SPELEO-GRAFFITI

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newsletter of NUCC

SPELEOGRAFFITI.

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CONTENTS.

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CREDITS.

Typing, printing and collating - MB, JB, JF, KP.
Cover Design - Ken Palmer.
Pessimistic Assistance - Ken Palmer.
Tea Lady,??!! - Ken Palmer.
We would also like to thank those nasty old cows out at Wee Jasper, which drove Ken home TWO DAYS earlier than expected, so that he could help bring out this issue.

TRIP REPORTS.

YARRANGOBILLY - Trip Leader .... Maurice. (16-20 May 1970)

The last trip to Yarrangobilly was one of the most rewarding trips for some time.

Over the time we were there the party (J.B., K.P., J.F., D.H., D.S., P.S., J.C., G.V., Bruce, N.C., P.C. and Amanda carried out a great deal of exploration and on the whole, speleological work, which included,

1. The mapping of Y58; a grade 6-7 mapis being drawn up and will soon be published.

2. Y21 was explored; all 30 - 40 ft. of it and a dig was carried out which extended another 100' of difficult fissure to this cave; anyone pottering around the cave entrance in the future should take note that there is now an approx. 90' pitch straight from the surface.

3. A very successful photographic trip was made through tourist caves.

4. A new route or link was discovered connecting the South Glory with the King's Chamber in North Glory, a link which will save the park a great deal of trouble with wiring North Glory for tourists because it emerges within 20' of the junction box. A cable was laid through the link for the convenience of the park.

5. Y19 was explored and some very interesting bones, including a skull were found; we believe them to be from a Giant Wombat; Ken McKree was with us and was very interested and later it was discussed with Greg Middleton, who was going to examine them later in the week; nothing further has been heard about them!

6. Extensive exploration on the surface of the tablelands was carried out and of the many grotty holes found, none proved much, but many bones were found within them.

7. Other caves entered included Y1, 2, 3, Y5, Y12 and Y13; of interest in Y13 a large possum made his appearance and scared the living daylights out of us; this same possum has been mentioned in a trip report made several years back, possibly an interesting fellow?

Many dig sites have been proposed and we hope to be back soon, hoping only that the next time the temperature will reach 40^{o} once or twice and that it doesn't snow for several days.

P.S. Friends were made with a new Ranger, Bill at Yarrangobilly -- a very happy bloke who did much to make our trip successful.

JENOLAN -- Trip Leader .... Maurice.

We were lucky enough to finally obtain permission to cave at Jenolan from Tuesday 30th June to Sunday 5th July; more than we had hoped for in the many letters written beforehand.

We all arrived up there on Wednesday (K.P., J.B., D.H., D.G., P.T., P.S., C.W., and J.F.) and spent the day looking around the area and finding the entrances to Mammoth J13, J41, and many of the minor fissures and holes which do nothing, but have numbers.

Instructions for finding J41 were "It's on the left side of the valley" so we were not optimistic about finding it, however a thorough search turned it up.

The next day we entered Mammoth and after a quick look in the upper system, moved off down into the maize of stream passages which criss-cross the whole system; this is indeed an extremely interesting cave; you enter it by a 60' ladder pitch which is in the middle of an extremely large cavern, from here you move down through the rockfall for several hundred feet and into a large Train Tunnel-like cavern which extends for some distance. The walls and roof show extremely good stream meanders and many points of geological interest were noted. From here you pass down a series of stream passages until you reach the Soup Kitchen; a small junction of two creeks; tucker was eaten here, then we moved off in the direction of the infinite crawl. After a wrong turning and a retrace of steps we soon found it and went the 6 - 700 odd feet on our stomachs to the sand sump which we proceeded to dig in shifts as the space is a bare 9" or less high and between 2 and 3' wide at maximum, and sloping downward very steeply we moved slowly forward another 40 - 50' where the passage is approx. 7" high and bends upwards. Rumour has it someone went 60' past this place?????

After digging under difficult conditions and having Pat get stuck, but extract himself, we soon began to realise the confined space we were in and after a worried shout from Ken, realised that matches wouldn't even flicker when lit; needless to say a hasty retreat followed.

I myself do not believe this sight has much potential for further digging largely because the large, very water-worn pebbles and cobbles etc. in the stream passage are extremely well rounded and indicate a long fluvial hitory, more indicative of a surface stream, an idea enhanced by examining several meander features and scallop marks; also that the stream passage is sloping up and down to such a degree that a very active and fast flow of water would be needed to carry rocks and debris of such a size as found, up and through this passage. The only drawback at present, noticeable to myself is the lack of organic matter in the passage.

Baring this I would conclude that the sand sump, and its adjacent stream passages are only part of the stream flowing so close on the surface.

Very little formation was found in the cave but it is indeed one of the most interesting caves I have been in.

The many fossil levels could well correlate with a glacial level change in sea level and I'm sure some interesting results could be obtained along this line of thought. It is a pity that very little information is published by speleological workers on their investigations and results about the work they do; if they would only do this, perhaps other speleos could help out with ideas that others have overlooked.

The well worn stream sides show a typical Jenolan limestone, fossil canal assemblage, of Silurian age, that is Favosites, Heliolits etc. and also many typical brachiopods.

Another feature indicative of a surface origin for the stream is the wide variety of rocks water worn. They included not only limestone, but cherty mudstones and a wide variety of volcanic rocks, also other sedimentary types.

Leave was made quickly back to the soup kitchen and from there to the surface as fast as possible, the final 60' ladder pitch proving to be the main obstacle except for the piece of wire, I assume telephone, which has been placed without thought throughout this cave, together with the reels it was on originally.

We emerged tired and weary after some 12 hours underground in this fascinating cave. Well worth visiting on any trip to Jenolan.

The next day was spent resting and looking at various dig potentials without success and a stroll resulted with many totally unposed pictures being taken in the valley. Phil, Pat, Dogs, Dave and Clynt left for Canberra; Phil for results, Pat and Clynt and Dave for a rest and Dogs to visit his long lost relatives at Bathurst.

That night Noel, Mike, Phil, Michelle and Noeline turned up with our results; joyous sounds were heard and beds were set, Noel spending the night in a well put up tent???? willing to sleep anywhere after the trip up. During his sleep he was heard to chuckle "V.W.'s were invented by Hitler as a sign of goodwill for the Jews".

