



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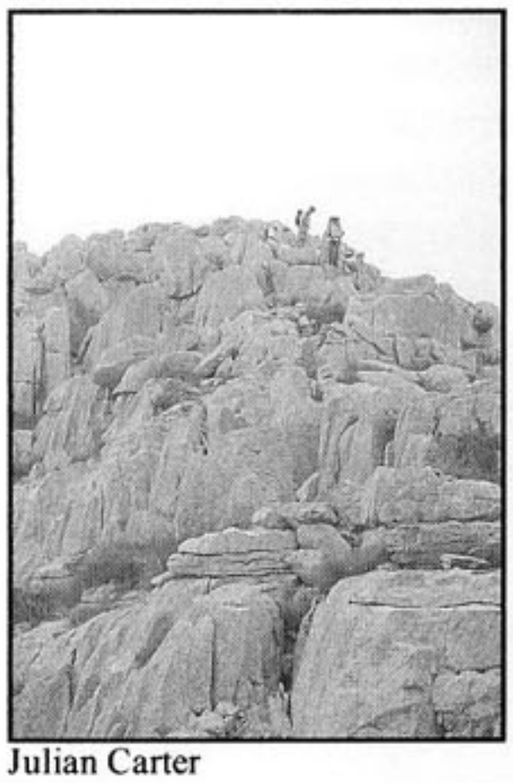
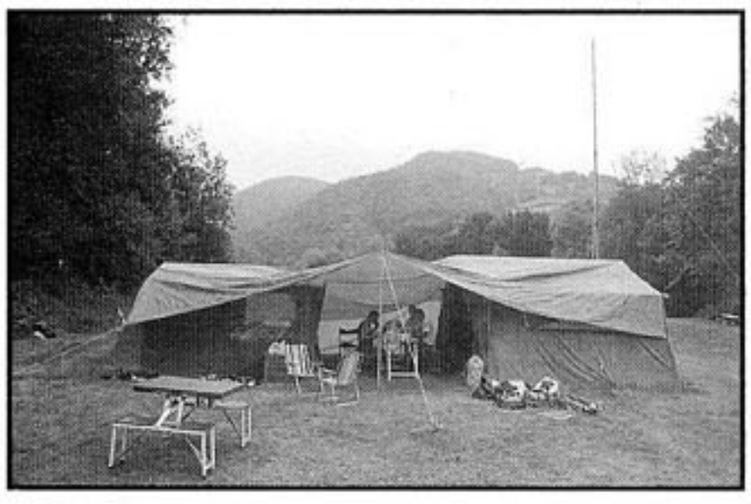
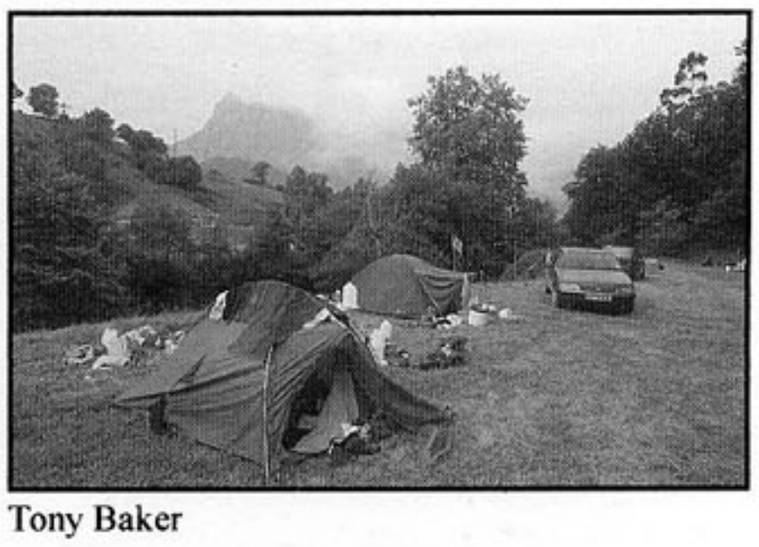


Julian Carter



Julian Carter



Tony Baker

An SWCC trip to cave and explore in Northern Spain

Part 1: The Scientific Stuff

The Geology and Caves of the Cantabrian Mountains

by ***Kieth Ball***

The area under investigation is bounded by the Rio Asón in the north, the Rio Gandara to the east and south, a tributary to the Rio Gandara to the south-west and the deep dry valley of La Canal to the west (Figures 1 and 2). Apart from the river valleys the dominant geographical feature is the mountain chain of Peña de Rozas which extends east to west across the central part of the area. This is white bare rocky upland with hardly any soil cover and featuring extensive limestone pavement (Lapias). The dominant farming in the area is cattle rearing for the dairy industry although small flocks of sheep, goats and horses are kept, usually freely roaming the upland areas. The area underlain by the interbedded shale/limestone of the upper part of the Aptian (see later) is the most productive area since deep soils are developed on this formation, however river terraces on the Rios Asón and Gandara also support mixed farming and vegetable growing. The lower ground of mixed woodland and stock farming in the northern part of the area is underlain by the massive limestones, but in this area residual soils are present patchily.

The geology of the area is summarised in the Mapa Geologico de España, 1:50000 scale map of Valmaseda. This is published by the Instituto Geologico y Minera de España (IGME). Accompanying the map is an excellent descriptive booklet. The purpose of this article is to summarise the geology and to outline the importance of those aspects that relate to cave development.

The dominant lithology in the area is limestone but to regard the whole sequence as limestone is a gross over-simplification since as well as pure massive limestones the calcareous strata are often interbedded with shales and sandstones in various mixes. A simplified geological map is shown in Figure 1 which also summarises the bedrock stratigraphical sequence. The superficial deposits such as river terraces and head are omitted for clarity. They are mostly confined to the river valleys.

The oldest rocks in the area encompassed by the map are from the Jurassic Period. These are well exposed in road cuttings near the camp site and in the Rio Gandara, upstream from Ramales (Figure 1). The sequence comprises interbedded limestones, argillaceous (shale-rich) limestones, shales and marls (margas).

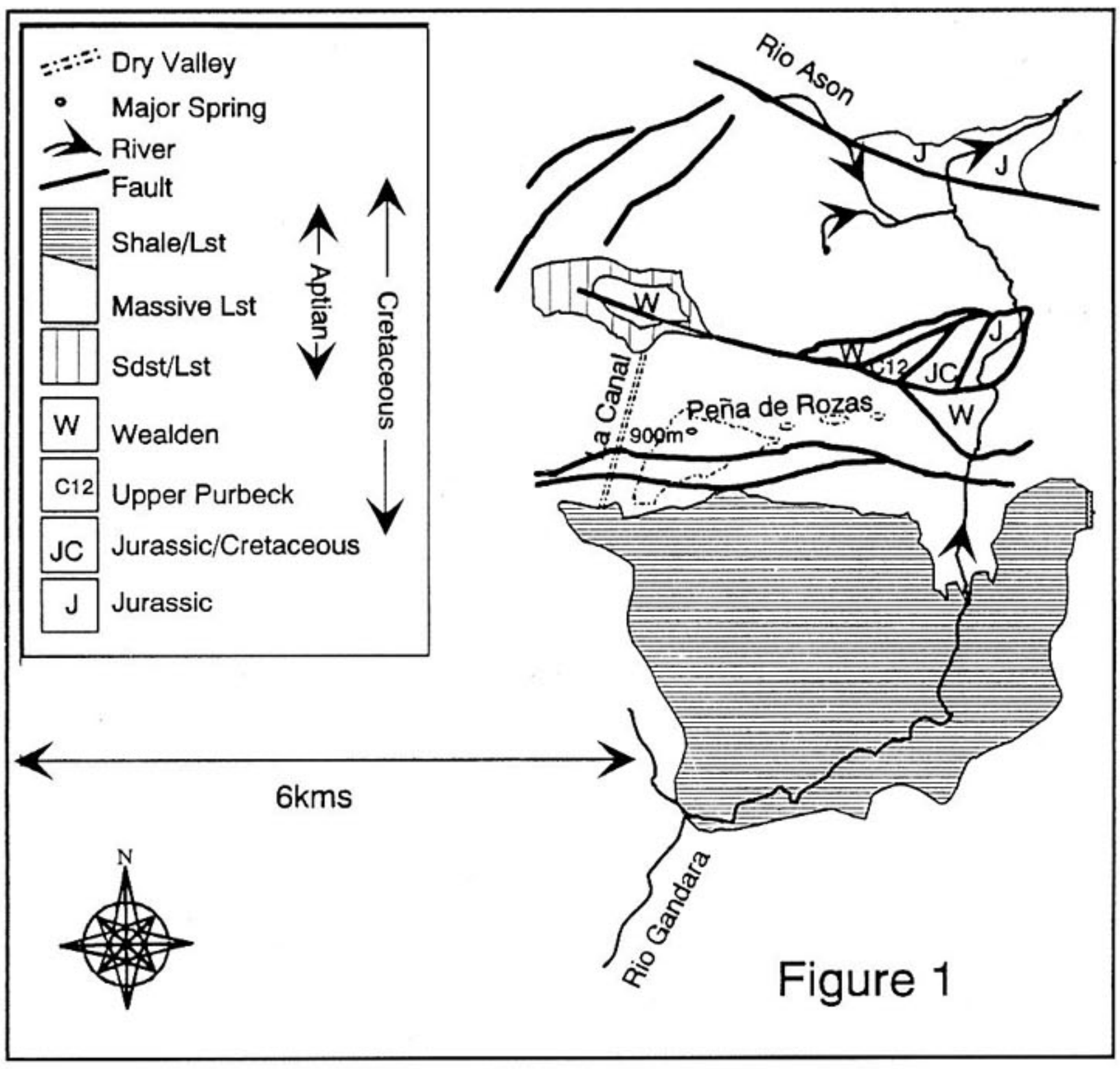


Figure 1

These beds are overlain by Purbeckian strata which bridge the junction between the Jurassic and Cretaceous. These are generally more arenaceous (sandy) with conglomerates, sandstones, grits, shales and limestones. In turn they are overlain by Upper Purbeck limestones with a well recognisable fossil assemblage being dominated by bryozoans and oysters. They are massively bedded with occasional sandy incursions. Sandstone and shale units become important again in the overlying Wealden stage rocks.

The above beds underlie a relatively small area and serve as a base to the more important and widespread overlying beds which are grouped together in the Cretaceous stage called the Aptian. These again are dominantly limestones but the equivalent beds in southern England are the Lower Greensand, a loose relatively unconsolidated sandstone. Near Ramales the basal Aptian comprises a sequence of interbedded sandstones and limestones and outcrops around the village (Barrio) of Ancillo.

These in turn are overlain by about 800m of massive recrystallised limestones. This sequence is characterised by generally well to massively bedded limestones containing thick to very thick unbedded mud-mound reef deposits. The reefs tend to stack one above the other, giving rise to a very thick local sequence and by its nature the rocks tend to vary both in composition and thickness over very short distances. The individual mud-mound reefs are often greater than 40m thick.

The intervening space between the reefs is made up of relatively thinner bedded but still relatively pure limestones with bedding planes separated by a few tens of centimetres. Figure 5 illustrates in diagrammatic form the relationship between the two facies at the cliff exposure of the Ventana de las Tapian (= Window in the Wall, but labelled Ventana de las Trapias on some smaller scale maps). The major fossil is the foraminifer *Orbitolina* but recrystallisation sometimes makes it difficult to recognise. A distinctive large fossil is the bivalve lamellibranch (pelecypod) *Rudista* which has a passing resemblance to a horn coral (Figure 6).

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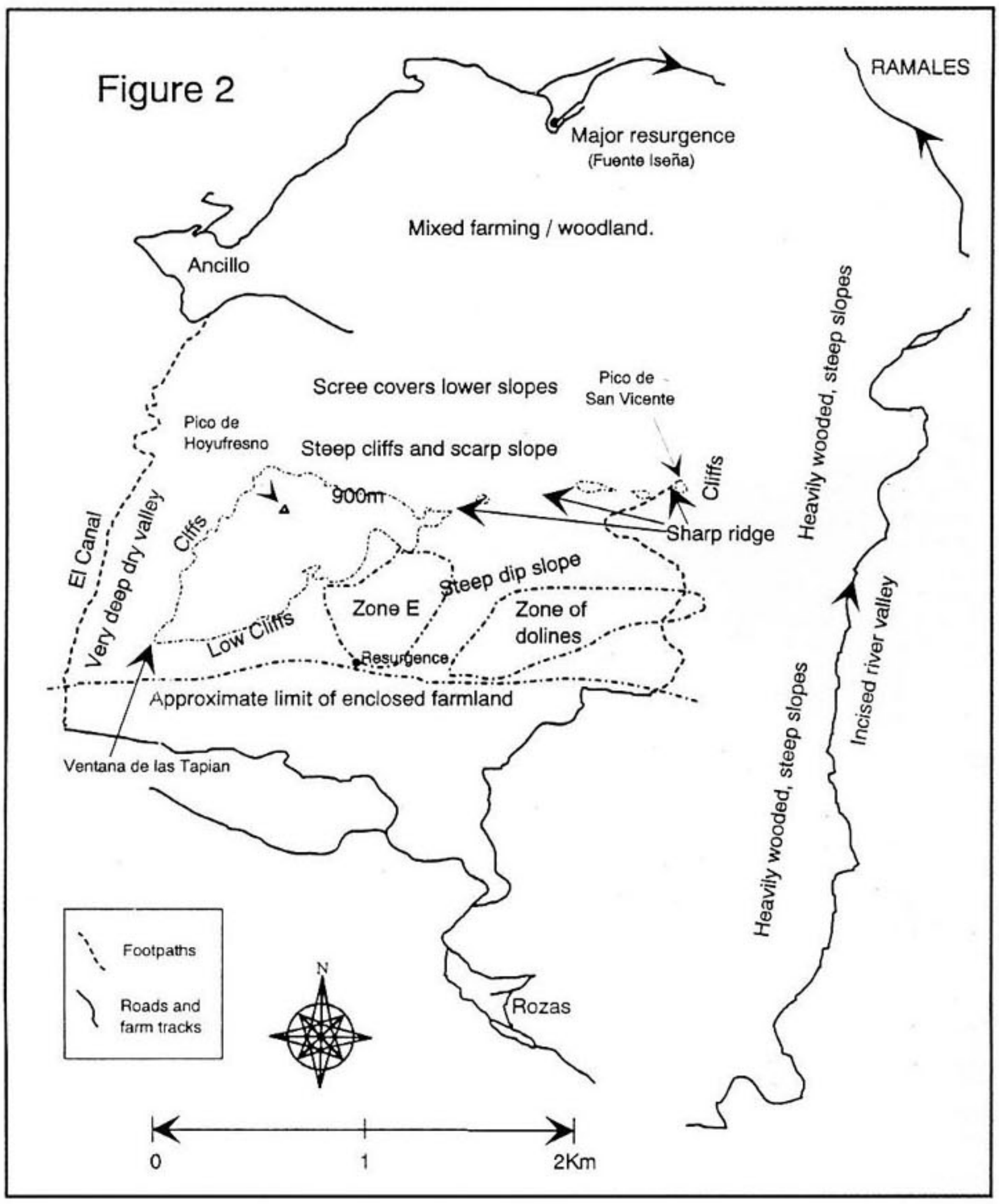
The upper part of the massive limestone formation passes laterally into, and is also overlapped by a thick sequence of interbedded limestones and shales. The basal portion is more calcareous but is soon replaced by the more typical sequence of interbedded shales and limestones. The shales typically make about 30% of the whole. Sparse lenticular beds of sandstone were also observed. The limestone units are seldom thicker than 0.5m. IGME note the presence of limestone beds up to 2m. thick but none were observed during this reconnaissance.

The rocks are folded into a broad east west trending anticline with its axis slightly to the north of the Peña de Rozas. Major faults have also been mapped in the area. Where these faults intersect the massive limestones on high ground often the only obvious evidence of their presence is a strip of grass-covered soil in an area of bare limestone.

Diagrammatic geological cross sections are shown in Figures 3 and 4. Figure 3 is a profile across the area from south (left) to north (right). The southern end is near the Village of Rozas and the profile extends over the main ridge of Peña de Rozas (avoiding the peaks) to the Rio Asón. Figure 4 is a sub-parallel traverse and extends along the line of La Canal from the

Figure 2



contact between the massive and interbedded shale / limestone units of the Aptian, through the anticlinal inlier of Ancillo and back onto the massive limestone again.

CAVES AND GEOLOGY.

As might be expected the more massive limestone beds of the Aptian (most important) and Upper Purbeck (less so), are the ones most likely to host

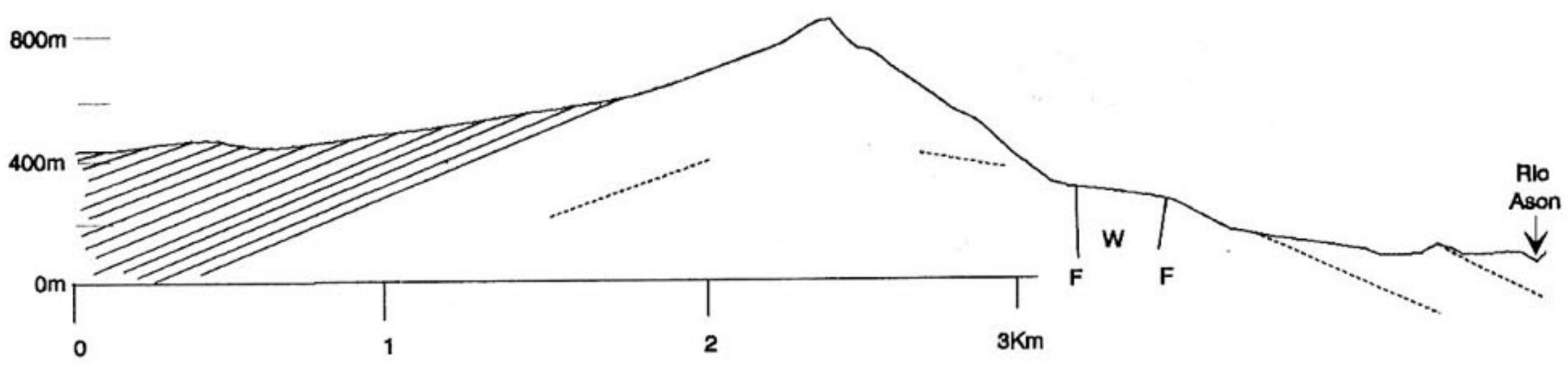


Figure 3

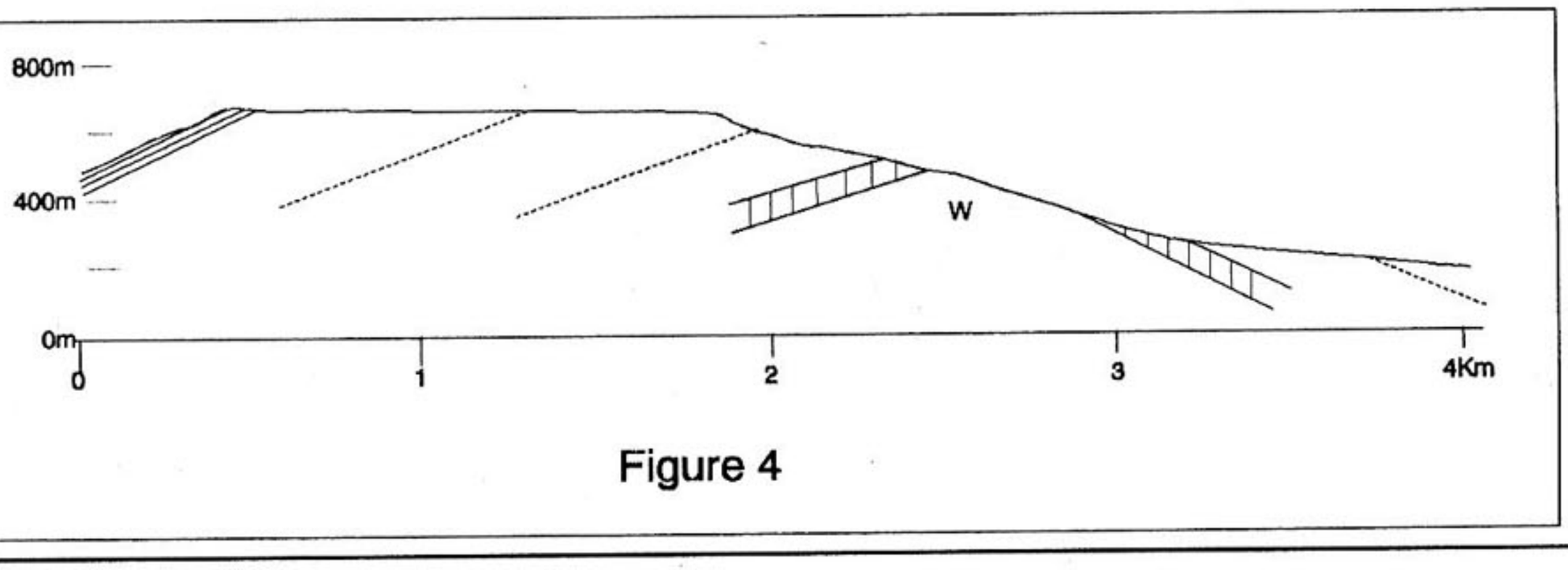


Figure 4

major cave systems. This is confirmed by the presence of major cave systems within similar lithologies in the same Aptian Stage elsewhere in the region. Although not in our immediate area the major Coventosa System and other caves in the Asón valley, as well as caves in the eastern side of the Gandara valley, are in the same lithology and their entrance chambers showed similar features but on a larger scale to anything found in our designated area. Work by the Cantabrian group had already shown the presence of a number of small caves in the particular area and following early reconnaissance investigations we were able to outline possible priorities for further exploration. Much of the farmland was underlain by the mixed shale limestone lithologies of the Aptian and this was regarded as having a low, although not totally absent, likelihood of being a host to major caves.

EXPLORATION

In such a large area and with the small team available for reconnaissance investigation it was essential to prioritise investigations. Much of the early days were therefore spent in a rapid reconnaissance of the area. Iain Miller and I climbed the Pico San Vicente on the first day out and subsequently we walked out parts of the Gandara valley and La Canal. Despite covering parts of the area more systematically later, some idea of the priorities to be assigned were possible following this cursory investigation. The farm land underlain by the interbedded formation was judged to have little potential or was otherwise regarded as not having a high priority. After all we were guests in the area and we did not feel it worth while possibly to antagonise farmers. We therefore decided to concentrate on the open country, which meant the higher ground.

At first glance therefore the area did not have the same degree of prospectivity as adjoining areas although on examining the other systems it is clear that the apparent paucity of obvious leads does not preclude the likelihood of there being substantial finds. e.g. the entrance to the Cueto pothole is very small and could easily have been missed in a cursory search. There is also the

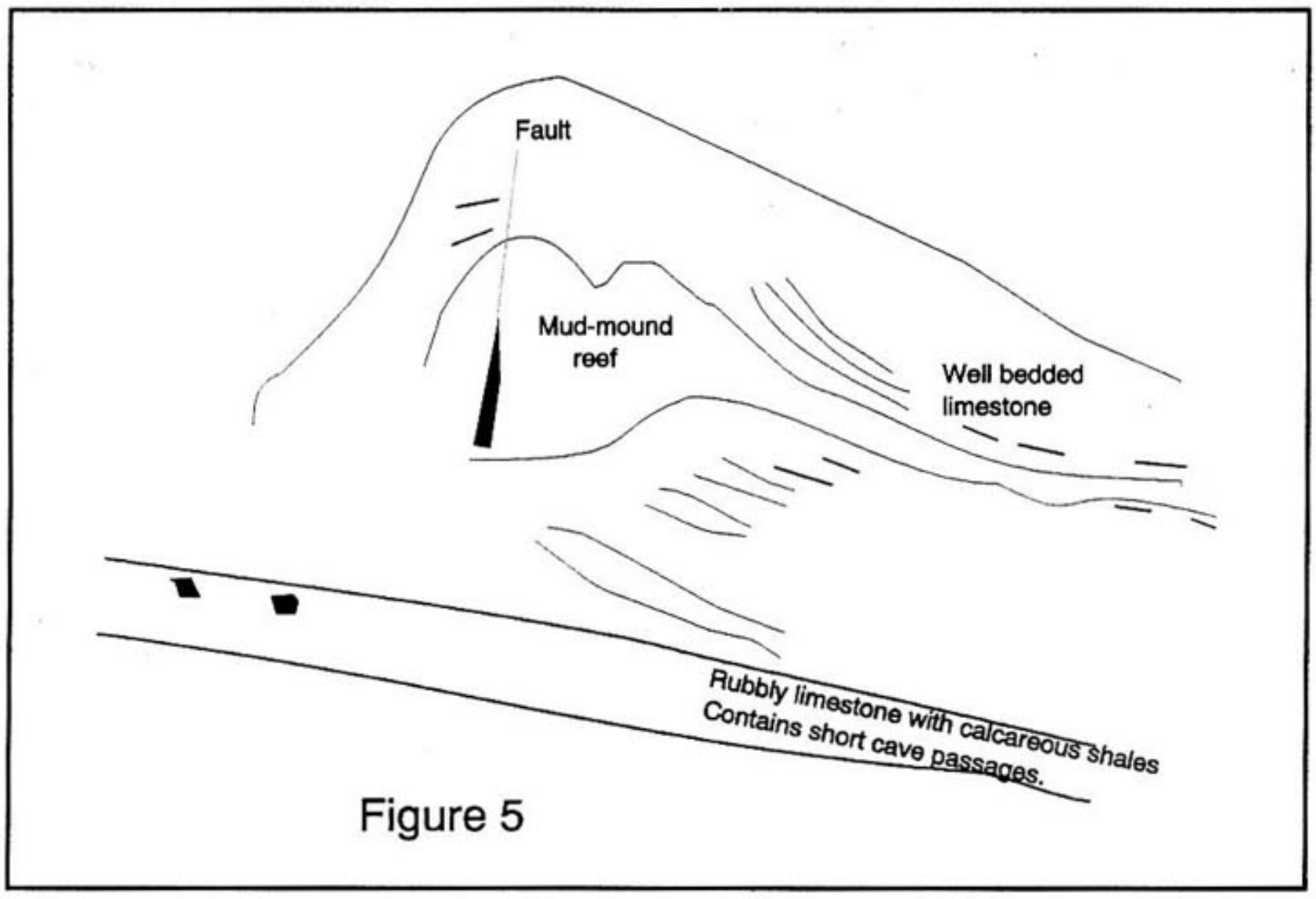
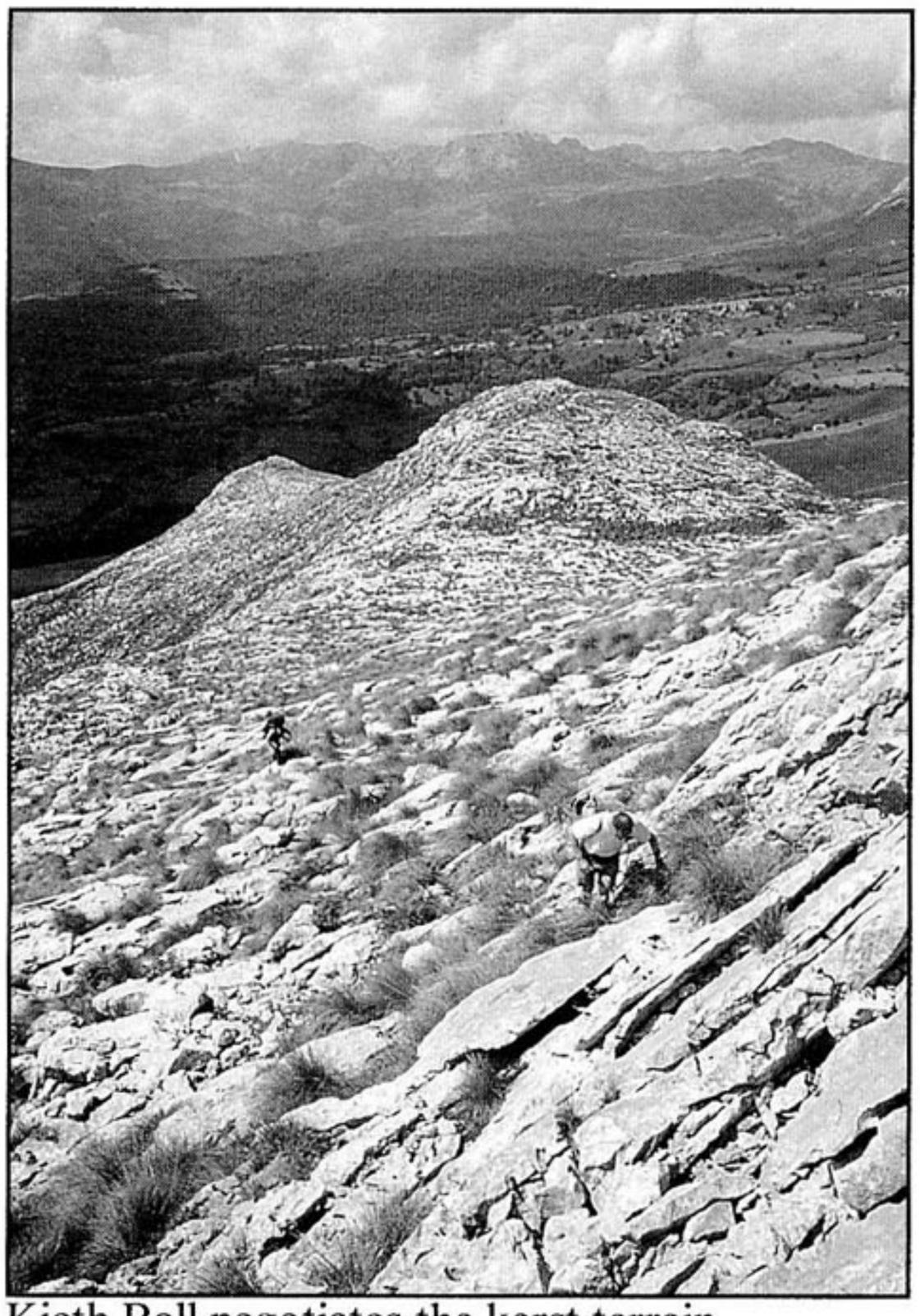


Figure 5

presence of a substantial rising: the Fuente Iseña, which is about twice the size of Ffynnon Ddu in summer, is used as a major water supply, and is the main spring draining the upland area.

The valley side of the Rio Gandara was visible from a main road and it was possible to identify a particular narrow group of beds within the thick sequence of the massive limestones in which cave passages were frequent. Later investigation showed that these were either parallel to the valley side or penetrated a mere 5 to 10 m into the mountain before coming to a halt as the floor rose up to meet the ceiling. A similar situation occurred on the other side of the area where a number of small caves were identified and investigated in the cliffs in the east side of La Canal. In many cases the caves showed arched roofs, dome pits in the roof, and other signs of phreatic or epiphreatic development. However they tended to close down, or rather up, despite having initially respectable sized entrance chambers, and in one case a substantial column of about one metre circumference and about 2m tall.



