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54

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JANUARY 1970

PROCEEDING FORWARD

G.C.COX.

The proceedings is now firmly established as an occasional publication. There can be little doubt that it is better as such than as an annual report of the Club's activities. Accounts of the umpteenth Freshmen's Meet to Swildon's may be amusing to those who took part, but are of no interest to anyone else. It is 3½ years since the last Proceedings appeared and this is the largest and most varied issue ever - as well as articles about caving in Spain, North America and Yorkshire it contains a short story about caving in France and a crossword about caving everywhere. Included are the full report of the Club's 1969 expedition, the report of the 1968 mini-expedition, and a geological article based on the 1967 expedition. (The main report of the 1967 expedition is still available from OUCC at 4 Keble Road Oxford.) It is impossible to predict when Proc. OUCC No.6 will appear, but I think I can safely say that it will not be soon, and also that it will be worth waiting for. I hope that those who have waited 3 years and 8 months will feel the same way about this issue. Let us proceed . . . .

CONTENTS

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LETTER FROM CANADA

JOHN DRAKE
Mc.Master University, Ontario.

There is one overwhelming factor to caving in North America - distance. The nearest caves to Ontario worthy of the name are the West Virginian group, 500 miles away. These are the northerly extremity of a great crescent shaped band of caving country which sweeps south and west into Alabama & Missouri. The caves themselves are extremely varied, except that there is little vertical development, and that they are for the most part wet. Schoolhouse is probably the most renowned, and it also has a typically West Virginian snag:- the owner, a highly religious character, who has a low opinion of scruffy cavers applying for permission to go down at 10 on a Sunday morning. In Yorkshire, all would be well, as a trip to the pub would obviate the need to cave. American beer has the reverse effect, however - particularly the West Virginian brew, which is a mere 3.2% alcohol. To compensate, there is the promise of hundreds of new caves; at present some 90% of all known caves are within half a mile of a road, and there aren't that many roads.

The same is true of most caving areas, the classic example being Mexico. For a Christmas holiday nine of us rented two vans and drove to Huaulta, some 250 miles south-east of Mexico City. The trip took 72 hours, and was enlivened by ten minor accidents (for which no stops were made) and a collapsed gas tank, which brought us to a halt at 12 noon on a Saturday in the middle of Mexico City. With a bit of broken Spanish and a lot of luck we found a mechanic, who cut the tank open, beat it back into shape and welded it shut again in 2 hours. The price - 10 dollars, and we drank two bottles of tequila between us. Then the caving started - on Christmas Day - and ended 2006 feet lower, most of this being vertical. The

sensation of sitting in a prusik sling in the centre of a 200 foot vertical rope is to be avoided. Following the retreat the trip went to pot, to say nothing of the psychedelic mushrooms for which Huautla is famed. Two more caves were pushed to the brink of pots over 200 feet deep, at which point we decided that it was time to go - particularly as the Indians had turned hostile.

Since Christmas there has been relatively little action, but the summer season is just beginning. As I write this we are sitting in Jasper amid snow covered mountains, preparing to go to an area of gypsum karst, about the size of England and Wales, in the North West Territories. Following this will be various fortnights all over Alberta, looking for yet more caves and working on those already known.

* * *

THE DISCOVERY OF PIGSH*T POT

or, An Amusing Hole, found by Accident, on a Yorkshire Weekend.

J.DAVIES

I suppose it is the thrill of discovery that makes any scrat hole appear at first to be full of interest and appeal, and seem to have a vast potential for extension, but its true nature is seen slowly, as the novelty evaporates. Imagine the excitement then, when, having set up camp near Penyghent in the small hours, one of our number stuck his leg down a small cleft. By sheer chance a discovery had been made and the midnight carbide was burned in an orgy of wild prophecy.

Next morning a little gentle sledge-hammering opened up a rift, some six feet deep, dropping into a streamway. Virgin passage! When, after some 400 yards of exciting crawling, we found a 60 foot pitch, our joy was complete. After returning

for some ladder, and a second time for a rawlbolt, we descended into a small chamber some 60 feet by 20. The way on was blocked, and on a third trip to fetch the trusty sledge-hammer one started to realize that the passage was rather small and fairly awkward, and the stones were the usual knee-wreckers. Even so, the scent was still warm. We hammered until it was realized that the water was rising, and an emergency retreat was executed, abandoning the tackle. Our fourth trip merely allowed us to retrieve our gear, and by this time the cave seemed quite bloody, especially when lugging the hammer through some of the tighter sections.

In the interval before our return the hole was also discovered by some local farmer, who used it as a dump for tins, binder twine and less healthy farmyard waste, and thus a squalid dig was neccessary to regain entry to the hole. Enthusiasm was fast waning but we lugged our hammer back to the chamber, the way now perilous with tins and bottles, and eventually broke through into a similar chamber, only to find that it ended in a mud-choked cleft. We tried to convince ourselves that it was a promising dig, but failure was assured as it was that time of day when the true caver fulfils his second, and usually more pleasant, pursuit. One hour and one gashed knee later we were in the Queen's Arms, and a solemn vow was taken never to return.

It is strange how absence makes the heart grow fonder as, in later years, I had persuaded myself that the dig would be feasible and worthwhile. However, a recent glance at the entrance, once again visited by our farmer friend, killed all desire even to look at the hole. So, if anyone wants a promising dig in an amusing little Yorkshire hole, let me know. You are quite welcome to this one.

* * *


Santander
Oviedo
Llanes
Castro Urdiales
Bilbao
CANTABRIAN MTS.
PICOS de EUROPA
PYRENEES
Barcelona
SPAIN
Madrid
Nerpio
Murcia
Sevilla
Granada

THE GEOLOGY OF CASTRO URDIALES

J.A.WINCHESTER

(Report of the geological section, O.U. Expedition to N.Spain,1967)

1. Introduction

The geology of the area around Castro Urdiales was studied in order to assist the expedition to locate new cave systems, and to explain the present form of the caves. A geological map was constructed, based on evidence gained from field work on the surface, then some underground correlation was attempted in one of the largest cave systems.

In this report, different aspects of the geology will be dealt with in turn; notably the different lithologies distinguished on the map, the structure, and the cave relations within the main area mapped. Shorter notes will describe the sedimentary structures noted inside the caves, and the mineral veins seen in the area, and these will be followed by a brief description of the areas reconnoitred but not mapped in detail.

Castro Urdiales lies on the north flank of the Cantabrian mountains, a range uplifted during the Hercynian movements at the end of the Paleozoic era, along the northern margin of the Spanish Meseta. Over a large part of the Basque Provinces the sediments postdate the main orogenesis, being of Mesozoic age, but they bear witness to the later movements in the Tertiary, which reelevated much of the chain at the same time as the Alpine earth movements.

In the neighbourhood of Castro Urdiales, the sediments now exposed at the surface are all of Cretaceous age, consisting of a Lower Cretaceous "Wealden" series of flaggy sands and shales, overlain conformably by the "Urgonian" series, embracing the Spanish Upper Cretaceous, and consisting largely of limestones.

The structure of the area consists of broad open folds, with axes trending approximately from east to west, but these are greatly complicated by faulting. Both folds and faults probably date from the movements in the Tertiary.

Urgonian limestones outcrop in two main areas west of Castro Urdiales which are separated by an anticline with Wealden exposed at its crest. The more northerly outcrop covers the summit ridge and northern slopes of Cerredo, and extends west beneath the Rio de Oriñon to include the whole of Candina, the Liendo Polje, and the hills south of Candina. The southern outcrop is much smaller, structurally almost a graben between two strike faults, and extends from La Peña in the south-east to the western summits of Punta Peña. All the caves currently explored, with the sole exception of the Cueva de Iseca Nueva near the Liendo polje, were situated in the latter limestone area, and therefore the geology of Punta Peña was mapped in the greatest detail. The geology of La Peña, separated from Punta Peña by a broad expanse of valley alluvium, was not mapped in view of its structural simplicity, but the relative complexity of Punta Peña made a map essential. When this had been completed, a few days were spent reconnoitring the limestone on Cerredo, and an approximate map of the south and west of this mountain was produced.

Since the limestones are the only rocks important to cavers, mapping was only done in and around the limestone areas. Thus the Wealden occupying the crest of the anticline between

Punta Pena and Cerredo was mapped very briefly; it was only checked to ensure that no limestone outliers were overlooked, and so that the broad structure could be noted. Many of the dip and strike readings, however, were taken from the Wealden bordering the limestones, since either weathering, or the frequent total lack of bedding planes in the limestone meant that Wealden readings were generally more accurate than those in the Urgonian, and thus a clearer picture of the local structures could be obtained.

In view of the size of the area mapped, and the short time spent in the area, some features of the local geology will undoubtedly have been overlooked: however, it is hoped that this study will clarify some of the reasons for the siting and the orientations of the cave systems in the area.

II. Stratigraphy and rock types.

A number of different rock units are distinguished on the map drawn up of the Punta Pena area. Since some of the units vary quite widely, all these are described in order to explain which rock types are included in each unit.

The Wealden is the basal unit of the area, and conformably underlies the other units, as seen near Penilla and on Cerredo. Although a considerable thickness was exposed in the area, it was not subdivided into separate units as it is lithologically monotonous, and of no importance to cavers. It consists of micaceous purple and brown sands alternating with blue shales, almost always non-calcareous, sometimes fossiliferous, and showing many sedimentary structures. Probably it was a terrigenous shallow-sea deposit.

Near Penilla the Wealden is overlain by a grey, arenaceous, micaceous limestone, containing abundant fossils: probably Orbitolinids. This unit appears to form a transition group

between the Wealden and the limestones above. It was only seen north-west of the mouth of Penilla, where it was about twenty feet thick, and it is probably only a local development; perhaps a shell-bank deposit.

The more widespread unit distinguished at the base of the Urgonian series is a grey, fine-grained argillaceous limestone, containing abundant recrystallized casts of unbroken bivalves, known here as the'bivalve unit'. Although similar limestones were occasionally seen in small quantities at other horizons, the bivalve unit was developed north and east of Penilla, where it was up to three hundred feet thick. It also made up the entire Penilla stream outlier, a mile to the west of Penilla.

The 'well-bedded limestone' unit embraced all the reasonably pure limestones in the area, which displayed clear bedding planes. It was unrelated to grain-size or colour. Grain-size varied from extremely fine, to coarse recrystallized limestones, while the colour varied from pale buff to dark grey. Possibly there is some development of cycles in these limestones, as the occasional sharp junction with a coarse-grained bed resting upon a finer one was noticed. Fining-up sequences may occur locally. Fossils were sometimes abundant, and sometimes almost completely absent. When present they were usually broken, so these well-bedded limestones may normally be classed as bioclastic. They were probably detrital material derived from the nearby reefs, and were laid down in an area greatly disturbed by wave and tidal action; hence the fragmentation of the fossils. Depositional dips may render the dip readings taken somewhat unreliable. These limestones were seen best on the south slope of Montealegre and on the south facing scarp of Cerredo.

A separate unit marked on the map is the alternating shaly and flaggy limestones. These consist of a rapid alternation of calcareous shales, shaly grey limestones and some arenaceous

limestones. Its boundaries are poorly defined in the field and it was interpreted as a transition unit between the well-bedded bioclastic limestones and the calcareous shales, into both of which it grades both vertically and laterally.

Calcareous shales are distinguished from the alternating unit on the map when the shales are clearly dominant, although thin limestone may still be present. The main locality where these were noted is near the Sangazo resurgence, and over the ridge to the north-west, but two other localities were seen on Montealegre, in addition to another on Punta Pena.

The last unit marked is the Reef Limestone. Typically this is extremely varied, and contains the occasional small lens of bedded limestone too small to be shown on the map. Usually, however, the reef limestones shows few signs of bedding, and consists of fragmented fossil remains mixed with others, possibly in situ. The grain sizes vary enormously, and local brecciation was noted, possibly indicating incipient dolomitization. Joint planes were dominant in this, and usually dictated the cave-forms in the reef limestone.

To understand the stratigraphy, the relations between these rock-types must be known. The Urgonian appeared to overlie the Wealden conformably wherever a sedimentary contact was seen, the basal limestone usually being the grey argillaceous bivalve unit, except where the orbitolinid unit was developed below it. The bivalve unit seems unaffected by reef limestones; it probably underlies them, and thus represents a phase before the reefs started to form. Three main reef masses were noted in the Punta Pena Urgonian; a northern one on the north side of Montealegre, and extending east to Monte Pino, and two on Punta Pena, locally connected but also divided by patches of shale and detrital limestone, such as that seen near the ridge of Punta Pena due south of the summit of Montealegre.

