BCRA

TRANSACTIONS

BRITISH CAVE RESEARCH ASSOCIATION

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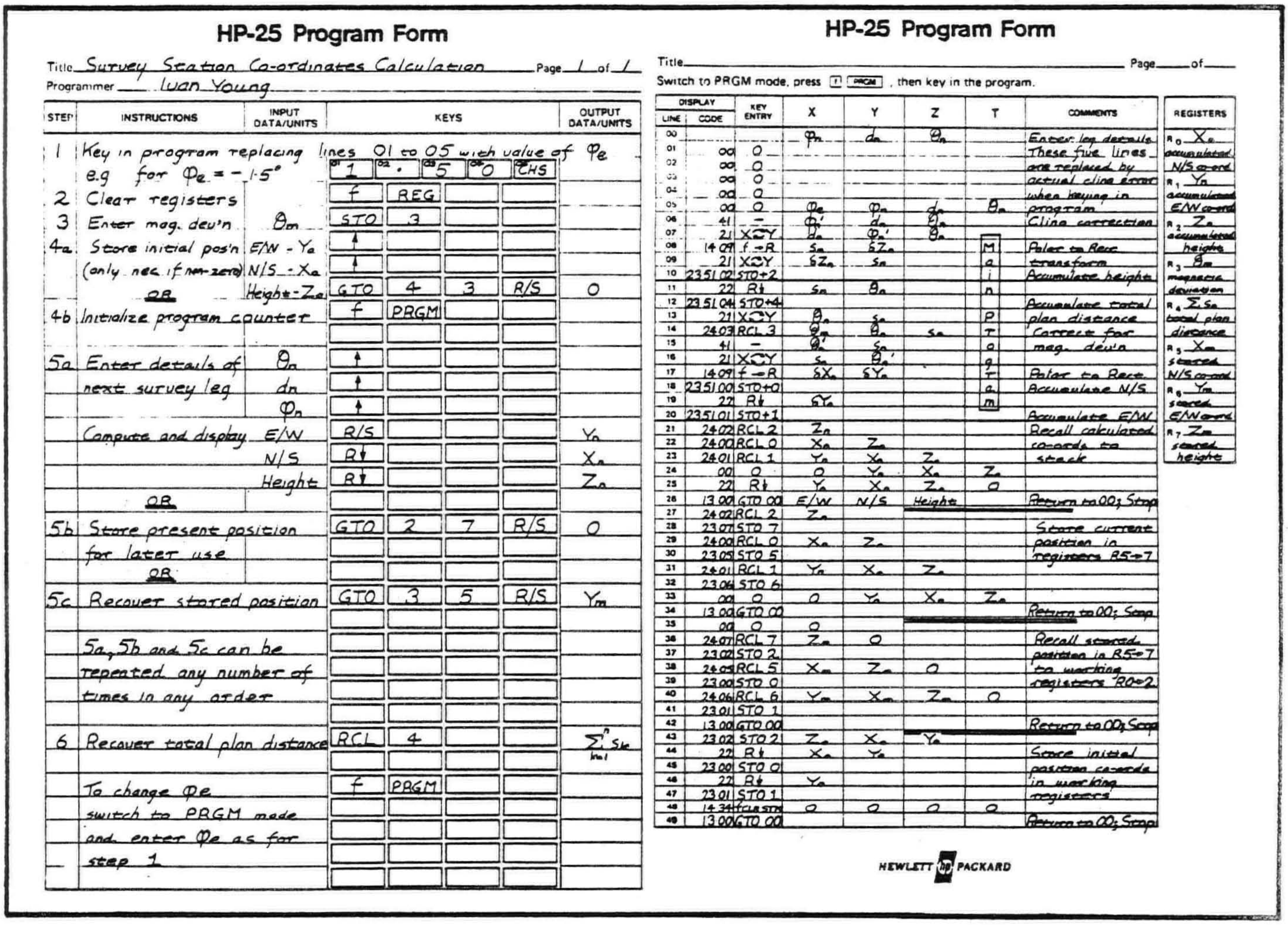

HP-25 Program Form

Title: Survey Station Co-ordinates Calculation Page 1 of 1
Programmer: Ivan Young