Julian Carter

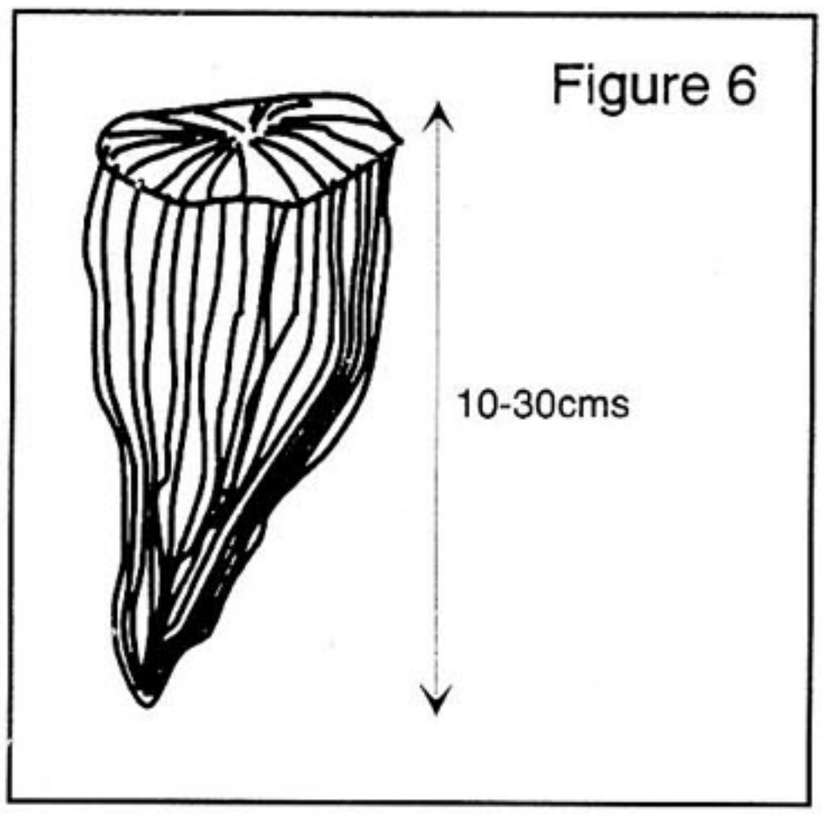
Kieth Ball negotiates the karst terrain

The upland area to receive the first detailed attention contains the highest peak in the area: the Pico de Hoyufresno (1054m). This is the area roughly outlined by the 900m contour in Figures 1 and 2. The area is underlain by the massive Aptian limestones and is particularly unforgiving country with little or no vegetation and a surface of sometimes razor-sharp-edged lapias. You simply could not relax. The area is bounded by large cliffs to the north and to the west, more subdued cliffs to the south-east and the plateau area tapers out into a sharp ridge to the east. The highest point is on the northern side of the area and the surface dips relatively gently to the south as a kind of sloping plateau, but interspersed with enclosed basins (dolines).

Although usually (surprisingly) quite sound for climbing on nevertheless great care is required for the 0.5% of unsafe holds. The method of investigation will be described more fully elsewhere but basically consists of a series of traverses. A line of people at 10m intervals traversed slowly across the area. One person with a GPS receiver was at each end of the line, so that accurate recording of each traverses was possible. Each per-

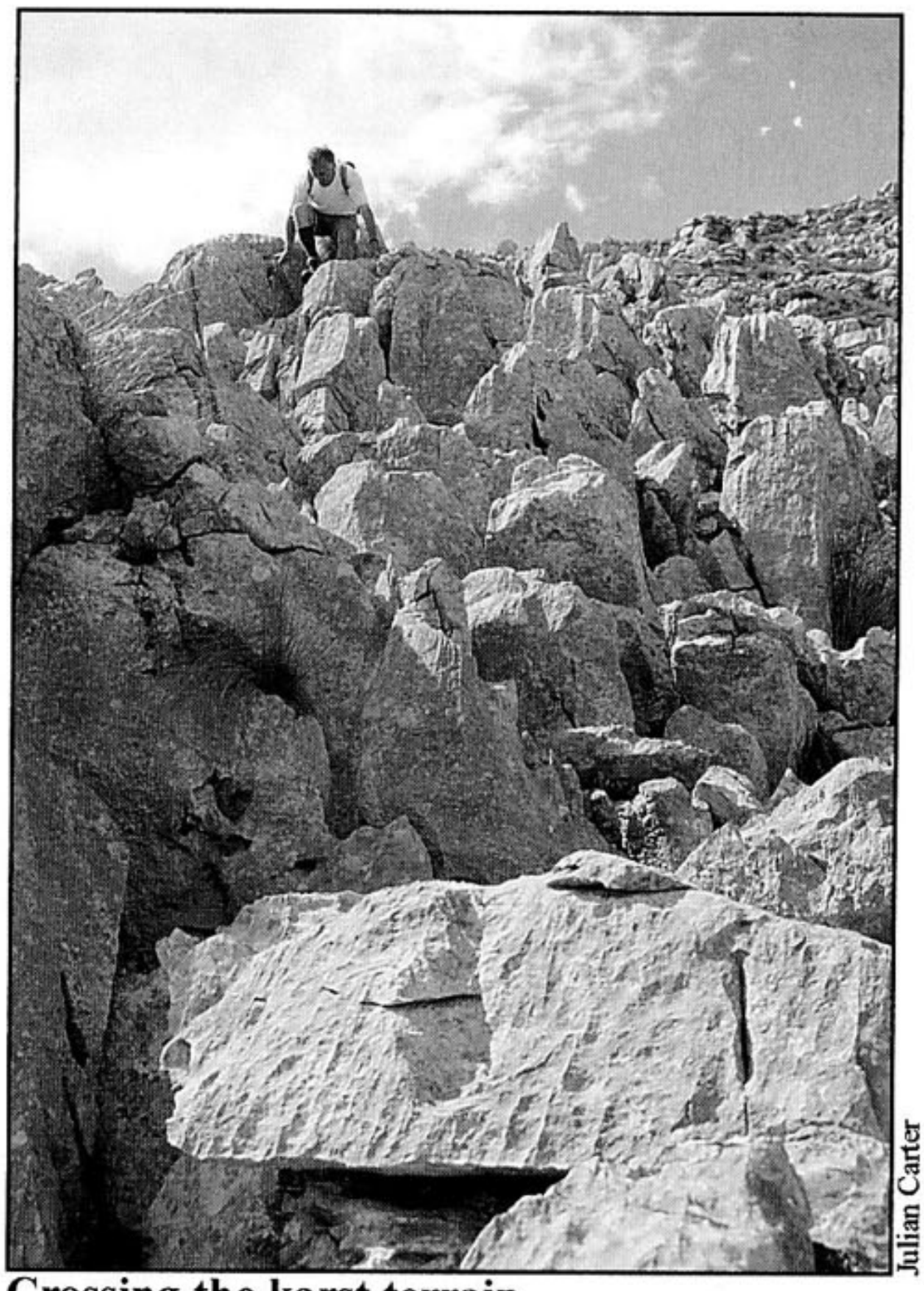
son was thus responsible for searching a strip of country about 10m wide and as long as the traverse. At each find, which normally consisted of a shaft or more rarely a cave passage, a GPS receiver was moved into proximity to record accurately its position, notes made of the orientation and a sketch plan made. The site was marked with red paint and numbered. At this stage unless access was particularly easy, no attempt was made to explore any of the many potholes identified. Most of the area above the 900m contour and bounded by steep cliffs was covered in this manner.

Using the same procedure the area to the south east of the main upland massif was also investigated (Zone E in Figure 2). The area is largely underlain by a thin covering of the basal beds of the Aptian interbedded shales and limestones but the depth to the massive limestone is not great (0-20m) A number of small shafts were recorded in this area. These were mostly aligned along the local joint directions and stones rolled a satisfactory distance down some of them.



During our reconnaissance a number of other areas were identified as having a high priority but were not investigated owing to lack of resources. In particular the Zone of Dolines outlined in Figure 2 to the north of Rozas was thought to be particularly fruitful. However it was also especially difficult country being covered by thorn scrub and the ubiquitous razor sharp limestone. It was left for another day. The area to the north of the Peña de Rozas was also hardly touched, certainly not in a systematic manner, and would well repay slow and careful attention.

Although we decided not to proceed with exploration in the Interbedded Shale / Limestone lithologies this area may repay some investigation in the future since there are abundant dolines, and these are often aligned along major and minor faults and master joints. There is a also a short-



Julian Carter

Crossing the karst terrain

age of surface drainage. For major cave systems one would like a few thicker beds of limestone in the mixed sequence but failing this attention might be paid to some of the fault zones in the first instance.

Descent of a small number of the major potholes was only possible during a few days towards the end of the expedition. As is typical of this type of high mountain limestone area all of the shafts descended ended abruptly at a depth of 20-40m, however the potential for big caves is there and finds await further work. Digs in the high level abandoned resurgences may well repay a little effort too.

DIY Differential GPS

*by **Iain Miller***

ABSTRACT

The use of GPS for locating the positions of caves has been attempted by many people over the last few years, but results to date have been rather uninspiring. This is largely due to Selective Availability, which gives at best a likely accuracy of +/- 100 metres. The aim of this project was to improve the accuracy in use to nearer the base resolution of the instrument. i.e. +/- 15m. The experiments were undertaken both in Wales under control conditions, and in the field in Spain to assess the practicalities of developing the system. The results of this work are promising.

INTRODUCTION TO GPS

GPS (Global Positioning System) is based around a series of satellites launched by the US Department of Defence. They transmit data about real and perceived time, status information, and details of all the other active satellites. This data is used by the receiver to calculate its position. The satellites transmit two classes of signal; Precise Positioning Service (PPS) and Standard Positioning Service (SPS). PPS is designated for US and allied military purposes only, SPS is available for civilian use and is the system used by commercially available GPS receivers

LIMITATIONS

Selective Availability

The biggest limitation to accuracy is Selective Availability (SA). This is a deliberate, random downgrading of the signals transmitted by the satellites. Controlled by the US military (who did after all put the system in place). It may be switched off if required, but is usually on! Historically it has only been disabled during times of conflict, when one would have thought it most appropriate. This is what reduces the accuracy to 100m 2DRMS rather than the 15m RMS that the lower cost civilian units are capable of.

Number and orientation of satellites

Another important factor in the accuracy of GPS is the number and orientation of active satellites (an active satellite is one whose signal is being received by the GPS). Best results are obtained with seven or eight active satellites (some units are capable of tracking up to twelve satellites, but more than eight in a terrestrial situation is rare).

The maximum resolution as claimed by the manufacturers is only true when this number of satellites are active. As the number of active satellites falls below this optimum level, the unit's accuracy rapidly degrades. Three satellites is the minimum on which the units can operate, and with SA on, the accuracy is probably no better than 1000m 2DRMS!

The orientation of active satellites also has an effect on accuracy. Usually this is most noticeable in the altitude reading, but can have some influence in other planes, i.e.:- eastings or northings.

Inherent instrument errors

The transmitted signal can be used to a better accuracy than that obtained for this class (price) of instrument. This difference is negligible given the accuracy versus cost ratio. The only real and avoidable errors are "homing in errors". When the GPS is first turned on, depending on the time and location difference since it was last used, the unit will take some time to fully settle on its new location. Given the stated aim of a budget solution, and the relatively small errors that one is likely to encounter in this respect no work on this aspect was undertaken. Averaging would tend to reduce this anyway.

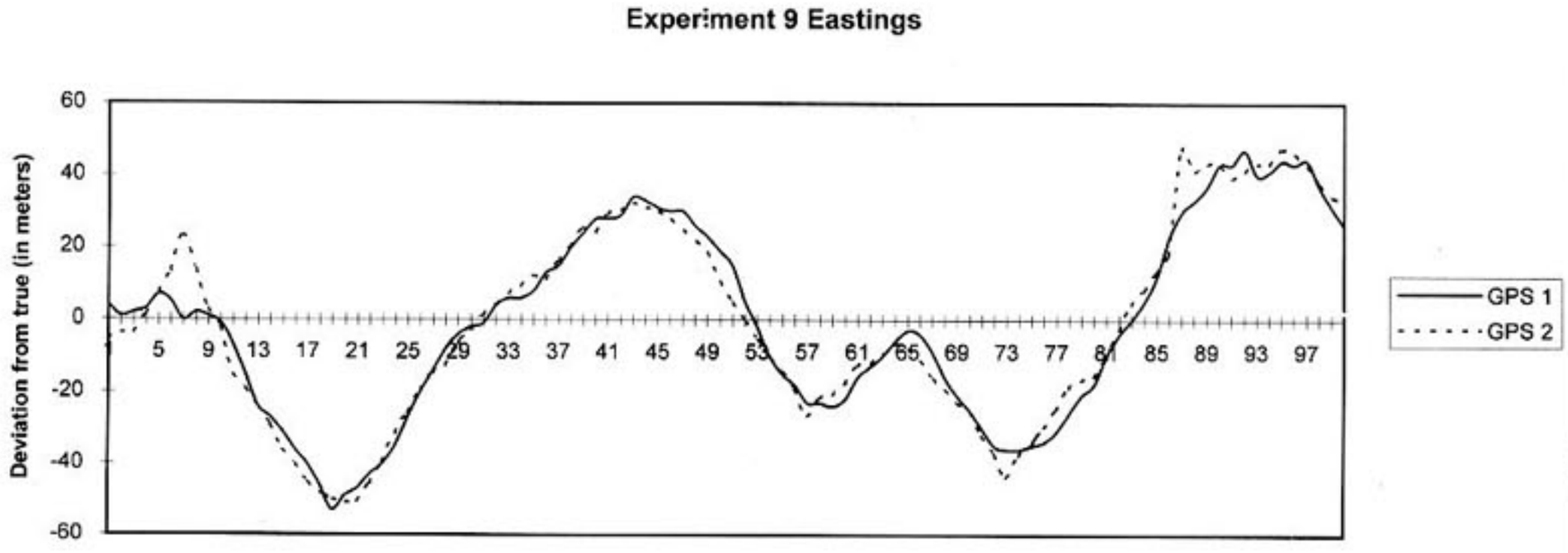
Atmospherics

Atmospheric conditions can also affect the accuracy of GPS , but under nominal conditions will have little effect on the devices that have been used.

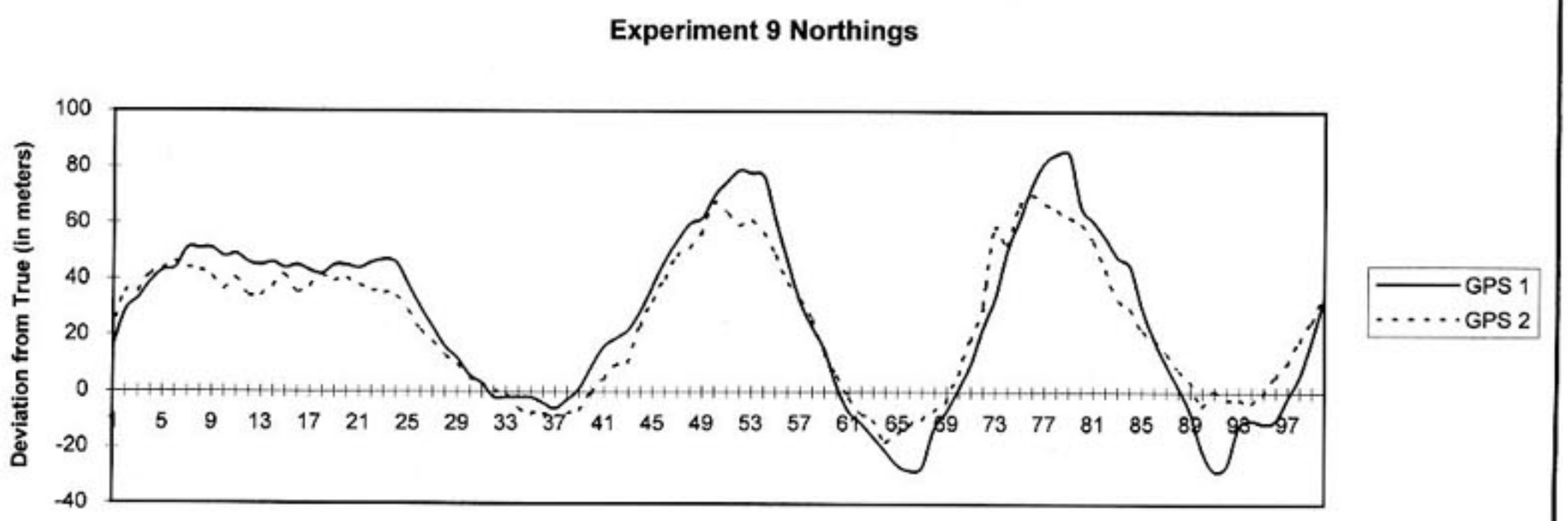
DIY GPS

The main aim of the project was to try and find a method of overcoming the errors of Selective Availability, which has the greatest influence on the potential error. At first we intended to use a proprietary differential system as produced by various Differential Ready GPS manufacturers. Further enquiries revealed that though able to meet most of our basic requirements, this system had yet to be adopted in Spain, let alone most of the third world. As one of our other requirements was for a system that could be implemented worldwide, and on a limited budget, this idea was

Graph 1



Graph 2



abandoned. Thus our experiments in DIY Differential GPS started.

EXPERIMENTATION

Equipment

3X GPS units (Garmin GPS45's)
1X Garmin marine antennae (10m lead)
1X Garmin PC lead and software

Description of experimental area

The area in which most of the experimental work was undertaken was around Penwyllt, Powys. One advantage of this location was the ready availability of a selection of known (British OS) points of reference. These points, or stations, are all part of the Ogof Ffynnon Ddu surface survey made by Bruce Foster and Gary Vaughan. This was established using a theodolite and EDM to better than centimetre accuracy. Given that the maximum resolution of the GPS units was only one metre these stations made for an ideal control.

Initial Experiments

The first real experiment was undertaken by Gary Vaughan and myself on 29/12/96. This involved first operating two GPS units side by side at various known stations. We then took readings at stations further and further removed from one another; for this experiment we took ten simultaneous readings at intervals of 10 or 20 seconds. Radios were used to synchronise the recording. The last couple of tests used three GPS units and a greater distance.

From the seven sets of data obtained, it was concluded that a longer period of recording would be necessary if any consistent results were to show up. The following morning I took a series of one hundred readings from one of the stations. I used a thirty second interval, for a total period of 50 minutes, to try and determine a more suitable timebase. This turned out to be the basis adopted for all following experiments.Interestingly, the average of the full set of data collected was very close to true :-

<u>True Location</u>
Easting - 85270, Northing - 15316
<u>Averaged Result</u>
Easting - 85261, Northing - 15321
Gross Error = 10m

Later the same day Gary and I undertook what was to be a larger, more significant experiment. We each took a GPS and radio to one of the theodolite stations, separated by a modest 1200m, and manually logged 100 simultaneous readings, separated by an interval of 20 seconds. We returned to the club and manually entered the logged readings into the PC. Having got the data where it could be analysed, we first graphed out the results to see if there where any useable similarities (**Graph 1 & 2**). As can be seen each trace is remarkably similar, and this was just the result we were looking for. Just to see what results we

TABLE 1

		Easting	Northing	Gross Error
Experiment 9	True co-ordinate	85270	15316	-
100 X 20 secs	Averaged co-ordinate	85269	15341	25m
	Differential co-ordinate	85270	15314	2m
Experiment 10	True co-ordinate	85270	15316	-
100 X 30 secs	Averaged co-ordinate	85266	15319	5m
	Differential co-ordinate	85265	15316	5m
Experiment 11	True co-ordinate	86309	15855	-
100 X 30 secs	Averaged co-ordinate	86304	15876	22m
	Differential co-ordinate	86309	15857	2m
Experiment 14	True co-ordinate	85632	15417	-
49 X 60 secs	Averaged Co-ordinate	85628	15411	7m
	Differential Co-ordinate	85630	15426	9m
Experiment 15	True co-ordinate	85270	15316	-
39 X 60 secs	Averaged co-ordinate	85269	15321	5m
	Differential co-ordinate	85268	15316	2m
Experiment 18	True co-ordinate	85270	15316	-
207 X 60 secs	Averaged co-ordinate	85276	15306	12m
	Differential co-ordinate	85274	15305	12m

could be expected to get from this similarity in profiles, one of the stations was temporarily assumed to be unknown. The errors from the known stations were then applied to the unknown readings and the table of results was averaged. We were impressed, if not still a little sceptical at this stage:- see **Table 1**

Experiment 9

Further experiments were carried out over the next few months, some using three GPS units. The distance between units was increased, and with more than 7km between units the test still proved successful. The results, though rarely up to the standard of the first experiment, were consistently good, with gross errors of between five and ten metres. The odd erroneous result was obvious from our conformity check.

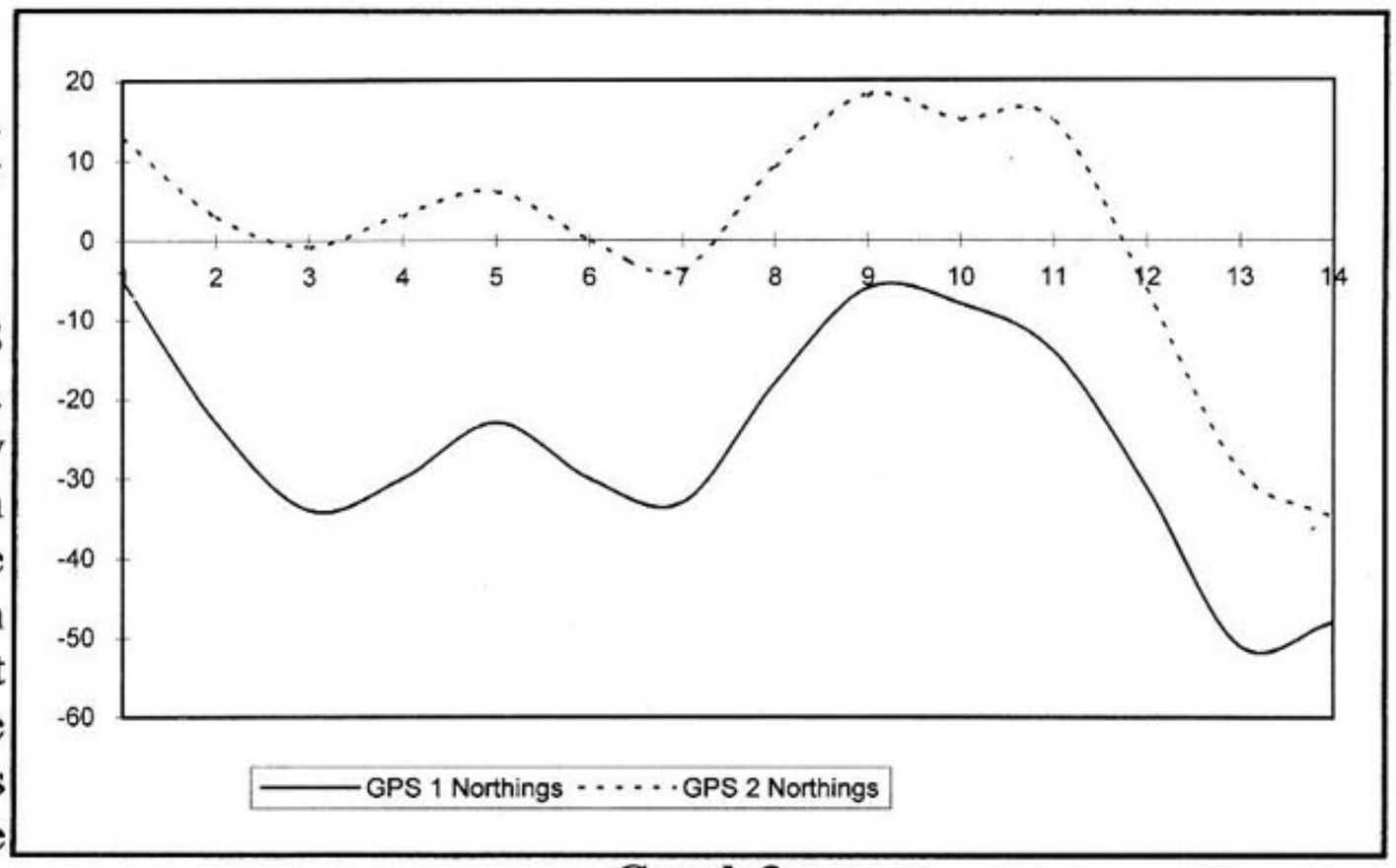
Methods Used

So what did we do to get the results, and how did we determine the likely accuracy?

First of all the data logged on the GPS unit was down-loaded onto a PC. This was done using the proprietary Garmin software and data lead, each set of data being stored as a unique file. Once in a suitable format each file was imported into a spreadsheet program. Most of the work was done in MS Excel v5, but on occasions other spreadsheet programs were pressed into service, and worked ok.

Individual errors were calculated for each Easting and Northing at the known station. The unknown station data was first averaged to obtain a nominal set of co-ordinates which were then used to calculate a set of errors at the unknown station. These error lists were then used to plot an x-y graph as in **Graph 1 & 2**. Depending on the accuracy of the averaged position there may be an offset as in **Graph 3**, but this is irrelevant as it relies on the averaged position. The point of interest is in the profile of each waveform, and the closer the match, the better the accuracy.

If the graphs are very similar then the errors calculated from the known station can be subtracted



Graph 3

from the individual components of the unknown station's co-ordinates. This gives the figures in columns m & n. These columns are then averaged to give the final result. To date no easy way of quantifying the likely error from the graphs has been considered. Errors stated for truly unknown positions are deduced from personal interpretation from the experience gained from the results of controlled experiments. A close consistent match in the graph profiles has, so far, always given a result better than +/-10m in the latter experiments.

USE IN THE FIELD

Equipment

As for experiments, plus 2X Extension leads and masts (1m) and 1X 9m sectional mast.

Base station

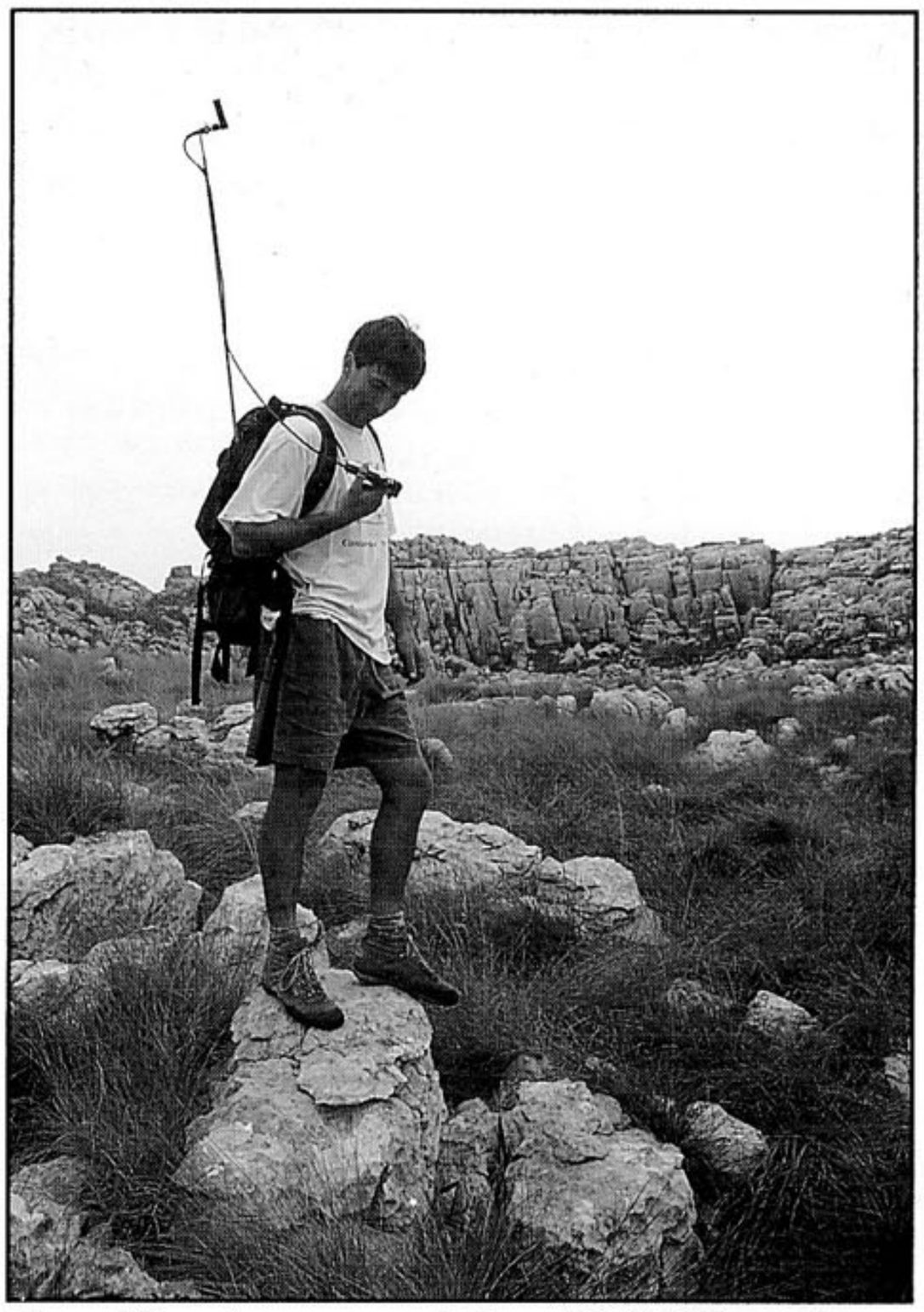
At an early stage it was realised that the base camp would most likely be situated in a valley. Given that GPS requires a good overall horizon to "see" sufficient active satellites a 30 foot sectional mast was constructed and transported to Spain. This proved successful and provided us with good satellite coverage for most of the time, despite our lowly position.

The results obtained in the field are reliant on the true position of the base station aerial. Apart from confirmation from local maps the position is based on the average of all readings taken at this point during the duration of our stay. The range of daily averages only spanned a 5m radius. The gross average is considered to be within +/- 2.5m of true. In all over five and a half thousand readings were taken at the base station.

Methods used - Hardware

For field use, an extension lead and short mast (1 metre) were constructed. The standard unit aerials were removed from the GPS and fixed to the top of the mast, which was slid down into the webbing of a rucksack. The GPS was clipped to the shoulder straps or other convenient point and the other end of the lead connected. ***(see photo)*** The leads were 1.1 metre RG59 grade network cables and proved to be highly efficient with no noticeable loss of signal.

These allowed hands free continuous use, without any possible effects from obstruction by the person operating the equipment. A slight downside was that the excessively amplified movement of the antennae seems to have caused the unit some problem in maintaining its location whilst traversing the search area. This was more noticeable on open karst where movement was erratic and uneven.