The remaining units, the bioclastic limestones, the alternating unit and the calcareous shales, are probably contemporaneous with the reef limestones, as they grade into one another and have lithological contacts with the reefs. The bioclastic limestones may be interpreted as the purest reef detritus, while the shales are probably clastic deposits derived from land, possibly the result of river transport. Where the water was muddier the reef development was prevented, and the alternations of shale and bioclastic limestone probably developed in a channel through the reef. Although thick vegetation made accurate appraisal of all these contacts difficult, this was taken as the likeliest interpretation of the stratigraphic column.

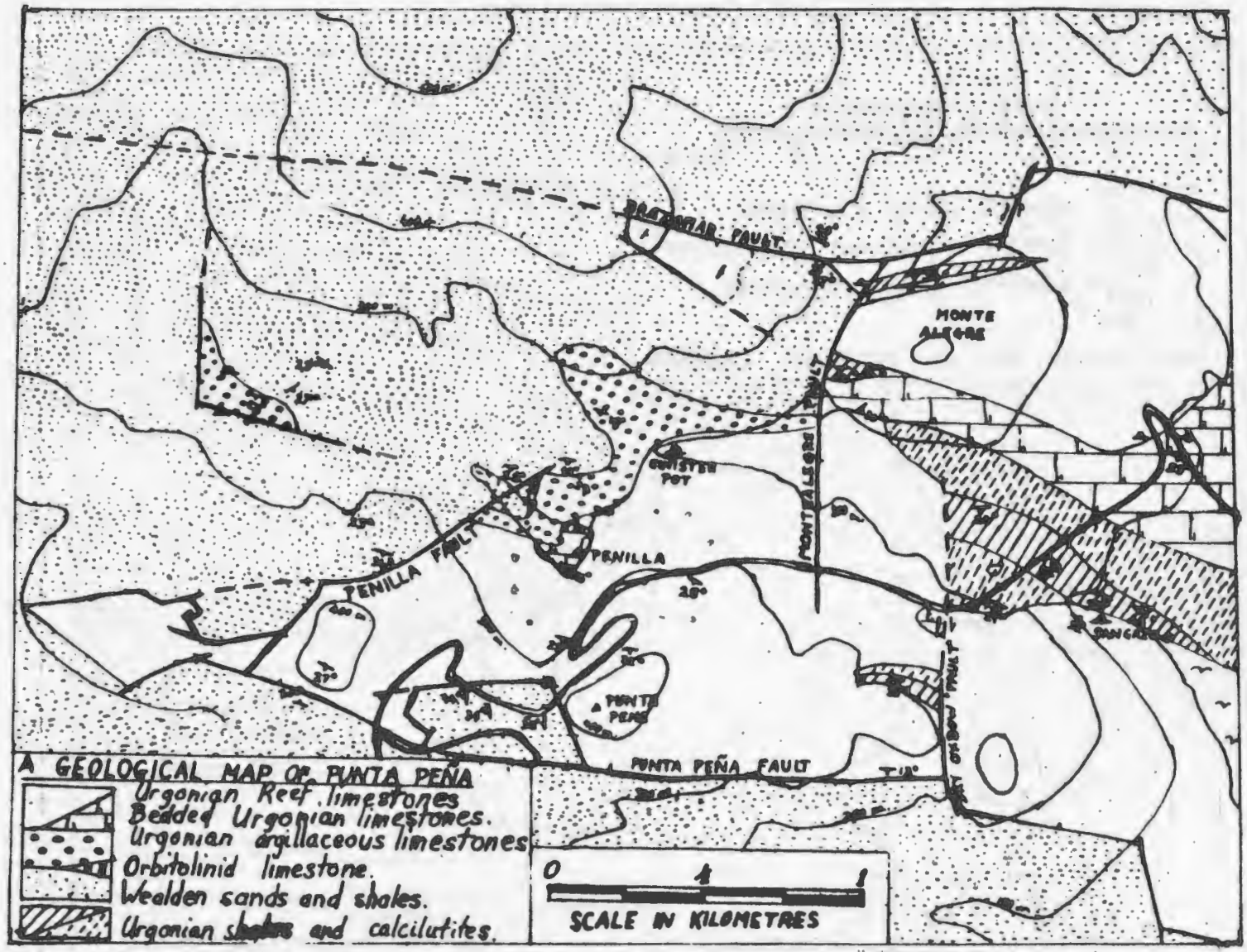
III Structure.

The form of the outcrops on the map suggests that the structure of the area west of Castro Urdiales consists of broad open folds with axes trending east-west; the Punta Pena limestones lie in a southern syncline, separated from the Cerredo limestones by an anticline with a Wealden core.

Closer inspection shows that faulting is everywhere a more important factor than folding: for example, in the Punta Pena syncline the regional dip is always to the south, while the only folds noted were wrinkles affecting the general southerly dip only slightly.

Major folding probably does occur, although the main structure seemed more the result of faulting. Minor wrinkles undoubtedly occur in many places, as both the dip and the strike vary within wide, but quite definite, limits.

All these, however, were of small importance when compared with the importance of faulting. Faults were common in the Punta Peña area: it was bounded by four major faults, while several smaller ones were also seen, especially where the limestone had been brought down against the Wealden. Three of the main faults


BACHIMAR FAULT
MONTE ALEGRE
PONTE ALEGRE FAULT
CRISTO POT
PENILLA
PENILLA FAULT
PUNTA PEÑA
PUNTA PEÑA FAULT
SANCA
PUNTA PEÑA FAULT
A GEOLOGICAL MAP OF PUNTA PEÑA
Urgonian Reef limestones
Bedded Urgonian limestones.
Urgonian argillaceous limestones
Orbitolinid limestone.
Wealden sands and shales.
Urgonian shales and calcilutites.
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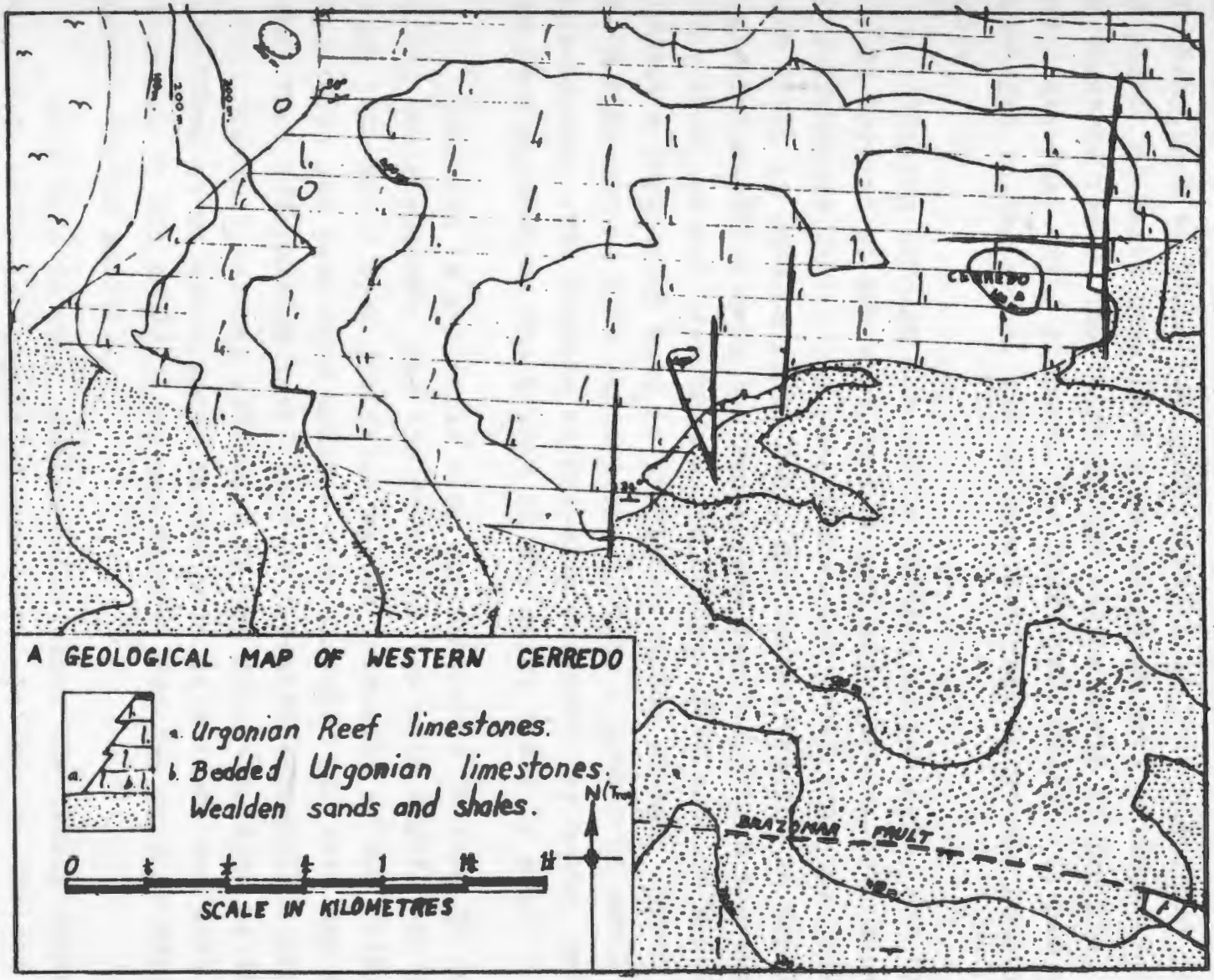
SCALE IN KILOMETRES


A GEOLOGICAL MAP OF WESTERN CERREDO
a. Urgonian Reef limestones.
b. Bedded Urgonian limestones.
Wealden sands and shales.
a.
b.
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SCALE IN KILOMETRES
N
BRAZOMAR FAULT

were strike faults; in fact the Punta Peña area could be interpreted as a graben bounded on the north by the fault referred to here as the Brazomar fault, and on the south by another parallel fault called here the Punta Peña fault. It was mapped by Rat as extending east to bound the south side of La Peña also, and near the summit of Punta Pena it was estimated to have a throw exceeding two thousand feet. The third strike begins north of Penilla, and runs south-west until it meets the Punta Peña fault. It has a down-throw to the south, and is here referred to as the Penilla fault.

Running through the saddle between Montealegre, and the spur of Cerredo to the west is a fourth major fault, here known as the Montealegre fault. It runs almost due south from the Brazomar fault until it ends on Punta Peña, and is not evident in the line of precipices which mark the Punta Peña fault. With a downthrow, to the east, of not less than seven hundred feet west of Montealegre it forms a large step down in the floor of the graben. Minor faults also cut in both directions, forming a number of small fault-blocks. Small scale strike-slip movement may occur, and this is suggested by the offset of the major fault by minor ones.