The next day we got off quickly and went into J41 and after searching for some time in the dry upper section, access was finally made to the lower section; until using this access route, I couldn't believe that I could bend my head backwards and touch the back of my knees with my nose.

At this stage the party split into two; one group left and went to look through caves further back while the other went on through the small passage and onto the 1st pitch and thence into the Chocolate Box. While Noel knotted his way up a very greasy rope about 20', Phil displayed his ability in clay modelling by sculpturing "Ickabod Mud"; I don't know who modelled for him but only Michelle and Noeline were with him.

After getting up with Noel we moved on in a series of climbs and pitches past some of the prettiest and most interesting formation I have seen.

This cave has on the whole, two major levels and is largely of a fissure nature with layered mud deposits quite extensively placed throughout.

Many deposits indicative of a filling in of the cave and a later excavation. On the whole it is without a stream passage and access is along a large fissure opening at various places into small to medium sized chambers extensively ornamented with crystals and formation, snow white in colour.

The crystals within this are some of the best examples I have seen to date. It would appear that ideal atmospheric conditions exist here for crystal growth.

The exact description, observations and interpretations will be detailed in a following article, however, it remains to be said that calcite, is regarded as the most diversified of all known minerals; it has been described in more than 300 different forms, and after seeing J41 I can believe it.

After a slow, awkward and tiring return out, after not reaching the very end, we surfaced again after 11 hours underground and wandered back to camp where we were met by the rest of the party and had a sing song etc.!??! around the fire.

The following day we all headed for home and were lucky to make it!

FIELD DAY -- RED ROCKS - 18TH JULY, 1970

PRESENT:

Greg Anderson
Frank Bergersen
Bruce Calvan
Michelle Chamberlin
Niel McCallister
Noeleen Smith
Dave Hughes
Susie with the long scarf
Dave Shaw
Mike & Yvonne
J.B., M.B., J.C., N.C.,
J.F., P.S., & M.W.

The above party congregated at the Brush's mansion early Saturday morning and after surveying the weather decided conditions were unsuitable for a trip to Mount Corree so our destination was changed to Red Rocks.

Upon reaching the rocks it was found they were festooned with a myriad of ropes, chocks, pitons, etc., erected in honour of the Cave Rescue Group and while awaiting the arrival of the trip leader (lost somewhere in the Western Creek subdivision) the party was treated to a display of free-hand climbing by M.G.W. & Co.

The remainder of the day was devoted to instruction in caving techniques. Prominent in this field was J.B. and all members should now be competent at tying the figure of ten double reef and slip knots.

In need of nourishment the party returned to Kambah Pool for a barbecue tea then left for home.

N. CALL

CHEITMORE - 6TH JUNE, 1970

The Mob - Michelle, Noeleen, Phil, Bruce, John, Dave, Noel, Paulette & Amanda, John & dave.

Of the 22 caves at Cheitmore listed in the A.S.F. handbook most (? all) were visited in a few hours. Nothing of interest was discovered.

N. CALL

BUCHAN. EASTER 1970.

Present. John Brush (L), John Furlonger, Ken Palmer, Phil Shepherd, Dave Gibson and Barry Thomas.

We all left Canberra at about 5am, and arrived in Buchan after taking some 5hr 20min for the 300 mile trip.

After setting up camp at Murrindal (overun by a large group from SUSS) we headed for the pothole area, where we threw some ladder down Ian's Hat Cave (M54), However the hole swallowed all our ladder (190')and was still not touching the bottom, (we were later told that we were about 40' from the bottom)and were wondering what to do next when some rocks fell from above, and which unfortunately struck JF, however he was only momentarily stunned, and was able to climb out of the cave unassisted.

We then headed for East Buchan, where we some VSA guys and decided to do Mable Cave with them. Much to our amazement the sump was open, and in one of the inner chambers our 2nd. mishap of the trip occured, when a handhold gave way as I was climbing one of the walls, I only fell about 6', but it was enough to put me out of action for the rest of the trip with a sprained ankle.

Due to a certain lack of enthusiasm(no doubt encouraged by the constant rain) we did not get under way till after lunch. The rest of the party then did Dalley's Sinkholes.

It was still raining the next morning when it was decided to do Trog Dip, however, due to lack of enthusiasm again, they returned without even getting anywhere near the entrance. A tourist type photographic trip was conducted in Lilly Pilly.

After a good nite's rest we left for home via Gelantipy and Suggan Buggan.

J. Brush.

COMING TRIPS

TUGLOW. 8th August - Leader N. Call

YARRANGOBILLY 22 - 23rd August - Leader M. Webb.

SNOW TRIP - 29th August - A frolic in the snow, toboggan races, etc. Leader N. Call

vYYYYvvvvvYYYYv

Letters to the Editor.

Dear Sir,

Cxvc cfhb mfvkdcvb tgd gfmf dv3
gfftud f vvjflsx,we occv,x fh m ngxz .

Anon.

Dear Sir,

I wish, through the pages of your publication, to draw attention to the unaussie-istic plot which is at present afoot, and which seems intent on undermining the integrity and high esteem of 'SPELEOGRAFFITI!

I refer of course to the wxg (Continental) sevens which have appeared on no less than two separate occassions on the covers of this newsletter so far this year.

To allow such an absurd practice to continue is nothing more than sheer pseudo-continentalism, which I believe is a disease worse than genuine continalism itself in a country such as ours.

I trust that you will rectify this situation, and ensure that never again will such disgusting material appear on the cover of our worthy publication.

I know that I have at least 75% of the committee behind me, and if this practice does not cease immediately, I will have no alternative but to take further action.

Antipseudocontinental.

Report from the past, compiled by K.Palmer.

-The continuing saga of A.J.Shearsby's Wee Jasper trip.

Through another winding tunnel and we enter more caves, one of which has its roof crowded with stalactites and packed as close as possible without touching each other. The fine white colour and delicate shapes of these dazzle the eyes when the magnesium light is thrown on. The place is like a fairy land and we feel loth to leave , but time flies and we have a lot to see before we can return to the sunlight again. In caves where the roof is studded withstalactites like thes, (sic) care must be taken that no guns are fired off; as the shock is liable to loosen many of the heavy stalactites and cause serious accidents. It is not often that the stalactites and stalagmites are met with joined together in an unbroken column, but several examples, some of them very beautiful ar (sic) to be found here in these caves.