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS					OUTPUT DATA/UNITS
1	Key in program replacing lines 01 to 05 with value of φ_e e.g. for $\varphi_e = -1{\cdot}5°$		1	.	5	0	CHS	
2	Clear registers		f	REG				
3	Enter mag. dev'n	θ_m	STO	3				
4a	Store initial pos'n	E/W - Y_a	↑					
	(only nec. if non-zero)	N/S - X_a	↑					
	OR	Height - Z_a	GTO	4	3	R/S		0
4b	Initialize program counter		f	PRGM				
5a	Enter details of next survey leg	θ_n	↑					
		d_n	↑					
		φ_n	↑					
	Compute and display	E/W	R/S					Y_n
		N/S	R↓					X_n
		Height	R↓					Z_n
	OR							
5b	Store present position for later use		GTO	2	7	R/S		0
	OR							
5c	Recover stored position		GTO	3	5	R/S		Y_m
	5a, 5b and 5c can be repeated any number of times in any order							
6	Recover total plan distance		RCL	4				$\sum_{k=1}^{n} s_k$
	To change φ_e switch to PRGM mode and enter φ_e as for step 1		f	PRGM				

HP-25 Program Form

Title: ______ Page ___ of ___
Switch to PRGM mode, press f PRGM, then key in the program.

LINE	CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00			φ_n	d_n	θ_n		Enter leg details
01	00	0					These five lines
02	00	0					are replaced by
03	00	0					actual clino error
04	00	0					when keying in
05	00	0	φ_e	φ_n	d_n	θ_n	program
06	41	−	φ_n'	d_n	θ_n		Clino correction
07	21	x⇌y	d_n	φ_n'	θ_n		
08	14 09	f →R	s_n	δZ_n		M	Polar to Rect.
09	21	x⇌y	δZ_n	s_n		a	transform
10	23 51 02	STO+2				i	Accumulate height
11	22	R↓	s_n	θ_n		n	
12	23 51 04	STO+4					Accumulate total
13	21	x⇌y	θ_n	s_n		P	plan distance
14	24 03	RCL 3	θ_m	θ_n	s_n	r	Correct for
15	41	−	θ_n'	s_n		o	mag. dev'n
16	21	x⇌y	s_n	θ_n'		g	
17	14 09	f →R	δX_n	δY_n		r	Polar to Rect.
18	23 51 00	STO+0				a	Accumulate N/S
19	22	R↓	δY_n			m	
20	23 51 01	STO+1					Accumulate E/W
21	24 02	RCL 2	Z_n				Recall calculated
22	24 00	RCL 0	X_n	Z_n			co-ords to
23	24 01	RCL 1	Y_n	X_n	Z_n		stack
24	00	0	0	Y_n	X_n	Z_n	
25	22	R↓	Y_n	X_n	Z_n	0	
26	13 00	GTO 00	E/W	N/S	Height		Return to 00; Stop
27	24 02	RCL 2	Z_n				
28	23 07	STO 7					Store current
29	24 00	RCL 0	X_n	Z_n			position in
30	23 05	STO 5					registers R5→7
31	24 01	RCL 1	Y_n	X_n	Z_n		
32	23 06	STO 6					
33	00	0	0	Y_n	X_n	Z_n	
34	13 00	GTO 00					Return to 00; Stop
35	00	0	0				
36	24 07	RCL 7	Z_m	0			Recall stored
37	23 02	STO 2					position in R5→7
38	24 05	RCL 5	X_m	Z_m	0		to working
39	23 00	STO 0					registers R0→2
40	24 06	RCL 6	Y_m	X_m	Z_m	0	
41	23 01	STO 1					
42	13 00	GTO 00					Return to 00; Stop
43	23 02	STO 2	Z_a	X_a	Y_a		
44	22	R↓	X_a	Y_a			Store initial
45	23 00	STO 0					position co-ords
46	22	R↓	Y_a				in working
47	23 01	STO 1					registers
48	14 34	f CLSTK	0	0	0	0	
49	13 00	GTO 00					Return to 00; Stop

REGISTERS
R_0 X_n accumulated N/S co-ord
R_1 Y_n accumulated E/W co-ord
R_2 Z_n accumulated height
R_3 θ_m magnetic deviation
R_4 Σs_n total plan distance
R_5 X_m stored N/S co-ord
R_6 Y_m stored E/W co-ord
R_7 Z_m stored height

HEWLETT PACKARD

Saturation Index

Cave minerals

Peri-glacial vadose effect

Survey programming

Location device

Hypogean Fauna

INSTRUCTIONS TO CONTRIBUTORS

These notes are meant for guidance of contributors in the hope of reducing the amount of labour for both the editor and the contributors! Adherence to the rules is desirable but not absolutely essential.