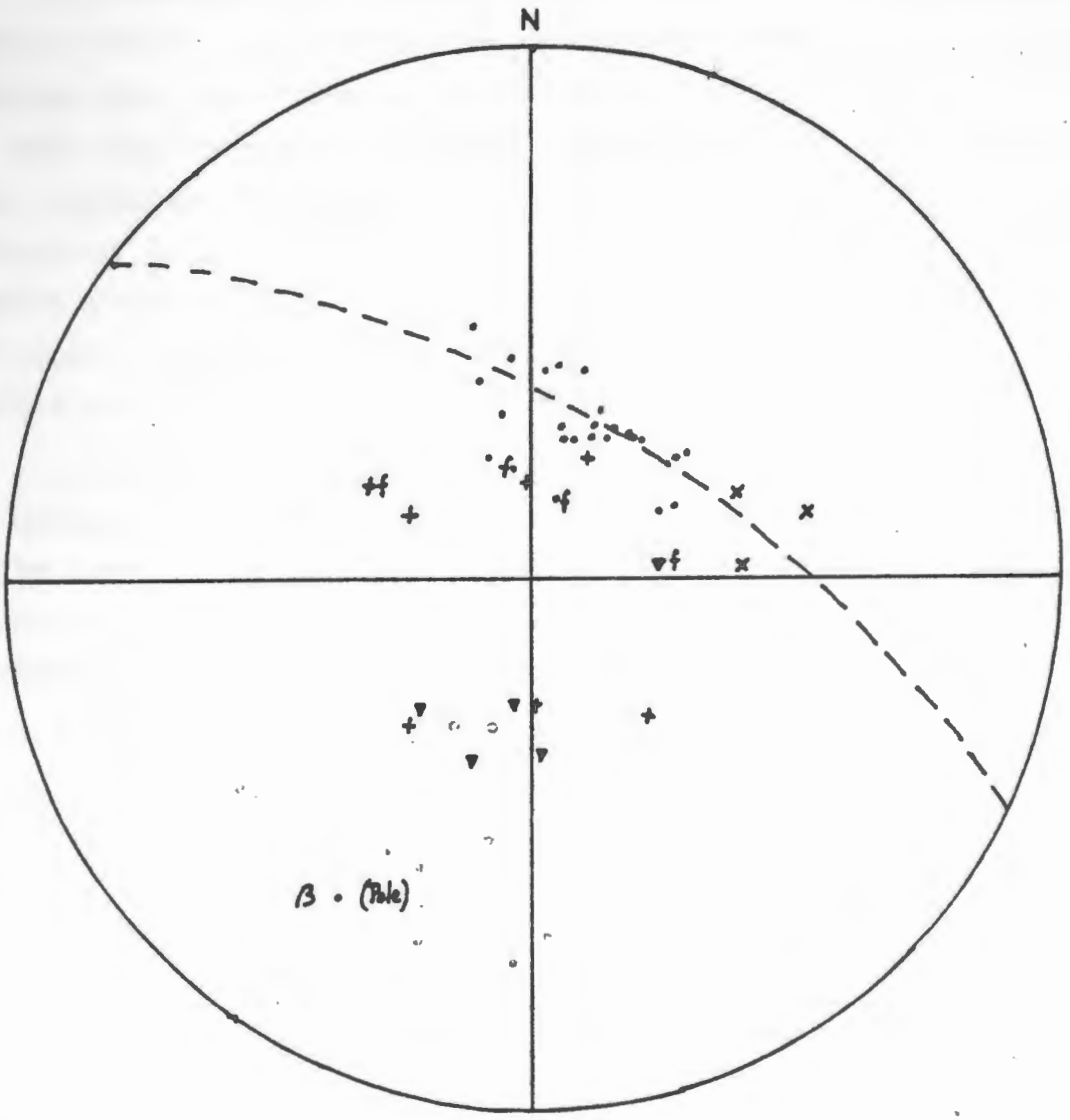
Faulting is evidently more dominant than folding in controlling the structure, for the throws of the main faults are far larger than would seem justified by the intensity of the folding. Deformation has been more brittle than plastic, and this may imply either that deformation took place at a relatively shallow depth, or that basement control exercised by the Hercynian core of the Cantabrians at no great depth is the main influence, and that reactivation of old fault lines may account for the type of deformation apparent at the surface.

With this in mind, a discussion about the likely nature of the Cerredo anticline may be of interest. Neither of the two readings taken north of the Brazomar fault shows the southerly dip

typical of the Punta Peña area, and all the other dips noted, but not measured, north of the fault appeared to be in agreement with the readings taken. One reading showed a dip to the west, but was probably influenced by the fault movement, which was within a hundred feet; the other showed a dip of 30° to the north, a figure strikingly similar to those measured later on Cerredo, and all the other dips and strikes noted in the neighbourhood were similar.

Further west, southerly dips were noted in the Penilla stream outlier, while northern dips were noted half a mile north-west of it, near the track up Cerredo. The crest of the anticline apparently lies between the two. If so, it was later seen to be in alignment with the Brazomar fault, and it is possible that the fault may continue westwards, separating a north-dipping block of territory from one that dips to the south. The position of the German oil-drilling platform may also be significant, indicating the crest of the anticline, whether faulted or not. If the Brazomar fault does extend to the west, the saddle north of spot height 383 metres may be a topographic expression of its position. The evidence does suggest indirectly that the crest of the anticline is faulted, and since elsewhere in the district only faults cause radical changes in the dip and strike, the Brazomar fault may form a sharp junction between the Cerredo block and that of Punta Peña.

The strikes of the main structures usually run east-west. This applies both to the major strike faults and to the folds they accompany. In addition, however, there are smaller faults which trend north-north-east and north-north-west. These may exhibit strike-slip movement, such as where the Punta Peña fault is offset, and may by their stress-pattern support the suggestion that north-south compression is responsible for the present configuration of the local structure.



π-POLES OF READINGS FROM NEAR CASTRO URDIALES.

• = Surface Readings between the Brazomar and Punta Pena Faults.

× = Readings from the La Granja Fault-block.

+ = Subsurface Readings from the Sangazo Cave System.

▼ = Readings taken from either side of the Punta Pena Graben.

f = Readings probably influenced by the proximity of a fault.

A stereogram was constructed, on which pi-poles were lotted in order to clarify the structures seen, and to reveal ny reason for the types of deformation seen in any one place. n it were distinguished readings taken from the Punta Pena raben, readings from the Wealden fault-block within the graben, ust east of La Granja pass, readings taken from either side of he Punta Pena graben, and, finally, subsurface readings taken rom within the Sangazo cave system. Readings thought to be nomalous on account of the proximity of a fault are indicated.

When these distinctions had been made, several interesting facts emerged. With the exception of one reading, which had probably been influenced by a fault, all the dips outside the Punta Pena graben were to the north. Underground, in Sangazo, all readings taken east of the dry oxbow were to the north, whereas all those taken to the west of it were to the south. In the passage north of the dry oxbow the limestone was extensively veined with calcite, and appeared to be extremely disturbed. It is suggested that this was the line of weakness running north from the small fault that offsets the Punta Peña fault, at the junction between the main Punta Peña reef and the East Punta Peña reef, and that dips within the cave may be largely depositional ones. Thus, whereas the main part of the cave is excavated well within the main Punta Peña reef, and displays normal dips to the south, the eastern part of the cave is on the northern edge of the East Punta Peña reef, and displays depositional dips on its northern flank; these consequently dip to the north.

The remaining readings are from surface outcrops within the graben, and show, in spite of an appreciable scatter, a tendency to lie on a great circle, with an axis plunging at 27° to the north-north-east. This plunge, with its slight variations, represents the regional dip of the floor of the graben, while the more extensive lateral scatter shows that small-scale folding has

occurred, in addition to the regional dip. If tilting had not occurred, these open folds might have produced dips of up to 15° to the east and west. These are the wrinkles already mentioned.

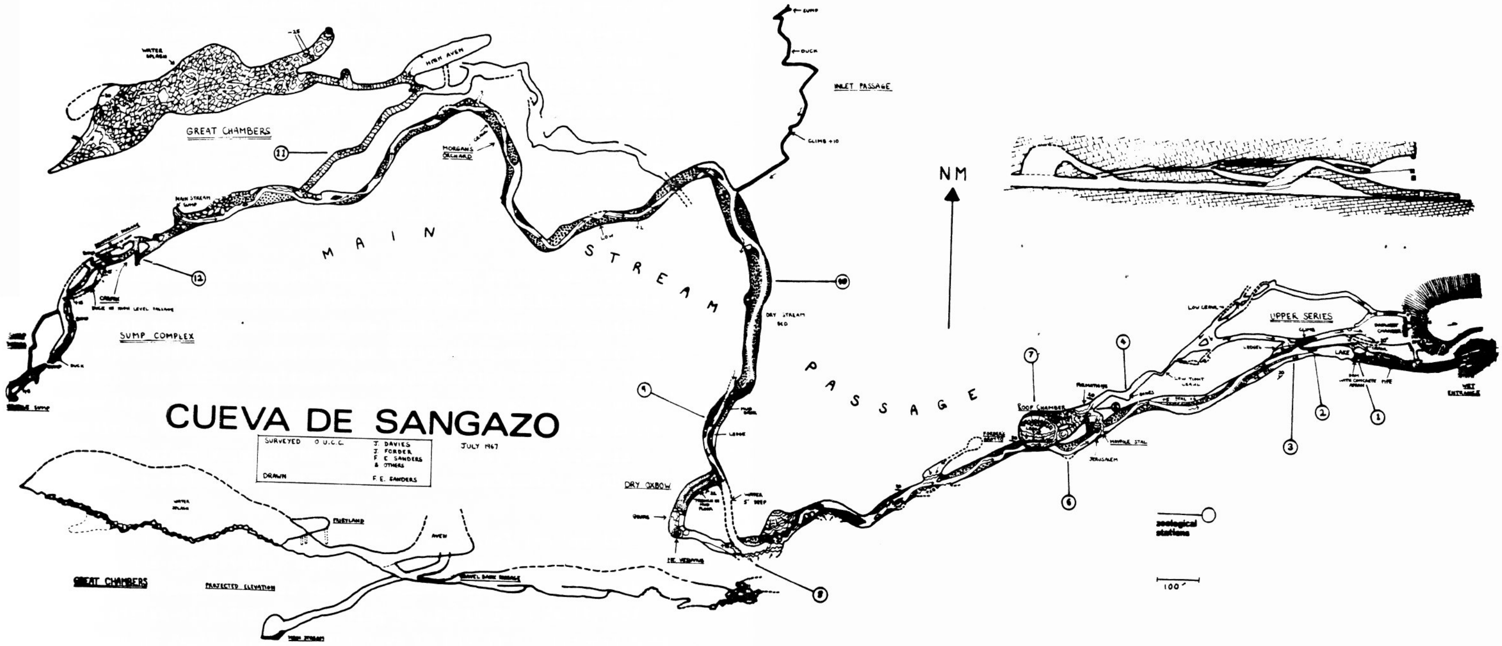
The conclusions which can be drawn from the stereogram are that faulting is responsible for the major regional dips, but that small-scale folding is also present, being probably independent of the main fold episode,

IV. Cave Morphology.

Only the Sangazo system was studied in detail, but all the other caves visited seemed to exhibit similar features. Sangazo was chosen for two reasons: it was the most extensive system in the district, and it directly underlay the area being mapped. Quite apart from providing useful additional exposure it also showed how a cave form was produced by the action of water, and the influence of geology on it.

In Sangazo the rock types vary between massive unbedded reef limestone, and the bedded bioclastic limestone which may be local reef detritus. Nevertheless, Sangazo has been excavated mainly in a reef limestone mass, and nearly every other cave of any size in the Punta Peña area, including Penilla, Sinister Pot and the cave above Montealegre village, has been eroded out of similar reef masses. Only a few small holes and the Penilla outlier caves form exceptions to this rule.

The influence of jointing and bedding, where present, on the cave forms was noted. Cave formations tended to occur below joint planes down which water could seep, and these planes of weakness in the rock also controlled the form of the cave passag If bedding was dominant, the passage tended to be broad but not high, the roof sometimes being formed by a single bedding plane. If jointing was dominant the passage tended to be elongated in the direction of the planes. More commonly it varied between


CUEVA DE SANGAZO
SURVEYED O.U.C.C.
J. DAVIES
J. FORDER
F. E. SANDERS
& OTHERS
DRAWN F. E. SANDERS
JULY 1967
MAIN STREAM PASSAGE
GREAT CHAMBERS
SUMP COMPLEX
INLET PASSAGE
UPPER SERIES
DRY OXBOW
ROOF CHAMBER
MORGAN'S ORCHARD
HIGH AVEN
SUMP
DUCK
CLIMB +10
DRY STREAM BED
LOW LEVEL
LAKE
WET ENTRANCE
JERUSALEM
MAYPOLE STAL
LEDGE
AVEN
FAIRYLAND
WATER SPLASH
GREAT CHAMBERS
PROJECTED ELEVATION
NM
zoological stations
100'
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7
8
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12

the two extremes, and joint influence was less important than the erosive power of the river.

The most notable geological feature seen in Sangazo was the fault, exposed best at Carfax, but also seen near the west end of the second Great Chamber in the Upper Series. Where the relatively small passage at Carfax turned sharply north-south for a short distance its roof was a fault breccia in a crush zone forty feet wide. On each side were broad disturbed zones where the limestones were extensively veined with calcite. The limestones seen to the west of this fault were quite different in grain size from those seen to the east, although both belonged to the reef limestone series. Slickensiding indicated that the fault had a downthrow to the east, and that movement had been almost vertical.

Superimposition of this cave survey on the surface map showed that the position of the Carfax fault tallied extremely well with that of the Montealegre fault, and this correlation was supported by the agreement in orientation and throw of the faults. The Carfax fault is almost certainly, therefore, the Montealegre fault discovered somewhat further south than was positively traced on the surface. Since the Montealegre fault dies out before reaching the Punta Peña fault, the throw in Sangazo is probably less than the 700 feet estimated further north.

The nature of the other main geological feature in Sangazo has not yet been discussed. This is the extensively veined zone seen north of the dry oxbow. It is in line with the small strike-slip fault offsetting the Punta Peña fault, and although no fault occurs in the cave it may be a tensional zone associated with the termination of the fault, which may still show some lateral movement. Significantly, it is here that Sangazo has its largest north-south bend in the passage, and

since the bend of the passage is in the same direction as the lateral movement once was, the geology may have influenced the course of the river. Surface mapping suggested that this line was the junction between two reef massas, now divided tectonically as well as stratigraphically. Their influence on the dips has already been mentioned, but the southward transport of the East Punta Peña Reef has brought relatively impervious shales into line with the upper cave passage. It is suggested here that the great bend in the cave passage is unrelated to actual movement of the fault, which must have occurred much earlier, but is a result of the diversion of the river to follow the line of the most permeable rocks. The positioning of the rocks is the result of tectonics; the course of the river is the result of the positioning of the rocks.