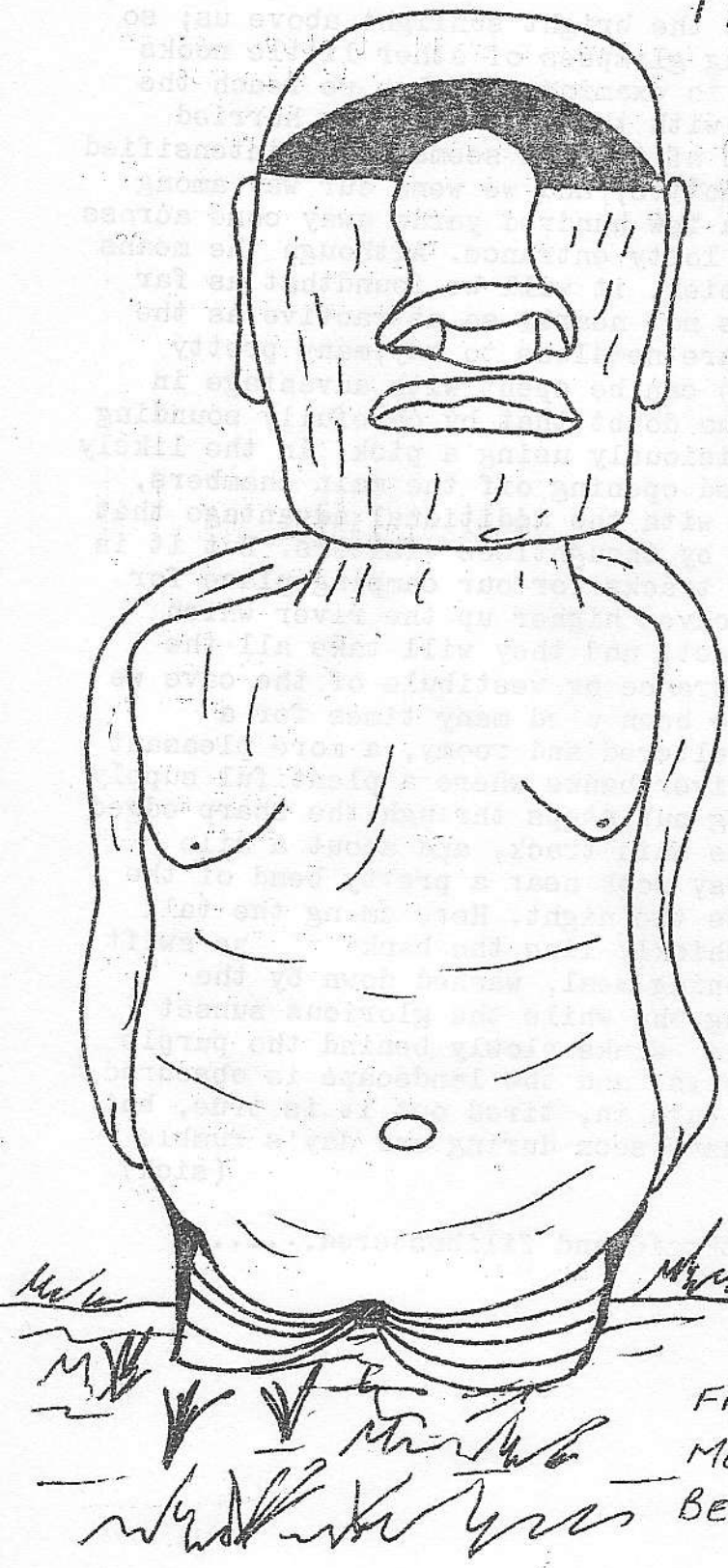
Another passage leads us into a chamber which contains little grottos with their delicate snow-white stalactites Hanging down like the bars of a cage, through which we notice that the walls and floors are adorned withcrystals.Some of these grottos remind one of similar formation in the Jenolan Caves, but alas! how they have been defaced by thoughtless visitors, who will persist in breaking and carrying away the most effective pieces, only to throw them on one side, when they see how commonplace they look when exposed to the light of day. There seems to be no end of tunnels penetrating this limestone mass, and many of them are worn smooth and polished by the traffic of myriads of animals which have been in the habit of passing in and out for thousands of years. Here and there we find heaps of bones of extinct marsupials. These bones when cemented into a hard mass with earth and carbonate of lime, form what is known as "Bone breccia."

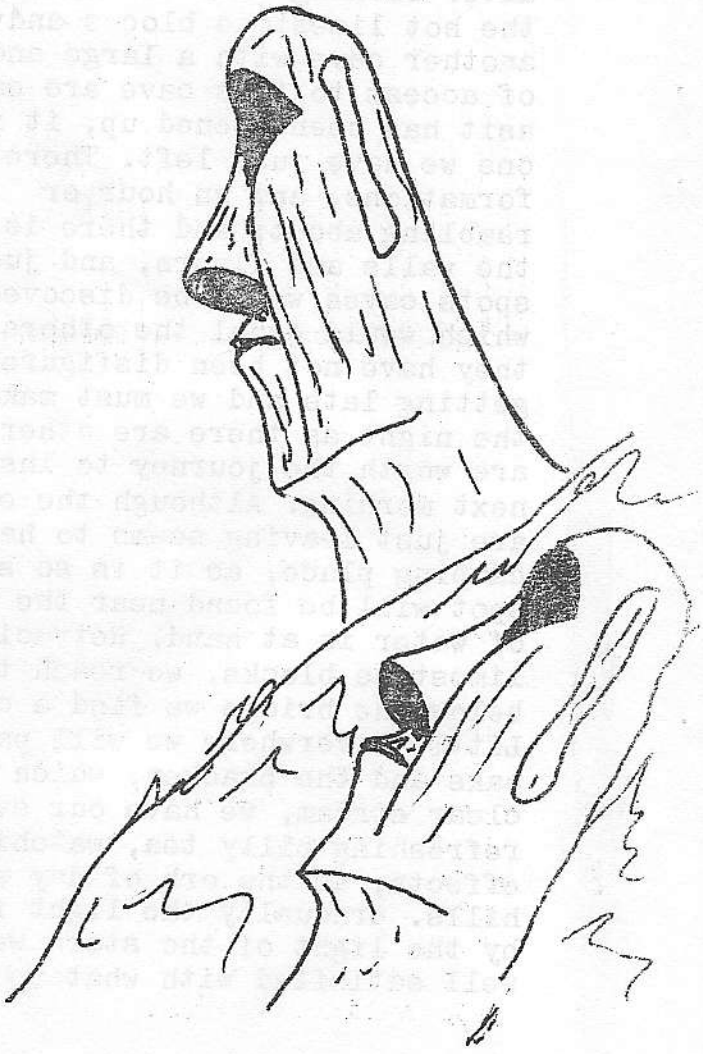
The tourist will find that these caves are nice and clean, that is, there are no running streams to make the place sloppy, and they would if a little money were expended on them,prove to be a very attractive holiday resort. It is a great pity that many of the best formations are completely ruined, by people--who ought to know better--writing their names and initials in far from attractive letters on the walls, stalactites, etc., andeven, as mentioned before, breaking pieces off. A trip to the caves is most enjoyable, and should be indulged in by all who have the time to go; but to advertise the event in such a vandalistic manner as leaving ugly initials scrawled or smoked on some of natures prettiest handiwork, is carrying things a bit too far. Considering the state that some of the caves have been left in by some visitors, it is no wonder that Mr. John Carey, on whose property the caves are, prohibits trespassing, but I know he is only too willing to allow people to inspect, on condition that no damage is done by them.