Tony Baker

Gary Vaughan, complete with GPS equipment.

The reason for trying to obtain the maximum accuracy whilst searching for sites was to provide us with a set of co-ordinates which we could plot straight onto a map. This allowed us to determine what parts of our area had been covered and what areas remained to be searched. This worked reasonably well though access to a printer or suitable digital maps would have made this easier to implement. Next year maybe?

For data recording in the field we used the Garmin's "tracklog" facility. All units were set up to record their position at intervals of one minute while activated, and this facility was the key to our project as we required a set of synchronised readings.

Downloading the data

The data collected in the field and logged at base, was downloaded to a laptop computer at the end of every day's work. Lack of running time on the laptop, meant that despite having the necessary programmes loaded we were unable to catch up with the processing of the collected data until we returned home.

Data processing

Some mention must be made about batteries. In an attempt to reduce cost we decided to use re-

chargeable Ni Cad cells. A problem soon became apparent from using these. When processing the data, gaps would appear whenever the batteries had been changed. This was generally more of an irritation whilst processing the data than of a serious affect on the accuracy of the final result. Of greater significance was the problem of leaving a GPS logging unattended during which time the batteries would expire. The constant question - had we recorded sufficient data?

CONCLUSIONS

1 If this system is used all the GPS units should be of the same type.

2 7 or 8 Active satellites are required for maximum accuracy. Using 5 or 6 straight averaging over a similar period is probably of equal accuracy.

3 Minimum logging period is 15 minutes, but longer is always better.

4 A stable unobstructed antenna is thoroughly recommended

5 7km from the base is the maximum tested useful range to date. 10 or 15 Km, given sufficient coverage, seems to be quite reasonable (supported by graphical evidence collected during uncontrolled experiments).

PROBLEMS OF SUPPLING POWER TO GPS UNITS AND COMPUTERS

by ***Brian Clipstone***

Before the trip to Spain we had been using Ni-cad batteries in the G.P.S. units without any problems, so we decided to use then in Spain as we had a reasonable supply.

Having no mains supply at the camp site we had to rely on Gary's B&B mains supply to charge some of the AA Ni-cads we used. Also I had made a variable, Mains/12 Volt input Ni-cad charger with 6 outputs, 10 ma to 750 ma, 30 volts with mains and 11.5 volts on a 12 volt input. It has fitted AA size battery holders, so I was able to charge at least 18 AA cells at the same time. This of course was OK as long as my car battery did not go flat or I wanted to use the car.

Ni-cads do not last as long in the G.P.S. units as alkaline batteries, this is because of the voltage difference, so they had to be changed more frequently. This was fine as long as there was someone around at the camp site where the base G.P.S. was sighted, they had to stay within earshot as the G.P.S. beeped at regular intervals to signal that its batteries were flat.

Having some time on my hands (this was a rest day), for the first time for months, I got around to reading the G.P.S. manual and discovered that you can power the G.P.S. with any voltage from 5 to 40 volts, as there were plenty of 12 volt car batteries around, I thought AH! a solution to the AA battery supply problem. If only someone had told me I could have brought the special plug that fits the G.P.S. But with bits and pieces that I had brought with me I made a plug to fit, so the power supply to the base G.P.S. was solved, which cut down on the Ni-cad battery supply. The roving G.P.S. units were not such a problem as they were constantly monitored. But on track logging there was an interruption to the data as the batteries were changed and the unit got up to speed.

The other problem was the lap top computer, this was charged up by Gary each day and used by Iain to download data from the G.P.S. units and input data to a spreadsheet, but the battery never lasted as long as there was work to do. Again I discovered by reading the label, that any DC supply from 7 to 30 volt would run the computer, if only I had the right plug! I tried all of the similar plugs I had, but none fitted, there seems to be an infinite number of those round type power plugs.

Eventually at the start of the third week-of the trip I managed with various bits and pieces of wire, etc. to arrange a higher supply of voltage to charge up the computer and the AA Ni-Cad batteries. In general the system of using Ni-cads worked out OK, with a few alkaline batteries as a backup, in case you run out of Ni-cads in the field or want a long uninterrupted run with the track log.

Next time I will go prepared with all the plugs, power supplies, mains supplies, batteries, lights and plumbing supplies, (but that is another story).

Part 2: The Sport Caving

I'll Get Me Boat.

A User's Guide to the Cueto-Coventosa Through Trip

by ***Tony Baker***

Over the course of three weeks in July and August 1997, sixteen participants in SWCC's Cantabria '97 expedition completed the classic through trip of the Cueto-Coventosa system. What follows are some observations and advice which may be of use to anyone planning to do the trip in future.

About The Cave

The through trip from Sima del Cueto to Cueva Coventosa involves a vertical descent of 695m (with a lowest point of -805m, and a total of 600m of pitches, including the 302m pitch that is the Juhue shaft) and a horizontal distance of some 6.5km. It also includes three long lakes, and a great deal of enjoyable and challenging caving.

The Bottom End

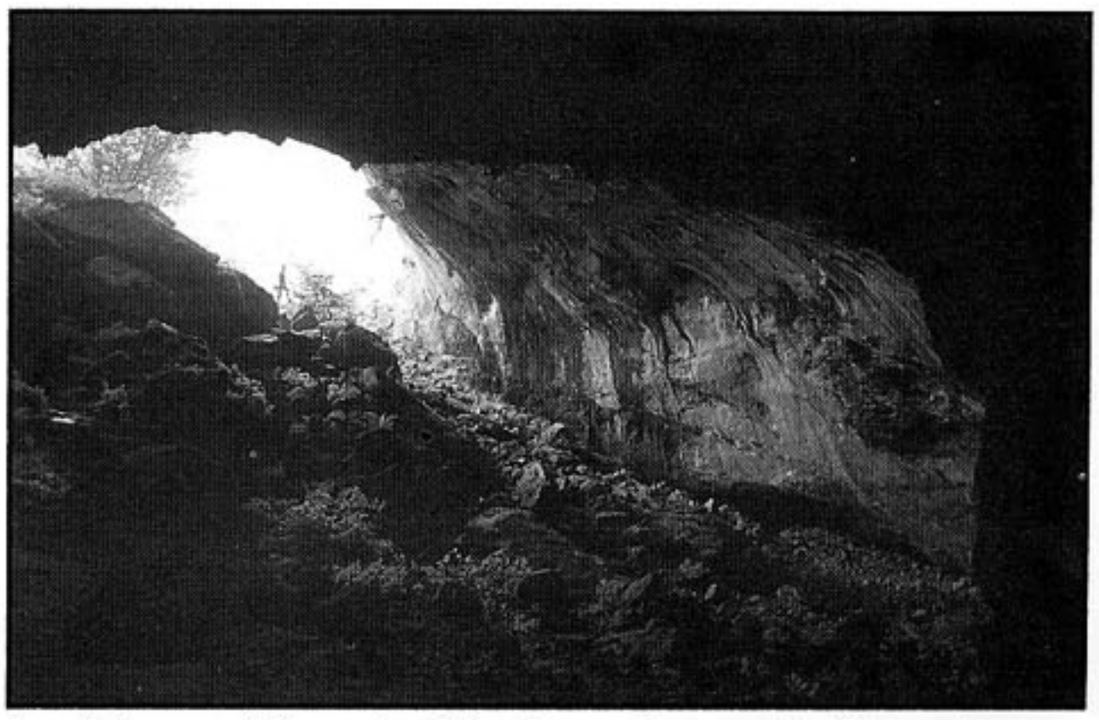
It may seem strange to start an article about a vertical through-trip with the bottom end of the system, but there are several good reasons why anyone intending to do the trip should visit Cueva Coventosa first, the first being familiarity. Routefinding in the bottom end of the cave is relatively straightforward and, as in the rest of the cave, there are plenty of waymarks. Nonetheless, towards the end of a long caving trip it is reassuring to find oneself on familiar territory, and to have some idea of what lies ahead. (There's little point in providing a detailed description of the route here, go and explore for yourself.)

Next there's the problem of the lakes: just over an hour's caving from the Coventosa (bottom) entrance are three very deep, very cold lakes, 50m, 100m and 150m long. Some form of flotation is essential for traversing these, and a visit in advance of a through trip can be used to install suitable boats upstream, which saves dragging them all the way from the top. (More on boats later.) We also put in an emergency dump with food, first aid, spare carbide etc. which remained there for the duration. Additionally, there are various climbs and traverses on the route out from the lakes, and while these mostly have tat in-situ we installed better ropes for our own use.

One final reason to visit Coventosa before attempting to go through the cave: La Turbina. This narrow rift could be considered the "crux" of the through-trip. While going down towards Coventosa, it is necessary to descend this 10m drop, which at its narrowest is only 30cm wide. It is an intimidating place; the draught literally howls down through it and keeping a carbide lamp alight is impossible. It would not be a place to get wedged, even for a short time, and while skinny cavers won't find it a problem those of a slightly stouter build will find it reassuring to visit from the downstream end and go up it and back down before committing to it on a through trip. La Turbina is about half an hour's caving upstream of the lakes and not easy to find from the downstream end.

How to Find Cueva Coventosa

Entering the village of Arredondo from the east on the road from Ramales de la Victoria, take the first left turn (signposted to Ason). After a couple of kilometres the water from the Coventosa resurgence can be seen flowing down the rock face just to the right. Immediately before the road crosses the Rio Ason on a small bridge, take the recently-metalled road on the right, immediately before the bridge over the Rio Ason and signposted 'Val de Ason'. Follow this round a sharp bend and then park at the wide open area near farm buildings. From here, a footpath contours along the hillside between hedges, roughly northwards; there are occasional yellow and white waymarks. Around 800m from the car park, as the path comes to a more open area, you should feel the air temperature drop (assuming you're there in summer); this is the cool air emanating from the cave entrance, which is a huge arch just above the level of the path.



Tony Baker

Looking out from inside the entrance to Coventosa

Sima del Cueto

The entrance to the Sima del Cueto is an insignificant-looking crevice high on the hillside

above Arredondo. The walk up from the parking place at Socueva takes even fit cavers *at least* one-and-a-half hours and usually two hours or more. It's also best done early in the morning, before the Spanish sun is too high in the sky. Don't underestimate this walk, and in particular the amount of water you will need to carry: even in the cool early mornings, many participants drank two litres before reaching the cave entrance, and it is a long way into the cave to drinkable water.

Tony Baker

The insignificant looking hole to SimaCueto

¿Donde Esta La Sima Pericolosa?

From Ramales de la Victoria, take the road to Arredondo. Once in Arredondo, drive right through the village to its western end and then take the left-turn signposted to "Socueva" and to the hermitage.Follow this road, which comes to an end after about 2.3km, and be sure to park considerately. From here the footpath, which is waymarked by yellow and white stripes on rocks, goes past some farm buildings and then zigzags steeply up the hillside. Once at the top of the hill keep following the waymarks - if you've gone more than about fifty metres without seeing a waymark you've ended up on the wrong path. The path may be overgrown in summer but is nevertheless distinct. After passing the edge of a doline and winding through some trees the path emerges on the slopes of a grassy bowl where the sharp-eyed will spot the word "Cueto" and a small arrow painted on a rock beside the path. The entrance is a narrow cleft that would be easy to miss were it not so close to the path and arrow.

Clothing

Before you set off down the cave, it pays to consider what to wear. We were there during a dry spell in the summer, and the cave was pretty much bone dry, as well as having an ambient temperature a little warmer than caves in the UK; anyone wearing the traditional fleece suit/PVC oversuit combination would have roasted. Some chose to wear just a fleece suit, I opted for shorts and a thin sweatshirt under a cotton boiler suit. It's worth carrying an extra sweater to put on if you stop for any longer than a few minutes as, just as in UK caves, you soon chill off when you stop moving. The canals pose a few problems of their own in this regard; more on that later.

The Juhue Shaft

The top of a 302-metre shaft is an intimidating place to attach one's descender to a rope. And yes, I know that the consequences of falling down a 302m shaft are much the same as falling down a 30m one. To descend this shaft and the pitches below it you have two options: you can rig it, like we did, or you can do the through-trip as a pull-down. Before you make your choice, consider the following: the 302m shaft takes you only just over halfway down to the master cave - immediately below it are another 283 metres of pitches. That's a f**k of a lot of rope to carry up the hill, to rig and - worse - to derig. I know, I was on the derigging trip. Our expedition took place over three weeks and involved nearly twenty people who wanted to do the though-trip. This meant we had enough manpower to do all the carrying, rigging and derigging; trips with less time and/or fewer people might struggle to achieve this.

If you've just read the last four sentences and are now convinced that your team will do the trip as a pull-through, let me present the alternative view. To do a pull-down abseil of the 302m Juhue shaft you don't need a 604-metre rope, because the kindly Spaniards have attached re-belays to the wall every 50m or so. Each of these consists of four 12mm bolts, arranged in an attractive diamond formation and joined with some rather flimsy chain. The idea is that a party of up to four sets off, each abseiling down one side of a 100m rope. The first down clips his or her cow's tails to one of the bolts and gets off the rope, the second comes down and so on. When all four are clipped to the bolts, the rope is pulled down and the procedure starts again.

"Oh, bugger..."

This is fine if all goes well: to illustrate the kind of situation you can find yourself in when the Law of Sod applies, allow me to quote from the account of a trip written up in the journal of a Well-Known Caving Club from the north of England. Our heroes, having not done their home-work, start by doubling a 60m rope and sending a hapless individual down, who of course arrives at the end of his rope only to find no sign of a rebelay. Up he goes, but fortunately his team have thought to bring a spare 60m rope in case of mishap. The two ropes are duly joined and Hero no.2 sets off down and finds the rebelay. Soon all three are dangling merrily from their bolts as the ropes are pulled down. They reach the second rebelay - "with upward escape now impossible" - and once all three are dangling again...

...we quickly started pulling the ropes through. But when we arrived at the halfway knot the rope suddenly jammed! No amount of tugging and pulling would budge it. Serious problems call for serious measures. The fattest and therefore heaviest member of the team attached his jammers to the jammed rope and slowly started prussiking. You could have cut the atmosphere with a knife as the rope stretch was taken in and Mark started to ascend. About 1ft above the belay whatever had trapped the rope gave way and he plummeted back down on to our belay with an almighty jolt, followed by 60m of rope. We all breathed a sigh of relief.

All this was going on with the team suspended above about 200m of black space and if this sounds like fun to you, remind me not to go caving with you. Fortunately the team managed to complete their descent without further mishap - the through-trip took them almost twenty-four hours - but their tale does illustrate why it is essential to have at least one spare rope on a pull-down trip like this. While they were unlucky to have their rope snag on the relatively smooth walls of the Juhue shaft, the lower series of pitches are peppered with flakes and crevices determined to trap ropes: I came across a length of rope snagged around a nodule of rock that had been cut off and abandoned by whoever had been using it.

One more point about this part of the trip: there is no water on any of the pitches, or for the first couple of hours of caving in the master cave. So you'll need to carry enough water for drinking and for carbide lights for this bit.

Once you've descended the Juhue shaft and the 283m of pitches immediately below it you are in the Juhue gallery: a wide, boulder-strewn passage. From the bottom of the rope you head south, and progress is made by scrambling over and around the boulders, following the waymarks.

Waymarks

In Britain we are vehemently opposed to placing of waymarks in caves, but on the continent the attitude is rather different and in places like the Juhue Gallery it becomes clear that they have a point. Despite the fact that you are following a single, wide passage the waymarks fulfil an important function; the passage is so wide that it is often difficult to see either wall and it is easy to become disoriented.

Add to that the facts that a) this is an extremely remote bit of cave, b) that the passage is full of loosely-piled boulders and c) it is comparatively rarely trampled and you start to realise that straying from the main route could lead to a serious mishap. Along this section of the cave you pass through something called Sala de las Once Horas - Eleven Hour Chamber - so named because an unfortunate Spaniard once spent that long trying to find his way out of it, and that's the best argument I've ever heard for waymarks in a cave.

Don't Look Back for Agua

A couple of hours after you've left the bottom of the pitches, the sound of dripping water looms out of the darkness ahead and you arrive at El Oasis; time for a drink and to refill your carbide generator. There's a cut-off plastic bottle or two lying around to catch the drips.

Next landmark on the trip is Pozo de Navidad (Christmas Pitch), an 18m drop rigged with the usual tatty rope; we put a rope of our own on this for the duration. The notable thing about the next long section of cave - all the way to La Turbina - is that it provides unremittingly sporting caving the whole way. There are traverses, climbs, a few more pitches and some crawly bits, more than enough to keep you entertained.

From the bottom of the Navidad, the cave changes character - there are some beautiful gypsum formations, and the passage is much smaller. The

Dave Dobson

Pozo de Navidad

passage doubles back, so you're now heading east. Along here there are a couple of minor drops and an exposed traverse, poorly rigged with rope that looks less than reliable. Shortly before the Sala Blanca are some stunning gypsum flowers on the walls that are well worth pausing to look at.

Sala Blanca is also beautifully decorated, with a huge column of gypsum towering up one wall. Another pitch (31m) soon follows, again with in-situ tat. From the foot of this you head east, to emerge at Pozo de la Union, close to the point where Cueto and Coventosa were first connected in April 1979. There's another drip and plastic bottle here for more refreshment.

Soon you clamber up into the Galeria de las Pequeñas Inglesas (Small Englishwomen's Passage, a name which, as Bob Hall observed, was probably contrived as some sort of

gynaecological slur on English females), where there are some fine short traverses. A bigger gallery follows where you cross the top of the 48m Pozo Josiane.

The Answer, My Friend, is...

Soon afterwards, the passage becomes occasionally scratty and awkward, with crawly bits and miserable dry rifts; you're getting towards La Turbina. A short pitch, rigged as usual with grotty rope, leads down into a chamber and from memory there's a carbide arrow or label that points the way, although the draught whistles through this bit. More rifts follow and the draught by now will have blown out your carbide lamp. There are one or two bits of tape flapping in the breeze, and soon you'll come across the rope that leads down to La Turbina.

Drop out of the bottom of La Turbina and you start to feel that you're on the home straight; the entrance to Coventosa is an hour-and-a-half or two hours from here if you're still in reasonable caving shape. Follow the passage downhill, turn right just after the bottom of a handline and further downhill you'll come to an awkward bit of tat that is half-pitch and half-traverse line, and not easy to spot from the top. Once you've negotiated this, you follow your nose and soon the lakes loom out of the darkness, and at this point I'll briefly mention boats.

That Sinking Feeling

Despite Gary Vaughan's extended paean to Intex dinghies in SWCC Newsletter no. 117, this cave confirmed to anyone still needing convincing that kiddies' toys and caves just don't mix. Ridiculously easy to puncture, every one of the selection of flimsy one-, two- and three-person so-called "boats" that went into Coventosa suffered a failure at some point, largely because the section of cave between Lakes Two and Three involved a few minutes' clambering over super-abrasive boulders. No matter how carefully one ferried the dinghies across this section of cave, contact with the rock was inevitable and this usually meant that the next through-trip team came across a soggy plastic pancake where a boat should have awaited them.

A half-hour of struggling with a pump and its determinedly useless tube then followed, before the unfortunate individuals concerned sighed and resigned themselves to near-total immersion accompanied by hissing sounds. And repairing the boats in-situ didn't work either (we tried);

if you want to repair a punctured toy boat you have to remove it from the cave, clean it, and dry it thoroughly and before you get out your glue.

You Can't Get Better Than...

Better by far are the inner tubes - preferably lorry-sized ones - that polite cavers can scrounge from Kwik-Fit or similar outfits. Take the Schrader valves out, fit good dust caps and you have sturdy craft that can be ferried into the cave flat, inflated with nothing more sophisticated than a mouth and which, unlike toy dinghies, won't puncture if you stare at them.

The lakes added some time to through trips done under our system, as someone from each party had to ferry the boats back upstream ready for the next party, thereby undertaking a total of three crossings of each lake. This process inevitably involved the ferryperson getting wet and his/her companion(s) getting cold waiting for them, a fact worth bearing in mind when deciding what to wear/carry on your through trip.

From here, though, the next few hundred metres of cave are superb. It's a fine river passage, punctuated by the odd climb and an awkward little traverse line along one wall that keeps you out of a deep pool. But then you knew that already, 'cos you came in here before as suggested at the beginning, didn't you?.

Tony Baker

Traverses downstream from the lakes in Coventosa

If you're anything like the SWCC members who did this trip, you'll emerge blinking into the sunlight (or, more probably, moonlight) around twelve hours after you ducked into the entrance of Sima Cueto. Add several hours to this if you're doing a pull-down trip. Most of our through-trip teams consisted of two or three people, and all considered that any more would have slowed things down unnecessarily, especially on the pitches and across the lakes.

And Finally...

My personal view is that a Cueto-Coventosa through-trip is one of the finest sporting caving trips you'll find anywhere, and I heartily recommend that if you get the chance, you go and do it.

The All Electric Vegetarian Through Trip Test
(or Andy, Dave and Tim give Spanish Caving Go)

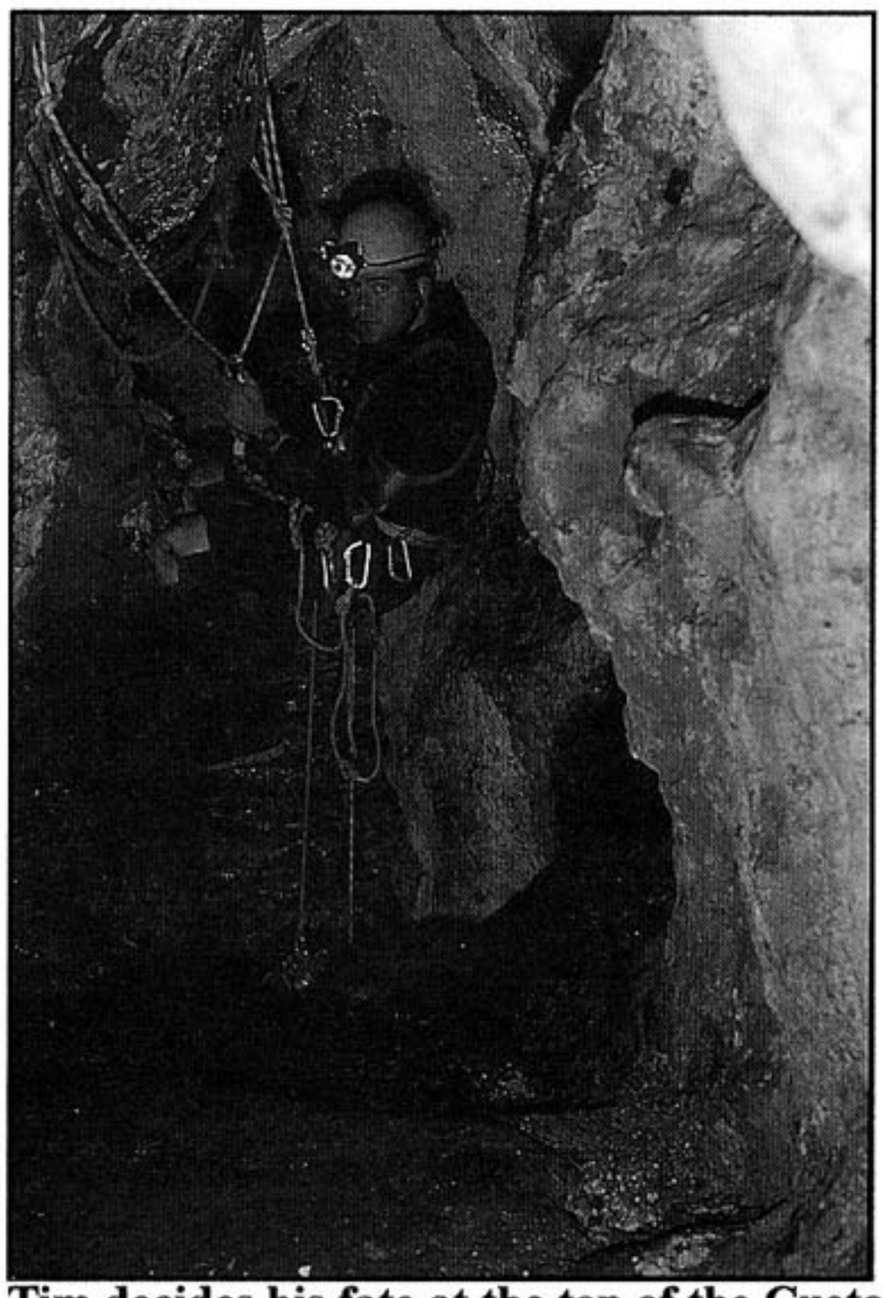
by ***Tim Clark***

The hill comes first and then the pitch. The hill isn't a problem. Straddling the darkness, whilst clipped to the traverse line, that isn't a problem. Inching through the bottleneck pitchhead, that's easy. The space all around me and the unlooked at space below, they're the problem.

I lock off my descender. My head is too full. My head is too empty. I am far, far away from calm.

Two metres is no distance to prussik, and they'll be quicker without me, I can walk away to daylight and down the hill, I can hitch a lift to Ramales, be asleep in my tent this afternoon.

Sometime later, something inside me decides to continue down the rope.



Dave Dobson

Tim decides his fate at the top of the Cueto shaft

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I had been training with Fred Levett for most of the year prior to the expedition. Cantabria 97 was to be my first caving trip outside of the UK. Pwll Dwfn was the nearest thing we could find to a huge shaft . If it had descended all the way through the hill to a master system it could have provided a rough scale model of the Cueto-Coventosa through trip. It was a shaft at the top of a hill and that seemed sufficient for our needs.

Fred broke his finger on our first training trip. I put my back out on our last. I lost a lot of dignity, but precious little weight, on intervening trips. Spain came all too soon. I backed out of the first through trip. The combined team of Payne, Parkin and Vaughan being much bigger and much tougher than I could ever hope to be. Fred would be arriving in Spain too late to accompany me on a through trip. Dave and Andy Dobson agreed that I could be the third member on their trip; they both assured me that they were very unfit. Claire Jones agreed to be our support driver for the early morning drive. We were up last that morning so we were the last team up the hill and the last team down the shaft.

****

The fear goes away. I slowly descend. Boredom sets in. Rebelays arrive periodically. Shouts from above and shouts from below. I don't look down, I wait for the rebelay. I am descending so slowly. At each rebelay, before I can stand and unclip my cowstail, I have to kick the blood back down to my feet. I shout up that the rope is free.

I arrive at the bottom. I see Andy for the first time in hours. I am very, very late. Andy is cold and worried. Dave soon arrives. We dekit and head off into the boulders.

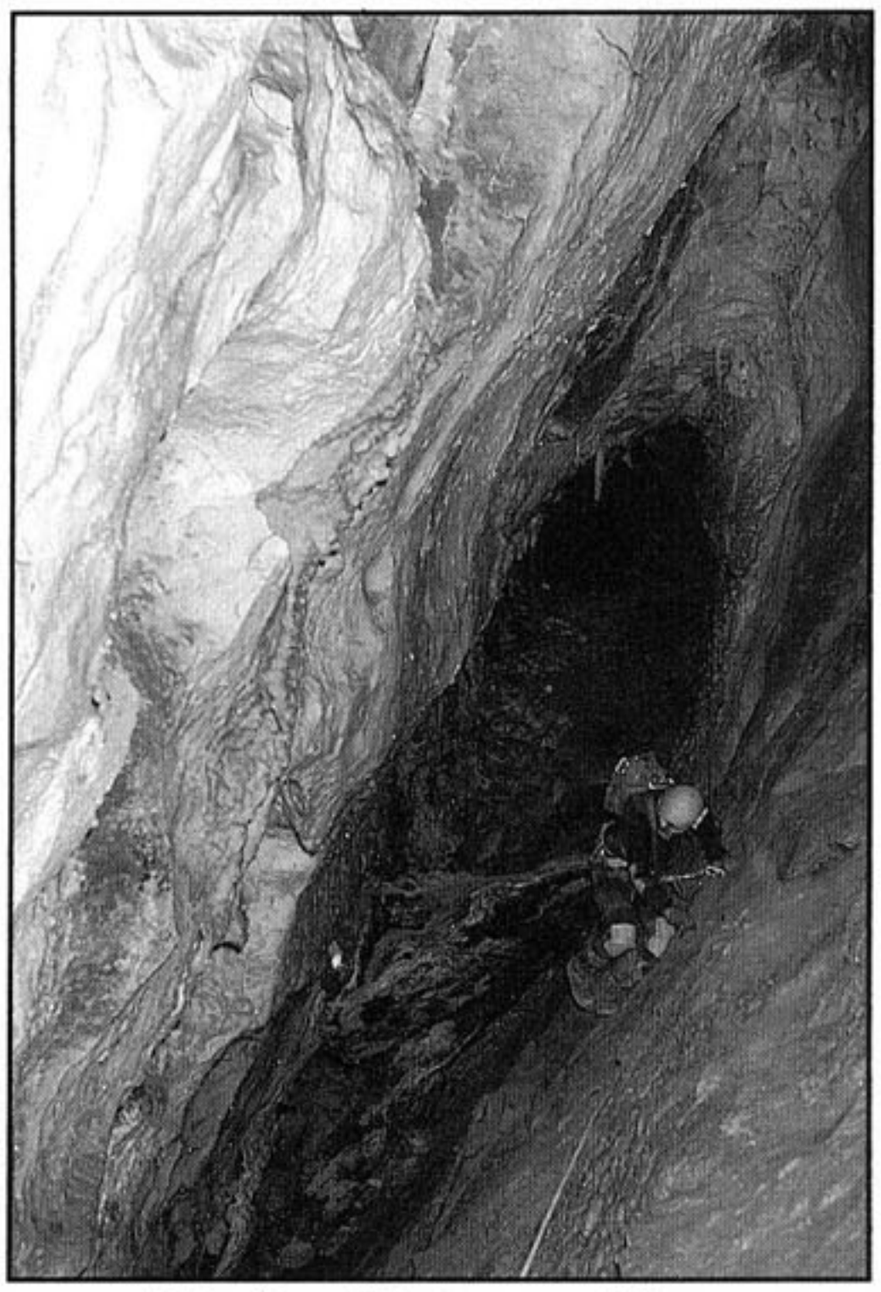
This is Draenen times ten. Up and down boulder after boulder after boulder. Occasionally Dave stops to take photographs of Andy, myself and the boulders. At one point we come across the inexplicable smell of burning carbide; we are several hours away from any other cavers, and all our lamps are electric.

The cave goes on and on. The pitch never appears. We read and re-read the trip description. We carry on.

The pitch appears. An end to boulders and down we go. This cave is all so dry. No water. No draughts. But down below the boulders is cave I can cope with, right sized and almost familiar. The traverse lines are terrible.

The passages go and go and then go some more. We drop the occasional pitch. The passages shrink down to nothing and at the last moment break into walking passage.

The passages go and go and then bedlam. No clear way on. Carbide arrows point in every direction down every passage and up every climb. We crawl up and down and around. We lose Dave. I find the way on. We wait. Andy fettles his light.