V. Sedimentary Structures within the Caves.

The river in the cave at Sangazo exhibited many of the characteristics of the streams outside, and showed in particular meanders, sandbanks, pebble banks and the alternating succession of pools and chutes typical of fast flowing streams. However, a few important differences were noted. The meamders could be seen in three dimensions, the higher levels of the passage having been hollowed by the stream on its previous meanders; the passage therefore displays a criss-cross pattern. Abandoned oxbows also occur, but in these the stream has cut through the neck by burrowing underneath, following a new plane of weakness in the rock. A good example of this can be seen in the Dry Oxbow, nearly 2,000 feet from the entrance to Sangazo.

Another notable difference in the sedimentation of the caves could be seen in the formation of stream conglomerates. A surface stream usually wears these away rapidly when eroding its banks, but inside Sangazo old stream pebbles above the present stream level have been partially cemented together with calcite precipitated from the drips from the roof, over a period

of probably not more than a few thousand years. This rapid consolidation must impede the progression of meanders, and may in part account for the burrowing meander cut-offs. The strength of these conglomerates, however, was not enough to form a permanent roof over any passage, and many collapsed shelves by the present river course were seen.

Mud-cracks were seen in one chamber in Sangazo, in a mudbank above the stream. Alyhough no sun could dry out the mud as rapidly as on the surface, possibly the river only reached the height of the mudbank during winter floods, and the drying out had continued uninterrupted for several months, in spite of the high humidity within the cave.

The relation of the stream to the water table remained obscure, but since the limestone was not unduly porous, the level of the river seemed to bear much more relation to the height of the inflow cave (Penilla) and that of the resurgence (Sangazo). Unfortunately, the short distance between these two was never penetrated, and no survey of the thalweg within the cave was undertaken.

The study of stream behaviour within the cave proved most interesting with respect to the meanders. It was this three-dimensional trace of the stream's history which was the most striking feature of this particular study.

VI. Mineral Veining.

Veining, though it occurred sporadically throughout the limestone, was concentrated near the main faults. This was well seen both on the surface and underground. In the limestone the veining was mainly of calcite, filling in small fracture planes, and in a few places in the limestone calcite-filled tension gashes were clearly seen.

The non-calcareous Wealden contains numerous small veins of ironstone, but these are of little importance. However,

as the region is one of the main iron-producing areas in Spain, other larger occurrences of ironstone were of interest. Veins of siderite were seen in the Urgonian limestones on the col into the dry valley above Sangazo resurgence; these were in line with the calcite veining seen above Dry Oxbow, but ironstones occurred mainly in some fault-zones. Such occurrences were first noted in the Penilla fault where it crosses the Punta Peña watershed, where there were some small iron-scrapings. This was a hard non-calcareous ironstone, and similar rock-types were later seen in the Punta Peña fault-zone. However, not every fault contained ironstone veining, for the Montealegre fault, when traced inside Sangazo, although extensively seamed with calcite, contained no ironstone. Urgonian limestones occurred on both sides at Carfax, but in both the Penilla ... the Punta Peña faults, the Urgonian had been brought down against the Wealden at the present erosion level. It seems likely, therefore, that the iron salts in the Wealden are concentrated along the lines of weakness, but have scarcely penetrated up into the Urgonian. However, in those faults where the ironstones occur beside the limestone on one side of the fault, exploitation must be more economically feasible, with the carbonate provided. The size alone of the Penilla and Punta Peña faults adequately explains why the largest quantities of ironstone occur in their shear zones.

VII. Cerredo.

The map of Cerredo is not the result of mapping as detailed as that of Punta Peña; it merely stems from the notes made on a few traverses across the area. These were made simply to give an idea of the structure of the region, and therefore the features are not plotted as accurately as those on the Punta Peña map.

The Cerredo area differed from the Punta Peña outcrop in many ways. Most of the limestones seen displayed prominent bedding, and the only true reef limestone seen was the reef forming the western ridge of the huge doline on the north-west corner of the mountain. Adjoining this on the east are bedded limestones, containing abundant nodules of chert, which are not especially common elsewhere. These bedded limestones are apparently continuous with those examined on the southern scarp of the mountain. Here the Urgonian limestones were seen to rest conformably on the Wealden, and the lower members of the succession consist of fine-grained grey limestone containing abundant bivalves, as do the lowest members of the succession near Punta Peña. These are not distinguished on the map, since their boundaries with the other limestones were not plotted. Significantly, several of the main beds were seen to thicken quite considerably towards the north, thus lending support to the suggestion that the dips may be partly depositional.

The area is structurally simpler than Punta Pena. The regional dip is to the north, averaging about 30°. Along the south facing scarp four faults were seen, three of them trending approximately north-south, and having a downthrow to the east. East of the main summit of Cerredo there is at least one similar fault with a larger throw, for the eastern ridges of Cerredo consist of Wealden, and the limestone outcrop is displaced to a position well down on the northern slopes.

Along the coast road to the north, several areas of shaly Urgonian were noticed, similar to those seen near the Sangazo resurgence. Another outcrop of the same lithology was seen near the track north-east of the large doline already mentioned. This facies does not seem to be developed near the base of the Urgonian succession, and the absence of any shales near the summit ridge of Cerredo may be explained by this.

Altogether the Cerredo Urgonian: contains less true reef limestone than Punta Peña, and this may be significant with regard to its position at the time of limestone formation. Possibly it was formed in deeper water beyond the main reef, with only isolated bosses such as that near the doline occurring on shallower parts. Whatever the explanation, the difference between Punta Pena and Cerredo does seem significant.

VIII Candina.

Observations on this mountain, across the Rio de Oriñon to the west of Cerredo, were made only from a distance, except for one traverse made at dusk in increasingly poor light. As on Cerredo, the regional dip was to the north, but the overall structure seemed to be more complex than that of Cerredo, with a higher proportion of reef limestones, especially on the west side. Seen from Cerredo, the north-eastern buttress seemed to be of unbedded reef limestone also.

Whether or not the Brazomar fault is continued westward as an anticline, the Wealden which covers the southern slopes of Cerredo is entirely covered by Urgonian on the hills to the south of Candina. In fact the lack of correlation across the Rio de Oriñon and the Aguera river valley to the south is so great that possibly a major fault follows the valley, concealed by alluvium. The very straight line of the valley, and its north-south alignment, parallel with several faults seen on Cerredo, support this hypothesis. This very brief glance at Candina shows that it differs again from both Punta Peña and Cerredo, showing that the lateral facies changes in the Urgonian are both fascinating and complicated, and may well profoundly influence the occurrence of caves.

IX. Conclusions.

The studies undertaken in this area near Castro Urdiales permit certain conclusions. The palaeogeography inferred from

the stratigraphy is that of a shallow sea environmemt fringing a landmass to the south, with brackish or muddy water during Wealden times, which became clearer during the Upper Cretaceous. Although the landmass may have lain to the south, the only set of ripple marks noted betrayed an east to west transport during Wealden times, suggesting, perhaps, the existence of currents flowing parallel to the coast.

The bivalve bed near the base of the Urgonian succession may be indicative of a period in which the water was too muddy for reef masses to form, although adundant life was still present. The remainder of the Urgonian appears to have been a time of clearer water, allowing reef formation on a huge scale, accompanied by the accumulation of detritus between individual reef masses. Since reef development at the present day is limited both by temperature and the depth of water, and the presence of impurities, these factors can be called upon to explain the present distribution of the masses of reef limestone, and in particular the lack of reef material in the Cerredo area. In view of its position to the north, deeper water, or stronger currents offshore may account for this lack.

Structural studies proved most interesting. The apparent open folds suggested at first sight appear to be more a series of variously tilted fault blocks, the effect being analogous to folding, but achieved by more brittle deformation. With each fault block treated as a different unit, with a constant regional dip, smaller folds were shown to exist when the readings were plotted on a stereogram. The axes of these folds apparently run north-east to south-west. Finally, depositional dips, appearing anomalous on the stereogram, were encountered inside the Sangazo cave system.

The caves occur mostly in reef limestones. It seems that

three conditions have to be satisfied to make the presence of a cave system likely. There has to be a watercourse flowing off impermeable rock, such as the Wealden, on to limestone. The watercourse should do so at an adequate height above the local base level of the surface water, and finally the limestones flowed over should preferably be reef limestones, as it is in these limestone types that the largest and most extensive cave systems are apparently found. Since these factors were found to be so important in Northern Spain, they are of evident interest to any caving party.

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* * *

EXPEDITION TO NORTHERN SPAIN 1968

Guy Cox

We had originally intended to go to Czechoslovakia. However, things were getting bad in Czechoslovakia in August 1968, and the expedition - a joint Oxford-Reading undertaking - split up. Half went to Czechoslovakia, and had to leave hurriedly.. Three of us - Dick Hazelwood, Francis Sanders and myself - went to Spain instead. We had no fixed objective, but we did intend to use the mobility we gained by being a small group and perhaps find some new caving areas.

Our first stop was at Islares, near our old haunts around Castro Urdiales. Across the Ria de Oriñon estuary from the Arenillas-Islares campsite is the village of Oriñon. This is the site of a cave which we had heard of but never investig - ated, the Fuente de Oriñon. The actual Fuente (spring) is on the hillside just outside the village, and a few feet higher up is a cave entrance. This leads into the upper levels of a large chamber, at the bottom of which is the stream. The stream runs through a series of chambers, sumping in between them, but they are also connected at high level, and one does not need to descend to stream level at all in this part of the cave.

The first chamber had been much visited - for various purposes.- and was rather sordid. After this, though, the cave was unspoilt, and it was obvious that most of the visitors had been speleologists. Eventually the high-level route ended abruptly, in a 5m. pitch. We descended, and followed the stream. This very shortly became a deep canal, and it was obvious that we would have to swim. Here the previous cavers had marked the end of their exploration, and a final survey station. Deep water, as so often in Spain, had daunted them. At first it daunted us too, as we were not wearing wet-suits. After a little hesitation, though, we plunged in and after a short

swim found ourselves in a large sandy chamber. This was completely virgin, and we entered it with high hopes. Unfortunately, at the far end of the chamber the stream disappeared in a large sump, and all high-level passages were blocked. Swimming back we discovered a fascinating passage, apparently a wet oxbow. The water in it was at least 2½m. deep; the roof was about 1½m. above water level, and hanging from the roof into the water were hundreds of large stalactites. Swimming among, and ducking under, these closely packed stalactites was a fascinating experience. It was no good clutching at them for support - they broke off, and one found oneself trying to swim in deep water holding 30-40 lbs. of calcite. After about 30m. this eerie passage was blocked by a stalactite barrier which we had no means of breaking, although we could see the passage continuing beyond. The existence of this passage can only plausibly be explained by a rise in water level relatively recently in the cave's history.

After a few days, the weather turned bad at the coast, and we moved inland, to the village of Quisicedo, near the Pantano del Ebro, and also near to the Ojo Guareña, the largest cave system in Spain. We made attempts at various parts of the system: the Ojo Guareña proper, where the stream sinks, which is a network of blocked passages, the Sima Dolencia, a large and spectacular shaft on the plateau above, which leads into the main system, although we did not penetrate very far. We also visited a pothole some 3km. away, which we later found was also part of the system, being near the resurgence. This we nicknamed 'Dead Dog Pot', since there was the corpse of a dog in the entrance passage. When we descended we felt inclined to revise the name - there was a much wider variety of dead animals!

We learnt that in ten days a large Spanish speleological expedition was to visit the Ojo Guareña, so we decided to

return to the area then, and booked in advance at the inn in which we were staying. Our next port of call was the remote hamlet of Cardaño Arriba, at the foot of Espiguete, the highest mountain, apart from the Picos de Europa, in the Cantabrians. We spemt a very enjoyable day climbing Espiguete, but speleologically the area was less fruitful. Near Cardaño Abajo was a large dry cave, which had been visited by many youth-organization parties, and spoiled of any beauty it might once have possessed. Just above this, on the road to Cardaño Arriba, was a resurgence. Our hopes were raised when we found a way through the entrance boulder choke and found ourselves in a large passage containing deep water. After about 20m. though, this ended in a sump.

From Espiguete a chain of mishaps, involving a punctured patrol tank and the illness of one of the party, brought us by chance to the campsite at Barro, near Llanes. So we stumbled on what was to prove a most fruitful area. Our most important discovery in the area was the Cueva de Bolugo. We had time only for one short trip, with very little tackle, down the cave before it was time to leave for Quisicedo again, to meet the Spanish cavers.