It is time we returned to the bright sunlight above us; so retracing our steps and getting glimpses of other little nooks which time will not permit us to examine closely, we reach the entrance, well salisfied (sic)with the result of our hurried inspection. The glare and heat of the sun seems to be intensified after issuing from the cool grottos, and we wend our way among the hot limestone blocks and a few hundred yards away come across another cave with a large and lofty entrance. Although the means of access to this cave are easier, it will be foundthat as far asit has been opened up, it is not nearly so attractive as the one we have just left. There are needless to say,many pretty formations, and an hour or two can be spent with advantage in rambling about; and there is no doubt that by carefully sounding the walls and floors, and judiciously using a pick, in the likely spots,caves would be discovered opening off the main chambers, which would equal the others, with the additional advantage that they have not been disfigured by thoughtless visitors. But it is getting late and we must make tracks for our camping place for the night as there are other caves higher up the river which are worth the journey to inspect, and they will take all the next morning. Although the entrance or vestibule of the cave we are just leaving seems to have been used many times for a camping place, as it is so sheltered and roomy, a more pleasant spot will be found near the river banks where a plentiful supply of water is at hand. Retracing our steps through the sharp edged limestone blocks, we reach the main track, and about a mile below the bridge we find a cosy nook near a pretty bend of the Little Riverwhere we will pass the night. Here among the tall oaks and the bracken, which thickly line the banks of the swift clear stream, we have our evening meal, washed down by the refreshing billy tea, watching the while the glorious sunset effects, as the orb of day sinks slowly behind the purple hills. Gradually the light fails, and the landscape is obscured by the light of the stars we turn in, tired out it is true, but well satisfied with what we have seen during our day's rumble (sick).

To be roothsaid and filibustered.....

THE MYSTERY OF EASTER ISLAND.





FOR MANY YEARS ARCHAEOLOGY HAS MARVELLED AT THESE FANTASTIC FIGURES & ALTHOUGH MOST QUERIES ABOUT THE HAVE BEEN ANSWERED. ONE MAJOR QUESTION HAS NEVER BEEN ANSWERED (UNTIL TODAY.) WHAT PROUD RACE MODELLED FOR THESE SCULPTURES? IN 1968 N.U.C.C. FOUND A POSSIBLE RACE.

THIS

PAGE
HAS
BEEN
IMPREGNATED
WITH
A
CONCENTRATED
MIXTURE
PREPARED
FROM
FULL CREAM MILK
EXTRACTS OF MALTED BARLEY
OTHER CEREALS
SUGAR
COCOA
VITAMINS A,A? B,D,
THIAMINE
IRON
RUM

IT WILL
SUPPLY
YOU
WITH
ENOUGH
ENERGY
TO
CAVE
FOR
MORE
THAN
20 HOURS.

JUST
TEAR
OUT
THIS
PAGE
AND
DISSOLVE
IT
IN
1 PINT
OF
COLD
WATER.

ADD
FULL CREAM MILK
EXTRACTS OF MALTED BARLEY
OTHER CERIALS
SUGAR
COCOA
VITAMINS A,D,B.
THIAMINE
IRON
RUM

POUR OFfTHE FLUID AND DRINK, SUCK, CHEW
AND SPIT OUT PIPS.

CLASSIFICATION OF BATS

Nasal membrane → RHINOLOPHUS (Horseshoe)

No nasal membrane

Tail goes outside the wing membrane

Half the tail outside the femoral membrane → TADARIDA

Tail outside interfemoral membrane by 2 or 3 vertebrae

- Wingspan II ins. → VESPERTILIO
- Wingspan 10 – 13 ins. → EPTESICUS

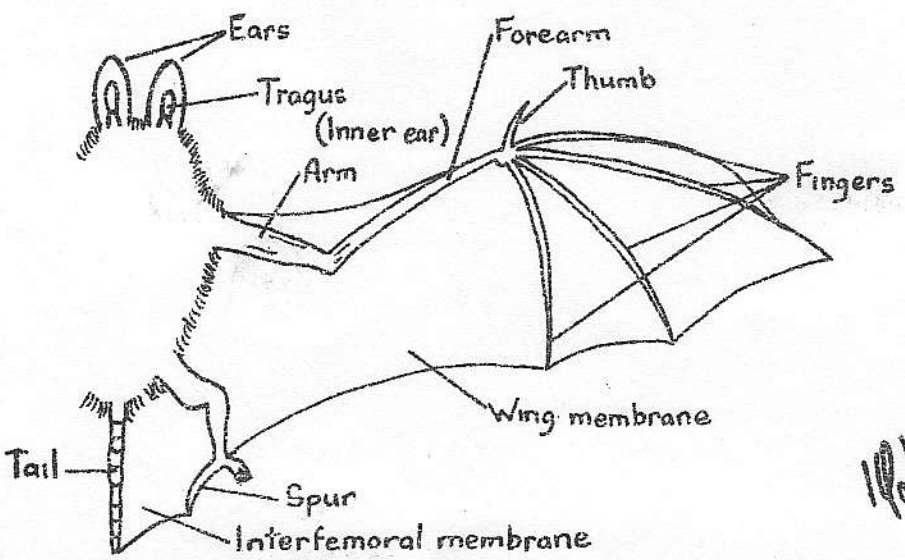
Tail completely enclosed within the uropatagium