Dave Dobson

The 'terrible traverse' lines

I eat whilst perched near the lip of the big pitch that we're meant to traverse. Dave eventually appears, not lost, just waiting a long way back for a shout from ahead. Soon we are back on track; our confidence returns.

Somewhere below the boulders and above the water is the only pitch on the whole through trip that needs to be ascended with SRT kit. It is the shortest pitch I have ever prussiked underground. Getting on to the rope I shock load my jammers as I swing out over nothing. The little diagrams from the Petzl technical leaflets swim before my eyes.

****

La Turbina is tight and awkward. A relief, not a problem, we are on our way out. The lakes are a problem. Four inner tubes. No boats. They said that they'd leave us a boat. Its a very long swim. I can't swim.

Andy immerses himself whilst embarking in an inner tube. Dave volunteers to fetch the boats back from the far side and sails off in a large inner tube.I lend Andy a balaclava, and he exercises to keep warm. I sit on my tackle sack and drift off to sleep. Every time my head nods forward I fall from my perch.

Dave returns. His main light is out and he's using his backup. Andy and I place inner tubes around our middles and launch our dinghy. All the rocks and walls are sharp and dangerous. Every tug on the rope as we move across the lakes seems to bring us closer to danger.

Dave Dobson

Andy Dobson traverses deep pools in Coventosa

From the end of the lakes to the base of the climbs up and out of Coventosa I am bestowed with magical caving ability. I cannot put a hand or foot wrong, my strength has returned. I traverse Las Marmitas with ease, and sprint along the streamway.

At the climbs I am an old man. I send Dave and Andy on ahead. I climb forever. From the bottom of the last climb I can hear a voice from above. It is Dave or Andy, I can't remember which, but in my fatigue it sounds like Tony Knibbs and I wonder why he is waiting at the top of the climb. Soon I am out in the darkness.

****

We have been underground a long time. It was the longest time taken by any party. Back at the campsite we shower.

Gary and Allison cook us chips, very very late but very very welcome.

Take two trips into the cave...?

by ***Andrew Dobson***

Even as I landed I could feel it was bad, the pain searing up from the bottom of my back and my mobility severely restricted. Fortunately I wasn't at the bottom of a deep cave in Spain, but playing basketball with the kids at the end of the cottage working week in May. I feared the injury would prevent me from contributing to the expedition, but a visit to an osteopath and some remedial yoga worked wonders and a fortnight before departure I was able to test my recovery on the Swamp Creek pitch in Ogof Ffynnon Ddu. My back only creaked a little bit, and the SRT was fun, even if my fitness was a little jaded.

Once in Spain the aches and pains fell away and the wonderful variety of Coventosa allowed me to check my caving health before making the long trip through from Sima Cueto. I was pleased to be able to join in with everyone else carrying rope, ferrying dinghies, mending punctured inner tubes, prospecting for new caves and thoroughly enjoying some superb caving. All too soon our last day came round. Dave wanted to take pictures of the lower reaches of Coventosa, while I wanted to visit the Torca del Carlista and its 100m freehanging pitch; the scene was set for an action packed last day.

A prompt start (well, prompt for us, anyway) saw Dave and me at the entrance to Coventosa, raring to go. It is a wonderful place to cave in, with plenty of variation: rope climbs, free climbs, traverses, gour pools, streamway, climbs round deep water and boulder hopping aplenty, interspersed with big walking passage, great fun especially when you've forgotten what sport caving can be. This variety gave plenty of shots for Dave to try, although many of them wanted about three more people suspended from the ceilings or walls with flashguns! Out into day-light then, feeling hungry and in need of a drink.

We made it back to the camp late, and Brian was waiting, but then what's new? I was born early and I've been late ever since. Having made sure I'd got all my SRT kit we headed off for the winding drive up to Carlista. We met Ian and Martin and got the lowdown on finding the entrance.

Just out of sight of the car, an unlikely gap in the limestone with a thorn bush and as if by magic there was a rope tied round a thread.
Abseiling down, easy stuff now Chris had rejigged the lengths, at first in a rifty chimney then the big drop like a cathedral dome, a spider on a tiny thread spinning round with little sign of the walls, keeping the descent nicely under control with the lights of Dave and Brian so small below. The floor finally came into view, and I lay down to feed enough rope through to unlock the rack. Wandering on down the rubble slope with Dave looking for something to photo. At 7pm we decided to head back up because of the inevitable time delays - I was to go first while the others explored the huge chamber.

The stretch and bounce was incredible - taking it very slow and steady at the bottom - impossible to race the bounce and keep in rhythm, but as I got higher managing to match the harmony of the rope and the weird sensation of seeing my breath hang in the air as I bounced up and down through it. The others coming into view at the bottom as I got nearer the top, or was it? No visible roof but the sides were definitely closing in, I was determined not to stop as the others were now waiting their turn. With sweat dripping off me at last I reached the rebelay. Up onto the next rope and a chance to look down on their lights so far below.

A steady plod out in no hurry, hearing Dave call 'Rope free' on the big pitch just as I negotiated the y-hang at the top of the entrance pitch. There was zero visibility on the surface as I had some water and dried off in the breeze. I got changed watching the cloud rift over and the panoramic view open up then close in again. Brian was struggling to de-rig with his home-made allen key, but at last he was in sight. While Brian dekitted, Dave and I hauled the bag out and packed in the rope - don't bounce the bag too hard as the ground seems to vibrate in sympathy. Carried the rope down just as the light faded, and back to camp for a refreshing cold shower. No time to start packing but a splendid way to end the trip - a full day's caving in two superb and utterly different caves.

Sima de Cueto - Coventosa "The Vice Presidents Trip"

Tony Baker and Fred Levett
Narrated by FL

And so it was at 10.00 am on 2 August 1997 only one decision remained; to go down or not to go down — we went down and down and down...

The day started at 5.30 am after a good dose of pasta and an early night. By 0730 Tony and I were ready to start the walk up. Tony's car had been left at Coventosa entrance and Jackie Levett provided the taxi service.

We were both equipped with 1 litre of fluid each for the walk up, 1.5 litres for underground plus 250ml of "carbide water" for topping up at the staging posts underground. I had enough food for a modest dinner party, Tony two pieces of fruitcake and a tin of fruit. SRT kit was closely examined. Various theories existed as to the benefits of using two Stops for quicker changes at re-belays and giving time for one to cool down. Simplicity won, only one Stop (each) was used, it seemed familiar, and the familiarity was comforting.

Tony elected to wear fashionable T-shirt, shorts and stylishly cut orange cotton boiler suit. I had a tatty old undersuit with shorts for added padding in the harness having heard reports of numb legs caused by the length of time dangling.

...As you gather this point in the trip engenders considerable procrastination.

Now to business.
Sun bright, strenuous up gradient, one and three-quarter hours to the entrance. A magnificent walk, worth it for the experience. Much effort at dumping, drank the water, fettled the kit. "Who's going first?" said Tony. "You" said Fred, master of the quick decision. So ended the preliminaries.

The Shaft.
One pitch, 197 metres to ledge, 5 rebelays. Top section hung mostly against wall, feet out to walk down. - Hell this Stop's hot - one finger on the cam back to monitor - nice and steady. The ropes on this upper section are dry, that's the problem. Average shaft diameter about 8 metres - where's that first rebelay? - what geology! 'Journey to the centre of the Earth' or what! Tony shouts up "Rope free" at regular intervals, the acoustics are incredible, size enormous. Everything seems in slow motion, the light below getting smaller. At last, the ledge. A quick stretch of the legs then on down. 105 metres to the foot of the main shaft, 302 metres in total. The diameter has decreased now and only about 4 re-belays take us to the bottom. The de-riggers will need to be good.

A further 270 metres of descent in 10 pitches followed, much tighter in comparison with the main shaft and colder and wetter. The ropes are wet here so no Stop-chaud problems.

Now at -581 metres, 2hours 27 minutes into trip and in the Galeria de Juhue. My left hand is stiff from holding the Stop open for so long, but I'm feeling good. This was Tony's second trip; he could handle any shaft now.

The Big Stuff
1.5 km of fossil passage ahead of us. Large boulder climbs going on and on. There's lots of degradation of the formations in this section. Just as I'm getting the hang of navigation techniques, namely reflector, cairns, tape, sweet wrappers and foil, Tony recounts the "lost for 11 hours in this chamber" story. 'Sala de las Once Horas' was definitely larger than Roundabout Chamber in OFD! The first stop came at 'El Oasis' for carbide water, and the second stop just before 'Pozo de Navidad' for my lunch and to fettle the carbide lights. Four hours in now.

The Smaller Stuff
A drop down and it's more like South Wales now. Crystalline deposits are everywhere but much destruction is evident. The area must have suffered earthquakes. The caving is different but no easier. Fewer ropes are evident and more exposure tolerated, especially on traverses. We climb up and down just like OFD. The first photoshoot takes place in the 'Galeria de Navidad'. An incredible formation just like an upturned cactus in crystals is the focus of our attention. I model and Tony does the business. The second photoshoot follows quickly in the same galeria consisting of close-ups of fine hair like formations and gypsum flowers. I've never seen formations like this.

Now the third session in 'Sala Blanca'. A big stal and I are the subject. Navigation's still going well considerably aided by Tony's electric spot. I'm saving the batteries in my "free with Esso petrol" torch. The trade route is much more obvious now.

Tony Baker

Fred Levett admiring fine crystal formations on the Cueto - Coventosa through trip

The third stop is at 'Pozo de la Union' for carbide water. A plastic bottle is filled from a drip using a funnel, all conveniently waiting for us. Still going well.

The fourth stop comes just before 'Pozo Josiane' to fettle the carbides and for my tea.

We were now in the crawly, snaggy grot before 'La Turbina' and every time I move something snagged on the rock. I was rather grumpy for a bit, swearing at my tackle sack and feeling the wind increasing [in the cave]. Tony remained steadfastly polite, could this be role reversal? Meanwhile Tony was increasing the wind utilising the stored energy of the previous night's curry. We reached 'La Turbina' at 20.25. Very windy. Carbides blow out. Descent on rope down a tight rift with chest jammer and extras removed. Stop attached to short cow's tail - "keep right," shouts Tony. Very like St. Cuthberts on Mendip.

The Lakes and out

The cave is very different now. Tackle sack on and keep moving, a cross between Aggy and OFD III. The welcome sight of the 3 lakes looms, and 3 blown up boats! Inner tubes are fitted into 2 for the comfort of passengers and the kit including the rescue dump goes into a third. Off goes Tony towing the luggage, I follow for my first cruise. 150 metres of water, 5 minutes caving [a pain with 3 boats], 100 metres of water, 50 more then dry land. The lines through the lakes are very handy. The submerged rocks and walls sharp - not so handy. Sailor T sets off back to leave the boats ready for the following party. Meanwhile I sit enjoying the can of lemonade stashed on the recce trip. By the time Tony returns I am cold, very cold. Even with my carbide generator down the front of my undersuit and hood on I feel my temperature dropping. Then I stop feeling cold. My numb brain tells me this is not good news. We arrived at the lakes at 21.00 and left at 22.35. We get going, my body soon picks up but my brain just won't function - could this be hypothermia or just tiredness? It was now well past my bedtime.

The entrance series is big and encouragingly familiar after a previous trip. The most notable features are the traverses, some over water to start with then into large dry passage.

Exit at 00.07. Back to the campsite 00.40. A magnificent trip taking 14 hours with photography and boat handling course. Shaft, rifts, climbs, lakes, pretties, all in one trip.

Times. Walk up 1hr 45min, pitches 2hr 27min, 'La Turbina' after 10hrs 25min, lakes after 11hrs,

Cueto Shaft - the start of the de-rig.

by ***Julian Carter***

On Saturday 2nd of August, Myself, Sue and Mike, following Fred and Tony, completed the last through trip of SWCC's visit to the Coventosa system, bringing with us all the SWCC rope in the 'middle' section of the cave and leaving all the remaining boats and bits of gear the right side of the lakes. All that now remained was to remove the assortment of sinking boats and bits of rope in the bottom section of the cave and to pull the 600 metres of rope out of the Cueto shaft.....

During the following rest day Tony started to mutter about the de-rig of Cueto, especially as people were now fast disappearing back home. For some reason I agreed to accompany Tony on this de-rig, which was strange because I was not even drunk. A plan of action was drawn up, gear was packed and an early night's sleep planned, especially with the joy of a 6.00am start. Unfortunately as with the night before the first through-trip I did not sleep too well. This was a mixture of nerves (with the thought of once again doing a 300m drop) and the sound of Miller's voice at 1.00am talking once again about GPS error corrections!

We were on our way up the hill by about 8.30am. We had estimated our ETO and some of the others had agreed to walk up the hill to help carry gear back in the early evening. The mist was down on the hill, and the weather looked pretty miserable (very much like Penwyllt). Luckily our navigation remained true, although it did waver once or twice, and we arrived at the Cueto entrance in the usual one and three quarter hours. Time was then spent fettling with equipment, changing and attempting final bowel evacuations. At around 11.00am our journey down began. Strangely enough it didn't feel any easier hanging oneself over a 300m drop than it did the first time, but after quadruple checks of every piece of equipment, off I went with the pinprick of Tony's carbide some 50-100 metres below. On the journey down Tony staged small bottles of water throughout the cave and we both dumped a good supply of food at the bottom of the main 300m shaft. After less than two hours we arrived at the bottom of Cueto - the de-rig now began.

We both started the de-rig with open minds, and a methodology soon set in. Tony did the de-rigging whilst I went up ahead with the first full bag of rope, waiting at the top of each main section to give a hand as required to haul on the additional bags as they appeared. The bottom half of Cueto is a complete contrast to the main shaft. It is made up of smaller scrappy pitches, often inclined. Some of the pitches were distinctly unnerving as you prussik up - the crap bolts became evidently more crap, the worn-out-bootlace deviation cords more obviously worn out and the large number of 'twang' points disturbing! However things went well - by 5.00pm we were at the base of the 300m main shaft, arriving with two 100m bags and one 200m bag of rope between us. Now for that last 300m.

We stopped for some food and drink, and to fettle carbides. Then the journey out began. I went up first, trailing one bag of rope and another of spare food, carbide and prussik gear. However on reaching the -190m ledge I was flagging, and decided to dump the bag of rope on the ledge for the part 2 team. Meanwhile Tony attached a full 200m bag to the end of the rope going from the -190m ledge to the base of the main shaft, and on his journey up removed all the belays and deviations from the wall. This would allow the part 2 de-rig team to start to haul the rope out from the -190m ledge. Tony was also armed with the other 100m bag of rope. On seeing I had dumped my bag at the -190m ledge he took up the challenge to take his bag out all of the way (hard bastard). The journey up from the -190m ledge to the top was the longest. By counting the rebelays you could position yourself in the shaft, but it was hot work and a dehydration headache soon set in. The worst section was the last one, which just went on and on and on and on. Eventually the top was reached and I emerged into a thunderstorm (which had been expected as you could hear the thunder as you got close to the top of the shaft). Luckily the storm was passing, but had stopped any of our porters coming up the hill. So all that now remained was for myself and Tony to walk down the hill in the rain, although we did see lots of salamanders, and (as those who have caved with Tony will know) talked endlessly about all sorts of things (Martin does what...?).

Part 3: The Exploration

SVA 29

by ***Tony Baker***

Objective 2.1 To carry out a reconnaissance of an upland karst area with a view to:

(i) Assessing the usability of GPS as a caving expedition tool for locating cave entrances.
(ii) Establishing the existence (or non-existence) of potential for future exploration in the designated area. This objective will involve the club working closely with the local Spanish club, Agrupacion Espeleologica Ramaliega, *who have granted the club permission for the work intended.*
- From the Registration Form, Cantabria '97.

Julian Carter

Filling in holes on San Vincente

I threw down a rock. *Thud*. It had landed ten metres or so below me, on what sounded like a mud floor. I threw another. *Thud* - the same result. I threw a third. *Thud*. Somehow I wasn't convinced; something compelled me to scratch around to find another rock, which I then lobbed carefully into the hole. *Thud*. Then: *bang, bang, bang, bang*, as it rattled away down what sounded like a very deep hole. "Yeeeee-harrrr!", I yelled, to draw the attention of the others to what I'd found.

"What have you got, another deep one?" Gary called from across the gully where we were all exploring different corners.

"Yep!"

"OK, I'll be there in a minute, but we'll finish logging this one first." Someone else had found a promising hole a couple of minutes previously, and Gary was shouting the details over to Iain Miller, who had the log sheets. A few minutes later he was standing next to me, as I proudly dropped another rock. *Thud*. Gary looked a little sceptical. Another rock, another *thud*. "Wait, honestly, I'll get one to go all the way down again in a minute." *Thud*.

Gary shouted, "All right Iain, we'll have to trust him on this one. Started logging here at 12.27 on the GPS."

"OK" said Iain, "this one will be SVA 29."

At that moment, the next rock went *thud, bang, bang, bang, bang*. "Ah" said Gary, "he wasn't fibbing, actually..."

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This was my first day up on The Hill, as it became known. I'd done my Cueto-Coventosa through-trip a couple of days previously, and now I was keen to get involved in the exploration side of things. I spend nearly all my SWCC weekends digging or looking for new cave, and the fact that we had this huge lump of limestone, with next to nothing known on it, to explore was exciting.

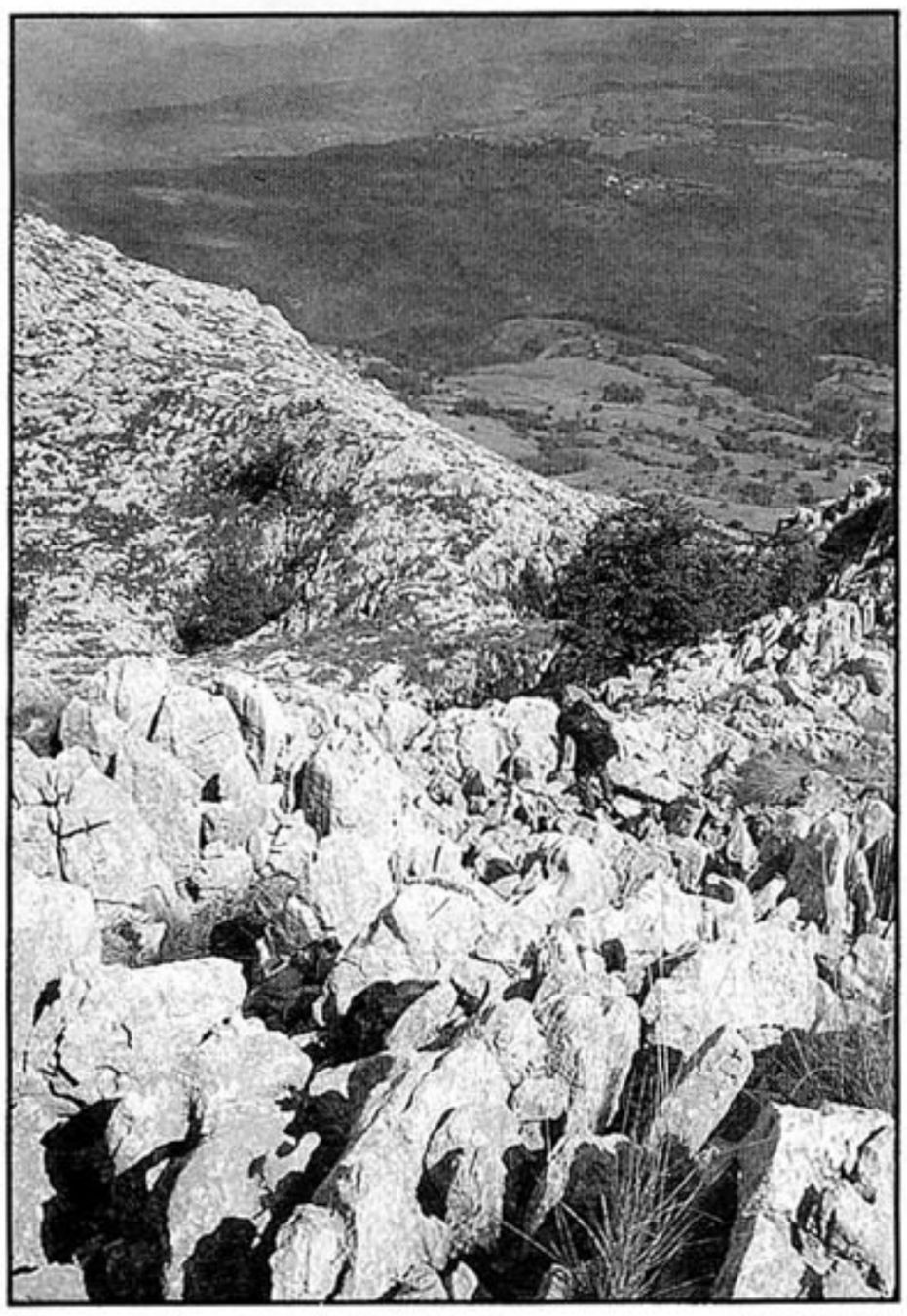
Gary Vaughan and Iain Miller had already been up here prospecting and were well-versed in the procedure for logging sites of potential speleological interest on the GPS. This was very much a reconnaissance, the idea being to cover as much ground as possible and note all the likely holes, marking them with spray paint.
Later in the expedition, a couple of days would be spent descending a few of the most promising sites, to establish what the real potential was. So, for now, SVA 29 was just another red spray mark on the lapiaz and another sheet of paper in Iain's file. ("SV" stood for San Vicente, the hill we were exploring, "A" for area A, the first of the nine areas into which the hill had been divided, and 29 being the twenty-ninth site logged in that area.)

Progress across the lapiaz was hard work. We walked in a line, one GPS at either end. Every crevice had to be checked, and the terrain was treacherous. Scrambling across the razor-sharp pinnacles gouged lumps out of boot soles, and scraped hands and legs. It could take twenty or thirty minutes to cover a hundred metres, carefully checking each footstep to make sure the rock you were about to stand on wasn't loose and likely to send you tumbling onto a sharp edge.

Every crack between the limestone pinnacles just might be the top of a shaft, and had to be looked

at. The occasional reward for all this effort was the thrill of hearing a rock rattle down a shaft that it was clear no-one had ever descended, or even looked down.

Over the course of the expedition, this area, "A" was the only one that was examined in detail, although on one scorching day Iain Miller and others chose to stay at the lower-level Area E rather than struggle up to Area A. A total of forty-two sites of genuine speleological interest were logged on the GPS and marked with paint.



Julian Carter

Searching for holes in the region of SVA29

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The last day of the expedition. Two teams walk up equipped with rope, bolting kits and surveying gear, to descend and survey some of the more interesting shafts. I'm with Jules Carter and Martin Hoff and our first objective is SVA 37, a hole almost in the bottom of the big doline at the top of The Hill that Jules had found a few days previously and was looking forward to exploring.

Several hours later, Jules has put in what seems to me like a huge number of bolts and reports that he's bottomed an impressive 35m shaft, reaching a boulder floor that might yield to some digging work in the future. Martin goes down to help him survey it while I pack up the gear; if we're quick, there's probably just time for a look at SVA 29.

I scramble over the sharp terrain as quickly as I can, sweating and breathless, aware of the clock ticking away the last of our time up here. Arriving at SVA 29, I work out that a nearby slab will serve as a back-up belay and a large round flake at the entrance will provide half of a Y-hang, so I need only put one bolt in to descend safely.

The hole is nearly finished when Martin and Jules appear. And it's starting to rain. I finish placing the spit, attach the rope to the bolt and slide down the narrow rift. The rock has the abrasive feel of virgin territory, and it's clear that I'm going to struggle to get back up this awkward slot. I land on the mud bank, which slopes down towards the far end of the rift.

And now I realise why it was so difficult to get stones further down; at the bottom end of the mud slope is a hole 15cm wide by 25cm deep, the only way on down.

What is really exciting, though, is what I can see down the slim hole - a wide shaft with light-coloured walls and an inviting echo. The thought is racing through my mind: *no-one has seen this before. Ever*. I throw down a rock, to remind myself of what I'd heard a few days previously: *bang, bang, bang, bang*. I claw frantically at the mud bank to enlarge the hole, in the hope that I can enlarge it enough to get through. After a few minutes work, I can just about fit both legs into the slot. By now a thunderstorm has broken out on the surface and the rain is making its way down to where I'm working. It occurs to me that Martin is more likely than me to be able to wriggle into the slot; I'm also aware that he's played second fiddle to Jules at the other hole and he's waiting on the surface here too. I take my descender off the rope and yell at him to come down.

He arrives, I show him the slot and the shaft below and he's excited too. This really feels like exploration. By now the slot is big enough for Martin to get through: he wriggles in and becomes the first to look down the shaft; "This is the dog's bollocks!" We're both really fired up by this, but a sour note of reality creeps in. The thunderstorm is now in full swing and Jules is getting anxious about the prospect of our having to walk back across the exposed hillside in the midst of it.

We need to put in at least one more bolt to descend safely, but our biggest problem is that the only other rope we have left is 23m long. Martin and I are both sure that the shaft is deeper than that, so reluctantly we accept that SVA 29 will have to wait for another day or, in this case, another year.

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Tony preparing to explore SVA29

As we pick our way carefully back across the sharp limestone pinnacles, the talk is of next year's trip. There had already been conversation about the possibility, but now, to Martin and me at least, Cantabria '98 is a certainty.

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The next day, while the rest of us were driving back up through Spain into France, Brian Clipstone and Mike Hazelden spent a day with the Spanish cavers on the banks of the river that runs along the bottom of San Vincente's eastern end. While canoeing on this river after heavy rains, the Spaniards had noticed clear water entering the muddy river from its west bank: a resurgence. Having made a mental note of the approximate spot, this was their first visit back to look for a likely way into the hillside. They crossed the river and thrashed through dense undergrowth for much of the day, before finding a section of the steeply-sloping bank where a cool draught could clearly be felt emerging from tiny gaps. It sounds as though some determined digging here could be worthwhile, and having laid the foundations of good relations with the local cavers, we could well get the chance to have a crack at it.

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We've all left "going leads" in caves, and come back the next day, the next weekend or the next month only to have our high hopes dashed. I'm under no illusions here: there is every likelihood that SVA 29 will go no further than the stones I threw down it. But we won't know unless we go and look. Plus there are all the other sites we found and no doubt tens, maybe hundreds, more across the rest of San Vincente. The very existence of a shaft like that, and the cool draught seeping out of the bottom of the hill, show that there just might be something special under that hill. I'm certainly going back in summer '98 to have a look.

Shafting

by ***Julian Carter***

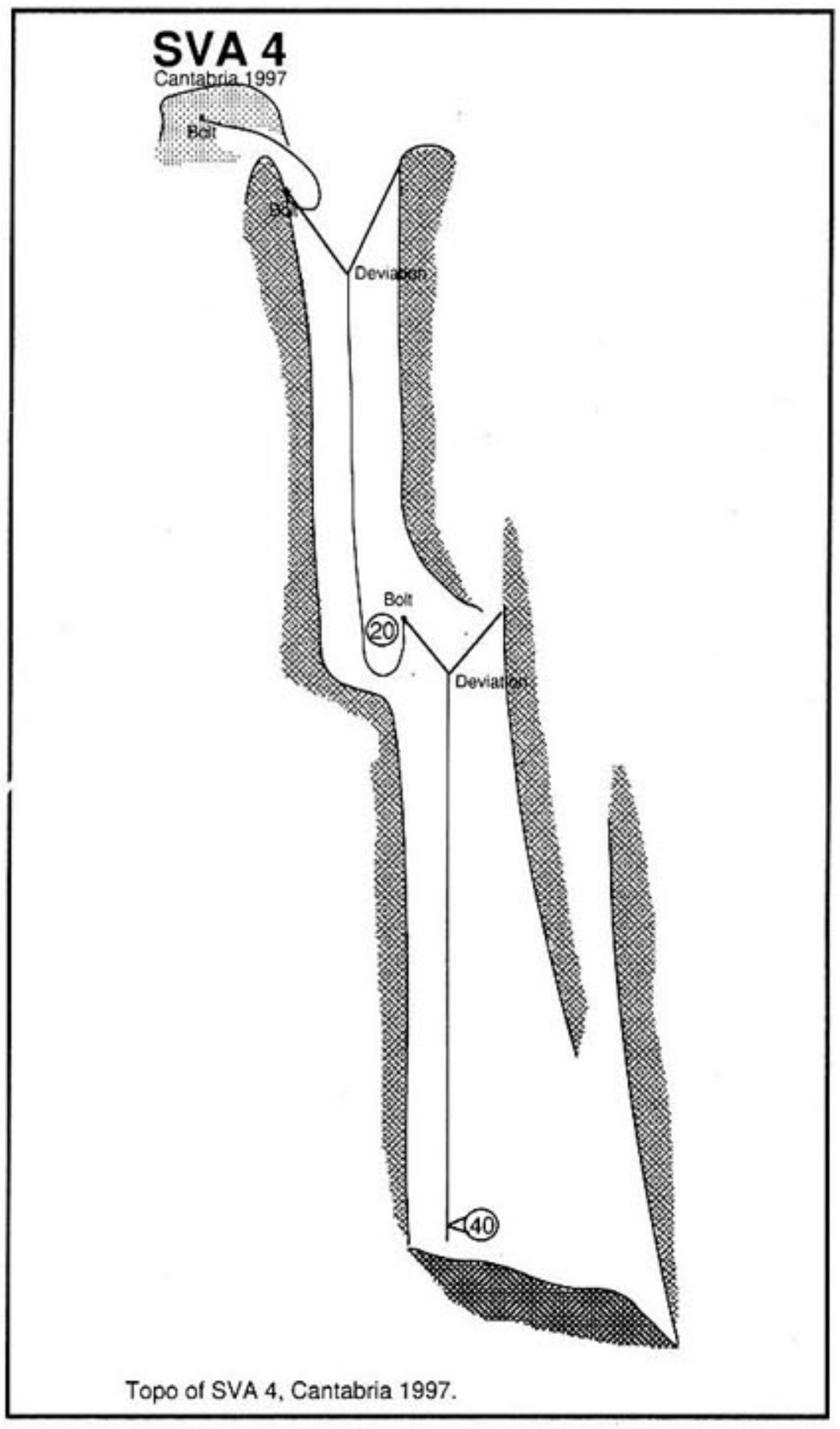
A key reason for going to Spain was the exploration. Originally I had also decided not to bother with the Coventosa through trip, but by the time myself and Sue arrived in Spain many had already done the trip, and the lure proved too strong (and in retrospect I had been shit scared of doing the 300m main shaft in Cueto) so a week later I found myself on the through trip which was excellent.