We returned to the Ojo Guareña to find the water-meadows below the cave a scene of organized but inefficient activity. A large number of Spanish cavers were there, and apparently even more had failed to turn up. We met some old friends, and made more new ones, but to our disappointment they were adamant that, for political reasons, we could not accompany them down the Ojo Guareña. Instead they recommended a cave at Escalada, in the Ebro gorge. This was apparently a very hard three-day trip, requiring boats, camping gear, etc.

The mayor af Escalada showed us a survey of the cave, which he kept in his office, and explained how to find the

entrance. His instructions were not easy to follow, but we did eventually find the cave. The entrance series consisted of an Agen Allwedd type passage, in which one constantly had to change height. After 20 minutes of this we reached a chamber - and the Spaniards' first campsite! From here the passage was spacious and sandy, with deep muddy lakes at intervals, leading to a final series of boulder chambers (by which time the stream had been lost) followed by a long, blind crawl. The entire trip, in and out, took us 1½ hours. However, if we had had to carry boats, camping and cooking gear and food it would doubtless have taken at least three days!

Near the Ebro gorge we also noted, but did not explore, an influent cave entrance. This, we discovered, was already known to the Spaniards. After three days in Quisicedo we set off to Barro again, for a further attempt at the Cueva de Bolugo. This was not to be, however, for torrential rain flooded the cave. Instead, we looked at the flood resurgence at Calduenin, a small cave of no great interest at Debodes, and various other sinks and resurgences in the neighbourhood. Full descriptions of the major caves in the area are given in the report of the 1969 expedition. Then it was time to return to England. We took a roundabout route to Le Havre, taking in on the way the Gouffre de Padirac - an expensive show cave, but well worth it.

* * *

REPORT OF OUCC EXPEDITION TO SPAIN, 1969.

PERSONNEL

A.G. Brooks
G.C.Cox
J. Davies.
G.J.M.Dare
F.E.T.Sanders
Mrs. C.M.C.Sanders
J.G.Sheppard

THE EXPEDITION

On the evening of August 26th. 1969, 5 people - Francis Sanders, Jim Sheppard, Geoff Dare, Jon Davies and Guy Cox - left Oxford in the Sanders' Land-Rover, with equipment in a trailer bought by the expedition. In spite of sundry minor troubles we arrived in Southampton with time in hand. Here we were joined by Andrew Brooks, and left on the night boat to Le Havre.

We drove down through France, picking up Christiane Sanders, the seventh member of the expedition, in Le Mans. On the 29th. we crossed into Spain at the Col de Somport. From there we drove down the Mediterranean coast to Murcia, then inland to the little village of El Sabinar, near Nerpio, where we met Dr. Michael Walker, senior member of OUCC.

He was leading an entirely separate archaeological expedition to the area, investigating rock-shelters in which (inter alia) cave paintings had been found. In exchange for a contribution to our petrol expenses, we were to join forces with Dr. Walker's expedition for a week, and search for caves containing paintings. In the event, many of Mike's personnel had left by the time we arrived, and he and the remainder left soon after, so we were on our own for most of the time. Unfortunately, the area proved to be totally barren of true caves, though full of rock-shelters (abandoned meanders at high

level in river gorges). We were therefore somewhat disappointed by the 6th. September, when we left El Sabinar for our usual stamping grounds in the Cantabrians.

On the 8th. we set up camp at Barro, near Llanes, and our work in the area is detailed in the following pages. We were concerned with the Sierra de Cuera, a fairly low (up to 1,200m.) range seaward (north) of the much higher Picos de Europa. The two ranges are separated by a valley which descends almost to sea-level. The Sierra de Cuera is formed of Urgonian (Cretaceous) limestones, whereas the Picos consist of Carboniferous limestones, which our past experience had suggested were less rich in caves.

We were not disappointed in our choice of area. We were, however, somewhat disappointed by the weather, which was extremely wet and flooded not only the caves but also our campsite. In spite of this, a lot of worthwhile work was done, and the area will well justify a further visit. We left Barro on Sept.26th., spent one night at Castro Urdiales (scene of two previous OUCC expeditions) and then came back through France to Le Havre. We arrived back in England on Sept. 30th.

CAVES EXPLORED

(Grid references on the 1:50,000 Military map, sheets 31 & 32)

Cueva de Bolugo - - -	5058 9758
La Boriza (Cueva del Agua) -	5065 9755
Cueva de Caldueñin - -	5047 9758
Cortines resurgence - -	5038 9757
Pozo de Fresno - - -	5053 9756
Cueva Sin Nombre de Mere - (Cueva Geoffo)	5005 9737
Kids' Cave - - - -	5050 9757
Cueva de la Llera - - -	5065 9816

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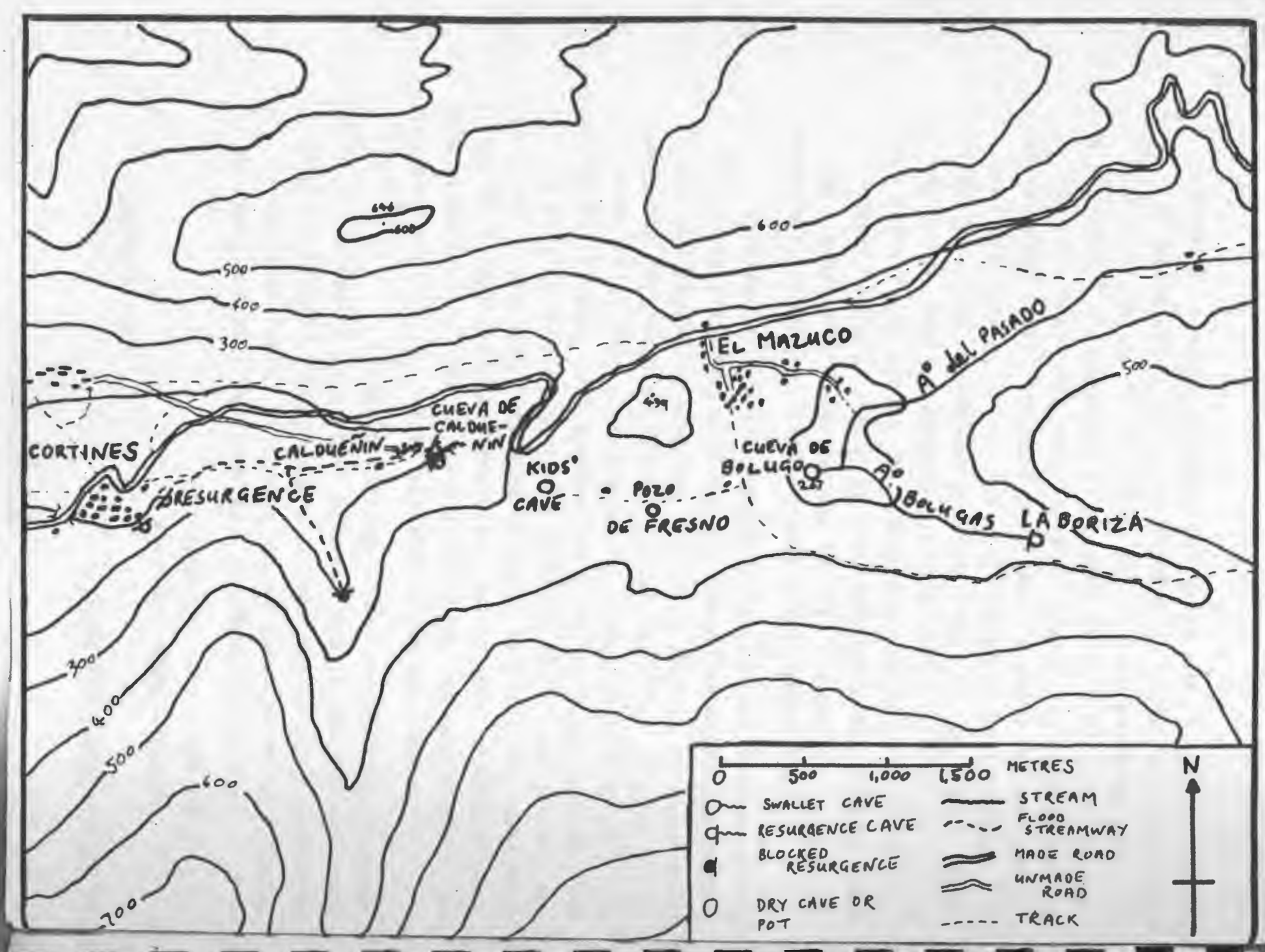

600
500
400
300
EL MAZUCO
A° del PASADO
500
CUEVA DE CALDUE-NIN
CALDUENIN
CORTINES
RESURGENCE
KIDS' CAVE
POZO DE FRESNO
CUEVA DE BOLUGO
A° BOLUGAS
LA BORIZA
300
400
500
600
700
0
500
1,000
1,500
METRES
N
SWALLET CAVE
RESURGENCE CAVE
BLOCKED RESURGENCE
DRY CAVE OR POT
STREAM
FLOOD STREAMWAY
MADE ROAD
UNMADE ROAD
TRACK

LA BORIZA (CUEVA DEL AGUA)

J.G. SHEPPARD

Length - 400m. (approx)
Height - 60m. (v. approx.)

This is a resurgence cave upstream from the Cueva de Bolugo. It is situated at the foot of a large, heavily vegetated cliff at the end of a dry hanging valley. A medium sized stream, one of the two main feeders of Bolugo, flows from the cave; this is the Arroyo Bolugas proper.

The cave was fully explored over a period of a week or so, about 5 separate trips being made in all. All of these were made in more or less flood conditions, as water levels in the area were, according to local information, abnormally high for the time of year. The entrance is about 10 m. high, and a wade of 20m. leads to the first cascade (2m) immediately followed by a second cascade (3m.). An alternative high level route in the roof to above the second cascade is possible, but there is no means of descent back into the stream passage and the rock is extremely slippery. On the roof and walls above the second cascade some rather beautiful moths were observed.

A fine meandering stream passage then leads to a large wet chamber, which can also be reached via a dry oxbow. The water enters from a passage high up in the roof, strikes a step about 5m. down and the sprays out in all directions, so that it is impossible to keep dry anywhere within 4m. of the pitch. Owing to all this water the chamber is extremely noisy, and communication is difficult. A climb up to the left into the roof of the chamber leads into a bedding plane which seems to lead back to the stream passage above the pitch, but the crawl closes down so much that it is impassable. A traverse to the right appeared more likely to go, so we attempted it and after about two hours of pegging and a few hairy moves we reached the top of the pitch and rigged a ladder. If hung

straight down, tha ladder would have given an extremely wet pitch, so we clipped it to the pegs in the traverse and used it as a handline cum footrail.