Ears joined at their base by a membranous band

- Ears also longer than forearm → PLECOTUS (Long-Eared)
- Ears almost straight, darkish colour → BARBASTELLA

Ears free

- Tragus long and slender → MYOTIS (Natterer's, Daubenton's, Whiskered)
- Tragus short and rounded at end Wingspan 7–9 ins. → PIPISTRELLUS
- Wingspan 11 ins. Crown of head swollen → MINIOPTERUS
- Wingspan 11 – 16 ins. → NYCTALUS



THE CAVE ENVIRONMENT.

(This is a reprint from SCIENCE - 5 September 1969, Volume 165,Number 3897)
(By L. Poulson and William B. White)

LIMESTONE CAVES PROVIDE UNIQUE NATURAL LABORATORIES FOR STUDYING BIOLOGICAL AND GEOLOGICAL PROCESSES.

During the past 10 years more scientific research has focused on the cave environment. This is because caves are simple natural laboratories. The cave climate is stable and easily defined. The cave communities are simple and can be studied in toto. This simplicity allows detailed analysis of processes that are difficult to study in more complex environments.

Here we discuss two classes of problems in detail. First, we consider the interrelation between cave formation and the origins of cave animals. Karst hydrologists study the movement of water through the drainage complex, and biogeographers describe the origin of cave organisms and their dispersal and distribution among the various surface and underground habitats. Second, we treat the cave as a specialized natural laboratory and give specific examples of problems in ecology, evolution, and mineralogy.

Historical Background:

Scientific interest in caves began in 17th- and 18th-century Europe with the development of elaborate (but erroneous) theories of the hydrologic cycle in which cave systems were essential elements (1). The beginnings of a correct understanding of the geology of caves date from about 1850 in Europe and 1900 in North America. In Europe, emphasis was on karst hydrology, particularly on subterranean streams (2). Early biological studies emphasized faunal surveys and descriptions of the degenerate eyes of cavernicolous animals (cavernicoles) (3); only after 1900 were a few experimental studies made (4).

In the early 20th century Racovitza and Jeannel sparked the spectacular rise of modern biospeleology in Europe. This period was, in general, an interlude for cave science in the United States, during which the only additions to knowledge about North American caves and their life were made by Europeans on field trips in North America (5).

Biospeleology advanced slowly in the United States from 1930 to 1950, even though this was the time of a lively debate over the origin of caves. The central point was whether caves form above or below the local water table. Davis (6) proposed cave development deep below the water table, by random circulation of slowly percolating ground-water ("phreatic" origin). This view became textbook doctrine for many years.

* (Dr. Poulson is assistant professor of biology, Yale University. Dr. White is associate professor of geochemistry. Materials Research Laboratory, Pennsylvania State Uni. Both authors are directors of the Cave Research Foundation, [illegible].C.)

Other theories placed the zone of cave development at or above the local water table ("vadose" origin). This debate and Davis' reputation as an authority had two stifling effects on cave studies: (i) the implied random pattern of cave development discouraged search for specific hydrological mechanisms causative of cave system patterns, and (ii) the argument over the location of the water table tended to reduce the research that was done to a sterile classification of some particular cave as having a vadose or phreatic origin.

Factors influencing reactivation of geological cave research and continued progress in biospeleology in the past decade include amassment of a large body of descriptive data collected mainly by non-professional explorers and surveyors within the National Speleological Society; growing acquaintance with the large body of European literature that had been largely ignored by American theoreticians of the 1930's; near-completion of a systematic description of many groups of cave organisms and their distribution (7), which permitted biologists to turn to ecological and physiological problems; and, finally, involvement of younger researchers whose interest arose from exploration and field experience. Today, research in the cave-related sciences is being pursued in a number of universities and by three specialized organizations: the Cave Research Foundation, the Institute of Speleology at the University of Kentucky, and the cave Research Associates.

The Cave Environment.

The cave environment is usually thought of as being separated into a twilight zone near the entrance, a middle zone of complete darkness and variable temperature, and a zone of complete darkness and constant temperature in the deep interior. The twilight zone has the largest and most diverse fauna; the middle zone has several very common species which may commute to the surface. We are concerned with the deep interior, where the unique aspects of the cave environment and its obligate (troglobitic) fauna appear (8).

Green plants cannot live in permanent darkness. Thus, deep within caves, the troglobite must find other forms of food, and food is scarce. Leaves, twigs, and soil fall into, or are washed into, caves and, in general, constitute the food base of the troglobite. Near cave entrances there are trogloxenes such as pack rats and hibernating bats and insects, but these contribute little to the food base of species that dwell in the deep interior. In the main, troglobites live in caves of the temperature regions. In tropical caves and in a few caves in southern temperate regions, perennial colonies of bats or birds (swiftlets or the oilbird) are important sources of food for the abundant facultative species (troglophiles); there are few troglobitic species in these caves.

The overall climate of the cave interior is much less variable than surface environments. The temperature is approximately the mean

annual temperature of the region. Thus, caves at high altitude or in high latitudes may contain perennial ice, and tropical caves are noted for their high temperatures. The cave atmosphere is humid, regardless of altitude or latitude. Relative humidities may be as low as 80 per cent, but more commonly they vary between 95 and 100 percent. Evaporation rates are usually low, but the cave air is not necessarily still. Air currents and even strong winds occur at great distances from entrances, activated by chimney effects and by changes in barometric pressure. A resonance phenomenon known as "cave breathing" occurs, in which air currents throb back and forth through constricted passages, with periods of a few seconds to a few minutes. A tabulation of macroclimatological variables for caves in temperate regions ("temperate caves") is given in Table 1.

The terrestrial cave environment has been less well studied than the aquatic cave environment. Much of the terrestrial fauna inhabits the cave floor, probably because inwashed food, soil, and chemosynthetic bacteria are there. Mineralogical processes are mainly those of deposition by aqueous transport, but the aqueous phase is limited to thin films of moisture or water droplets. Floor materials include clastic sediments such as sand, silt, and clay (originating both as weathering detritus from the limestone and by transport from distant sources by subterranean streams). Fallen rock slabs from the cave ceiling are also a frequently occurring substrate.