As far as possible all material submitted for publication in the Transactions should be typed on one side of the paper only with double spacing to allow for editorial corrections where necessary. Paragraph sub-headings should be clearly marked. Metric measurements should be used wherever possible.

A very short summary of the principal conclusions should accompany every contribution.

References to other published work should be cited in the text thus . . . (Bloggs, 1999, p.66) . . . and the full reference with date, publishers, journal, volume number and page numbers, given in alphabetical order of authors at the end, thus . . .
Bloggs, W., 1999. The speleogenesis of Bloggs Hole. Bulletin X Caving Assoc. Vol. 9, pp. 9-99.

Italics are not normally used and only the volume number should be underlined. Periodical titles should be abbreviated in accordance with the World List of Scientific Periodicals, obtainable in any public library.

Illustrations: line diagrams and drawings should be numbered fig. 1, fig. 2, etc., and referred to in the appropriate place in the text. All such illustrations must be drawn in BLACK ink on clean white paper, card or tracing paper. Anaemic grey ink will not reproduce! Illustrations should be designed to make the maximum use of page space. If photo-reduction is contemplated all letters and lines must be of a thickness or size to allow for this. Captions may be typed on a separate sheet if space is left for insertion on the final illustration.

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If illustrations are submitted which have already been published elsewhere, it is up to the author to clear any copyright and acknowledgment matters.

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A SIMPLIFIED METHOD OF CALCULATING SATURATION INDEX AND PARTIAL PRESSURE OF CARBON DIOXIDE FOR KARST WATERS:

by N.S.J. Christopher

SUMMARY

A simplified arithmetic method of calculating saturation index (SIc) and partial pressure of carbon dioxide (Pco_2) is presented using the best available equilibrium constants, precalculated temperature and ionic strength corrections. Methods of approximating ionic strength are discussed.

The saturation index has been variously defined (Picknett, 1976) but all definitions have common roots in the two apparently different definitions of Langelier (1936) and Langmuir (1971).

Langelier's definition is:

$$SI_c = pH - p(H)_s \quad \text{where}$$

$$p(H)_s = p\,Ca + p\,HCO_3 + pK'_2 - pK'_c + \text{Log}\,\left(1 + \frac{2K'_2}{(H)_s}\right)$$

Langmuir's definition is in terms of the ionic activity product (IAP) whence:

$$SI_c = -\,\text{Log}\,\frac{IAP}{K'_c}$$

where IAP = (Ca)(CO_3) and (Ca) and (CO_3) are the ionic activities of the respective ions. In these definitions:

pH = the pH value of the water under consideration

Ca & HCO_3 are the molar concentrations of dissolved calcium and titratable alkalinity respectively.

p is an operator representing the logarithm (base 10) of a reciprocal ($-Log_{10}x$)

K'_2 is the effective second apparent dissociation constant of carbonic acid corrected for ionic strength.

K'_c is the effective solubility product of calcium carbonate.

The concentration of dissolved calcium is easily obtainable and converted into an activity, but the concentration of CO_3 is too small in normal karst waters to be measured directly so it must be obtained using the second dissociation constant of carbonic acid:

$$(CO_3) = \frac{K'_2\,(HCO_3)}{(H)_s}$$

Thus by substitution of this in Langmuir's equation, rearrangement and rewriting using the 'p' nomenclature it can be seen that excepting the complex term on the right hand side of Langelier's equation the definitions are the same.

Now the term Log $\left(1+ \frac{2K'_2}{(H)}\right)$ is small and negligible in the pH range 6.5-9.5 which covers that normally encountered in natural waters. Lowenthal (1976) has pointed out that Langelier's equation neglects the effect of ionic strength on $p(H)_s$, that is an error magnitude log f_m, where f_m is the activity coefficient of a monovalent species. Consequently for karst waters

$$p(H)_s = pCa + pHCO_3 + pK'_2 - pK'_c - \text{Log}\,f_m$$

and using this equation both definitions are essentially the same in the waters of interest.

The significance of SIc in karst hydrogeochemistry has been evaluated by Langmuir (1971) and found to be useful in distinguishing karst water types, especially in conjunction with the second index Pco_2 (Drake, 1973).