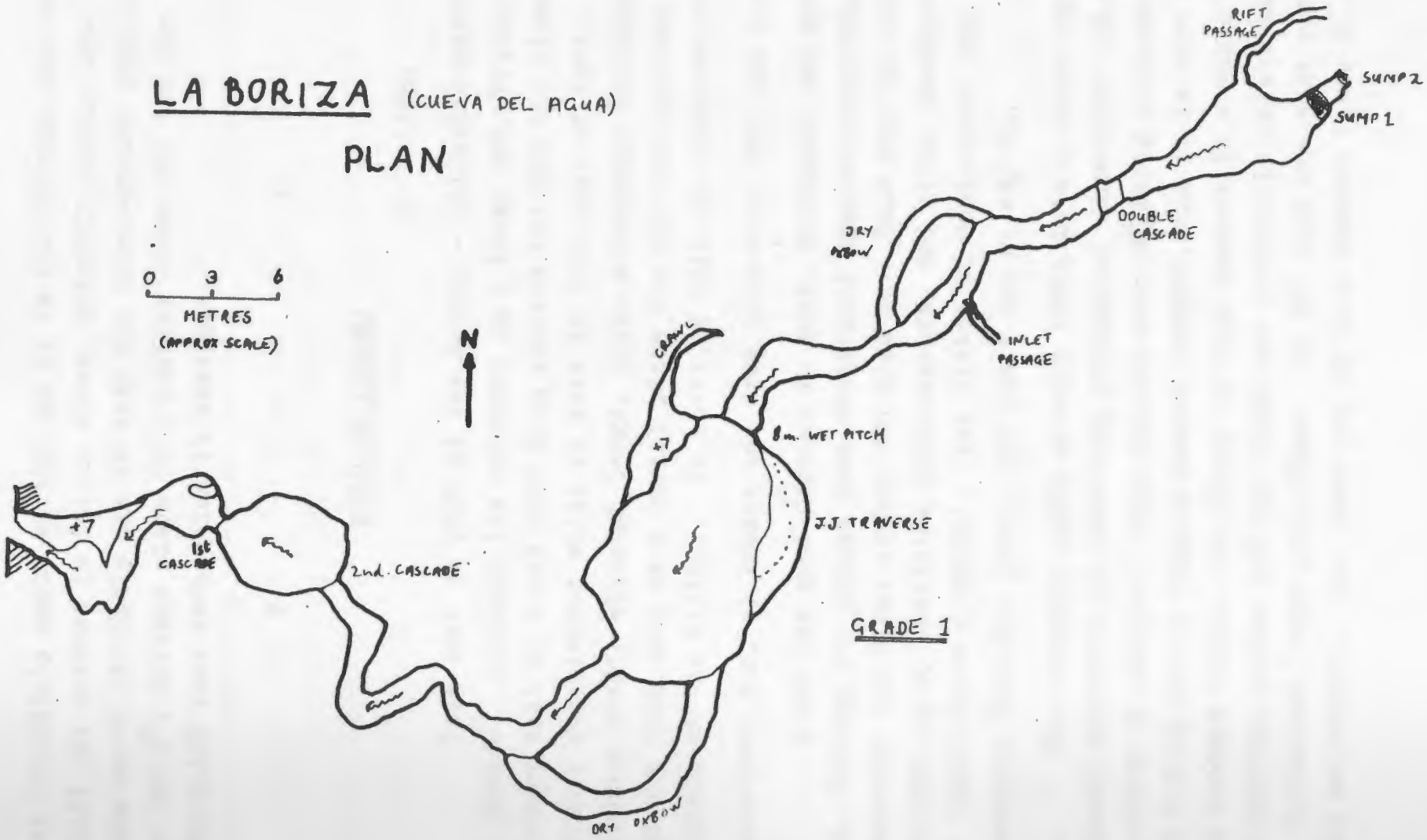
The stream passage above the pitch is smaller than that below, and the water deeper. A twisting passage full of deep holes, some of which require swimming across, leads to a double cascade after about 70m. There several dry passages leading off in the roof, but all of these turned out to be oxbows. A small inlet passage was found to be impenetrable. The stream passage is almost completely devoid of formations, apart from occasional stal flows, and this was found to be the case in the rest of the cave as well. The rock itself, however, is quite interesting, ranging in colour from black to light brown with many quartz veins in it.

The double cascade (7m.), the last part of which is vertical and only just climbable, then leads to the final part of the cave. The passage widens considerably above the cascade, the stream gradually deepens and after about 40m. sumps. We free-dived the sump as it was only about ½m. long, and found ourselves in a large airbell (5m). The second sump was not attempted, as we could not feel an airspace on the other side. The water in the sumps is superbly clear, and it is possible to stand on one side of the first sump and see the feet of the person on the other side. An exceedingly rare occurrence in British caves!

Coming back after diving the sump a wet passage off to the left was noticed. "Aha, a sump bypass!" we thought, but no such luck. The passage goes up and along in the right direction, first over shingly sand and then mud, but finally degenerates into a three-dimensional maze of passages which all close down and are impenetrable. A very strong cold draught blows through all this passage, and at the extreme end the

LA BORIZA (CUEVA DEL AGUA)

PLAN



GRADE 1

air definitely smelt earthy, so it is our opinion that at this point the surface is fairly close, possibly within 10m. or so. This would certainly fit in with our above-ground observations, as the A°. Bolugas sinks in a boulder choke not too far above the cliff face from which it resurges.

* * *

POZO DE FRESNO

J. DAVIES.

This cave is part of the Bolugo - Caldueñin system at El Mazuco. Although its entrance is a large and obvious shaft, I doubt that it would have been entered but for the dismal weather experienced while we were in this part of Spain. The entrance shaft, although large, looks singularly unpromising and has been used as a burial place for all the nastiest dead animals of the village. In spite of this Jim Sheppard and I threw down 20m. of ladder and drew lots as to who was to descend.

I had the good fortune to lose, descended the shaft and, finding the refuse less unpleasant than anticipated, inspected the first of the two ways on. This was the route followed by my unwitting predecessors, and leads immediately to 'Spare Parts Chamber'. The litter of bones made this a strangely desolate place, and there was no way on.

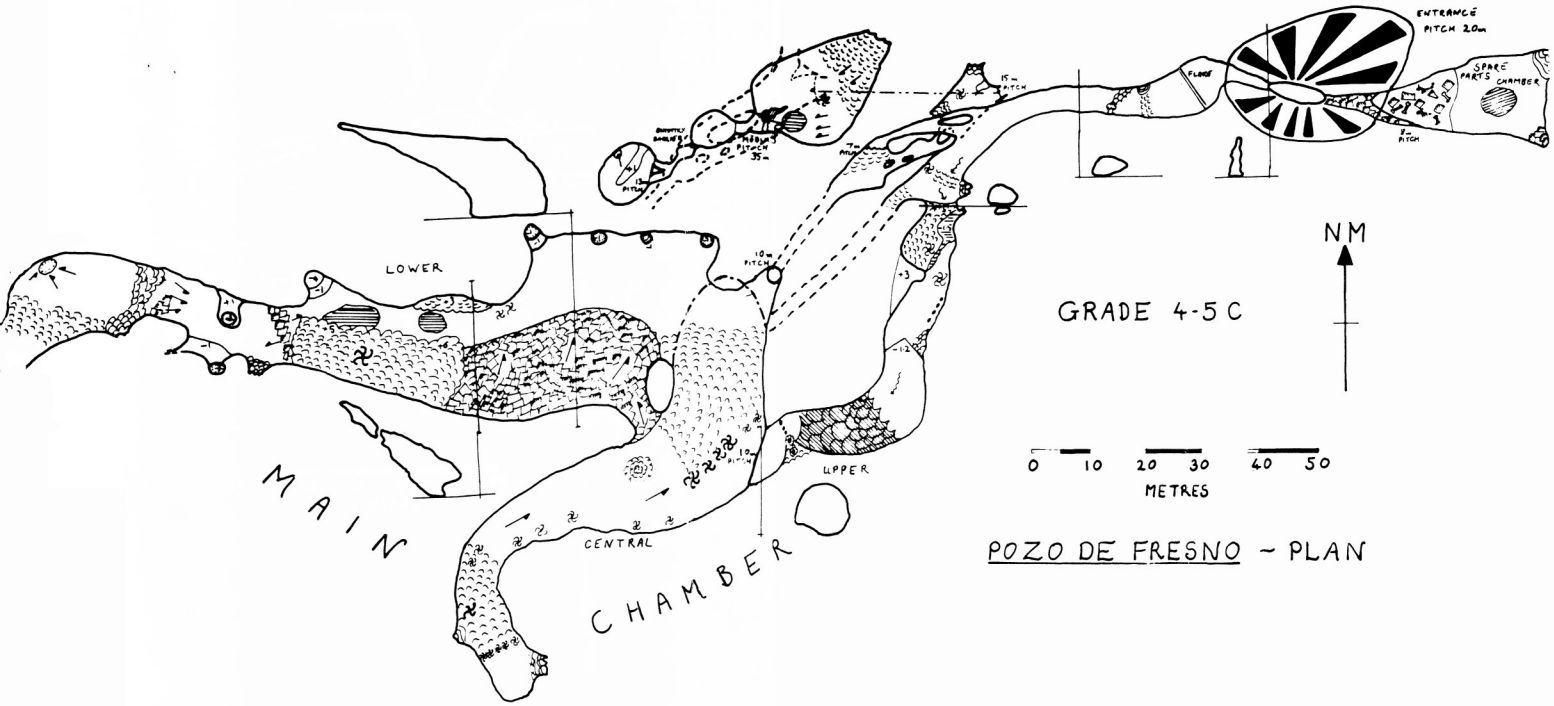
The opposite route quickly leads into a large dry passage decorated by crumbling stalagmite formations and a frosting of calcite. This passage soon collects a minute stream and widens into a bagpipe shaped chamber, and it is here that the wonders begin. The floor of this chamber is a whole series of rimstone pools, and the walls are tastefully embellished by occasional large stal flows. On the roof are some very fine helictites. The lower end of this chamber leads to the

10m. pitch into the main chamber.

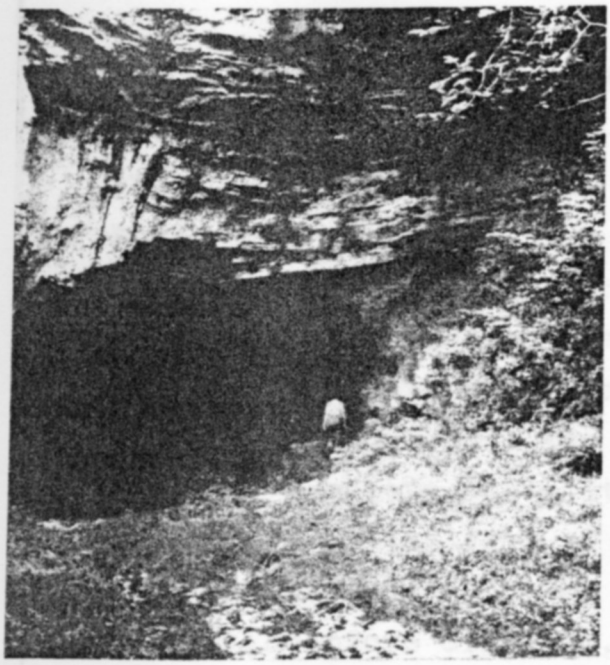
This pitch is curtained off by a colonnade of stalactites, and this shields a truly wonderful vista. Towering up into the vastness of this chamber is a row of immense stalagmites, like a row of distillation columns in an oil refinery, the largest being some 12m. tall. Yet they seem almost to be lost, as the walls and roof remain out of sight. The floor of the chamber consists entirely of calcite, brown and dead in parts, but on the whole clean, white and glistening. As in the chamber above, the walls are only occasionally decorated, and the head of the chamber is curtained off by a stalactite colonnade. Giant stalactites hang from the roof; they can be seen from the top of the pitch but are more or less out of sight from the bottom. A steep stalagmite slope leads to a lower part of the main chamber; on climbing down we found that the water sinks through a mud floor and all possible ways on are blocked.

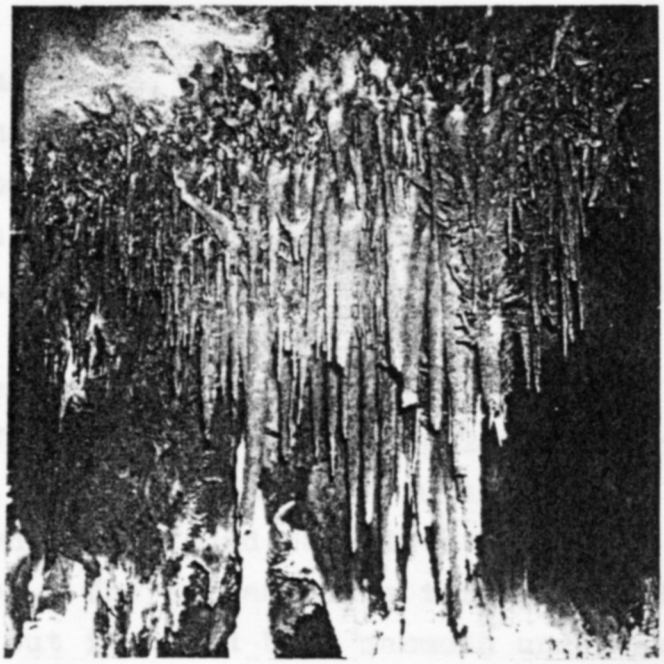
This lower chamber runs almost parallel to the upper main chamber, and is older and more decayed. One has to climb over boulder falls, and old stal flows, until eventually it peters out completely, once again behind a stalactite curtain. This is obviously the oldest part of the cave as it lacks the vitality of the other parts of the system.