The aquatic environments include running streams, and pools fed by dripping water. The pools are characterized by high pH, high concentration of dissolved carbonates, low content of organic matter suitable for food, and a sparse fauna. The running streams, with connections to outside food sources, have a lower pH, are often undersaturated with respect to carbonates, and have a richer fauna. Some typical values for the biotic and chemical parameters for temperate caves at low altitudes are also given in Table 1.

Hydrological Regimes in Karst Regions.

Caves are truncated fragments of the larger conduits of the karst drainage net and must be interpreted according to their hydrologic role. Some caves are now active as drainage conduits; others have been abandoned as base levels receded and are useful for the record they retain of past flow conditions and connections.

Karst drainage nets have three principal types of tributary systems connecting to water inputs. Smaller tributaries are typically of high pH and low organic content. They derive their diffuse flow from the bottoms of sinkholes and from cracks and crevices in the limestone surface. They are not directly observable, so details of their pattern are not known. Larger tributaries are characterized by

moderately high pH and food content. One kind of large tributary is the vertically flowing tributary seen in many karst regions of the Appalachian plateaus and Interior Lowlands, where flat-bedded rocks are overlain with shales and sandstones which cap the ridges. In these circumstances it is common to find groundwater bodies (aquifers) perched in the overlying rocks. When the bases of these perched aquifers are sealed with shale aquicludes, as they are in much of Kentucky, Tennessee, and West Virginia, the water of low pH drains from them, ermerging in small surface springs and in seeps on hillsides or along the edges of plateaus. Much of this water seeps underground again after it has flowed over the aquiclude and moves rapidly through the aquifer, forming large cylindrical vertical shafts (9). Shaft drains, usually of small dimensions, carry the shaft water to nearby trunks as tributaries. The third major tributary type is the sinking stream. Surface streams which rise on non-carbonate rocks bordering the carbonate aquifer often sink when they reach the limestone contact, forming a sharply focused recharge point. Such swallow points form an upstream interface between the surface and underground drainage nets. Dry stream beds formed on carbonate rocks accumulate debris which can be an important source of food for cave organisms when the dry streams flood during spring rains.

The chemical process by which the aquifer is modified into networks of conduits and caves is the solution of limestone by CO_2-charged groundwater. The resulting pattern may be highly complicated in terms of details of lithology and geologic structure. If the dissolving solutions were percolating through all available joints and bedding planes, one would intuitively expect the flow system to have a "swiss-cheese" pattern. Such patterns are rarely observed. Most karst waters are not in thermodynamic equilibrium with the carbonate wall rock. Dripping waters are often supersaturated; flowing streams are often undersaturated, especially during spring flooding. The time constants for water movement in these large flow nets, relative to the kinetics of the chemical reactions, are such that waters can flow the length of the aquifer before becoming saturated. This in itself provides a mechanism for the development of cave passage far from water inputs. Thus, many drainage nets consist of long major horizontal conduits of uniform cross section which pass beneath clastic-rock-capped ridges with no change in morphology.

A second mechanism which allows solution of rock near the water table is the mixing of the vertically and laterally moving waters (10). Vertically moving waters often trend toward equilibration with the high carbon dioxide partial pressures of the surface soil, while laterally moving waters approach the much lower saturation carbon di-oxide pressure of the atmosphere. When two such waters mix, because of the nonlinear relation between carbonate concentration and carbon dioxide pressure, the mixed water is again undersaturated and can dissolve more carbonate.

Examination of the solutional sculpturing on cave walls and geometrical considerations of spring discharges as a function of the

feeder-trunk cross section place the flow velocities in many passages in the range of 0.03 to 0.3 meter persecond. These velocities are high compared with the velocities (in meters per year) usually cited for movement of groundwater in other aquifers. Calculations of Reynolds numbers for channels place most of these flows well into the turbulent regime.

It is not to be inferred from the foregoing discussion that all limestone aquifers can be treated as integrated-flow net systems. Some are highly interconnected joint and fissure systems without well-defined flow paths, and indeed differ only slightly from noncarbonate aquifers. The dolomite aquifers of northern Ohio and Illinois are of this type. Other such aquifers are in artesian situations where flows, although through open solution cavities, are at great depth and under hydrostatic head. Even among those aquifers to which the model best applies, the degree of interconnectivity between underground drainage basins may be high (11).

Origin and Dispersal of Cave Animals.

The number of species in the caves of a region is the result of a balance between colonization and extinction (12). In the early stages of karst development, underground solution is the predominant geological process. Connections to the surface are rare, and so there is little cave colonization. Passages are small and poorly integrated, so there is little movement between caves. The very low food input also makes colonization difficult, but the constant physical conditions are conducive to survival. Troglobites are most common in the intermediate stages, when diffuse connections to the surface allow colonization and when integration of passage allows movement between caves, but they become less common in the latest stages. As caves are dissected by erosion and filled by deposition, there may be many sinking streams and numerous collapse entrances which increase the chances for colonization but limit movement between caves. A high food input also increases the chances for colonization, but the more variable physical conditions are less conducive to survival (see 13).

In the case of troglobites we must also consider the chances for genetic isolation, because there must be both cave colonization by a troglophile and extinction of the intervening surface populations before a troglophile becomes troglobitic. On the worldwide basis the predominant restriction of troglobites to temperate areas of Europe, North America, Japan, and New Zealand is undoubtedly related to high rates of isolation of troglophiles by climatic changes associated with glaciation. In the stable climates of the lowland tropics there is little chance for isolation, and high rates of erosion may result in ephemeral caves and in high rates of extinction of troglobites (14).

The ability of troglobites to move between caves depends mainly on their size. Small species attain wide geographic distribution

because they can move through stream gravels and soil outside of caves as well as through interstitial routes represented by minor joint and bedding planes in the limestone. Small terrestrial groups, such as mites and springtails, use such routes, but the most spectacular examples are among the small aquatic species. The efficacy of interstitial distribution for two species of amphipod, Stygobromus mackini and Crangonyx antennatus, is attested by their large populations in drip pools of upper-level passages that never flood and by the fact that they occur in 75 to 90 percent of suitable caves within their geographic ranges (15).