However my main goal remained to explore, and a day after arrival saw my first trip up the hill. The terrain was spectacular. The St Vicente area may not be the grandest in the region but it impressed me. This first trip up was very hot, with the sun out and the vultures circling overhead. The stomp up over the broken karst hill side was hard, and open holes were spotted on the way, but the aim was to get to the previous end point in order to resume the GPS sweep searches. On arrival at our previous end point we arrived at an open hole the previous team had missed! It was checked out but wasn't very much. A spot of lunch and we got ready, with the masterful Miller dragging us out into some sort of line and our budding action camera man Chris jumping all over the place in an attempt to film the hot action! We then proceeded to sweep the hillside in a sort of very wobbly line. Eventually we hit an area of dolines, and holes started to appear. The methodology was then to mark the station by leaving a GPS unit stationary for a while and to mark the hole with some nice bright red paint - SVA n - while logging the details.

Tony Baker

Jules Carter starting the exploration of SVA37

Eventually after a tiring day we returned to camp. The next couple of days continued the same. Then some caving got in the way. The following week was the last week of the expedition. People were starting to disappear and Coventosa needed derigging. After doing my bit in the Cueto shaft I returned to the hill. The aim was now to bottom some of the holes we had found to get an idea of the potential, and thus some shafting began. Many of the holes we looked at didn't really go anywhere, but had to be properly checked out just in case, after all the entrance to Cueto is a pretty miserable looking place! A few of the holes we looked at do have further potential, whilst others made short interesting trips, but with no way on. SVA 4 was such a trip - short and interesting but



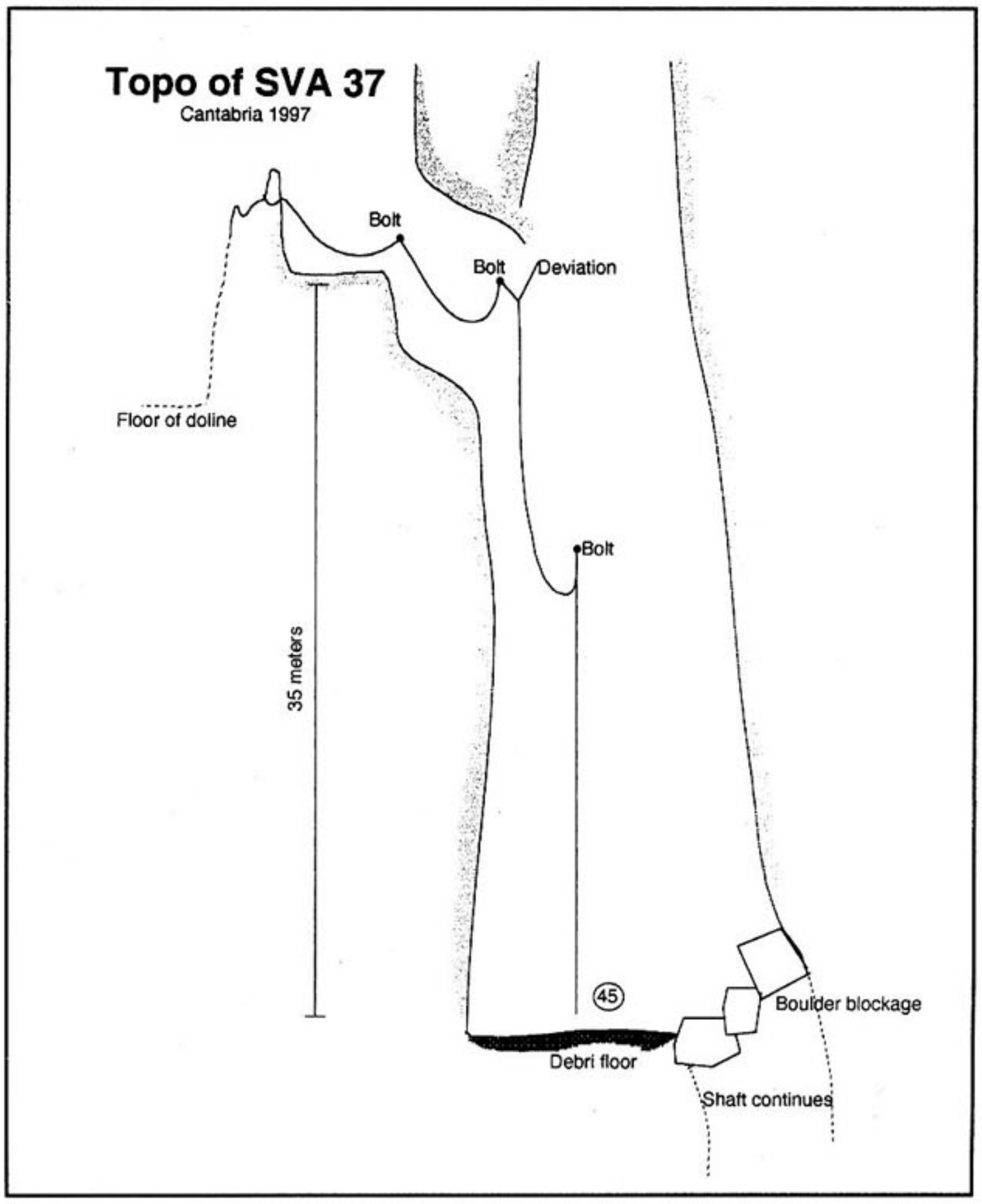
Topo of SVA 4, Cantabria 1997.

with no futher potential. SVA 4 is situated in a typical depression for the area, with a cluster of holes close together. Iain and Keith decided to have a closer look at this particular hole as it had an exciting stone fall duration. The exploration began with the placement of a couple of spits, one as a back up, which was the first spit I had placed for some years, and the other at the head of the shaft. A deviation allowed a free hang to be arranged, and the journey down began. At the end of the rope the shaft changed direction and continued down - was this it? It certainly looked good. The other rope was called for and a spit placed for a rebelay. We had only expected the cave to go 20m and thus the rope I had used was

little more than 25m. I placed the spit and came up, changing over with Iain (after all we had to get him underground somehow!). Iain quickly descended the second pitch only to find no way on. All in all the cave was 40m deep and made a sweet but short trip which the newcomers to SRT would love, especially if we had it in South Wales.

However a trip with some possible further potential was SVA 37. This is located close to the base of very large doline on the top of the St Vicente hill. The doline makes an impressive site, being surrouded by pinnacle karst. The start of SVA 37 was a vegetation filled bowl about 8m wide with a descending rift on the far side. Chucking rocks into this rift met with a encouraging crash, silent pause, and boooom! This was one I was determined to have a go at. Returning a few days later with rope and spits the descent was made. The entrance involved a short but greasy abseil to get into the bottom of the bowl. The rift was quickly reach, but a spit had to be placed. This done, an inclined rift was followed which soon entered the side of a much larger shaft, with a second entrance visible some 20m above. Another spit had to be placed. This was combined with an deviation obtained with a Wild Country Friend, and the journey down began. Another spit had to be placed 20m down as no deviations were forthcoming and the journey down was safely completed. The floor of the shaft was choked with debris which formed a flat peaty floor. Martin joined me, but it wasn't looking hopeful. However at one end was a boulder blockage, underneath which the shaft continued for at least another 8-10m. The boulders were sizeable, but easily shiftable with the aid of a crowbar. We then had to call it a day, especially as Tony was chomping at the bit to get to SVA 26, but that's his story.....

Well we may have yet to find a master system, but it was excellent fun finding open holes in the ground and going down to have a look. Combined with that, the area is amazing and the existing sports caving superb. Go there - it is good.

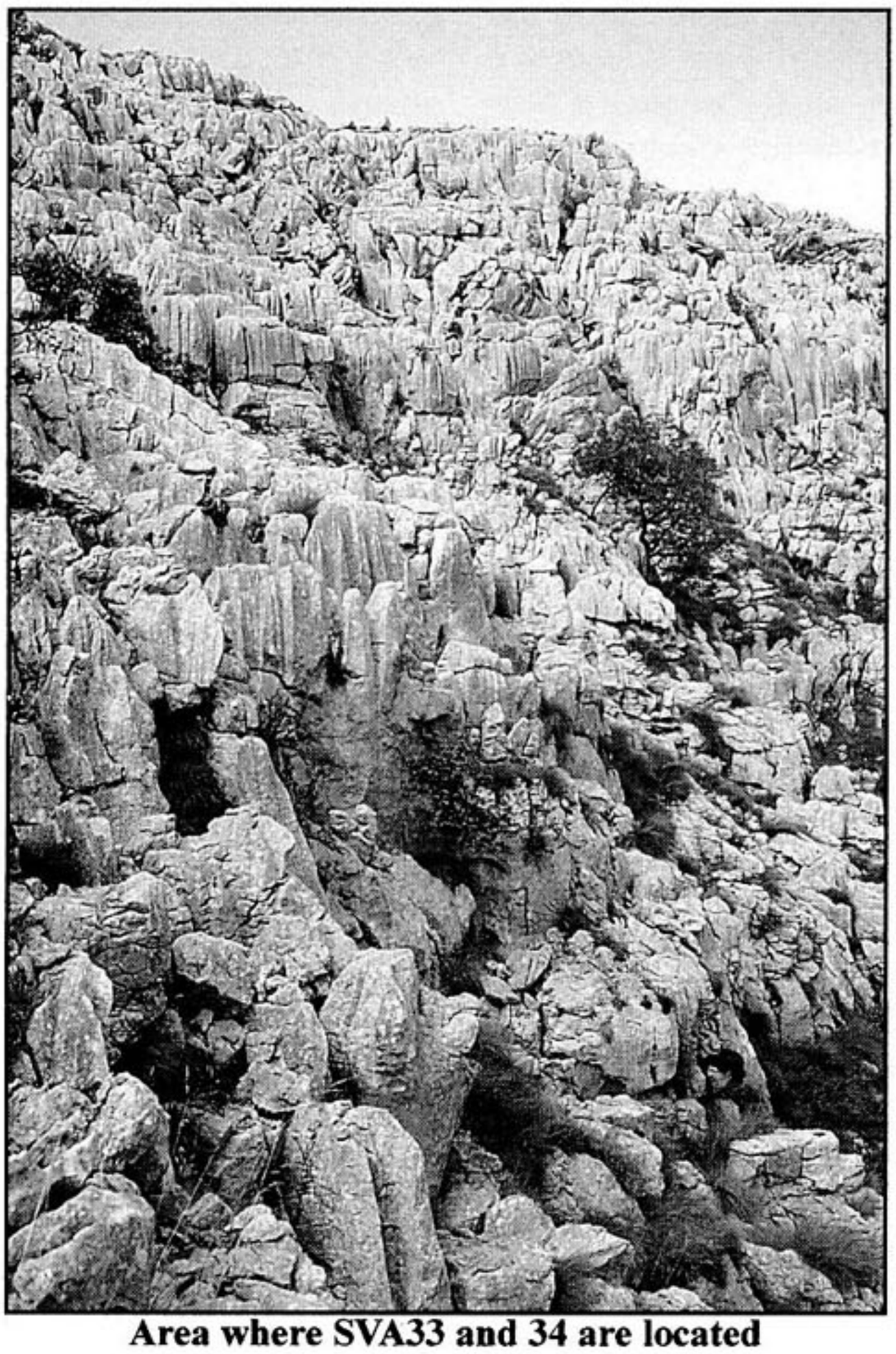


Exploration of SVA 33 and 34

by ***Gary Vaughan***

7th August 1997 12.13pm SVA34 and 34A

Arrived at entrance with Brian Clipstone and Mike Hasildon. Entrance of SVA 34 is narrow vertical rift some 0.5 - 1.0m wide by 3.0 - 4.0m long descending amongst large pinnacle karst blocks. SVA34A is small steeply descending passage some 4m west of SVA34. Not all of the pebbles dropped into 34A made the bottom of the shaft, so we decided the direct shaft (or so we thought) would be the best option. Very little in the way of reliable natural belays so we set about placing two spits, one at the pitch head, Station 1, west face of rift and one backup belay also west of rift approximately 1.5m south of Station 1. Rigged head of pitch and descended slowly into the unknown, surveying as I went. Cross sections of shaft were measured at 5m vertical intervals with dimensions relayed to surface booker (MH) by reliable intermediary (BC). At -6.0m encountered 'Tradesman Entrance', easy scramble into same point. Entrance bottomed at -8.0m onto loose cobble/pebble/dirt floor sloping steeply North East. Brian descended via 34A to assist in gardening of potential missiles. Short descending rift leads to small 500mm diameter hole in moonmilk! One small piece of limestone hard around on left hand side provided only belay possibility. Spit placement long and protracted due to awarkness, cramp etc.



Area where SVA33 and 34 are located

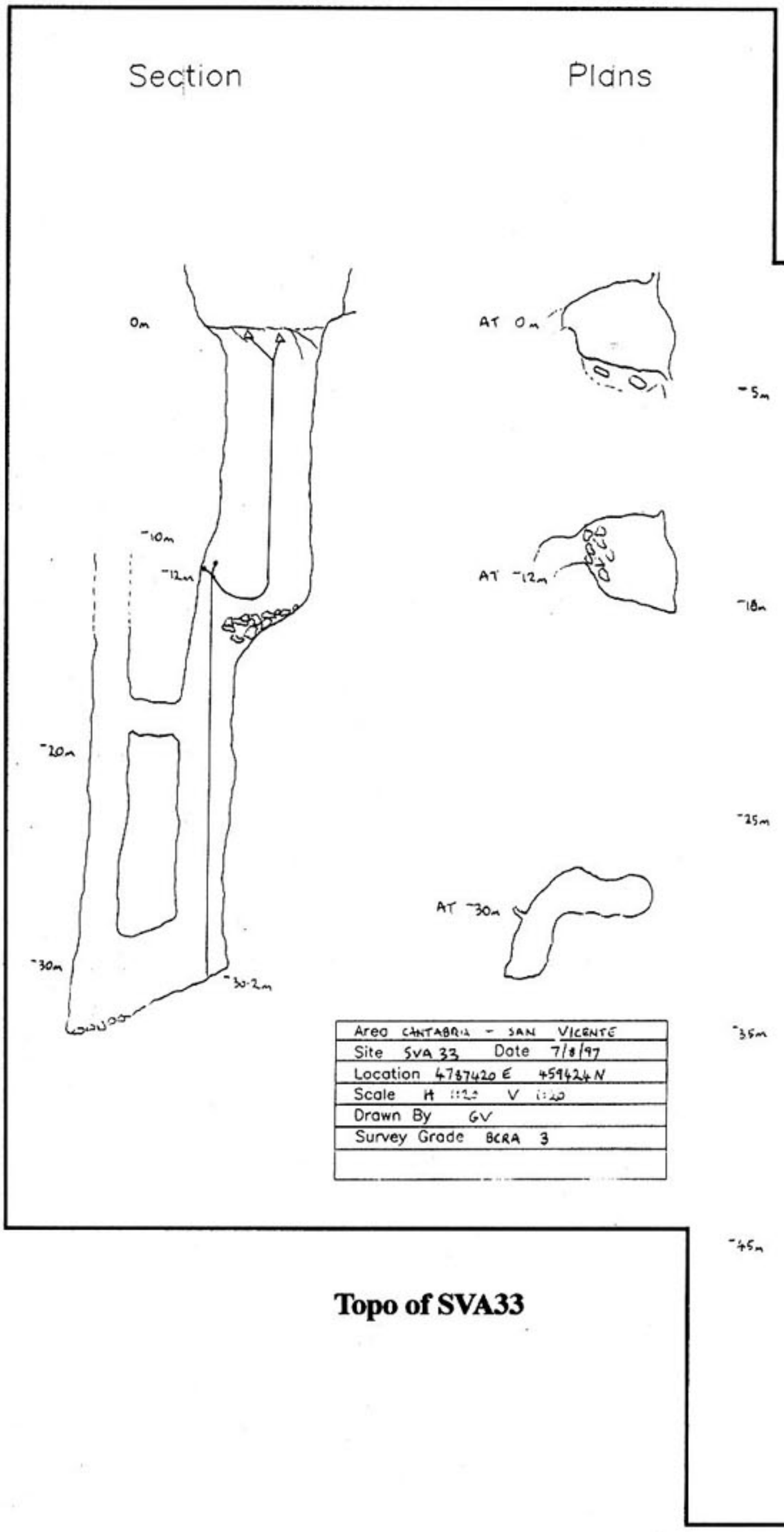
With spit placed rope re-belayed tight with minimal loop, slipped through constriction and continued to descend and survey. Bulge in east wall at -22m forced another rebelay in what was turning into a pleasant shaft. Shaft appears elongated along rift trending North-South, on average 3-5m in length and 1-2m in width. Below -22m the rope runs very close to the east wall, not a problem until the east wall starts to arch in at between -35m and -40m. A suitable deviation placed on the west wall at this depth will alleviate the potential problem.

Rope appeared to be running out as I reach -50m but the floor of the shaft loomed up at -56m with the rope also ending at precisely floor level. Base of shaft is floored by reasonably sized clean washed limestone cobbles (most dropped down shaft two days earlier). No real passge or chamber development which led me to suspect that I had reached some sort of false floor. A small alcove at the extreme southern end 600mm wide by 800mm high appeared to be rapidly closing down to the cobble floor. At this point small stones could be dropped between the cobbles and heard to drop at least another 6-10m. There was no draft detected at any point in the cave but also no sign of detritus or small particle sized material on the floor suggesting that water escapes easily downwards.

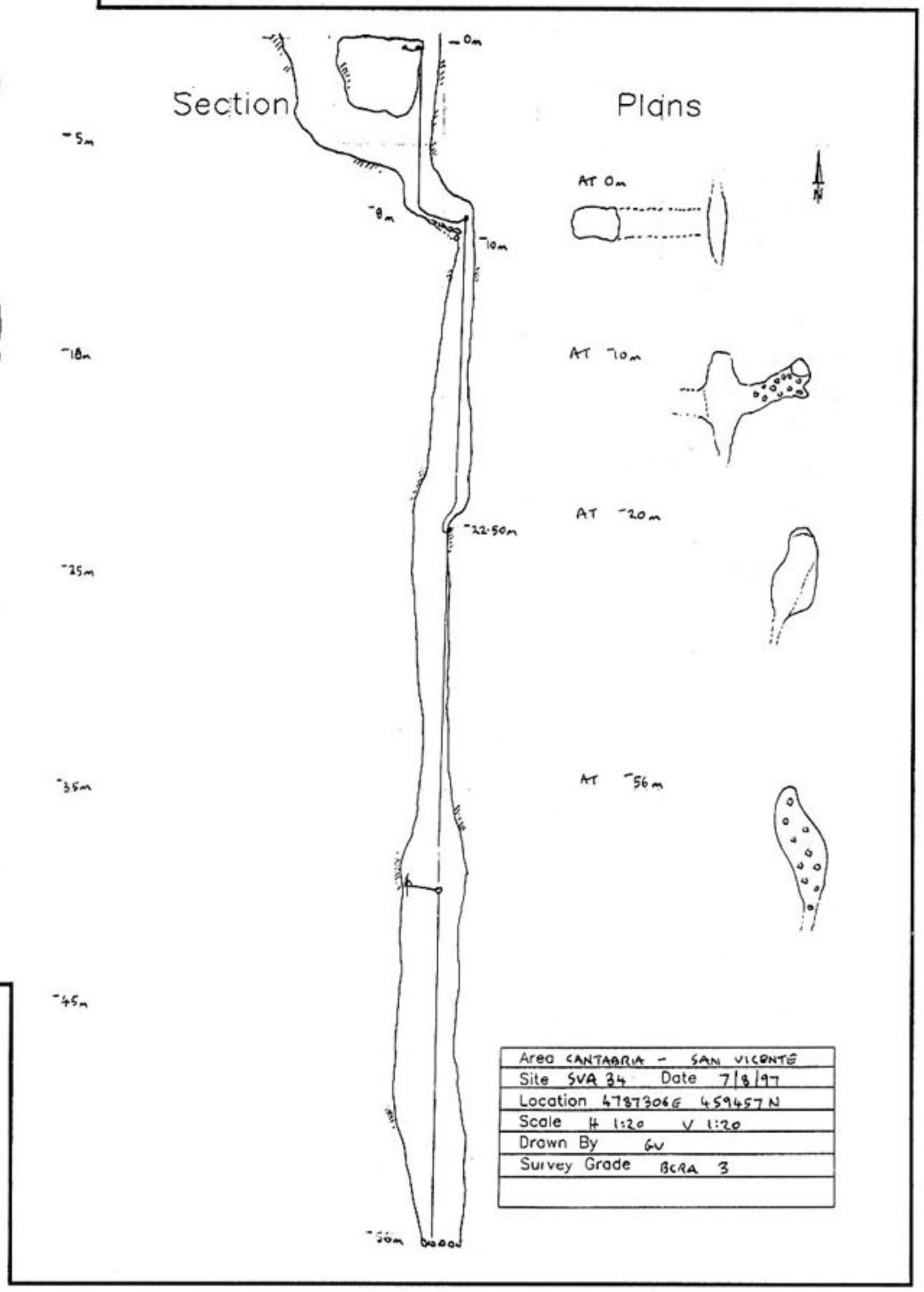
When all of the other open leads are pushed to a conclusion this point may be worth spending a small amount of time on to see if access can be gained to the continuing rift below.

7th August 1997
14.12pm SVA33

Arrived at entrance with Brian Clipstone and Mike Hasildon. Belayed rope to large boulders on southern rim of large squarish section shaft which could be seen to descend to visible boulder floor some 10meters below. Mike descended shaft whilst GC and BC sheltered from hailstones amongst the blocks. Fine 4m wide shaft descends vertically to boulder floor at -12.20m. Floor slopes gently to western corner where the shaft becomes elongated into narrow vertical rift. Lack of natural belays required the placement of two anchors from which a clear hang could be obtained. Rift descends trending westwards to south westwards passing window at -17m into parallel shaft. Floor of rift is met at -30.20m sloping west and south west to meet base of second shaft with daylight visible above. No obvious way on, no draught and no sign of flood debris.



Topo of SVA33



Topo of SVA34

101 Great Caving Trips: No 9

Canalizos 1, Picos de Europa, Northern Spain

by ***Rhys Williams***

The main shaft of Canalizos 1 is an awesome 170m drop, split into four or five hangs, with some daylight reaching right to the bottom. It was first explored by the Spanish group SIE in the eighties, and the limit of exploration was an impenetrable rift encountered after a further three short pitches from the bottom of the main shaft. In the summer of 1997, Oxford University Cave Club rerigged the cave to find the rift not to be so impenetrable after all when it yielded to a few minutes' hammering. Beyond this point, several hundred metres of cave, two more pitches, a temporary sump and an extremely draughty choke were found. Towards the end of the expedition, which I was lucky enough to tag along with, derigging time arrived.

Nobby Mumford (Expedition Leader) and I left Ben Lovett and Kev Welch bolting around the corner in the parallel shaft series of the cave and went to derig the main shaft. As we prussiked up the parallel route towards daylight to swap ropes at minus fifty metres or so and descend again, it appeared quite thundery on the surface. The last few days had brought a few showers, so this was no surprise. I abseiled deeper into the cave, and thought to myself, "Looks like this could be a wet one" Catching up with Nobby at the breakthrough rift, we moved on to the temporary sump. The 'sump' was dry, and on we went to collect the rescue dump and the other tackle from beyond it. I was relieved to be on the right side of the sump again, even though the water was as low as we had seen it.

We fettled our lamps and continued out, derigging as we went. It soon became apparent that we would not complete the derig on this trip. We had underestimated the amount of tackle stashed in the cave over the week, and could only head out with all that it was possible to carry. I started up the main shaft first. It certainly was pretty wet, as a lot more water was coming down the shaft than earlier. Still, we should just about have enough time to get out, and be back before our callout time. One hour of prussiking, and one hour to walk back to camp, I calculated.

As I prussik, Nobby sings a Pogues song to keep warm. The first rebelay is rapidly passed, and I start off up the second leg of the ascent. It is now seriously wet. The rope is in the direct line of all the falling water. Wellies are full within a few sitstands on the rope, and my furry suit quickly becomes saturated. As I approach the next rebelay, a tape sling hung off a natural, three thoughts occur. 'The next rope looks tight. My lamp seems to be fading. Goodness me I'm wet.'

Due to the water conditions my acetylene flame had become redundant long before, when I started back up the rope some seventy metres lower. I attempt to pass the rebelay, then mid-manoeuvre the electric lamp dies completely. Calmly I switch off the torch to give the batteries a short rest. The next hang would be drier, and I could change the batteries then. I attempt to complete the changeover in the dark, thinking 'should be easy enough, I've never struggled with SRT before'.

Gloves off now, but still unable to get enough slack in the rope. This is becoming tricky. Numb hands trying to feel the way on confuse me. Try the torch again, but the batteries are well and truly flat. Reach into the bag for spares, remove old ones and can't get the good ones in properly with cold hands and the torch body continually filling up with water. I casually shout back down to Nobby, waiting at the rebelay below, "Tight rebelay. No Light. Lots of water. Bear with me..."

Nobby continues singing.
I spend another ten minutes trying to progress onto the next rope, stopping occasionally to sort my light out, or just to hang out of the water. None of these seems possible. I'm now getting a bit desperate, and I've been in the pitch dark for perhaps twenty minutes, and soaked for nearer thirty. I recall a rescue statistic from Descent, about a caver in Yorkshire dying of hypothermia due to getting stranded on a rope. 'Couldn't happen to me', I grimace, and hope. Still, I'm not doing very well. I decide to forget the rebelay and light problems, and just get out of the water for now. Fix everything else later.

With all my strength I haul up on the tape sling and try to struggle on to the ledge which I am sure is there above me. Trying to do a pull-up in a waterfall, I feel like I'm on the edge of existence. I've never had to do anything else quite like this before, my arms seem to be failing and I'm still in the water. 'I really don't like this.'

I seem heavier than I ought to be, and the tackle

bag of rope hanging from my harness doesn't help. Clipping it to the rebelay I get one leg onto the ledge but am desperately uncomfortable. By now my jammers are right up against the knot. I fight with them for some time, but it's hopeless. My harness and the rebelay threaten to pull me from my ledge at any time, and somehow I get into a sitting position and try not to worry about fall factors and climbing above anchors. At least I'm out of the water. A rest.

Ok, try to pull up the tackle bag. Shit, it's jammed. So what now? Surely Nobby can help me. He can prussik up and give me light... Hang on though, I'm being pulled off my ledge as it is. If he loads the rope I'll be pulled back where I was under the waterfall, or the tape will cut into my leg as I'm sure I'm entangled in the belay. Suddenly I hear a sliding noise, followed by a few seconds of some kind of whistling and an almighty boom.
"What the fuck was that?" Nobby is concerned. I did try to shout 'Below', but with two batteries in my mouth at the time, it was a little muffled.
"Just my tackle bag of rope, are you ok?"
"Yes. Is the rope free?"
"No, give me a couple of minutes."

The tackle bag is one less problem anyway! The situation is still fairly worrying, however. I'm very cold, out of the water, yes, but almost shivering uncontrollably. The diving torch defeats me yet again, and I drop the dead batteries on the ledge. Cave conservation is not high on my list of priorities right now. I need Nobby to come up to me.

My spare jammer is fumbled out of the bag, and attached to my belay belt with a decent bit of cord. This is put on the up rope, and backed up by wrapping my footloops around the rope and clipping these into my belt also, though this eight millimetre cord has seen better days. Now the moment of truth. I undo the main buckle of my harness, remove the chest strap and slide the whole SRT kit down my legs. I'm free. I can stand up, and stretch, I'm not in the water, and things look a little better. An update is called down to Nobby, who sounds as cold and slurred as any good Pogues singer should. I suggest he comes up. 'Is it safe?'

I check the rebelay by touch, and relocate the sling in its notch. As Nobby prussiks towards me I start to worry again. He'll be as wet and cold as I am. What if he's in too much of a state to help? He's experienced though, it'll all be fine...

By the time Nobby joins me I have the torch working again and am able to survey the situation more clearly. My ledge is pleasantly large. Three people could stand on it sheltered behind a large spike. Nobby looks in wonder at the mess I've left for him on the rope. This rebelay was difficult anyway, but with two jammers and an SRT kit in the way it could now be near impossible to pass.
Somehow he manages it by clipping into various bits of my gear, and comes to join me on the ledge.

We both shiver and mumble to each other for a short time. I convince Nobby that sharing his gear or using prussik knots would take ages. Rescue is quite likely to be some time in coming and really we need to be out of this cave rapidly to avoid hypothermia. At this point in time, cutting the rope just above my jammers is the fastest way that we will escape. My penknife I suspect is somewhere down my oversuit leg when I missed the pocket while derigging. Several minutes pass while we retrieve Nobby's knife from his first aid kit.

I hold my SRT kit tight while the rope is cut, and a whipping, crashing noise accompanies the free end's fall to the bottom of the shaft. I put on my SRT kit again, and try my carbide light for something to do while Nobby stands still shivering next to me. The flame lights, warmth at last! We stay in the haven of our sheltered ledge for some time, convinced that we can hear voices above. Our shouts get no reply. Neither of us wants to be the first one back out into the spray and exposure of the shaft. Eventually, Nobby takes the plunge, and I follow as soon as he passes the first bolt.

At the surface we are greeted by Kev, who had waited for us. Ben had buggered off to bed ages before, figuring that singing cavers are happy cavers and allaying any concerns about rescuing us for a few more hours. We are very late, but out of the cave at last.

The sky above is clear, but in the distance lightning can be seen over towards the central massif. We slog the forty five minutes back uphill to the camp to eat. As I go to bed I disturb Ben, who seems unconcerned.

The Black Mountain Survey Project

by ***Gary Evans***

Some time between May and July 1997, I remember hearing one or two people talking about a project coming up involving logging caves on the Black Mountain. I also remember thinking that it would be interesting but probably a bit time consuming. Now there was an understatement if ever there was one.

Anyway, I forgot all about it until at the beginning of August, when Toby turned up with a proposition that we could work on this project together during the spare days between work projects. I didn't take much convincing and we set about finding out more.

The project was undertaken for Meithrin Mynydd on behalf of the Brecon Beacons National Park and basically involved researching, locating and recording all sites of speleological interest in the Black Mountain area of the National Park. Having met with the Project co-ordinators, we felt sure that their motives were sound and that they wanted to work positively with cavers. We could also see great benefits from a Cave Rescue point of view and as a research opportunity to provide useful information for cavers and diggers.

The following pages are a selection of items taken from the final report. The report contains 1,100 pages and there are only 3 copies. One I have kept, which is the master copy, one is held by the Brecon Beacons National Park and the other is held in the South Wales Caving Club Library. A copy of all the sites in data form has been forwarded to the Cambrian Cave Registry. The project took a total of 39 man days and all the work was done by Toby Dryden and myself, with help and advise from those mentioned at the end of the this article.