The theoretical partial pressure of carbon dioxide, Pco_2, is the theoretical equilibrium partial pressure of that gas which has been in contact with the water in order to produce the particular determined composition. It can be calculated from the first apparent dissociation constant of carbonic acid

$$K'_1 = \frac{(H) \quad (HCO_3)}{(H_2CO_3 \; + \; CO_2^{\circ})}$$

and Henry's law $(CO_2^{\circ}) = Pco_2S$ where CO_2° is the total undissociated dissolved carbon dioxide concentrationand S is the Henry's law constant.

In natural waters the concentration of H_2CO_3 is very small compared to CO_2° thus combining these equations

$$Pco_2 = \frac{(H) \quad (HCO_3)}{K'_1 \quad S}$$

and taking logs

$$- \text{Log } Pco_2 = pH + pHCO_3 - (pK'_1 + pS)$$

The use of these indices has been discussed in detail by several authors (Shuster, 1972; Drake, 1973; Harmon, 1975) and a useful summary of the concepts was given by Harmon (1972).

Table 1 gives the average values of SI_c and Pco_2 found in North America for six classes of water:

Table 1 (after Drake 1973)

Water	SI_c	$- \text{Log } Pco_2$
Allogenic Surface Water	-3.52	2.63
Soil Zone Recharge	-2.57	0.97
Conduit Springs	-0.89	2.38
Diffuse Springs	-0.24	2.22
Wells	-0.13	2.00
Basin Surface Drainage	+0.26	2.98

These indices are valuable hydrogeologic indicators of ground-water type and provided a reliable method of computation of these indices is available, they can be used in karst water studies. Jacobson (1972) has used a complex computer programme for evaluating the indices in which full allowance for ionic strength and ion pairing is possible and the probably accuracy is quoted as $\pm$ 0.01 units (Langmuir, 1972). Less accurate methods have been described (Anon., 1962): these include nomograph methods which have the advantage of simplicity for ionic strength corrections can easily be introduced but ion pairing corrections are more difficult to cope with, as will be discussed below.

The saturation can be measured directly by the Stenner method (Stenner, 1969) and SI_c values are susceptible to disturbance by traces of magnesium (Picknett, 1973) but practical experience indicates that, accepting these limitations, they are useful hydrogeological indicators.

ION PAIRING CORRECTIONS

The principal ion pairs to be considered are $CaSO_4^{\circ}$, $MgSO_4^{\circ}$, $MgHCO_3^+$, $CaHCO_3^+$ and $CaCO_3^{\circ}$. The first three of these have been considered adequately by Langmuir (1971) who found that the maximum error in SI_c introduced by ignoring these ion pairs would be approximately 0.02 units in the worst case, approximately half due to sulphate ions.

Langmuir (1971) has considered the $CaHCO_3^+$ ion pair to be negligible but Picknett (1973 & 1976) disputed this and using his data for the equilibrium constant for $CaHCO_3^+$, it can be calculated that for a typical resurgence water the effect of this ion pair on SI_c would be 0.01 units.

The effect of the $CaCO_3^o$ ion pair has been evaluated by Picknett (1976). Using this author's data the effect of this ion pair on SI_c can be estimated as 0.01 units at pH 7.4 rising very sharply to 0.06 units at pH 8.3.

It can be seen that the overall effect of ignoring these ion pairs is about 0.04 units in most cases, but increasing to 0.06 units in the presence of significant concentrations of sulphate ion, provided the water has a pH value of 7.4 or less. Above this pH value the effect of the $CaCO_3$ ion pair becomes more significant and the error introduced is probably up to 0.12 units. It is uncommon for resurgence waters to be above pH 7.4, and if desired this error could be reduced by interpolation of the data given above.

IONIC STRENGTH CORRECTIONS (ISC)

As already stated, SI_c can be calculated from

$$SI_c = pH - (pCa + pHCO_3 + pK'_2 - pK'_c - \text{Log } f_m).$$

pCa and $pHCO_3$ are measured and calculated in molar concentrations; for use in this equation the respective activity coefficients are included conveniently in the pK'_2 and pK'_c terms (Lowenthal, 1976, p. 73). Lowenthal has also shown that: $pK'_2 = pK_2 - \text{Log } f_d$ where f_d is the activity coefficient of a divalent species, and pK_2 is the infinite dilution value of K_2