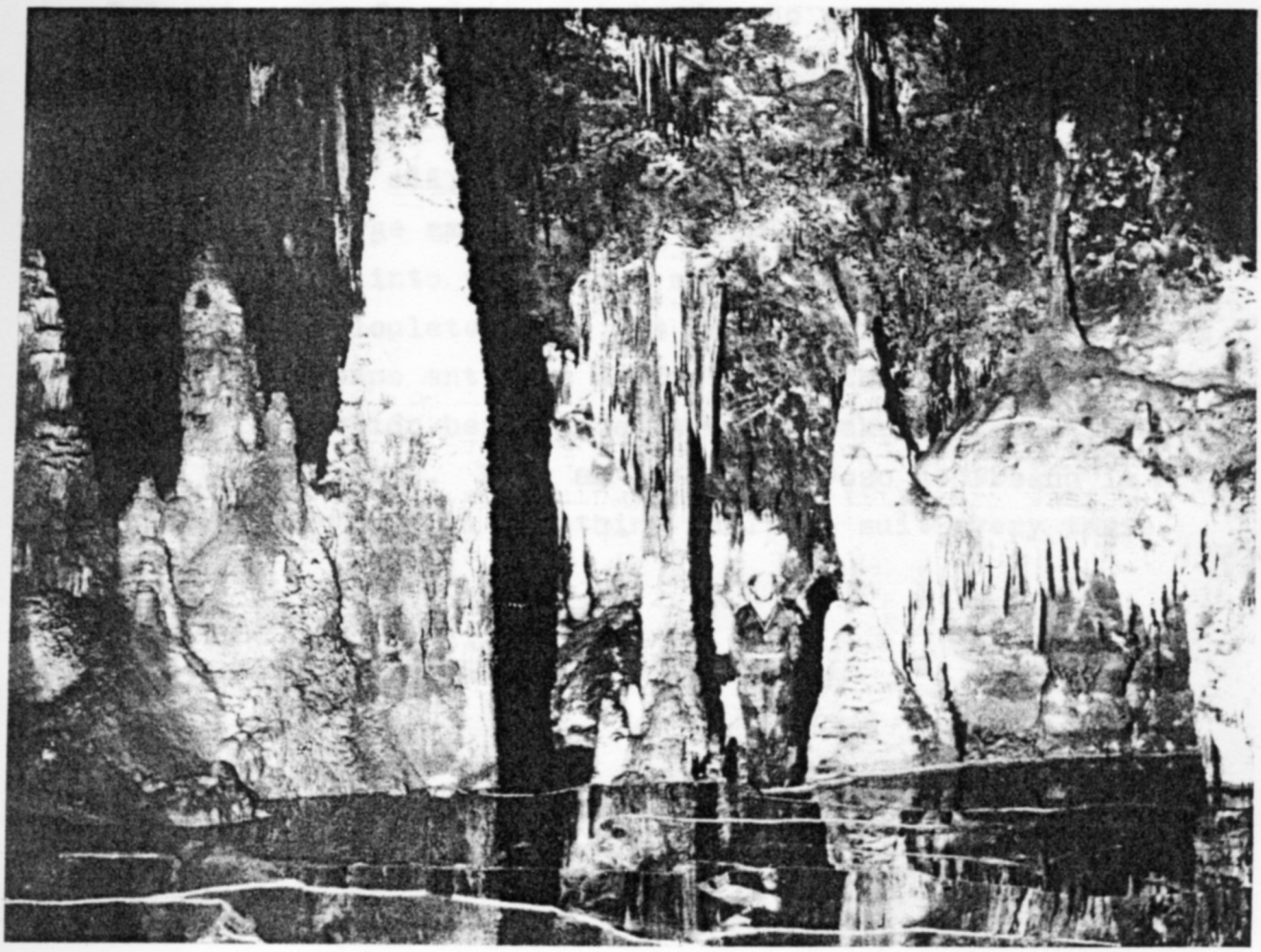
Leading from the entrance series is a second route, which spirals downwards to a final depth of some 140m. A short crawl leads to a 7m. pitch, beyond which the way bifurcates. One route leads to a pitch into the lower main chamber, while the other leads, via a rope pitch, into a small chamber. From this a magnificent 15m. pitch hangs free into the centre of a pear shaped chamber, where a small stream is met. A steep stal slope, which needs a rope, leads to the head of a 35m. pitch.



POZO DE FRESNO - PLAN







Top L. Cueva de Caldueñin. Top R.& Bottom Pozo de Fresno.

This we called Möbius pitch, because of the strange manner in which the ladder hangs. On the lower half of the pitch one climbs with ones back to the wall in a veritable shower bath of water. The exit from this aven was blocked by a stalagmite barrier, which quickly succumbed to the hammer, but within a few metres the passage was again impeded, this time by a boulder, well cemented in with calcite. After a vain attempt to remove it, Jim Sheppard and I wriggled through the small gap left above it. We soon reached a further 12m. pitch, at the foot of which we found ourselves in a small chamber, with no way on. The stream sinks through boulders, which might prove diggable, but it would be a mammoth undertaking. Returning, we found it much harder to get past the boulder in an upward direction, and we therefore named it the Schottky Barrier.

All in all, this route formed a most satisfying trip, and used a large amount of our tackle, but it was a pity that a way through into the Bolugo master system could not be found. We calculate that the master stream runs some 200m. below the Fresno entrance shaft, so in the unlikely event of the connection being made it would make an exceptionally fine through trip. Even as it is, El Pozo de Fresno is a very fine cave, with something in it to suit every taste.

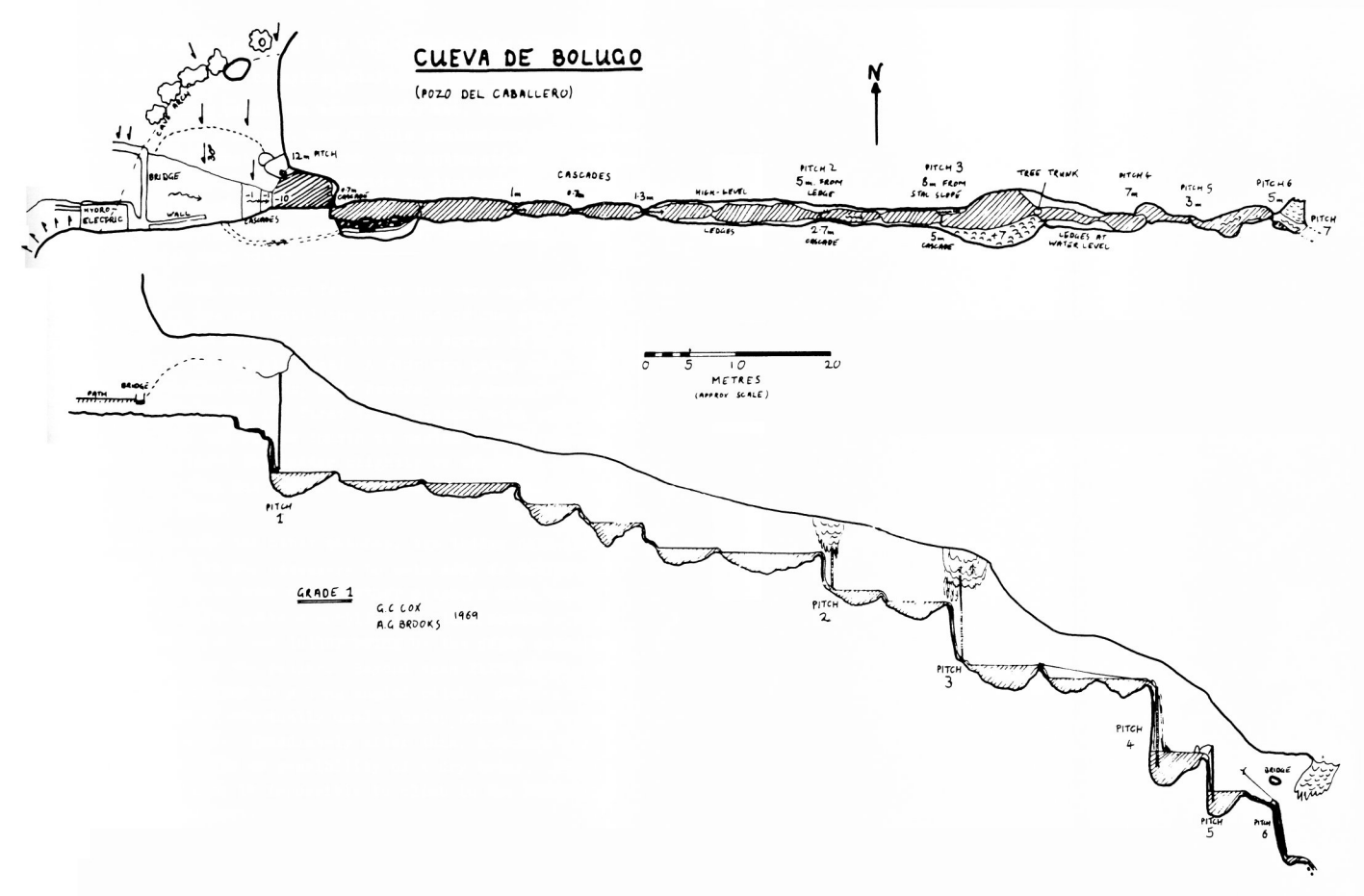
* * *

CUEVA DE BOLUGO

G.J.M.DARE

This cave, familiarly known to the expedition as the Pozo del Caballero, lies in an ideal site for a cave, at the very bottom of a deep blocked valley, providing the only outlet for a very considerable stream which flows into it from the Sierra de Cuera to the west. This stream proved to be an insurmountable obstacle to a thorough exploration of the cave, for the persistently inclement weather swelled it to a size which would have made the re-ascent hazardous if not impossible. Part of the stream is used to run a primitive hydro-electric installation in the cave entrance, supplying El Mazuco with lighting.

The location of the cave, below El Mazuco, was already known, for it had been discovered by the 1968 expedition, which had not had time to explore it fully. Consequently it was one of our first objectives. A preliminary reconnaissance made it plain that only a limited trip down would be possible; however, Jim Sheppard and myself, followed by Jon Davies, went as far as the top of the fourth pitch. The entrance pitch is some 15 metres, from beneath the natural arch of the cave down into a deep pool, clearly visible from the surface. It is then necessary to swim across to a narrow submerged ledge in order to untie the lifeline; the passage then consists of a series of small cascades alternating with deep pools which must be swum through. The second and third pitches were little more than steep water chutes, made impassable by the force of the stream. By climbing up to the left suitable rock formations were found on each pitch for hanging a ladder, so that the ladder hung away from the water. This made both take-offs slightly tricky, however. The passage between the third and fourth pitches was notable for a large


CUEVA DE BOLUGO
(POZO DEL CABALLERO)
N
ROAD
BRIDGE
WALL
HYDRO-ELECTRIC
CASCADES
12m PITCH
CASCADE
CASCADES
1m
CASCADES
1·3m
HIGH-LEVEL LEDGES
PITCH 2
5m FROM LEDGE
2·7m CASCADE
PITCH 3
8m FROM STAL SLOPE
5m CASCADE
TREE TRUNK
LEDGES AT WATER LEVEL
PITCH 4
7m
PITCH 5
3m
PITCH 6
5m
PITCH 7
0 5 10 20
METRES
(APPROX SCALE)
PATH
BRIDGE
PITCH 1
PITCH 2
PITCH 3
PITCH 4
PITCH 5
PITCH 6
BRIDGE
GRADE 1
G.C COX
A.G BROOKS 1969

tree-stump tightly lodged at the top of a cascade - we later made use of this as a belaying point.

The fourth pitch was exceedingly wet, being a sheer waterfall of some 7 metres, and on this preliminary exploration we decided not to continue further. We optimistically believed that the stream would quickly subside to its normal summer level, a mere trickle; we therefore left the ladders for the second and third pitches on their belays, hung up away from the stream, and came out.

Torrential rain then fell, and the cave was soon in full flood. It was not until the very end of our stay in Spain that we were able to enter the cave again: if nothing else, we wanted our tackle back! A four man party made the descent, comprising Guy Cox, Andy Brooks, Jim Sheppard and myself. We negotiated the first three pitches with comparative ease, and at the top of the fourth we rested to take stock. Jim Sheppard belayed the ladder slightly to the right of the pitch and, with Guy Cox acting as lifeliner, made the descent, Andy and I followed.

As with all the other pitches, the ladder fell into a deep pool, and it was necessary to swim away to the next lip. Immediately we came upon another pitch, a mere three metres deep but with quite a complicated climb around a rock pillar, the belay for the ladder being on the right hand side, on the near side of the pillar. Beyond this fifth pitch was a short passage ending in a long angled pitch. After a long fruitless search we eventually used a belay point high up on the right hand side. Immediately after this, however, was a seventh pitch, with no possibility of a dry belay. The volume of water made it impossible to climb in the waterfall, so here we had to halt.

In drier weather it should be possible to penetrate much further. The cave, as far as we have penetrated, runs more or less due east - directly away from its resurgence. At some point, therefore, it must reverse its direction. The flood resurgence at Calduenin, 90m. below, terminates upstream and down in a sump. The stream-passage from here to the Vauclusian rising at Cortines has a gentle slope - 50m in in 1 km.- and is probably mostly flooded. It seems likely, therefore that the cave will to descend steeply eastward, following the dip of the rock, until something approaching the -60m. mark is reached, and then turn westward, having a more or less level passage, possibly frequently sumping.