The report is contained in 4 volumes and consists of :

Volume 1 -	*Summary of findings*
Volumes 2 & 3 -	*A write up on every site found with a photograph of the site and any relevant literature.*
Volume 4 -	*Dan yr Ogof*

1. Project Brief

Meithrin Mynydd is a three year European Union funded research project on Common Land Management in Upland Wales. Brecon Beacons National Park Authority is the lead body with additional funding from the Countryside Council for Wales. It is based on the Black Mountain in the West of the Brecon Beacons National Park, an area of 14,800 ha. Research is currently taking place into agricultural use, stocking levels and grazing practices; recreational use; vegetation; archaeology; ornithology and other aspects. Further information is to be found in the full Project Brief, which details survey needs and includes the requirement that 'an assessment of the ecological and geological importance of the cave system on the Black Mountain should be undertaken'. An integral part of this will be to define the extent and current status of the cave systems over the whole of the project area. This will provide a baseline survey and will also allow the cave systems to be taken into account when considering management proposals over the site. It is the intention of the Project and the National Park to support cave research and exploration and it is likely that this information can be used to secure a good working relationship. A surveyor or group of surveyors is needed to carry out a survey of the Project area and collate existing and new information.

2. Introduction and Rationale

Having seen the Project Brief and discussed the requirements in detail with both the Brecon Beacons National Park (BBNP) and Meithrin Mynydd, we realised that this was an excellent opportunity to undertake a research project with real value. As we saw it, there would be a number of worthwhile outcomes from the results of this work :

1. The Project would meet the requirements of Meithrin Mynydd and the BBNP and hence provide them with one element of the information needed to draw up a realistic management plan for the Park and specifically the Black Mountain area.

2. Our input would ensure that from the start, there would be a productive dialogue between the Caving world and the Brecon Beacons National Park who own the land on which many of our caves and digs are located.Our aim throughout was to foster a sound working relationship between the two parties.

3. The site information would allow the BBNP to prioritise work in covering open holes left by diggers. Until now, they have known of the existence of a few holes but these new results allow

them to judge where the urgent need for work is situated. As the sites are on their land, the BBNP has a need to attend to dangerous man made holes from both a moral and an insurance point of view. It is hoped that Caving Clubs and teams of diggers involved would give assistance where appropriate and possible.

4. The results gained, the report and the information in it's entirety, would be a valuable research tool for cavers and diggers working in the Black Mountain area, and we intended from the start to provide a copy of the final report for the South Wales Caving Club (SWCC) library.

5. The data generated in fixing cave, dig, sink and resurgence positions would be very accurate, as the survey would be undertaken using a sub metre GPS system. This information, in the form of 10 figure grid references, would be provided to the Cambrian Cave Registry to both solve the problem of inaccurate data on the current register and also provide a significant input of new site data that is not currently held by the registry.

6. The identification and position fixing of the Black Mountain sites would be an essential library of information for the West Brecon Cave Rescue Team. With the ongoing digging and caving taking place on the mountain, the Cave Rescue Team has been concerned for some time about the lack of accurate data on sites.This new data will allow the Rescue Team to provide a Rescue service quickly and efficiently should it be needed. The added benefit would be two members of the Team having a significantly enhanced personal knowledge of nearly all sites on the Mountain.

It was also recognised that there were two possible negative aspects to the work.

Firstly, not all cavers shared our enthusiasm and trust. Nearly everyone we spoke to believed our involvement was for the better and would result in positive outcomes for all parties.These were the people who helped us with our work without question. There were however one or two who were sceptical and even felt that we should not get involved.

Having thought about and discussed this point at length, both Toby and I were convinced that the Project aims were genuine and that the benefits of the project far outweighed the possible negative aspects. We also felt that involvement and discussion was significantly preferential to just waiting to see what would happen. We are cavers and diggers too and most certainly would not want access to the Mountain jeopardised in any way.

Secondly, we realised that no matter how much time and effort we put in to the project, because of the time window available to us, there would inevitably be errors in the final report. There will without doubt be a number of people, who have detailed knowledge of some (or all) areas of the Mountain, who will spot some mistakes or errors of site recognition. On this point, we decided that we could live with a few errors or omissions in the scheme of things. The overall huge quantity of information gathered, much of it not written down before, made the prospect of taking this on worthwhile.

So, having taking all things into consideration, on Wednesday 6th August, 1997 we commenced the research, on Monday 18th August the field work began and on Monday 20th October I began writing the report.

3. Area of Survey and Phases of Project

The project followed three distinct phases as follows :

Phase	*Estimated Time*	*Actual Time*
1.Research	5 days	9 days
2.Field Work	12 days	14 days
3.Report	5 days	16 days

Once we had begun gathering data at the Research Phase, we soon realised that we would have difficulty dealing with the huge amount of information coming together if we looked at the Project area as a whole. It would also be extremely difficult to organise the field work based on the Black Mountain as a whole. In order to get over this problem, the Mountain was broken down into three areas for collation of information, the field work and for this report. The three areas are as follows :

Area	*Designation*	*Limits of Area*
Area 1	West	National Park Western Boundary to the A4069
Area 2	Central	The A4069 to the Afon Twrch
Area 3	East	The Afon Twrch to the A4067

These designations describe the West/East boundaries of the three areas. The North/South boundaries are dictated by the position of the limestone band and those sites which are known adjacent to it. In addition, Resurgences and Springs related to sites in the limestone band are included in the North/South boundary designations.

4. Type of Sites Reported

Although the Project Brief mentions 'Caves' and the 'Cave Systems', we have tried to be more

specific with the listings of sites. The main terms we have used and their equivalent terms from the research and names are :

Our Designation	*Other Terms*
Cave	Cave, Pot, Passage, Ogof, Hole, Pwll
Dig	Dig, Pot, Passage
Sink	Sink, Sinc, Swallow Hole, Swallet
Resurgence	Resurgence, Spring, Rising

Some sites can be designated with more than one descriptor. For example, we came across more than one site that was a Cave, with active Digging taking place and also a Sink or Resurgence. We have indicated this where appropriate.

5. Research Methods

It was clear from the start that the quality and thoroughness of the field work would be inevitably reliant on the degree of effort put in on the Research phase of the project. The outcome of this work, the Report, would then reflect how much preparation had taken place before going on out on the Mountain.

The research phase was broken down into six distinct sub-phases :

1. Identification of sources of information
2. Gathering information and collating rel evant texts
3. Extracting the required data from the re search work to prepare field data sets & maps
4. Preparation of field work data sets
5. Preparation of field work maps
6. Storage of research papers and information ready for report writing

Quite a lot of information came to us after the planned field work was complete, which in some ways confused the data, but in other ways cleared up many discrepancies. In fact, the information provided by Gareth Jones arrived on the day before completion of the final project site data sheets and allowed us to compete them more accurately than would otherwise have been possible. There were however some sites that could not be visited as knowledge of them came too late. They are included in the report though.

6. Survey Methods

The field work survey methods were fairly straight forward in approach and we imagined the task to be reasonably easily achievable. However, we were not prepared for the difficulties that were to be encountered.

The approach was to first choose an area for the day, then looking at the field work maps that had been produced, to work out a route which would take in all sites to be visited. On finding a site, we would then photograph it, take a GPS measurement and then record the GPS findings and the photograph roll and shot number, both on paper and on a Dictaphone. We would also record information about the site in terms of description, general location and condition.

The four main difficulties that we encountered were as follows :

1. Finding the sites was extremely difficult for more than half of those recorded. We were also often unsure if we were at the right place.
2. For every site that we had identified in the research, we found another two. This confused the issue considerably and gave us real problems of recognition and correlation later.
3. The weather was atrocious throughout the first few weeks of the field work and it rendered the equipment unusable at times. It became impossible to photograph sites, because we were afraid the heavy rain would ruin the camera and because we could not see anything in the mist. The rain also waterlogged the Steannes GPS (see later)which would result in needing two days to dry it out each time, blew up my mobile phone, stole Toby's water bottle and threw it down a sink hole and made it impossible to write anything down.
4. The Sub metre (Steannes) GPS system became increasingly unreliable resulting in at least 6 man days lost in trying to sort out the problems. The technical support people at Steannes worked hard to try to get things sorted out, but it soon became clear that we could not waste any more time. The walk to some sites was over an hour and to then have the GPS break down after one site fix, meant walking all the way back again. Even taking a mobile phone did not help as the problems were never really solved. It was at this point that we went over to using a combination of a hand held GPS and conventional micro navigation to fix site positions.

Despite these setbacks, we persevered and gradually gathered as much information as we could whilst we were on the Mountain.

At the end of each day, all the data was manually transferred on to a computer so that we had a constant knowledge of what was still to be done. All three Areas were visited 3 or more times as they were too big to cover in one day and also because sites were missed first time around. A second or third pass with further information allowed us to find nearly all of the sites.

Global Positioning System (GPS)
The two systems used were as follows :

1. Steanne Solution Sub-Metre GPS System :
   Horizontal Accuracy - 40cm (95% - 90cm),
   Vertical 95% - 1.6m
2. Garmin GPS 45 Hand Held System :
   Horizontal Accuracy - 100m, Vertical Accu racy - 150 to 200m
   Used with micro navigation and maps to in crease accuracy of site fixes

7. Correlation

Having gathered a large amount of data from the field work and research, the next step was to correlate that data into a usable format that could be then used for the final report. Another spreadsheet was designed to take all the main data which correlated the following information :

- Data set reference numbers
- Known sites and names
- Field work grid references and altitudes
- Field work descriptions
- Photograph numbers

From this table and from other information gained throughout the project, the field work data-sets were then converted into final project data logs, one for each area. The data and our understanding of sites, positions and descriptions continually changed as new information came to us throughout the research and field work phases. The report on each site was generated directly from the final project data logs. They were also used to pre-sort the site names into alphabetical order. This phase was time consuming and required constant reference back to research, photos, field maps, data sets, final project data logs and personal memory.

8. Report Limitations

The data and information held within this report represent the most detailed and accurate compilation of Cave related sites on the Black Mountain to date. As has already been discussed, a huge amount of relevant material has been collated and the knowledge of some of the area's most experienced diggers has been reported here. However, it is important to consider the limitations on this report and it's information. The size of the project and the number of sites was greatly underestimated and in the time frame given for this project it was very clear by September that we would have to make some sacrifices to completeness. These are as follows :

- Some sites were deemed to be too far away from the main areas to make long journey times and possible search times worthwhile. For example, nearly three hours were wasted collectively on two attempts to find Ogof Diwedd Yr Enfys.
- We could not look in every shake hole and search every possible place where there might be a cave, dig or sink. We did look at every possible place that fell reasonably within our daily route and found a large number of previously unknown (to us) sites.
- To have recorded every Sink on the Mountain would have been a project in itself. A high proportion of shake holes had water sinking in them at some time, so we only recorded the most obvious ones.
- When the weather was very wet, the field work was impractical, so it was not possible to be there when the Afon Giedd was in flood and hence we could not record the High Flow sink points other than the final known Sinks.

There were also a number of sites that we just could not find. The reasons we believe for this are :

- The Grid References for a great many sites were inaccurate or wholly wrong. This we believe is caused by a combination of mistakes in writing down the grid references (us and the writers), slight errors in navigation by providers of the original grid references and diggers deliberately misleading others.
- Six figure Grid References only give a position within a 100m square and any error in that reference makes it very difficult to find a site.
- Some digs had clearly disappeared, some being filled in by farmers and shepherds, with others having collapsed and folded in on themselves.
- Some sites that we found in the research were only names (e.g. Ogof Haffes, Cave of the Red Kite) and we had no lead on where to find them. It is likely that a number of the digs or caves that we found that were new to us may have been named sites. So we were sometimes not able to correlate an unknown find with its name (which we already knew).
- There were occasions when we did not search thoroughly enough because of the time constraints.

9. Findings Overview

The following is a list of general findings:

- There were many more sites than expected and there are undoubtedly many more than we were able to find in the time available.
- The information on sites on the Black Mountain is very randomly recorded. Tony Oldham's book 'The Caves of Carmarthen' and Tim Stratfords' book 'Caves of South Wales' cover between them the main cave sites, but everything else is scattered.

- The Cambrian Cave Registry contains many errors and very many omissions.
- A large number of digs have never been disclosed by the diggers.
- There is still today an air of 'secrecy' about some digs.
- There are some very well secured and covered digs that are a credit to the diggers.
- There are some very dangerous holes left by some diggers that are a danger to livestock and people.
- The overall relationship between cavers and local people is a good one in this area.
- There is clearly a huge potential for cave discovery and exploration remaining on the black mountain.
- We saw very few people during our 14 days on the Mountain.
- There are a quite a number of people who do not understand the designation and ownership of the Black Mountain area.

10. Data Lists

All the basic data is laid out in a data list, where each site takes up one line and there are two lists; one in alphabetical order, the other in grid reference order. Each of the two lists is 7 pages long. The lists are broken down into the three areas, West, Central and East.

11. Maps of Results

The report contains maps of the 3 areas showing the location of every site on the data list.

12. Hydrology

The hydrology of the Black Mountain area has been the subject of much conjecture and a considerable amount of study over the years. The major hydrological systems have been positively proven using dye tracing and spore tracing techniques, but there are still many questions unanswered.

The main known Hydrological and hence 'cave systems' are :

1. Sinc Y Giedd to Dan yr Ogof.
   This includes Waen Fignen Felin, Twyn Tal Draenen, Ogof Carreg Lem, Rusty Horseshoe Dig.
2. Carreg Yr Ogof to Frwd Las Resurgence
3. Pwll Swnd and Llynfell Sink to Ffryddiau Twrch Resurgence
4. Ogof Gwynt Yr Eira and Pwll Cwm Sych to Llygad Llwchwr

These hydrological systems have been well documented over the years and rather than attempt to represent them, copies of the actual works are included in the report. Also included is an overview map of all known Sinks and Resurgences.

13. Summary

A. Site Statistics

Sites Listed -	*296*	
Visited -	*221*	(74.5%)
Not Visited -	*58*	(19.7%)
Not Found -	*17*	(5.8%)
No. of sites requiring attention -	*29*	(9.9%)

Area Surveyed - *45 square kilometres (approx.)*
Total of known cave lengths - *25,320 metres*
Estimated total cave lengths - *26,000 metres +*
Estimated potential cave lengths (additional) - *20,000 metres +*

B. Report Summary

This report achieves much more than merely listing detail and data for all the known sites on the Black Mountain. It brings together for the first time a very significant amount of written work and research data and it is now possible to look at the area as a whole as a consequence of this work.

The main finding from this project is that the area is a complex one in terms of the relationships between different sites, the hydrology and the known geology. For example, even after many years of research and study, the hydrological connections between the main sinks in the Eastern area and Dan yr Ogof are still debated in terms of route and connection. Also, even though much work has been done in tracing hydrological routes for many of the sinks throughout the range, there are still quite a number whose route and final destination is unknown.

It is clear, however, that there are four main cave systems present on the Black Mountain as described in Hydrology above. It is likely that many of the other sinks and caves are related to these four systems, but there are certainly a number of minor systems that are probably unrelated to them.

The number of digs on the Mountain clearly prove that this is the belief of many cavers and diggers who have made almost unbelievable efforts to find the many missing links in the cave systems of the Black Mountain.

14. Conclusions

Future Recording and Corrections

Without any doubt, the day that this report is published, it will be out of date. Cavers and diggers work at a remarkably fast pace if they feel they have a lead to new discovery. This prompts the question of what to do about future additions to this report and how it is kept up to date.

One of the biggest problems, which was clearly proved during this project, is that very many sites had never been disclosed by the diggers and even if they were, very few found their way to the Cambrian Cave Registry. This is a problem for the Registry, the BBNP, for this report and for Cave Rescue.

There is no way that cavers and diggers can be forced to provide this information, but it may be possible to encourage them to do so where possible. This is a great opportunity to do this, as for the first time, a whole area has been surveyed and this report written. Thoughts on how to keep the information up to date are contained in the report and any ideas would be welcome.

Management of Sites - Cavers and BBNP

Having undertaken this project, we are sure that the overall standard of responsible digging on the Black Mountain is significantly better than that of past decades. Most of the holes that we found that were unsafe were quite old, whereas the newest digs were mostly well protected. However, like all things, there were exceptions, and it is important that all cavers and diggers not only understand their responsibilities but put them into practise.

There are a numbers of area of communication that the BBNP could undertake to improve the situation regarding it's management of the area and ensure that it's motives are clear. These are contained in the report

Those who are driven by exploration and caving will continue to work in the area whatever happens. The real 'smart' answer is to ensure that all those involved work together and that all parties understand and meet their responsibilities.

The Cavers View and Importance of Area

For cavers and cave explorers, the Black Mountain area is of huge importance. The existing, known cave systems are incredibly diverse and certainly, Dan yr Ogof is a cave which cannot even begin to be described in words.

The potential for exploration on the Black Mountain cannot by quantified. The huge areas of the Mountain where no significant cave passage has been found, yet we know that they are there, have inevitably been the subject of much attention for many years. It is inevitable that the area will yield some more of its secrets over time and this presents an opportunity not only for further research and scientific analysis, but also to fill in the 'gaps' in Speleological knowledge of the area.

It is essential that access to the Black Mountain remains open to cavers and explorers. There is so much more work to be done in understanding what we have now, let alone what remains to be found, that work will continue indefinitely in attempting to unlock the secrets of the Black Mountain's limestone areas.

The Black Mountain represents one of the greatest opportunities for exploration in British Caving. We believe that provided those who wish to continue exploration there do so in a responsible and sensible manner, that they should not only be allowed to do so, but should be supported in doing so, by the Caving world and the BBNP.

15. Acknowledgements

We would like to thank the following :

- South Wales Caving Club for the use of the club library and for their support for this project.
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- Claire Barnes for help, patience and support.
- Ian at Steanne Solutions for help and information with the GPS
- Bouncer and Zach for keeping us sane and company on the long walks.

So there you have it, a taster of the report and a summary of what happened. It really was hard work, but we learned a tremendous amount about the Black Mountain and it's caving history. I really hope that the work we have done is of use, both to the BBNP who commissioned the work and to cavers and diggers. Whatever you think about this project, please take the time to look at the report and data, it makes fascinating reading, whatever your viewpoint.

What is happening at Waun Fignen Felen?

by ***Keith Ball and Clive Jones.***

INTRODUCTION

Waun Fignen Felen contains a major peat bog which provides a substantial drainage into the Dan yr Ogof system. As such its influence is profound. In our memory there have been significant changes to the bog, These are mostly related to the apparent destruction of the surface vegetation with its knock-on affects on the lack of protection of the surface and accelerated erosion by wind and water of the peat deposit itself. The purpose of this investigation is to consider the possible causes of this destruction and to give an indication of the probable effects that this may have, or may have had, on the cave system.

Waun Fignen Felen (The Moor of the Yellow Bog) is the name given to the moorland extending to the north west of the main peat bog. The origin of the name is obscure but we think it may be based upon the yellow / golden colour of the (by now) sparse cotton grass during late autumn and winter. The main bog is strictly; Mignen Felen.

GEOLOGY.

The relevant bedrock geology is made up of the following formations, in descending order (based upon Barclay, Taylor and Thomas, 1988):

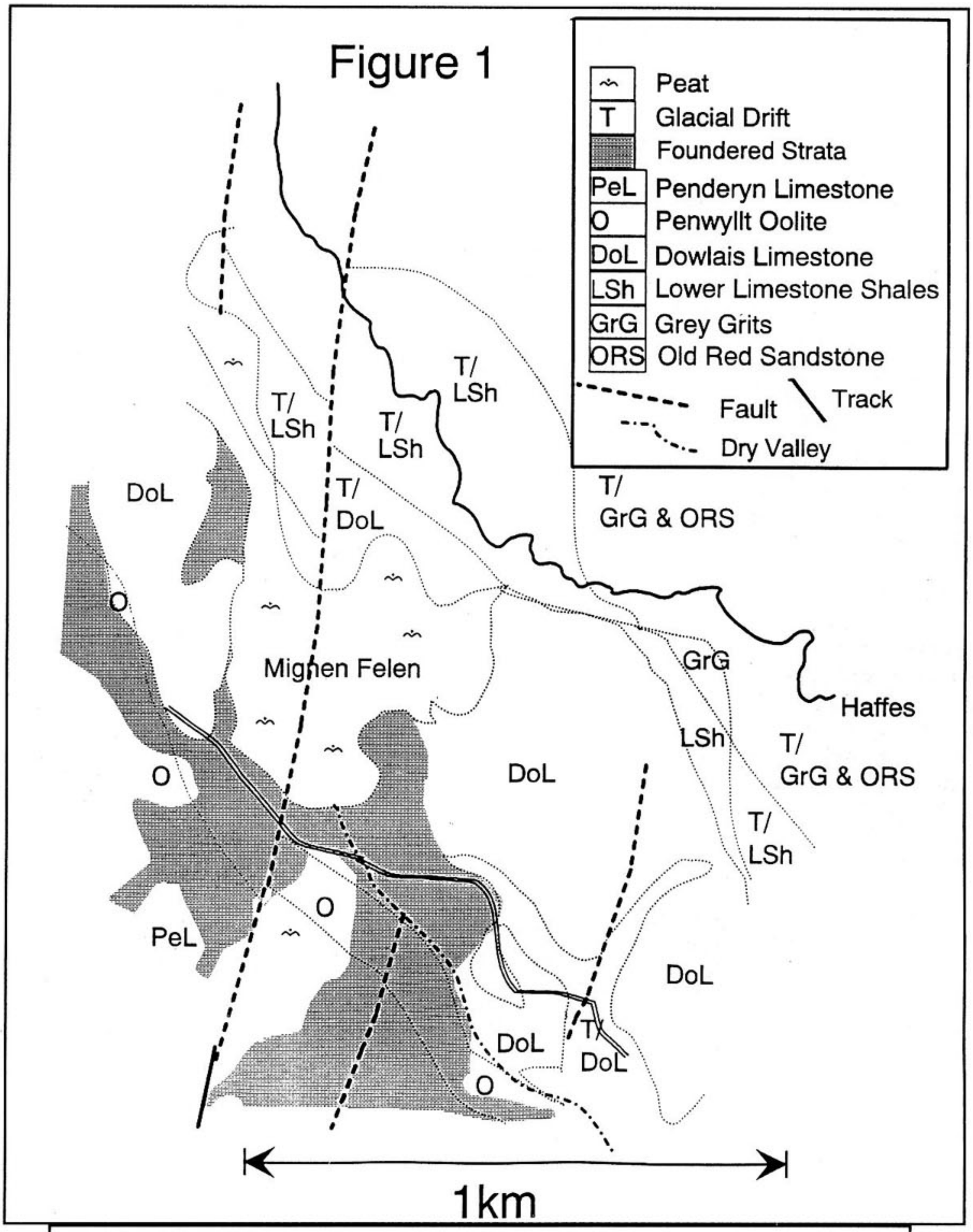
Namurian	Basal Grit	>100m
Dinantian	Upper Limestone Shales	~2m
‘	Penwyllt Limestone	30m
“	Penderyn OÖlite	20m
“	Dowlais Limestone	100m
“	Lower Limestone Shales	~10m
	Gray Grits and Conglomerates	~8m
Devonian	Old Red Sandstone	Thick

A simplified geological map is given in Figure 1 and a diagrammatic section in Figure 2.

The Dowlais Limestone (sometimes also called the Cil yr Ychen Limestone) is a dark bituminous rather sulphidic limestone and hosts the major cave systems in the area, including Dan yr Ogof (Ball and Jones, 1993). It is overlain by the Penderyn OÖlite which is a pure oolitic limestone. This tends not to have caves developed in it, but is important to cavers because it provides a stable roof and it is likely that without this non-cavernous limestone many of the caves would be filled with glacial debris. Locally at the base is a distinctive carious weathering siliceous limestone known as the Honeycombe Sandstone. The oÖlite is overlain in turn by the chert-rich dark Penwyllt Limestone formation, which contains a few small caves. The Lower Limestone Shales in this area, like the Upper Limestone Shales, are a series of calcareous shales with thin limestone bands. These are underlain by a series of hard grey conglomerates and grits which are variously ascribed to the Basal Carboniferous or the Devonian Old Red Sandstone. The relatively impermeable rocks of the Old Red Sandstone underly these. The Basal Grit is Namurian in age and consists of a relatively pure silica (SiO_2) sandstone.

The whole sequence was faulted uplifted and eroded probably in response to the Hercynian (end Carboniferous and early Permian) and Miocene earth movements. The end of the Miocene has been dated at about seven million years ago. It was during the Miocene that the major folding that produced the Alps occurred, but in our distant area the earth movements were more muted. The main response was a major uplift of the land mass resulting in a fairly stable platform on which the various land forms were developed. Following the Miocene period there was a time of relative stability and major erosion surfaces were cut across the early uplifted strata. This quiescent period came to an end with the decline in sea level caused by the initiation of glaciation in the northern hemisphere (Funnell, 1995). It is presently thought that this took place about 2.5 million years ago. The rather abrupt drop in sea level resulted in a readjustment of the base level of the rivers in the area, and a different pattern of drainage resulted. This pulsatory decline in sea level was repeated and three such major events are recognised, interspersed with periods of standstill (For a fuller discussion see Ball, Davies and Ford, 1996). In our particular area these events resulted in “nick points” in most rivers at about 425, 330 and 265m above sea level. This applies to both active stream valleys and to some dry valleys. Significantly this pattern is not recognisable in the Haffes. (*Over a sufficiently long period of time a river bed will tend to describe a logarithmic curve between source and mouth. If the mouth or base level drops, then a new curve will tend to be produced. The curve adjusts from the mouth upwards and the new curve will eat into the old one. If this process is incomplete due to insufficient time, the two curves will meet at a “nick point”*).

Figure 1



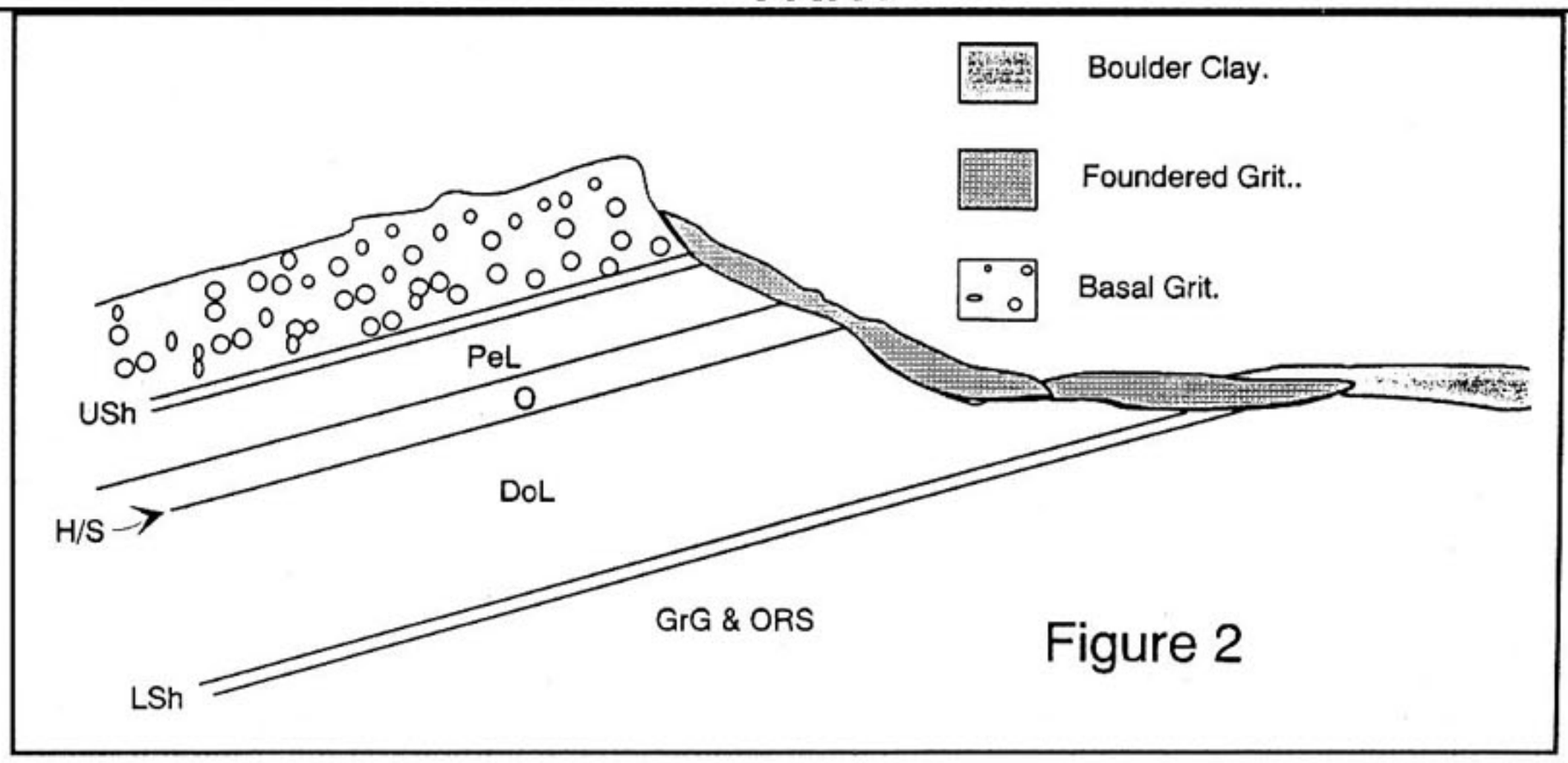


Figure 2

Tiers in our caves are also referable to these horizons. The full picture emerges for Ogof Ffynnon Ddu with tiers at 425 (Top Entrance area), 330 (Cwm Dwr) and 265 m (Rawl and Waterfall Series) OD. The known parts of the Dan yr Ogof system only show evidence for the 330m Synclinal Area) and 265m tiers (Far North), the highest tier is still waiting to be found. These later events are difficult to date accurately but it is likely that they took place during the end of the Pliocene and early Pleistocene. It is likely that glaciation was initiated about 750 thousand years ago (Bowen, 1978) but the ice ages have had little effect on the overall drainage patterns, both above and below ground.

The bog itself is sited partly on one of the major "solution subsidence outliers" of Thomas (1954). These outliers comprise a disaggregated jumble of detritus derived from the Basal Grit outcrop. The idea is that as the scarp formed by the basal grit receded, so the relatively insoluble acidic debris ate its way down through the alkaline limestone producing an outlier of Basal Grit resting upon much lower levels in the limestone. This may have occurred gradually as a normal process of surface erosion in limestone, speeded up by the acidic weathering reactions of the siliceous material of the basal grit debris, and further speeded up in certain areas and lithologies by a catastrophic collapse as cave systems were unroofed. Thomas wrote that these "outliers" were initiated during the Tertiary and clearly the processes that lead to their formation is still going on. The BGS label these as "Foundered Strata" and show that at least half of the limestone outcrop is covered by such Basal Grit derived debris (British Geological Survey, sheet 231).

The area has undergone several glaciations. These events were mostly erosive for our area but there are sparse deposits of glacial drift, probably resulting from the waning phase of the last glaciation. This ended about 15,000 years ago, although there was a minor re-advance about 12,000 years BP (before present). Over the limestone much of the drift has descended to shallow depth into the surface karst features and shallow cave systems, although surface pockets remain. These are characterised by the presence of Old Red Sandstone debris. The drift is more intact and continuous over the relatively insoluble rocks. In places some of the Basal Grit debris is incorporated into the glacial drift.