and for pK'_c : $pK'_c = pK_c - \frac{8A\sqrt{I}}{1 + Ba\sqrt{I}}$

The activity coefficient of an ion (i) of effective diameter a can be calculated from the Debye-Huckel equation

$$\text{Log } f_i = \frac{AZ^2\sqrt{I}}{1 + Ba\sqrt{I}}$$

where A and B are constants; Z is the charge on the ion, and the ionic strength (I) is defined by

$$I = \tfrac{1}{2}\sum c_i z_i^2$$

In natural waters where several electrolytes are present with unlike charge the Debye-Huckel limiting law breaks down and several approximations to it have been suggested, that of most utility in these situations is that of Davies:-

$$\text{Log } f_i = AZ^2 \frac{(\sqrt{I} - 0.2\,I)}{(1 + \sqrt{I})}$$

Hence the ionic strength corrections are reduced to

$$pK'_2 = pK_2 - 4A \frac{(\sqrt{I} - 0.2\,I)}{(1 + \sqrt{I})}$$

$$pK'_c = pK_c - 8A \frac{(\sqrt{I} - 0.2\,I)}{(1 + \sqrt{I})}$$

and $\text{Log } f_m = A \frac{(\sqrt{I} - 0.2\,I)}{(1 + \sqrt{I})}$

Values of $pK_2 - pK_c$ taken from the best available sources (Picknett, 1976) are given in Table 2. Values of A were obtained from Manov, et al., (1943) for the range 0 - 25°C and these values incorporated into Table 3 which gives values of ionic strength corrections of $pK_2 - pK_c$ for temperatures up to 25°C and ionic strengths up to I = 0.026. The calculation of P_{CO_2} has to take account of the effect of ionic strength on K_1 and this has been calculated from

$$pK'_1 = pK_1 - \frac{0.5\sqrt{I}}{1 + \sqrt{I}} - 0.2\,I$$

Values of the right hand term of this equation are given in Table 4 for values of I up to 0.024 and 25°C.
Values of $pK_1 - pS$ are given in Table 2 for temperatures up to 25°C.
The method of calculating SI_c and P_{co_2} is illustrated by an example given below.

TABLE 2 VALUES OF $pK_2 - pK_c$ AND $pK_1 - pS$ FOR TEMPERATURES 0 - 25°C

temp °C	$pK_2 - pK_c$	$pK_1 - pS$	temp °C	$pK_2 - pK_c$	$pK_1 - pS$
0	2.23	7.73	13	2.06	7.75
1	2.22	7.73	14	2.04	7.76
2	2.20	7.73	15	2.03	7.76
3	2.19	7.74	16	2.02	7.77
4	2.17	7.74	17	2.01	7.77
5	2.16	7.74	18	1.99	7.78
6	2.15	7.74	19	1.98	7.79
7	2.13	7.74	20	1.96	7.80
8	2.12	7.74	21	1.95	7.80
9	2.10	7.74	22	1.94	7.81
10	2.09	7.74	23	1.92	7.82
11	2.08	7.74	24	1.91	7.83
12	2.07	7.75	25	1.90	7.84

TABLE 3 IONIC STRENGTH CORRECTIONS FOR VALUES OF $pK_2 - pK_c - \text{Log } f_m$ (ISC)

Ionic Strength	temperature °C					
	0	5	10	15	20	25
0.001	0.07	0.08	0.08	0.08	0.08	0.08
0.002	0.10	0.10	0.11	0.11	0.11	0.11
0.004	0.14	0.14	0.15	0.15	0.15	0.15
0.005	0.16	0.16	0.16	0.16	0.16	0.17
0.006	0.17	0.17	0.18	0.18	0.18	0.18
0.007	0.19	0.19	0.19	0.19	0.19	0.19
0.008	0.20	0.20	0.20	0.20	0.20	0.20
0.009	0.21	0.21	0.21	0.21	0.21	0.22
0.010	0.22	0.22	0.22	0.22	0.22	0.23
0.011	0.23	0.23	0.23	0.23	0.23	0.24
0.012	0.24	0.24	0.24	0.24	0.24	0.25
0.013	0.24	0.25	0.25	0.25	0.25	0.25
0.014	0.25	0.25	0.26	0.26	0.26	0.26
0.015	0.26	0.26	0.26	0.27	0.27	0.27
0.016	0.27	0.27	0.27	0.27	0.28	0.28
0.018	0.28	0.28	0.28	0.29	0.29	0.29
0.020	0.29	0.30	0.30	0.30	0.30	0.31
0.022	0.30	0.31	0.31	0.31	0.31	0.32
0.024	0.32	0.32	0.32	0.32	0.33	0.33