The large troglobites do not disperse through interstitial routes outside of caves, so distributions of such species tells us about the extent of underground connections between caves. If there is no morphological differentiation of a series of populations of a species, then the caves the species are found in must be connected. In many cases man can explore, or use stream-tracing dyes to directly demonstrate connections, but in other cases this is not possible. Terrestrial troglobites move through upper-level passages which are unexplored or inaccessible and not subject to dye tracing. Similarly, there are unexplorable aquatic connections which cannot be inferred by means of dye tracing because they flow only during floods. For example, underground streams have been explored in West Virginia which flow in open passages transverse to, and beneath, major ridges under 330 meters of overburden. However, the flood drainage may follow completely different and inaccessible routes to surface outlets far removed from the low flow outlets (11) and so allow troglobites to disperse to another basin far beyond the boundaries of both topographic and underground divides. If there is morphological differentiation of a series of cave populations, then the relative magnitude of differentiation gives an index of how long the caves have been separated, and its pattern suggests the positions of former connections. For example, honeycombs of solution channels as far as 60 meters below some river bottoms (16) are problems for engineers building dams and are proven dispersal paths for aquatic troglobites, but rivers are barriers to the dispersal of terrestrial troglobites. As such rivers become larger, older, and more sedimented they become barriers to aquatic species as well. Morphological differentiation of the cave fish Amblyopsis spelaea (see cover and Fig1), but not of the crayfish Orconectes inermis, on either side of the Ohio River suggests that there is a recent barrier, probably dating from the last Pleistocene glacial outwash that filled the river bed and solution channels with sediment.

Biogeography of Troglobites.

The composition of an entire troglobitic fauna depends both on interconnectivity of caves and on the balance between colonization and extinction. Here we compare the Appalachian and Interior Low Plateau cave region of southern Indiana to the cave region of northern Alabama to illustrate how these factors influence speciation and rate of

adaptation to life in caves. These two regions are similar with respect to (i) the geological time available for colonization and (ii) the groups of troglophiles available as colonizers.

Limestone outcrops in the Appalachian Valley-Ridge are typically long and narrow, paralleling the characteristic Appalachian folding. The caves typically consist of a single conduit parallel to the ridges; large lateral extents are relatively rare. The limestones do not have a protective cap rock, so the caves are subject to relatively easy attack by the process of truncation and collapse. The limestones of the interior Plateaus, in contrast, are nearly flatlying and often occur under sandstone and shale-capped, mesa-like ridges. These caves are related to much larger drainage basins than the caves in the Appalachians and have a larger lateral extent and a higher interconnectivity. The capping beds protect the caves from decay, so they exist for a long time. In general, it may be said that the integrated drainage basins of the Interior Plateaus are larger, perhaps by a factor of 10, than the drainage basins of the Appalachian valleys.

Barr has analyzed the biogeography of trechine beetles, a group of animals which show extreme contrast in characteristics, depending on geography, those from the Appalachian Valley-Ridge area differing markedly from those from the Interior Low Plateaus of Indiana, Kentucky, and Tennessee. Like certain other groups (17) the Valley-Ridge beetle fauna is characterized by (i) high density of species; (ii) rare co-occurrence of related species (sympatry); (iii) limited distribution including only some of the potentially habitable caves, frequently only one cave; (iv) extreme rarity in any one cave; (v) small modal size of individuals; (vi) only one or two genera in each group; and (vii) few groups of troglobites in any one cave. In contrast, the troglobitic fauna of the Interior Low Plateaus, such as Mitchell Plain of Indiana and the Pennyroyal and Cumberland plateaus of Kentucky and Tennessee, is characterized by (i) low density of species; (ii) frequent sympatry; (iii) wide distribution, including many of the potentially habitable caves; (iv) moderate-to-large populations in a cave; (v) moderate-to-large modal size of individuals; (vi) commonly three or four genera in each group; and (vii) many groups of troglobites in any one cave.

The most critical factors determining the faunal differences seem to be density, size, and connectivity of caves. To paraphrase Barr (17), the number of trechine species per unit area of limestone terrain is high in the Valley-Ridge area because the limestone is highly discontinuous and there is more speciation when different segments of a once-continuous population are isolated in caves by extinction of the intervening surface populations. The low number of trechine species of the Interior Low Plateaus of Indiana, Kentucky, and Tennessee is attributed to a high potential for subterranean dispersal. We agree with Barr but extend his argument to explain the other biological differences between the two regions.

We suggest that the small size of individuals, the low populations, and the low number of genera in the Valley-Ridge caves reflect both high chances for extinction and slow rates of evolution. With few caves there can be few colonizations, and each colonizing population will be small, so chances for extinction are high. Also, the rate of adaptation will be slow, since the total variation of the ancestral population on which natural selection can act is minute; in other words, there is a genetic bottleneck (18). This problem is accentuated by the low potential for mixing of different genes between caves of the Valley-Ridge. However, in the Interior Low Plateaus more caves are available, the caves (and thus the colonizing population) are large, and a high potential for intercave dispersal results in a greater gene pool and faster rates of adaptation. We believe that this explains the greater proportion of "successful" or well-adapted species in the caves of the Interior Low Plateau. Barr has indeed recognized this success by designating the large trechine bettle species, with their wide distributions, large populations, and wide ecological tolerance, members of separate genera.

Caves as Ecological Laboratories.

Rules that govern community structure and evolution can be discerned in studying cave communities. Here the community boundaries are discrete, and most of the species can be studied and manipulated in the field and in the laboratory. In this section we consider the control of species diversity and two related phenomena, competition and rarity.

Examination of the basis for local differences in species diversity is of interest because ecologists have speculated about the basis for latitudinal differences -- for example, between the arctic and the tropics without understanding local differences that involve a common group of species. Poulson and Culver, in their studies of species diversity in terrestrial communities of the Mammoth Cave area in Kentucky (19), show that there are definite local differences in the 110 kilometers of the Flint Ridge cave system even though the potential species pool is the same for each local area. They categorize explanations for the control of diversity as primary, secondary, and tertiary. The time available for dispersal between, and adaptation to, habitats is considered a primary factor, as are differences in climatic rigor, variability, and predictability. The factors of spatial heterogeneity and availability of food are considered secondary, whereas competition, niche overlap, and predation are tertiary. The Flint Ridge system has been in existence since the late Pliocene, so the time factors are constant. Other explanations are based on significant negative correlations of diversity with microclimatic rigor and variability and on positive correlations with spatial heterogeneity and availability of food. The results on microclimatic rigor and spatial heterogeneity are in accord with the results of previous studies of latitudinal diversity but food supply is usually negatively correlated with diversity. The explanation may be that the that the persistence of larger cave species tends to be governed by the availability of food.