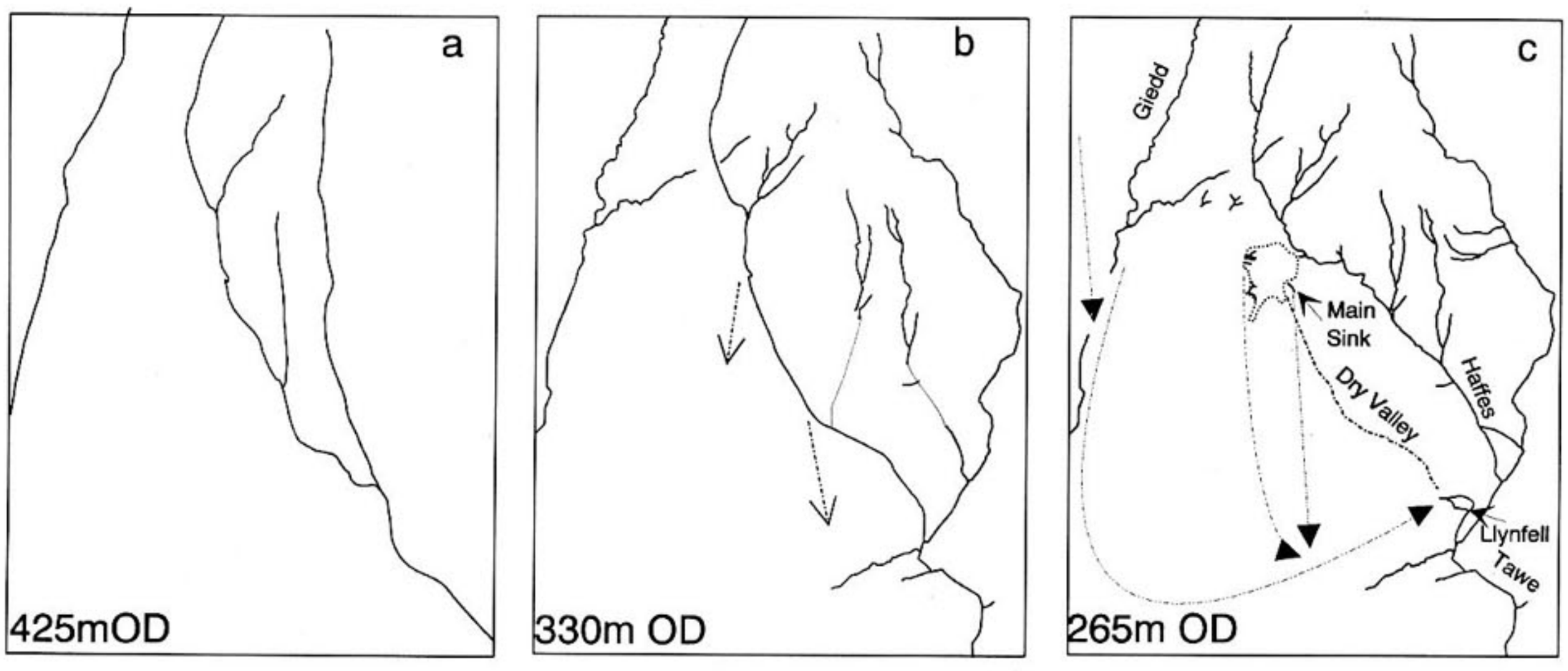
LANDFORM DEVELOPMENT.

Whereas we can give no exact dating for many of the erosional events we can date the likely erosional responses and their effects on the cave systems by reference to the erosional standstill levels which are recognisable in the area. For further information see George (1976).

The 425m topography.

The kind of drainage pattern that may have existed in the area between 7m and 2.4 million years ago is shown in Figure 3a. There is a large element of guesswork in it. It is likely that the dip slope of the Old Red Sandstone extended much further north than we see it at present and the catchment of the Upper Haffes was consequently greater. It is very difficult to relate the possible drainage pattern to this erosion level, although we suggest that the Upper Haffes continued along

Figure 3



Suggested drainage patterns in relation to periods of stand-still for declining sea level
Hatched lines show possible underground drainage courses.

the course of the Dan yr Ogof dry valley, to connect with the lower part of the Tawe. It is possible that the course of the Haffes / part Tawe flowed past Coelbren to join the Nedd.

It is likely that the limestone outcrop extended further to the north and we would probably have observed the initiation of the extensive boulder fields that eventually gave rise to the "solution subsidence outliers"

The 330m adjustment

We can view the surface features with a little more certainty as the local drainage adjusted to this new coastline erosion level (Figure 3b).In the early part of this period the Upper Haffes still flowed down the Dan yr Ogof dry valley and met the present course of the Tawe (but at a much higher level) at about the Cribarth/Craig y Nos Castle area.

If you need a present day analogue for the limestone section then look at the Hepste. The upper part of the Hepste, which is developed at the equivalent geological level, has a similar gradient and shows intermittent surface flow and shallow active cave systems. The water table was controlled by the surface level of the water. Large chambers started to develop in the "Far North" of the Dan yr Ogof System, related to the water table.

265m adjustment.

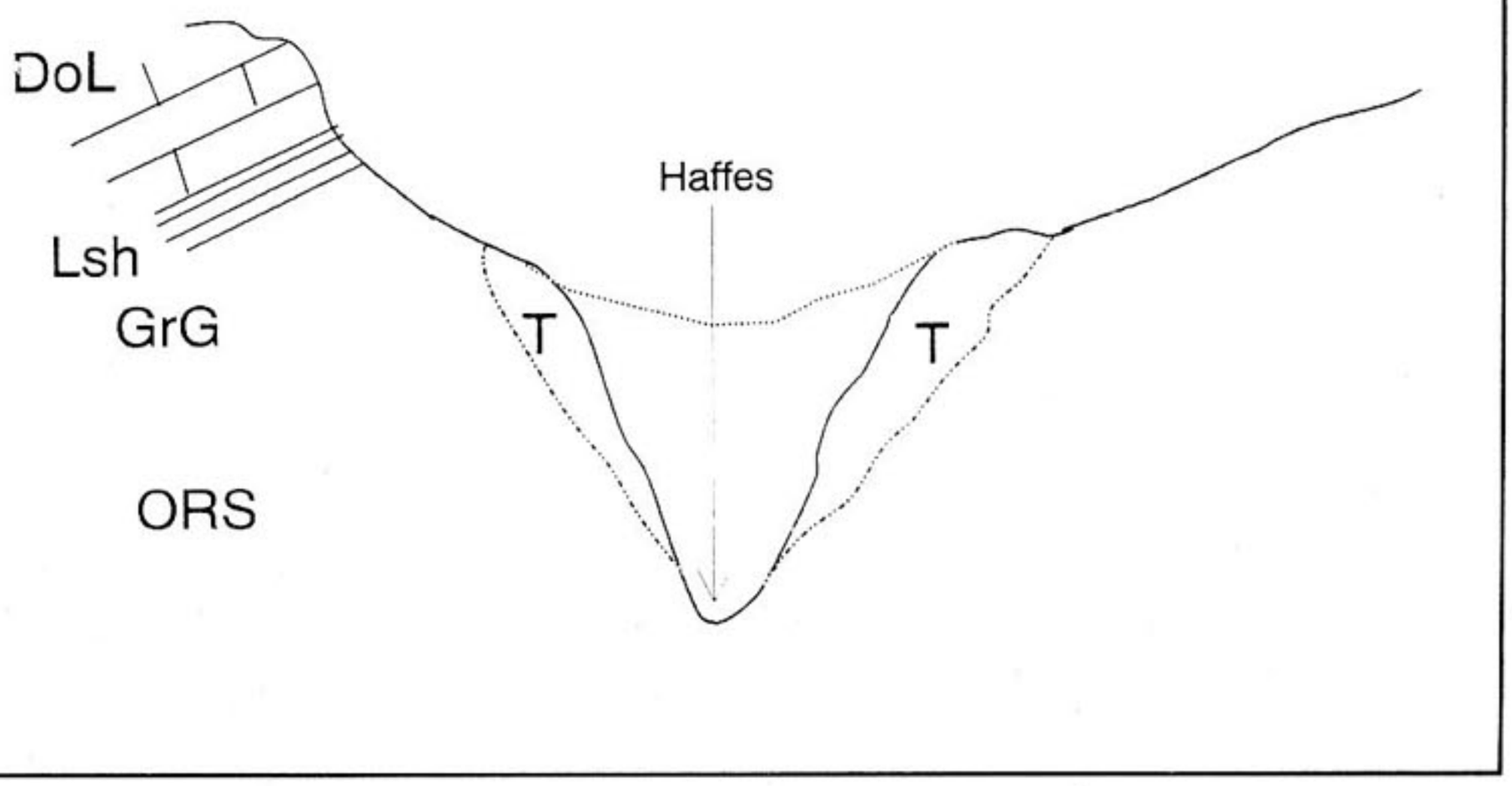
Things started moving at this level. There was sufficient surface flow for water to extend all the way, at least intermittently, down the Dan yr Ogof dry valley. A marked nick point is observed indicating that phreatic development of cave passages had not extended so far that total sinking of the stream resulted. A cataract formed in what is now the dry valley, just down valley from the Pwll Dwfn. The base level advantage of the new incised Tawe river resulted eventually in several major developments. A new tier of major chambers and passages developed in response to the new base erosion level. The main development of the Dan yr Ogof system as we know it resulted. Underground piracy resulted in the temporary capture of the Haffes via Pwll Dwfn, followed by possibly progressive sinking further up the valley with major influent streams entering the Great North Road area. At about the same time headward erosion of the Tawe resulted in the headwaters extending beyond the present input of the Haffes and Byfre into the softer rocks of the middle Old Red Sandstone. Towards the end of this time (certainly predating the latest glacial episode) tributaries of the Tawe captured the headwaters of the Haffes and diverted all of its flow into the Tawe along its present course.

Present day (post-glacial) level.

The present-day situation is summarised in Figure 3c (based upon Coase and Judson, 1977) Currently there is still active erosion of the lower part of the Haffes as it struggles to readjust to the new base level of its entrance into the Tawe, which is at about 200m. This base level adjustment seems to have occurred before the glacial infill of the lower Haffes. The banks of the Haffes are mostly in glacial drift although bedrock is exposed along the river bed. The Haffes recently (in geological terms) has cut its way down through the drift filled valley to expose the former river bed. This clearly post-dates any glacial activity (Figure 4).

Adjustment of the Llynfell, at the point where it issues from the Dan yr Ogof System, is limited

Figure 4



by the fact that the point of resurgence is constrained by the base of the limestone. The resurgence is situated at the lowermost possible limestone so that there is no deeper limestone to which the active cave system can adjust. Any further downcutting at the resurgence can only take place in non-limestone beds, in which solutional activity is minimal The headwaters of the Giedd has been captured by the Llynfell. Consideration of the drift infill and later downcutting through the drift of the Giedd, shows this can only have occurred in late or post glacial times. Any resulting cave is likely to be young.

POST GLACIAL GEOLOGY.

The geological map shows that Waun Fignen Felen is underlain by both glacial drift and Basal Grit debris which has effectively impeded the drainage of the area. This is despite the presence of the cavernous Dowlais Limestone under the bog, Smith and Cloutman (1988) in a very comprehensive study of the bog, note that the extensive covering of peat is actually underlain by lake alluvium. The peat consists of two types: Blanket or moorland peat, which is also found mantling higher ground, along with phragmites (fen) peat which has a more restricted outcrop. Detailed surveys, aided by boreholes and radiocarbon dating, showed that 8000 years ago a shallow lake existed (Figure 5). This implies that the many current sinks along the western side of the bog (see Figure 3c) were ineffective at draining the area. It is probable that they might have been blocked either by glacial till or by vegetation. Smith and Cloutman note that there was probably a fringe of "carr" along this side. (Carr is fen peat covered by trees, usually willow and alder). The outlets to the east was possibly impeded by peat and this allowed the lake to form behind the barrier. Over the course of time the pool filled with peat and the resulting uniform surface allowed the accumulation of blanket peat over the whole surface. The extent of the blanket peat is much greater than the fen peat deposit. The total cover by blanket or moorland peat was complete by 3,700 years BP. It is likely that the main south eastern sink was active during this time, but we cannot be certain at what relative date it became active. Since that period several other things have affected the bog. The stream for the main south eastern sink flows down a well defined steep valley to end at the base of a 20m cliff. The valley extends in the opposite direction presently well into the bog area and is a major drainage outlet. Several sinks also occur along the western margin of the peat deposit (Figure 5).

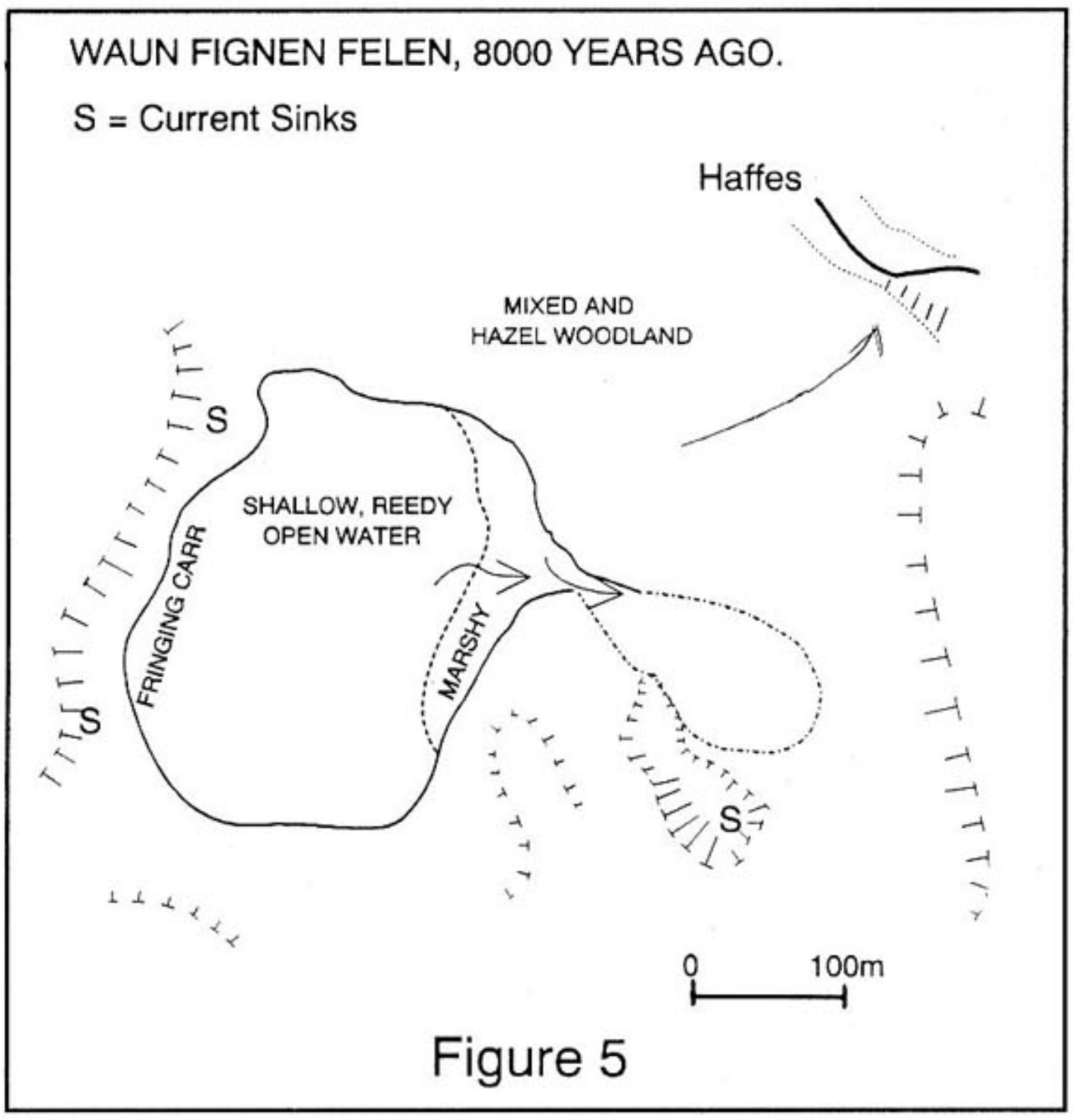


Figure 5

INTERPRETATION AND CONCLUSIONS

There are many possibilities to explain why such a large peat deposit is being eroded. Peat bogs are by their nature ephemeral, either disappearing by oxidation or even being converted eventually to coal.

1. Climate change. The climatic changes which resulted in the peat bog forming may be reversing. About 5000 years ago there was a marked change in climate. A rather warm dryish period with extensive upland tree cover gave way to colder wetter environment which resulted in the growth of moorland peat. There are hardly any blanket peat deposits that are older than 5000 years. Some people see the hand of man as contributing to this, with widespread burning of forests to "improve" agriculture and wild-game management. The generaliy accepted global warming over the last 50 years may simply be reversing the trend and hence destroying the bog. More immediately, we must ask ourselves how the sequence of very dry summers and winters over the past few decades has affected the integrity of the bog. The resultant drought affected surface conditions with successive dry summers means that surface vegetation has little chance to regrow.

2. Increased grazing pressures. It is generally accepted that the recently increased stocking of the upland areas by sheep has resulted in over-grazing with a resultant change in vegetation cover.

Certainly the presence of sheep inhibits the growth of trees. However the grazing of sheep in upland pastures has been on the go for at least 200 years and this follows deforestation in the late 1700s. The normal woodland coverage at this height would be hazel and birch, but the only trees that seem to survive presently are hawthorns and these are sparse. Although the recent over-stocking might be a contributing factor we remember the surface of the bog being extensively eroded at least 40 years ago, presumably before the grazing pressures were as great as today.

3. Changes in drainage intensity and pattern. Unfortunately records do not go back far enough for us to determines whether there has been a reduction in rainfall over the past 2000 years. However it is quite clear that much of the drainage on the western part of the bog now flows underground through the Dowlais Limestone. This presents an interpretational problem since it is also quite clear from the work of Smith and Cloutman (1988) that there was an effective drainage barrier along this side of the bog when the lake existed. It is possible that the drainage has increased by the passages getting bigger owing to the increased dissolution of limestone. Alternatively the original drainage conduits formerly blocked by drift may have cleared themselves.

4. An eroding peat bog introduces a complex of organic matter into the caves via sinking streams. We know from the work of George Bray (1976), that the organic matter is rapidly oxidised and converted to carbon dioxide. This is then available for the increased dissolution of limestone. We thus have a possible runaway chain reaction: the eroding peat bog introduces organic material into the cave passages; this increases in size resulting in increased flow of water and accelerated erosion of the peat bog which introduces more organic material into the cave passages and so on. The process only stops when the peat bog is totally eroded.

Peat bogs by their nature are transient features, however they can have a marked effect on the development of caves by providing a reservoir for organic matter that can then be liberated and channeled to accelerate passage erosion. Mignen Felen is an unique feature but its years are numbered.

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New Gravity Measurements at Penwyllt, South Wales

by *Rob Davies*

Sir Isaac Strikes Back; *forward by Clive Jones*

The article that follows this introduction by Rob Davies is on 'Gravity Measurements at Penwyllt on the site of the abortive drilling tests' and it brings to a conclusion our dabblings in that area. Using very superior gravity equipment, he shows that there is no cave at the junction of the paths and that there may be no new cave North of Ogof Y Dynion. More gravity work is required.

This does not mean that our Resistivity work is finished. On the contrary, a more compact version of the equipment is being designed and we shortly hope to produce this on a PCB. Additions to the software will also be made and the equipment will be calibrated by the Terradat Company.

We have learned a lot and the new equipment will be easier to transport and use and our interpretation of results will be more consistent.

To finalise the work being undertaken in this new phase, we need people with ideas to help us design lightweight looms. Anyone wishing to be involved, please contact me on 01685 876339.

Background

A 'blank' area above the Ffynnon Ddu II survey was one of a number of sites selected as a test area for geophysical methods of cave-detection. There are many shake-holes in the area, some small sinks and a known cave at nearby Gents Dig which all indicate clear potential for discovering previously unkown parts of the Ffynnon Ddu system.

Several lines of resistivity measurements across the site showed that a relatively resistive zone, suggestive of a cave passage, lay close to the surface. This was supported by ground penetrating radar measurements that showed clear diffraction patterns such as would be produced by buried voids less than 10m deep in the same area as the resistivity 'high'. A simple gravity experiment, consisting of a small traverse of readings, supported this possibility by recording anomalously low readings over this part of the site. However, in spite of these encouraging data, test-drilling of the anomalies did not encounter any signficant cavities within 25m of the surface. Although one shallow, mud-filled, passage was revealed, it was far too small to be responsible for the geophysi-

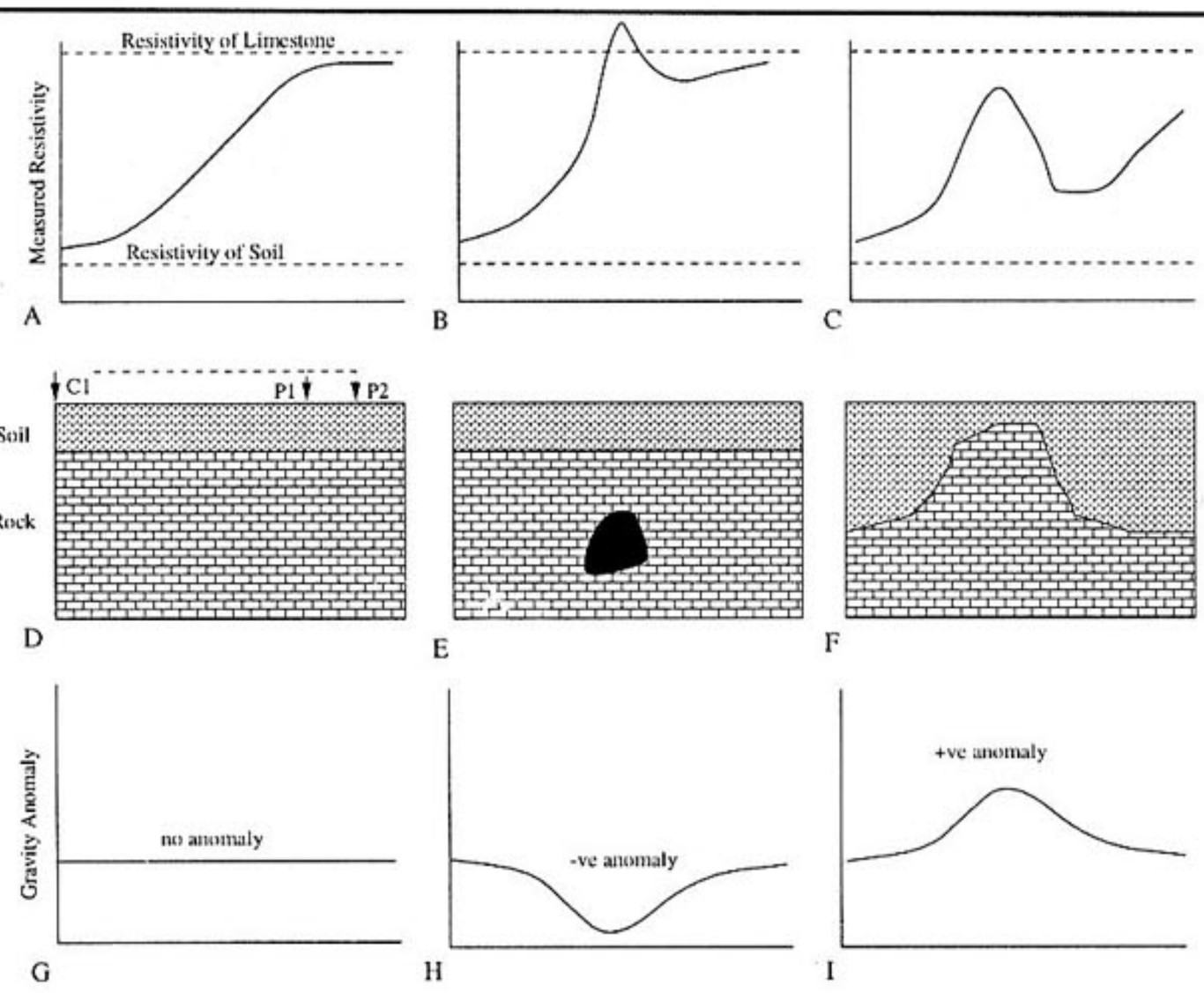


Figure 0.1: **Simple models of the site and their expected electrical and gravitational signatures. The corresponding resistivity (top) and gravity profiles (bottom). Note that a fourth model, in which deep soil forms a central trough, would be at odds with the observations of rock lying close to the surface.**

cal anomalies that had been observed. Contrary to popular belief it is exactly when a scientific method fails in prediction that advances in understanding are made and so a new experiment was designed in order to improve our awareness of the problems in general and to explain why geophysics had failed at this site in particular.

Simple Models

Figure 1 shows that there are only three simple models of a vertical section through the site. In the first case (D) the ground is a simple layer of soil over solid rock that contains no shallow caves. In this case resistivity measurements close to a current electrode would be most influenced by soil and so we would expect soil-type values. Further away from the current source most of the current's path would be through rock and so we would measure much higher rock type values (figure 1A). Gravity measurement over the same area would show no anomalies once all of the elevation and topographic corrections were applied.

Figure 0.1: Simple models of the site and their expected electrical and gravitational signatures. The corresponding resistivity (top) and gravity profiles (bottom). Note that a fourth model, in which deep soil forms a central trough, would be at odds with the observations of rock lying close to the surface.

In the second case (E) the rock is assumed to contain a large and shallow cavity. The cave differs from the rock in that it is even less conductive of electricity (higher resistivity) and it has a much lower density. An electrical survey (pole-dipole traverse) would show an anomalous high resistivity region over the void (B). Conversely, the gravity measurements would reveal the missing-mass as a negative anomaly (H).

In the final case, there is no shallow void, but instead the bedrock is assumed to form a pinnacle or ridge so that it approaches the surface in a small area of shallow soil. The resistivity profile in this case is similar enough to the cave model to lead to confusion, especially if we do not know what the actual resistivities of rock and soil are (in general we don't and they certainly vary greatly from one area to another). However, the gravity profile neatly resolves the ambiguity since it shows high values over the shallow, dense rock, and low values over the deep soil (I).

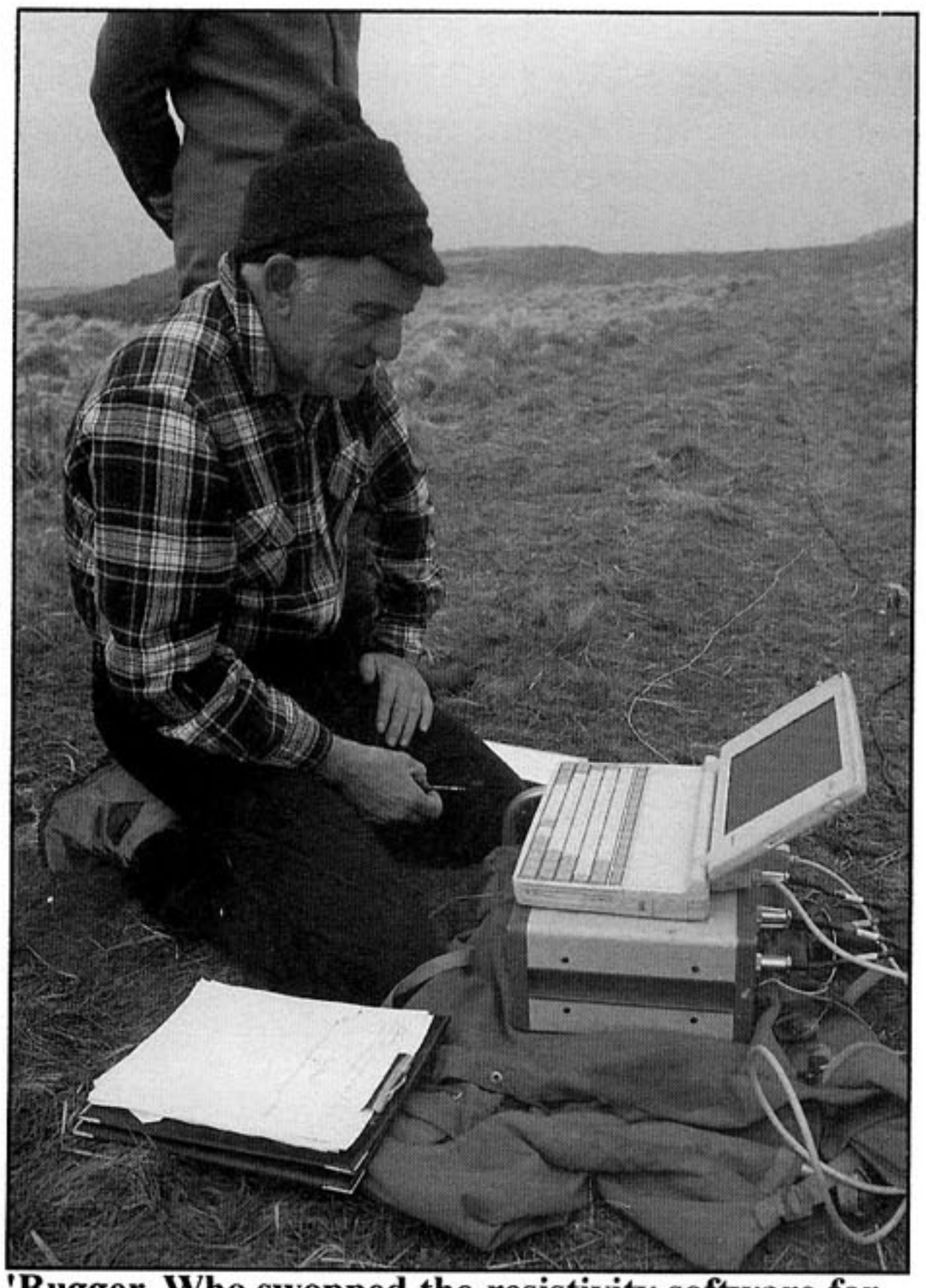
A fourth possibility, not illustrated, would be a localised region of deep soil, such as we might encounter over an ancient shake-hole. Intuitively we would expect this to be revealed by low gravity and low resistivity values, but since we observe rock lying at or close to the surface at the centre of the survey area it is of no further interest. Clearly, by using 2 geophysical methods that are sensitive to different physical properties we are able to distinguish between these different models. However, reality is rarely as simple as these examples and more complicated geometries, are less intuitive and inherently ambiguous. Because no single geophysical method can locate caves unambiguously the best we can do is to apply more than one technique to any same site.