TABLE 4 VALUES OF IONIC STRENGTH CORRECTION (ISC) FOR pK_1

Temp °C / Ionic Strength	0	5	10	15	20	25
0.001	0.01	0.01	0.02	0.02	0.02	0.02
0.002	0.02	0.02	0.02	0.02	0.02	0.02
0.004	0.03	0.03	0.03	0.03	0.03	0.03
0.005	0.03	0.03	0.03	0.03	0.03	0.03
0.006	0.03	0.04	0.04	0.04	0.04	0.04
0.007	0.04	0.04	0.04	0.04	0.04	0.04
0.009	0.04	0.04	0.04	0.04	0.04	0.04
0.010	0.04	0.04	0.04	0.04	0.04	0.05
0.011	0.05	0.05	0.05	0.05	0.05	0.05
0.015	0.05	0.05	0.05	0.05	0.05	0.05
0.016	0.05	0.05	0.05	0.05	0.06	0.06
0.018	0.06	0.06	0.06	0.06	0.06	0.06
0.022	0.06	0.06	0.06	0.06	0.06	0.06
0.024	0.06	0.06	0.06	0.06	0.07	0.07

CALCULATIONS OF pCa AND $pHCO_3$ AND ESTIMATION OF IONIC STRENGTH

Calculation of pCa and $pHCO_3$ can be eased if a pocket calculator with base 10 logs is available; if not graphs of calcium and alkalinity concentrations in mg/ℓ related to pCa and $pHCO_3$ can be constructed. The equations of the lines are as follows:

Calcium Hardness expressed in mg/ℓ $CaCO_3$: $pCa = -Log\ (Ca) \times 10^{-5}$
Calcium Hardness expressed in mg/ℓ Ca: $pCa = -Log\ 2.5\ (Ca) \times 10^{-5}$
Bicarbonate (alkalinity) expressed as as mg/ℓ $CaCO_3$: $pHCO_3 = -Log\ 2(HCO_3) \times 10^{-5}$

Selected values are given in Table 5. To ease construction semi-log (log linear) graph paper should be used, then straight lines, not curves, will be obtained if pCa and $pHCO_3$ are plotted on the logarithmic axis.

TABLE 5

pCa or $pHCO_3$	CALCIUM Mg/ℓ $CaCO_3$	CALCIUM mg/ℓ Ca	ALKALINITY mg/ℓ $CaCO_3$
4.00	10	4	5
3.00	100	40	50
2.00	1000	400	500

mean ionic strength is defined as:

$$I = \tfrac{1}{2} \sum C_i \ Z_i^2$$

where C_1 = molar concentration of ion i
Z^1 = charge on ion i

To use this equation a total analysis of the water under consideration is necessary: a reasonable approximation can be made using:

$$I = 4H - \tfrac{1}{2}(HCO_3)$$

where H = total hardness in milli-equivalents per litre, and HCO_3 = titratable alkalinity in milli-equivalents per litre, or from the total dissolved solids (TDS), which can be easily determined gravimetrically at 180°C:

$$I = 2.5 \text{ TDS} \times 10^{-5}$$

This equation is Langelier's suggested approximation of 40 ppm TDS = 0.001I. Langmuir (1971) has suggested an approximation from the conductivity of the water:

$$I = A\ 1.88 \times 10^{-5}$$

where A is the conductivity of the water in micro-mhos/cm. This approximation is claimed to be accurate to within 10% of the true value of I.

This would be equivalent to 0.001 I = 53 micro-mhos.

The author has computed the ionic strength of 31 natural waters for which the ionic balance was within the limits of experimental error, these were plotted against conductivity and the slope indicated 0.001 I = 51 micro-mhos.

It would therefore be reasonable to assume the approximation 0.001 I = 50 micro-mhos, and, if preferred, the slightly more accurate estimations can be used.