To be continued....

FILCH 1970

The annual silly season at the A.N.U. has come and gone again, with the passing of Bush Week 1970. This year, a N.U.C.C. team again participated in the Scavenger Hunt with the intention of improving on their effort of fifth (out of over 20 teams) last year.

The event started with the gathering of as many club members (and others) as possible at 9.30am on Friday in the Union to receive copies of this year's pilferage lists and the "Tarago Telegraphs" -we had to sell 60 of these (Anybody who wants one or more see J.B. -special reduced rate for club members and anyone else who wants one 10¢ each). We were fairly stunned by the length of the list and by the relative difficulty involved when compared with previous years.

It had been decided previously that any items in short supply should be tried for before the others and accordingly, P.T. took off to make away with the high table chair from Bruce Hall and C.P. to get the painting of Pope John XXIII from the College. Then people scattered in all directions. Two adventurous members attempted to remove one of the minute hands from a certain prominent clock. They were thwarted by rust, lack of time, lack of tools and a couple of members of the local constabulary, who, despite much fast talking, would not part with their Commonwealth number plates for the good of the club's cause (ie a share in the nine gallon keg first prize).

About this time, K.P. and D.G. were chasing the manager of the Monaro Mall He wasn't at the Mall but his secretary carefully noted us as the team which had got in first. Unfortunately, we missed out there, some other team caught him before he got back. Fast-talking J.C., in the meantime, had collared a barmaid and bagpipes from the Scottish Bar at the Canberra Rex and (don't ask how) had fronted up with an old lady who maintaied she had been abducted against her will.

Meanwhile, back at the ranch, P.T. had visited the Zoology Dept. and had astounded the judges by conjuring up an officially labelled bottle proclaiming the contents to be aardvark-first quality. He followed this by inducing a gorilla to abort itself so that he could produce, much to the judges horror, the afterbirth (charges will be laid later by the S.P.C.A.).

About this time, J.F. and M.B. were running rampant in the studios of 2CA. They induced all present to buy copies of the "Taragraph" (some feat this-the staff hadn't been paid yet) and had seized a vital component from one of the computers used there. They had also plundered Boots Lansley's personal collection

of recordings, to obtain a copy of "A pub with no beer" (on tape -the instructions sais on a portable record player, so cassette machine was placed on top of a hastily borrowed turntable for this rendition).

J.B. and D.S. were about then confronting a bewildered Vietnamese embassy in search of a relative of a member of the Saigon Government. They found one but, things were against us again, he could not go without the permission of the ambassador who had just gone out, it was not known where to. So, instead, they spent some considerable time finding a piece of concrete pipe over one foot in diameter and a length of railway line (over five feet long) which was not too heavy to be lifted.

Back to the Union where a thrill-seeking crowd watched rapt as Amanda Call (age four months) bared her chest (left female breast-15 points). Then there followed a sequence which the judge concerned, at any rate, found quite amusing. The instructions called for a"live whore" -15 points. We produced Amanda again-Call girl!

Time was running a bit short by then, but M.B. had an idea- a diseased sheep was required. He and P.S. dashed out to a nearby farm and ther found a very dead lamb, consisting of head, four legs and skin -nothing more. This was produced as a diseased sheep:

Judge: What's wrong with it?

M.B.: It's got an upset stomach.

They accepted this- 10 more points to the club's cause.

This was followed closely by a beer bottle hastily filled by three members. The judge felt it (warm), sniffed it and said: "Ugh! Take it away!"-more points scored. Then came what was deemed by most people present to be the most enjoyable exercise of the day -prone press ten people high on D.G.- K.P. missed out on this but he has been promised a special demonstration that he can join in on on the next trip -one way to raise our membership.

This section of the contest closed with the presentation of J.C. as a speed freak. The judges took one look and accepted the submission. You must be well known Jim. We were all wondering how you managed to turn up earlier with a member of the Drug Squad.

The final section of the Hunt for this year involved the production of a true ethnic bush-type character to entertain the gathering at the Bush Dinner the following night. An eager group took off on a tremendous pub crawl around the neighbooring towns in search of such a character who would come. Captain's Flat and Major's Creek both drew a blank, but we came upon two likely people in Araluen- Patrick and Basil. They said that they would come and that Patrick would even perform his famous egg

trick for the amusement of the crowd. M.B. and K.P. took off the next day to get them, only to find that Basil's wife had telegrammed to say that she was arriving that afternoon and that they should meet her at the station. So we missed out on an er y in that sectionof the competition -worth 40 points. We found out later that only two out of twenty-six teams produced anyone at the dinner, and that the standard was considered so poor that that section of the competition was cancelled.

Special commendations should go to:

P.C. for coordinating our efforts,

M.B. for the help from 2CA,

J.C. for getting the barmaid and old lady and for freaking,

P.T. for the aardvark(!?) and Packhard's seat,

N.C. for his artificial insemination syringe,

D.G. for his pint of blood,

C.P. for the painting,

J.B. & D.S. for the train line and their pipe,

P.S., D.G. & J.F. for you know what in the beer bottle,

and especially to A.C. for the strip and mis(s)use of her name,

and of course to K.P. for his undying optimism and drive which kept us all going when we were all ready to give up.

Result: We came second by 38 points.

Now, next year.....

John Furlonger

FOR THOSE OF YOU WHO WERE PUZZLED BY THE MYSTERY OF EASTER ISLAND, WAIT FOR THE ANSWER IN THE NEXT BIG ISSUE OF SPELEOGRAFITTI.

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Keep those cards and letters coming in folks. This week we'd like to thank that little old man from Lyneham for his 700 copies of his autographed photo, I'm sure all the little old gals will simply LOVE'EM ???????

ALL SPELEOGRAFFITI contributions to the editors MAURICE ? PHIL? FURRY? KEN? JOHN ? WHO

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