The 1997 Gravity Experiment

Method In order to compliment the resistivity measurements that had already been made a gravity experiment was designed to establish whether the most applicable model was of a shallow outcrop of rock surrounded by deep soil or a void. Because gravity effects of voids are small, typically a few tens of microgals, a Syntrex CG3 meter, with microgal precision, was generously lent by Terradat UK, a geophysics company based in Cardiff. In addition, because gravity is greatly affected by small changes in elevation a Topcon electronic distance measurement (EDM) was used to survey in all locations of the gravity meter so that it's relative height was known to the nearest millimetre. A total of 90 gravity measurements were made over a period of about 10 hours. A further correction that must be applied to gravity data is a topographic correction and so the EDM was also used to survey a number of other elevations around the site so that the wider topography could be described in the computer program.

Results of the Gravity Survey

The gravity data were processed using the Gravred program, developed by the author for Terradat UK. The simple Bouguer Anomaly plotted in figure 2 indicates how gravity varies across the site from a simple concentric Earth model (Figure 1D). In calculating the anomaly a rock density of 2.7 grammes per cubic centimetre was assumed, typical for Carboniferous limestone. Figure 2 is a perspective view from the SW and shows the gravity anomaly draped on top of the topography. The white line shows the position of the fence and the black circles are the locations of the readings. It is evident that the area of the resistivity anomaly corresponds to a gravity high and that the anomaly is caused by an area of shallow (high density, high resistivity) bedrock embedded in a wider area of (low density, low resistivity) glacial deposits of some considerable depth. It is possible that the red area of shallow rock contains very small shallow cavities or else larger deeper cavities that are not resolved by the experiment. Further readings at larger offsets would reveal whether or not the anomalously low



Julian Carter

'Bugger. Who swopped the resistivity software for DOOM 2?'

values are due entirely to deep soil, or whether there are large cavities within the underlying rock. In addition, a seismic refraction experiment could easily profile the bedrock in these areas. If it was found that the soil was shallow in these areas too then large cave passages would be the only reasonable explaination for these gravity observations. Alternatively, resistivity measurements in these areas would establish whether or not these gravity lows correspond to low-density conductive soil or low-density resistive voids.

Figure 0.2: The gravity anomalies shown in relation to the stations on a north-south grid. The observations have been corrected for the gravity effects of elevation and topography around the site. Previously drilling had been concentrated in the area -20m to -l0mN, -40m to -20m E, approximately the same area as the resistivity high. It is clear from the gravity measurements that the resistivity high is also a gravity high and so the causative body is an area of highly resistive dense limestone.

Figure 0.3: In this figure the data of Figure 0.2 have been linear de-trended in order to remove the unknown effects of distant topography and deep geological structure. The data have then been draped over the measured topography to create a perspective view in which the while line represents the boundary of the reserve. It is clear from this figure that the lowest densities(blue) underlie the edges of the gravity survey area. It is possible that this is caused either by deep soil/ buried voids or a combination of the two. However, without additional resistivity measurements in these areas the gravity results alone can not distinguish between the possible causes.

Conclusions

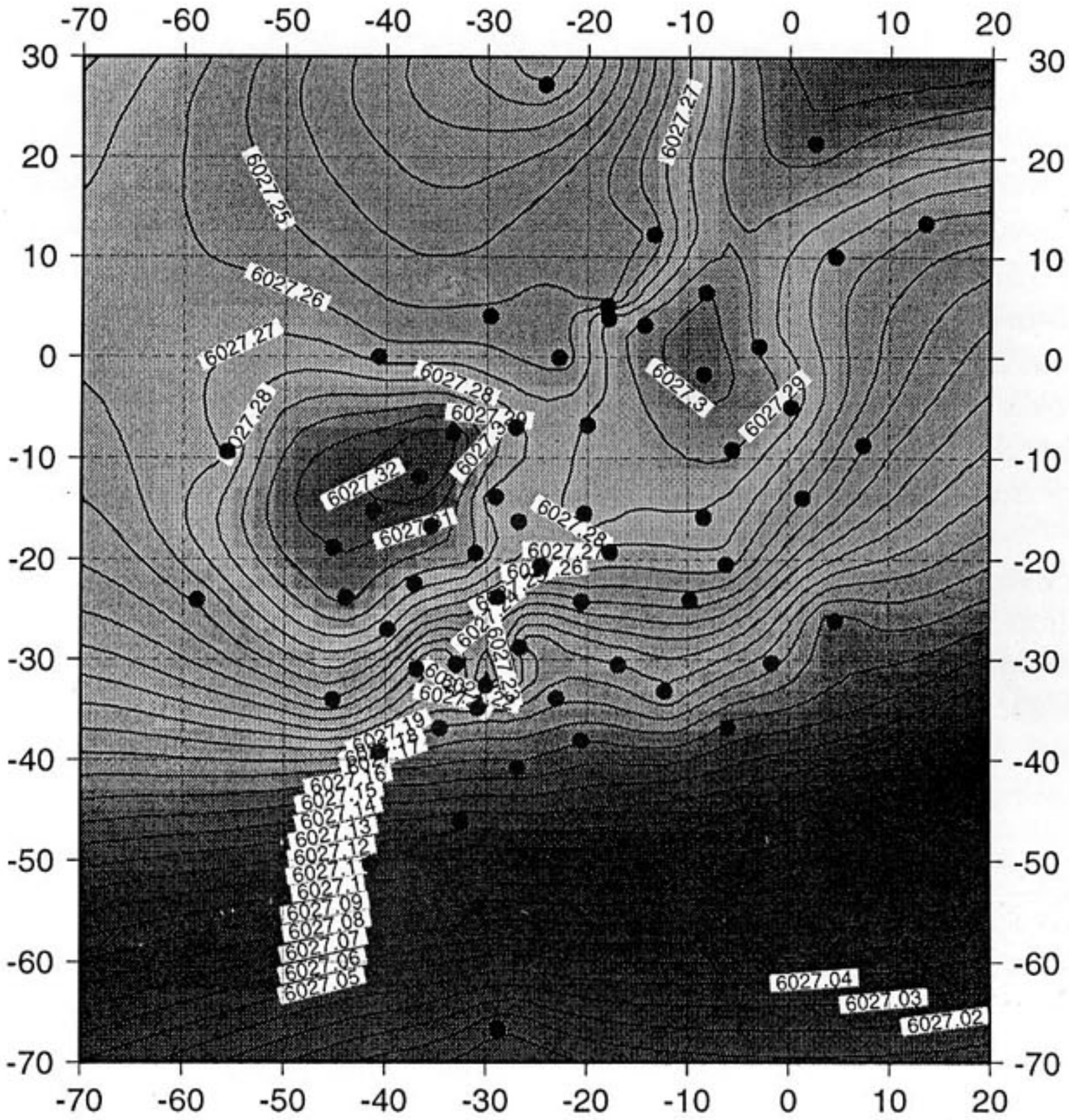
- The previous gravity experiment is inconsistent with this one because it utilised greatly inferior equipment and a far less rigorous approach to the survey design and the data reduction. Because of the nature of its sensitivity gravity experiments are far more prone to gross errors than other geophysical methods. Ground radar, although a potentially powerful tool suffers from two principal problems in the S. Wales context. First, the method is adversely affected by any soil moisture and second the uneven nature of the buried limestone/soil boundary can lead to spurious diffractions that are easily mis-interpreted as shallow voids.

- The new gravity and resistivity results are consistent with a localised area of shallow rock with little soil cover, but surrounded by areas in which the rock-head is much more deeply buried. No voids are indicated and had the gravity data been available earlier the site would have been rejected as a poor prospect for caves.

- Unless it is known a priori that an area has an even soil depth (ideally this should be negligible) then resistivity measurements alone do not distinguish between caves and variations in the depth to rock-head

- Where some combination of gravity, resistivity and shallow seismic measurements are used together there is potential to locate modest sized shallow cavities (say a lm diameter pasage at 5-l0m depth) or much larger features at correspondingly greater depths.

Figures 0.2 and 0.3



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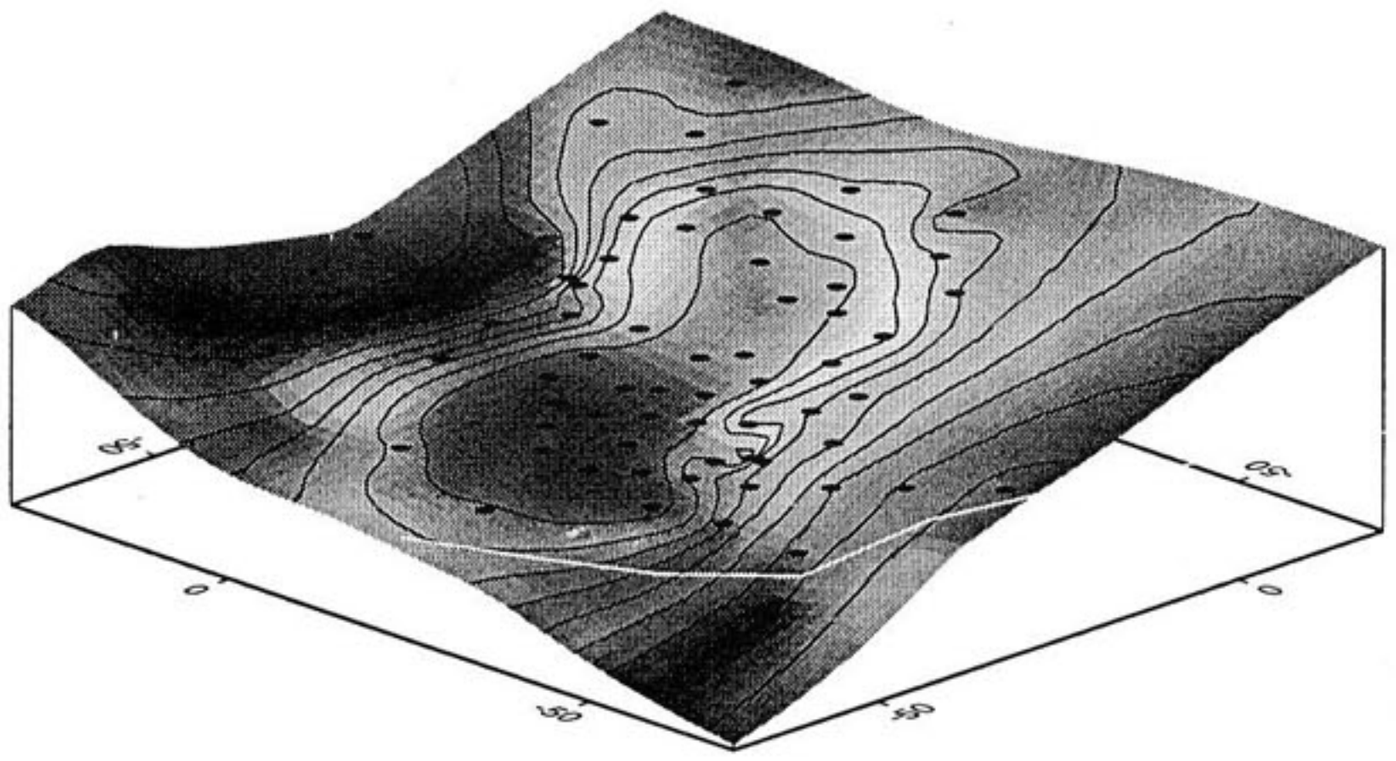

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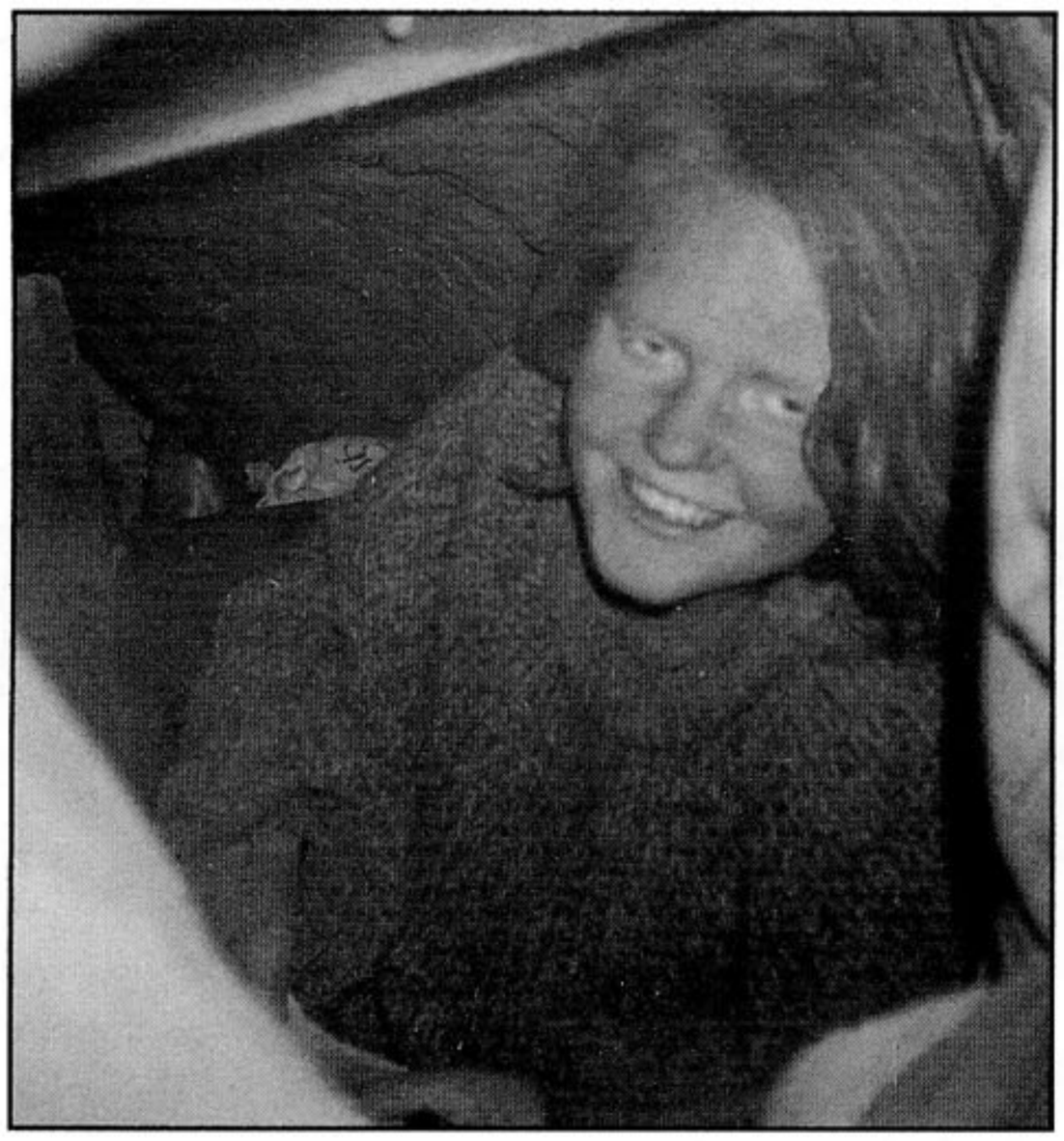
Life in a Protest Tunnel *or* Too Close to Nearly Have Sex

by ***Annwen Jones***

At the end of May I was involved in the campaign to stop the building of a second runway at Manchester Airport. We occupied the site of the proposed second runway to prevent its building, the beautiful Bolin Valley, an area of ancient woodland twice the size of that lost to the infamous Newbury Bypass. I spent seven days in a tunnel before being dug out by bailiffs.

As the daughter of two cavers it would seem natural that, having turned up on an environmental protest site, I would become a tunneller - but this was not the case. It came as a great surprise to find myself underground, I'd only gone over to the entrance to say hello, I didn't expect the bailiffs to turn up at that moment. My belongings were in a tree house, I wasn't ready for this! That was the beginning of a seven day siege - not an 'ordeal' by any means but certainly an experience!!



'Sir Paul McCartneys Cavern' was by far the smallest tunnel on site, but like the largest, had four people in it. This meant that we were packed in like sardines. Jeni and Blowpipe were in a small chamber (about the size of a single bed) which had a storage alcove leading off it. Merrick and myself occupied a passage about 8Ft long. This was an extremely small space for two people, and we had to be in very close contact for most of the time. It was lucky that we had practised this and liked it.

The tunnels were dug in red clay, which packed together nicely and was stable - you could spot who'd been digging by the strange orange 'tunnel tan' which clay caused. The bigger tunnels were shored up with wood. Our tunnel was primitive in comparison to the others - some tunnels had chambers big enough to sit up and turn around in and different depth levels with worm hole passages in between. 'Cliff Richard' camp boasted the "tightest, nastiest, meanest tunnel in the world". 'Cakehole' (the mother of all tunnels) had a food storage alcove which was reputed to be bigger than our whole tunnel, they had fourteen steel doors with which to delay the bailiffs. We had two. We had no illusions about holding out for weeks, but hopefully we would occupy the bailiffs and tunnel team for a good portion of time, allowing other tunnels to last longer, to prevent them bringing heavy machinery on site to evict tree protesters (as there was danger of causing tunnel collapses, especially in unshored tunnels) and to prevent the felling and bulldozing of trees above us. Putting ourselves physically in the way of destructive projects like this involves doing all we can to make our removal difficult, lengthy and expensive. This in turn makes the whole project difficult lengthy and expensive so that , even if this project is not stopped, in future similar projects may not happen.

I jumped down the hole as quick as I could and tried to pull the heavy steel door shut after me, it wouldn't shut properly, I grabbed the chain that was nailed to it and pulled, a bailiff was trying to pull the door open from above. The tug of war seemed to go on for ages, and he was beginning to win " The chain is 'round my neck, let go or you'll kill me" I shouted. The bluff worked "we'll be back for you" he said and backed off. I crawled into the tunnel catching my breath, thinking that I'd be able to sneak out later on. I felt relieved not to have been evicted so easily, and curious as I'd never even seen inside this tunnel until now.

The first night I spent underground was in the firm belief that it would be my only night in the tunnel and that the coast would be clear in the morning to go back to the trees. My sleeping space was tiny. Our passage was not wide enough for us to sleep side by side, we had to sleep in single file - my head rested on Merricks knees trying to avoid being kicked in his sleep. I in turn had to

be careful not to kick Blowpipe. We were woken up on the first day by the loud shouting of AROOGA! which is the protesters warning cry for when the police and bailiffs are approaching to begin evicting us. Then I realised - if I try to leave now I'll be escorted off site and that will be the end of it, and if I stay I'll be underground for the duration, however long it takes. Now that the eviction had officially begun we became the responsibility of the authorities (in their eyes) and they began to pump compressed air down to us. This was welcome as even though we had our own air system, it wasn't the blast of fresh air that this was, besides, ours ran on an old car battery and nobody knew how much charge was left in it. We heard the Undersheriff of Cheshire give a warning over the loudhailer that if we didn't leave within the next ten minutes we would be liable to arrest. This was it. The others told me that if I wanted to leave that no-one would think any less of me - I hadn't prepared myself for this like the others had (Jeni and Blowpipe had been using the tunnel as their bedroom for weeks now) but I was fine, it felt ok, I can do this!. " The same goes for all of us" I said. " We've all worked very hard and put our hearts into this - if anyone wants to get out before the end, then you can hold your heads up high and everyone will know that you did what you could" said Merrick. There was no bravado involved, I knew that this would be easier than I expected because I knew I could leave anytime and had the support of <u>everyone</u> involved in the campaign whatever happened now. Anyone who turned up on site even for a day did something to be proud of and stood out from the millions of people who know we're right The ultimate responsibility is always to be true to yourself and not to what others expect of you. The important thing is to give what you can and to realise that you *can* have an effect. These issues are too important and too urgent to wait for someone else to wake up and save the day . **<u>We</u>** have to act **<u>now</u>**. What will future generations say about a generation who knew the damage they were doing but did it anyway?

In the same way that specialists have to be hired to evict tree protesters, occupying tunnels means that specialist tunnellers need to be hired to get us out. The longer we can delay them for, the longer they have to be hired for, making it difficult, lengthy and expensive. We had several delay tactics at our disposal e.g. steel doors which are difficult to remove without destabilising the tunnel and 'lock-on's which consist of a block of concrete around a tube in which you place your arm. Inside the tube is a bar to lock yourself to, using caribena attached to your wrist. They have to drill and chip you out as they cannot pull your arm (although we could unlock ourselves if we had to).

It was a whole four days before they began the task of digging us out - they only had one team of tunnel bailiffs, and I don't think they expected the number of tunnels which faced them. These were the so called 'men in black'. They were extremely overpaid men who drove around the valley on four wheel buggies wearing black from head to toe (even a balaclava). There had been much speculation in the press as to who these men were - were they Cavers? Cave rescue? the military? Rescue International? nobody really knew, as they kept their identity secret for some reason (Shame?) but we overheard them say they were ex-military. Three weeks earlier we had heard that the British Cave Rescue Association had said that none of their members would be used as bailiffs (but would help in the event of an accident). This decision meant a lot to me. It's a distressing thing to be evicted from the trees by climbers - people who spend their free time outdoors. People whose passion involves going to areas of outstanding natural beauty. People who you would expect to be against the destruction of wilderness. Which side would they be on if the runway was being built through Snowdonia or the Scottish Highlands where they spend their weekends? Jim Perrin, a speaker at the British Mountaineering Council AGM in Llandudno said of them "If we do not disown and obscure these mercenaries and renegades, we undermine the very reason for our existence" They were then expelled by both their climbing club and the BMC. I think that such an outcry occurred in the climbing world because it's the same awe and love of nature that drives their will to be dangling halfway up a mountain that is revulsed by the pointless and enormous destruction caused by projects like these.

For four days the tunnel bailiffs were working on the tunnel at Cliff Richard camp and so all we could do was sit and wait, listening to the tree protesters being evicted somewhere above our heads, unable to get out without being arrested by the bailiff stationed at the entrance. Merrick and I could hear what was going on above ground fairly well as we were near the entrance. Blowpipe and Jeni were about 10ft into the hillside and had to communicate with the surface using an intercom. We were totally reliant on the bailiffs to tell us what was going on but we knew from the experience of people at previous protests that they could not be trusted. People in the tunnels at the protest at Trollheim, Devon, had been told by a bailiff that someone had died in one of the other tunnels, in the hope that this would make them come out. It was a strange feeling to be reliant on someone for information who you know will say <u>anything</u> to get you out. We spent those days being prepared for them to come at any moment as the bailiffs sometimes told us

that the tunnel, team were on their way , and other times said it would be a matter of weeks. We knew we would get some warning though, as the steel door would give them some trouble!

Boredom was the biggest fear during this time - which is why we had plenty of things to read. We trawled our memory for songs - singing to each other all those we could remember the words to, and singing together if we both knew the words. Merrick and I hadn't known each other long so the potential for each others life stories was massive. I began teaching him to say nice things to me in Welsh. We also slept a lot, our bodies slowed down to hibernation mode (which was very welcome after the amount of work we'd all put into the campaign up till now). The tunnel gained a very relaxed air, as if we were just spending some time with friends lazing around eating - although every now and then certain loud noises from above could set the adrenaline going and have us whispering 'Get ready, this is it'. We mainly ate cold food out of tins (e.g. beans, spaghetti, fruit) as we had no method of heating it up, and just to make things interesting, the puddle of condensation collecting in the storage alcove had soaked off all the labels giving meals a 'lucky dip' quality. We also had a store of 'treat' foods e.g. crisps, chocolate, peanut butter, jam, biscuits and plenty of water to drink.

Everybody seems to want to know how we went to the toilet, humans are fascinated by these things! When Neil Armstrong came back from standing *on the moon*, he was always asked how he went to the toilet in space. We used plastic water bottles with lids to piss in and shat into carrier bags which is the single most unpleasant thing I've had to do in my life. There was only one place in the tunnel big enough to sit up in for this purpose, so when you needed to crap everyone had to move out of the way, put their fingers in their ears and hum loudly!! The bags were tied and then stored in another alcove wrapped in bin bags. We got rid of the days waste at night when the bailiffs wandered off for a few minutes. This was a risky operation as they were never more than a hundred yards away so we could only open the door briefly and put it out - leaving them to remove it.

The most difficult time came when they began chainsawing trees down. That noise is the most sickening thing I have ever heard. Some of these trees have taken hundreds of years to grow, and they were all flattened in a day. We listened to each one going - the buzz of a chainsaw, a hideous tearing crack, and a thud as it hit the ground, sometimes causing the ground to shudder. We had been living among these trees for months. This place had become our home. Hearing it being smashed up without being able to do anything is horrible. We witnessed the trashing of a woodland valley which means the loss of a whole ecosystem, involving countless species of animals and plants including protected species that you or I would be prosecuted for even touching. Not only is this area being obliterated by the second runway, it is unnecessary and unhealthy for the people of Manchester. Its construction has more to do with political attempts to generate civic pride rather than any transport needs (Gatwick, with it's single runway takes more flights than the two runway Manchester will). It is absurd that prestige is based on giving a good impression to businessmen rather than the needs of the city's people or even on taking pride in diverse and rare wildlife, ancient trees and winding rivers. The airport began by promising 50 thousand jobs - no small promise in an area of high unemployment like this. However, they were unable to prove this during the public enquiry and had to drop the figure to 8 thousand. They then dropped it again to 5 thousand, and have refused to provide actual evidence of a single job other than temporary construction workers. If investing money to create jobs was actually the aim, then investing in other areas would be more effective e.g. three times as many jobs could be created in education. But no, the most destructive option which is beneficial only to investors and politicians is chosen, the option which creates an extraordinary amount of pollution for local people and for us all. This comes not only in the greenhouse gasses produced by increased air traffic, or in the form of exhaust fumes from the planes and increased car traffic and new roads in the area, but perhaps the most frightening is the dumping of excess aviation fuel over houses, schools, shops and farms of the surrounding areas. All this without a penny paid in aviation fuel tax. We have to stop this madness.

Blind acceptance of things like the second runway is what is going to destroy not only our own quality of life but that of all future generations forever. It was this realisation that not only made me put myself here in the first place, it made sitting out the siege surprisingly easy. It became impossible to do anything less than what we did. Doing nothing means allowing them to get away with it, putting myself in the way is withdrawing the consent that silence **is**.

They finally came for us on the fifth day. Our first line of defence was a bolted steel door, made impossible to lift off by the fact that Merrick had a chain around his neck attached to the underside of it. This sounds extremely dangerous because he would have been strangled had they attempted to lift the door, but his safety relied on the fact that they simply wouldn't. This is Britain

and luckily people do not get strangled by bailiffs who are only doing their job and not in the business of killing people. Instead they dug down alongside our tunnel until they could come in underneath the door and remove the chain. They now had the tunnel exposed but still couldn't get Merrick out because both his arms were inside 'lock-on' tubes. They spent hours drilling through the concrete to free him and by the time he was removed and arrested they had been working for ten hours to get him out. However, tunellers work slowly as they're paid large amounts by the hour. Once Merrick was out I retreated behind the second steel door, this reduced my space by half. Merrick told me afterwards that his legs had given way when he'd tried to stand up outside after so long in a confined space, and he'd had to be supported by a policeman for the first few minutes. By this time I'd developed quite a nasty cough from the clay dust and began, for the first time, to hope that it wouldn't be long before I got out. To their credit, the first thing one of the bailiffs did once they'd got the door open was to pass down a litre bottle full of hot coffee. This was the nicest and most welcome cuppa I'd ever had. They spent the next day digging the hillside away, so that the second door was barely underground anymore. In the afternoon they worked on the door. My head was directly behind it so they couldn't simply knock it through, but managed to force it out towards them. They still couldn't remove me as both my arms were in 'lock -on's. This was a pretty uncomfortable position to be in - I was lying face down with both my arms locked on inside tubes embedded in concrete in the floor, I concentrated on how amazing the smell of fresh outside air was.

They then left me for the night. This was the worst night, the only really bad time, I hardly slept. I was almost completely exposed to the outside, and so had to try and sleep with one arm in a lock-on tube, otherwise a bailiff could just grab me easily while I slept. The night shift bailiff assured me that as I was still underground he was not insured to pull me out even though he could reach in from where he stood. I didn't trust him. Finally the morning came and by now I was very tired, looking forward to standing up more than anything. From this point onwards things became strange, they began on what I now know to be psychological techniques for getting me out. I thought I'd been well guarded against believing their lies up until now, but I suppose tiredness had got the better of me. They told me that they were under enormous pressure to begin evicting the other tunnel because one of its occupants, Denise was pregnant. They told me that they would leave us until they'd cleared the other tunnel the 'cakehole'. I was mortified, I knew that it would be weeks before they'd done this ('cakehole' being the most well defended tunnel of them all) and I didn't think I would last another night like the last one, besides our food wasn't going to last much longer either. It came down to a choice - either I could leave of my own accord, or hang in for a few more weeks and neither option seemed possible. I'd promised myself that that they wouldn't be able to build this runway unless they physically removed me first, I wasn't going to just walk out now after all we'd been through. Giving up just wasn't an option. Having said this, there was no way we could last much longer. This was an impossible choice, I was in tears. Then I found myself in the extremely strange position of trying to persuade the tunnel team to evict me. Jeni and Blowpipe had bravely decided to stick it out as long as they could. They agreed to drill me out before moving on to the cakehole provided they could do it in an afternoon, I began co-operating e.g. telling them how far down my hands were, and describing how my hands were fastened to the metal bar. They finished drilling me out after about three hours and led me out, blinking into the sunshine, where I was arrested and taken to the police station. I was exhausted, but relieved and happy to be out, The police cell would be a doddle after this!

This is about more than just the Manchester Airport second runway, it's about the fact that air travel is on the increase on a global scale, and most airports in Britain are looking to expand. It's about raising these issues, and getting people to confront them. Global Warming is now accelerating at an alarming rate, but still society encourages increased air travel and encourage people to use private cars. The rate of respiratory illnesses in this country is rocketing, even the politicians are admitting that we need to reduce pollution levels if we are to survive. We're not trying to deprive families of their annual holidays abroad, what we're talking about is, for example people commuting from Manchester to London by plane regularly without considering the effects. Future generations are not going to be able to live as we do, and will look back on us as the selfish ones who used up all the worlds resources. People will have to change the way they live, and these large dinosaur projects will have to be stopped, it's inevitable. So why not try to make it happen sooner, before we make it any worse.I can't solve everything, but I can do **something**.

Rob Parker

Rob died in a cave diving accident during 1997. There have been obituaries in the Times, in the Guardian and in Descent which will have been read by many of you by now. Rob was an exceptional caver and adventurer. He was above all a wonderful human being who enriched the lives of everybody who was fortunate to have known him. His personality and generosity was such that memories of him will live on. There is a poem by a poet unknown which with a little modification expresses it all.

Do not stand at his grave and weep;
He is not there. He does not sleep.
He is a thousand winds that blow.
He is the diamond glints on snow.
He is the sunlight on ripened grain.
He is the gentle autumn rain.
He is the waves on waters deep.
He is the restless mind that goes to seek
For places strange and places rare.
He is the summer breeze of scented air.
He is the underground stream that sparkles bright.
He is the dawn at the end of night.
When you awaken in the morning's hush
He is the swift uplifting rush
Of quiet birds in circled flight.
He is the soft stars that shine at night.
Do not stand at his grave and cry;
He is not there he will not die.

Robs Friends

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