METHOD OF CALCULATION

The method of calculating SI_c and Log Pco_2 values is best illustrated by an example:

A major resurgence has temp. 7.5°C, conductivity 390 micro-mhos at 20°C, pH 7.20 (determined on site), (Ca) = 75 mg/ℓ, (HCO_3) 130 mg/ℓ as $CaCO_3$.

$$I = \frac{390}{50} \times 0.001 \quad = \quad 0.008 \text{ approx.}$$

$pCa = 2.73$ (from Table 3 at I = 0.008 & 7.5°C, ISC for pK_2-pK_c = 0.20)

$pHCO_3 = 2.56$ (from Table 4 at I = 0.008 ISC for pK_1 = 0.04)

from Table 2 at 7.5°C $pK_2 - pK_c = 2.12$

$pK_1 - pS = 7.74$

now $SIc = pH - (pCa + pHCO_3 + (pK_2 - pK_c) + ISC)$

$$\begin{aligned} pCa &= 2.73 \\ pHCO_3 &= 2.56 \\ (pK_2 - pK_c) &= 2.12 \\ ISC &= \underline{0.20} \\ & \quad 7.61 \end{aligned}$$

$$\begin{aligned} SIc &= pH - pH_s \\ &= (7.20 - 7.61) \end{aligned}$$

$\underline{SIc = -0.41}$

$$-\text{Log } Pco_2 = pH + pHCO_3 + ISC - (pK_1 + pS)$$

$$\begin{aligned} \text{as above } pH &= 7.20 \\ pHCO_3 &= 2.56 \\ ISC &= \underline{0.04} \\ & \quad 9.80 \\ \text{subtract } (pK_1 + pS) & \quad \underline{7.74} \\ & \quad 2.06 \end{aligned}$$

$\underline{-\text{ Log } Pco_2 = 2.06}$

COMPARISON OF RESULTS WITH OTHER WORKERS

As a check on the overall accuracy of the method, SIc and $-\text{Log } Pco_2$ have been calculated for six springs (three 'open' and three 'flooded') for which data has been given by Jacobson and Langmuir (1972). Extensive data on 51 springs was given by Langmuir (1971) and as sulphate analyses were included, the effect of ion pairing can be evaluated, and a selection of five of his resurgences has been made on geochemical grounds. Picknett's data (1973) has been interpolated to give an additional comparison with another full method of calculation of SIc; Picknett does not evaluate $-\text{Log } Pco_2$. The results of these comparisons are given in Table 6.

TABLE 6 COMPARISON OF RESULTS WITH OTHER WORKERS

Site	This study SIc	This study $-\text{Log } Pco_2$	Jacobson & Langmuir (1972) SIc	Jacobson & Langmuir (1972) $-\text{Log } Pco_2$	Picknett (1973) SIc	Temp °C	SO_4 mg/ℓ	Other Comments
NYSP 1	0.48	2.55	0.38	2.64	0.51	8.2		
NYSP 3	0.39	2.43	0.26	2.53	0.44	7.9		Similar to many
NYSP 6	0.45	2.31	0.32	2.40	0.40	8.8		British karst
NYSP 2	-0.29	1.84	-0.50	1.95	-0.43	9.5		resurgences
NYSP 4	0.06	2.21	-0.06	2.29	0.06	9.2		
NYSP 5	-0.04	2.04	-0.17	2.12	-0.07	9.6		
			Langmuir (1971)					
1	0.08	2.26	-0.04	2.35	-0.18	10.0	14	high Mg
10	-0.28	2.04	-0.41	2.13	-0.42	10.0	19	low Mg
25	-0.36	1.85	-0.49	1.94	-0.35	10.5	28	low Mg
59	0.07	1.67	-0.04	1.76	-0.08	14.4	36	low Mg
317	0.16	1.81	-0.14	1.70	0.08	10.8	74	medium Mg

The results given in Table 6 show that SIc and $-\text{Log } Pco_2$ values calculated by the method adopted here are acceptably close to those obtained using more complete methods of calculation. The effect of sulphate ion pairing does not appear to be as significant as previous discussion suggests from the results, for sample nos. 25, 59 and 317. The range of sulphate concentrations represented by these samples covers that normally encountered in British karst waters. The agreement of $-\text{Log } Pco_2$ values is even better which probably reflects the greater simplicity of the theory in this case.

It must be remembered in comparing this data that some of the ionization constants of Jacobson (1972) have been criticised by Picknett (1973) and data approved by the latter author has been used in the preparation of Table 2. The differences between the two sets of data is slight (0.04 units) and decreases with increasing temperature.

From consideration of the results of Table 6 and the previous discussion the probably accuracy of SIc values calculated by the method described here is $\pm$ 0.05 units and Log Pco_2 values $\pm$ 0.03 units. These accuracies are sufficient to distinguish water classes based on the data given in Table 1.