* * *

OTHER CAVES IN THE A°. BOLUGAS SYSTEM

Cueva de Calduenin.

Near the village of Calduenin is a large cave entrance in a cliff, at the head of a dry valley. Water only flows from the cave entrance in exceptionally wet weather, but the main stream of the Arroyo Bolugas is met just inside, in a large chamber. The stream sumps both upstream and down, at least during the weather conditions prevailing while the expedition was there.

At the top of the cliff is a small cave containing some long-dead stalactites, obviously a long abandoned resurgence.

Cortines.

The stream resurges in a most impressive Vauslusian rising just above the village of Cortines. The roof can be felt to rise just inside, and it is possible that it might be feasible to enter in very dry weather.

Downstream is a small resurgence cave, bringing a tributary into the river. After about 20m. the cave becomes too tight for further progress, and it is almost certainly unconnected with the main system.

Kids' Cave.

This cave was shown to us by the village children (with one torch between them). It is at the western end of the saddle between El Mazuco and Caldueñin, and consists of a descending bedding plane. At first it is spacious and well decorated, but eventually it closes down and is blocked by boulders. It might repay digging.

* * *

CAVES IN OTHER AREAS

Cueva de la Llera

Near Barro a limestone knoll stands out from the coastal plain. A stream sinks on one side of this, at Quintana, and resurges on the other. The stream actually sinks in a series of blocked sinks, but there is a penetrable cave entrance nearby. This we did not investigate, since Jim Sheppard cut his foot while crossing the stream (which was very polluted), and it was considered more advisable return so that the wound could be cleaned and dressed.

The resurgence, the Cueva de la Llera proper, is a fine cave entrance, which has been dammed to provide head for a water mill. About 30m. in the stream sumps, doubtless the effect of the dam.

Cueva sin Nombre (Mere)

This was a save by the side of the road near Mere, which a local inhabitant informed us had no name (sin nombre).

He told us that it had been explored the previous year by some English cavers; on our return to England we found that these were the Nottingham University expedition, who had given it the name of Cueva Geoffo. We were unable to penetrate into the master system, since the water level was so high as to turn their 'Duck One' into a sump.

La Borbolla

Near the village of La Borbolla is the source of the Rio de las Cabras, a very large and impressive resurgence cave. Some 20m. up the cliff above it is another entrance, in which the stream can be seen again. The underground course of the stream can be followed by a series of shake-holes and collapses, and some kilometres away a pothole gives access to the stream again. At the time of our visit, the system was in an extreme state of flood, and it was not possible to make any progress in any of these caves. It seems possible that most of the underground streamway is collapsed, but a further visit in dry weather is definitely called for.

Sierra de Cuera

The top of the Sierra de Cuera is a relatively level area of very rough karst, dotted with shakeholes which take all the drainage of the area. Several potholes appear to go to some depth, and to be worthy of exploration. The great problem, though, is the transport of tackle. There are very few paths up, and these are very steep. The karst on the top is very difficult going. The only feasible method (short of using a helicopter) would be to use mule transport. The organizational problems would be considerable, since food and camping equipment for a stay of several days would be needed.

* * *

THE DEVIL'S BREAKFAST

R.J.COOPER

"Where are you heading for?"
"Oh, up there somewhere." Indicating a wide sweep of the mountains on the right.
"Well, good luck mon vieux. Give my regards to the devil if you run into him."

The young man caught the rucksack and stood watching the truck plough up over the col and disappear towards Spain in the bright morning light. He started the long scramble up over the springy turf and rocks.

He was panting when he sat down and looked into the shadow of the huge circular depression on the edge of the flat mountain crest, out of sight of the road and away from the tinkling animal bells. There was a patch of snow in the bottom with a dark hole to one side.

"La Marmite du Diable" the old shepherd had called it, two months before.
"Has anyone been down it?"
"Mais qu'est-ce que tu veux? Of course not. Only the ravens and a few sheep perhaps. That is a bad place, it smells of death, monsieur." The superstitious old man was too serious for Jean-Pierre to laugh.

Jean-Pierre was a loner. He belonged to a club, but used it mostly for equipment. The others said he was crazy and called him "Le petit Casteret", but they were often impressed by his new finds.

He scrambled down to the edge of the hole. It was about ten metres wide. He threw in a small stone and listened for it to strike. He heard it bounce once and then was startled by a raven which flew up past his face and wheeled into the sky.

He shivered suddenly as a strangely nauseous smell seemed to rise from the pothole.

He soon dismissed the impression and prepared to go down. "Gouffre Jean-Pierre, la marmite du diable, gouffre Jean-Pierre...." he hummed to the tune of Frere Jacques, as he put on the musty boilersuit and checked his old miner's lamp. It took three lengths of wire ladder before he was satisfied that it was touching a solid rock ledge or floor.

"Not bad, thirty metres the first pitch, but hardly a bottomless pit," and he thought of the old shepherd and laughed, the sound echoing loudly. He hid the rucksack behind a boulder.

"Fait être toujours méfiant, quoi?" He clipped two more coils of ladder and belays to his waist and gave the ladder a tug to check the piton. It seemed all right, although it had not sounded very good when he had hammered it in.

He clambered down carefully into the dankness of the pothole, blinking to get used to the dim light. Another raven rushed up past him with a warning cry and again he caught the miasma of rottenness in his nostrils.

He shrugged it off and carried on. He passed the first join in the ladder and immediately found himself hanging free for the first time. The pothole had opened out like the neck of a bottle and he could now move faster. He soon found himself on a wide ledge. He rested for a moment and then clipped the other two ladders to the rest. He hesitated before continuing. It would be a very hard climb back up, but after all he would be able to rest halfway and he had once climbed a fifty-metre pitch solo before.

The smell was now unmistakable. Jean-Pierre began

to feel sick as he hurried down the last few metres of the ladder. He looked down.

In the yellow light of his lamp he could see an enormous heap of bones, sloping steeply away into the darkness below. On top were the bodies of two more recent victims, one loathsome and liquidly oozing while the other was a swollen woolen bag, moving gently as the maggots seethed inside it.

Jean-Pierre clung to the ladder with his arms beginning to ache. The rungs felt slippery in his hands. He could not see the far side of the cavern and the light from the entrance was blocked by the ledge above him. He peered into the blackness beneath him again. He was transfixed by two luminous red eyes. Which moved. The stench was overpowering.

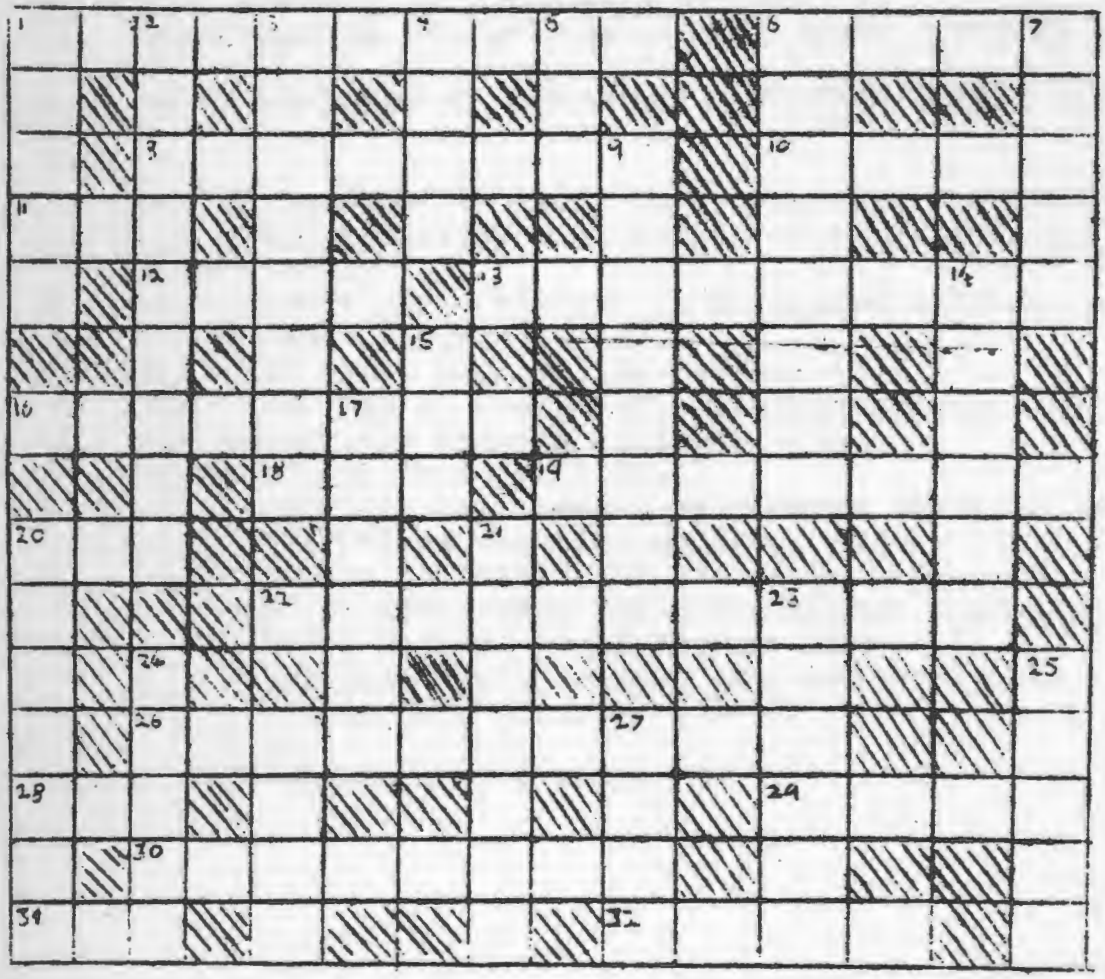
Jean-Pierre gave a cry. The reverberations sounded like mocking laughter. He started scrabbling up the ladder. It swung violently. And came furling down after him as he fell.

The shepherd paused as he skirted round the punch-bowl. He crossed himself, watching the two ravens circling in the sunlight. He remembered the young man from Toulouse and wondered when he would be coming for the fortnight's holiday he had mentioned.

* * *

CAVING CROSSWORD

Set by JOHN FORDER



ACROSS

1. Oar peddler turns out on caving trip. (4,6)
6. Caver's favourite pot? (4)
8. Lamp like hardware sale we hear. (4,4)
12. Last note, poorly, may be wide open. (4)
11. Opener which, followed by empty space, may give passage in Agen Allwed. (3)
10. I replace letter in makeshift vessel, making narrow passage. (4)
13. A cad's case for waterfalls. (8)
16. Monarch who provides refreshment after Swildon's trip? (5,5)
18. Point at preparation before going underground. (3)
19. Sounds like they provide punishing illumination. (7)
20,29. Well-dressed man's clothes after immersion prevents exposure. (3,4)
22. Punctuation changes Danes in Lancaster Hole. (10)
26. Guts needed for route in Marble Steps. (10)

28. It reverses north as object of 24 down's exertions, perhaps. (3)
29. See 20 ac.
30. Tiny particle in place of 1 across. (8)
31. Organ used in conjunction with 20 down, found in bear pit. (3)
32, & 25dn. We stare at transformation under Mendip. (4,5)

DOWN

1. Hundred in rebuilt county town describes floor of chamber. (5)
2. Girl without direction on Belgian town is deep hole or high hill. (9)
3. File Eastern river mixture to safeguard climber. (8)
4. Fowl hazard of caving. (4)
5. Height of creep sounds like letter. (3)
6. Change the rap in charge of submerged passage. (8)
7. They sound like hanging squeezes. (5)
9. Lonely boy on Leck Fell? (4,4)
14. Chelsea Speleo. Soc. tangle with Devon river too much. (6)
15. Soft, it provides work for 24 down. (3)
17. So Dave turns to describe a stream passage. (6)
20. Card game on the French for subterranean communication. (7)
21. Conspirators without pound become trogs. (7)
23. Sleeps colloquially in caving hut, perhaps? (6)
24. Lesser underground worker? (5)
25. See 32 ac.
27. A grave number near Priddy. (4)

SOLUTION

ACROSS

1. Rope ladder.
6. Pint.
8. Nite cell.
10. Rift.
11. Key.
12. Gill.
13. Cascades.
16. Queen Vic.
18. Eat.
19. Torches.
20. Wet.
22. Colonnades.
26. Interstines.
28. Tin.
29. Suit.
30. Electron.
31. Ear.
32. East.

DOWN

1. Rocky.
2. Penygbent.
3. Lifeline.
4. Duck.
5. Ell.
6. Phreatic.
7. Tites.
9. Lost John.
14. Excess.
15. Pit.
17. Vadose.
20. Whistle.
21. Potters.
23. Doses.
24. Miner.
25. Water.
27. Nine.