PRACTICAL CONSIDERATIONS

The most important and difficult determination in using this method is an accurate determination of the water's pH value. A determination on site using a glass electrode meter is essential; the meter should be readable to at least 0.1 unit and preferably better than this value. Temperature drift is the most potent source of error and the electrode and buffer solutions should be allowed to equilibrate with the sample water temperature. Two buffer solutions should be used so that the sample pH value falls within the calibrated range. Results obtained on bottled samples and with coloured pH sensitive dyes are unreliable on waters with a low buffer capacity such as the average karst water.

A sample of water (about 500 ml) is also necessary and should be collected in a clean dry acid-washed polythene bottle. This sample is used for the determination of calcium and bicarbonate.

The analysis should be completed as soon as possible after sampling and definitely within 1-2 days.

Calcium content may be determined by EDTA titration at pH 12 or by atomic absorption spectrophotometry. Alkalinity can be determined by titration with standard acid to pH 5.1 at 50 mg/ℓ alkalinity, pH 4.8 at 150 mg/ℓ and pH 4.5 at 500 mg/ℓ. For waters with an alkalinity below 50 mg/ℓ a more sophisticated potentiometric method must be employed (Anon., 1971, p. 55).

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RANCIÉITE AND MIRABILITE:

SOME PRELIMINARY RESULTS ON CAVE MINERALOGY

by Martin Laverty and Stephen Crabtree

ABSTRACT

Studies of Yorkshire speleothem mineralogy and chemistry have identified rancîéite as an important mineral in black calcite in karst regions; humic substances are present in some brown calcite. Reflected light microscopy has suggested the presence of manganese oxides in "peaty" stalactites.

BLACK CALCITE

There are several references in the geological literature to black calcite, most examples studied coming from mines. Various manganese oxides have been idenified as responsible for the colour, but few of these are likely to occur in caves because of the different geochemical environment of deposition (Hewett & Radtke, 1967). Recent reviews of cave mineralogy (White 1976; Hill 1976) suggest that little is definitely known about manganese oxides in caves, but reference to geological works does show that some information is available which speleologists have previously overlooked, e.g. Park (1942). Here, we will concentrate on one particular mineral which appears to be especially significant,ranciéite. This was described as a cold spring deposit associated with tufa in North Dakota (Hendrick & Laird, 1943) but it has rarely been mentioned since then.

Ranciéite is the calcium-rich end member of the mineral corresponding to the formula (Ca, Mn) O.4 $MnO_2.3H_2O$. (Richmond *et al.*, 1969). It is a soft mineral which is black or very dark purple-brown and has been found in manganese deposits in France, in an iron deposit in Bulgaria, in cave sediments in Cuba, and in manganese deposits, caves and tufa deposited at springs, in the U.S.A. This mineral has now been identified by X-ray diffraction (Fig. 1) in a sample of black calcite flowstone between the Second and Third pitches of Gingling Hole. Here it is notable that the stalactites in the entrance passages are black, while those in Stalactite Chamber and Fools Paradise are pure white; beyond there is more black flowstone. Ranciéite has also been identified in peaty-looking stalactite from near the entrance pot of Blayshaw Gill Pot No. 2, and by electron microprobe, in a grey stalactite close to black flowstone from Ibbeth Peril Cave, Dentdale. The standard X-ray diffraction pattern was in fact determined on a specimen from Paxton's Cave, near Bolling Springs in Virginia (ASTM X-ray powder diffraction file No. 22-718; also Richmond *et al.*, 1969), but unfortunately no more details seem to be available. In each of the three examples from Yorkshire, the mineral appears to be associated with organic matter and/or structures but only aluminium was present as a metallic trace element in the sample analysed by electron microprobe. Iron is absent and it is clear that the mineral presents many

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Editor's Note: The accompanying preliminary studies of cave minerals suggest that there is a wide-open field for future research. For example, manganese occurrences are far more widespread than the authors note, having been seen by your editor in both Speedwell and Treak Cliff Caverns at Castleton. Black manganese coatings are commonly found on pebbles in cave streams. A mixture of iron and manganese oxides was found forming large masses in Black Reef Cave at Ribblehead by Peter Crabtree (see Cave Science, vol. 4, no. 32, pp. 360-361, 1962), though the iron content distinguishes it from the occurrences noted herein.

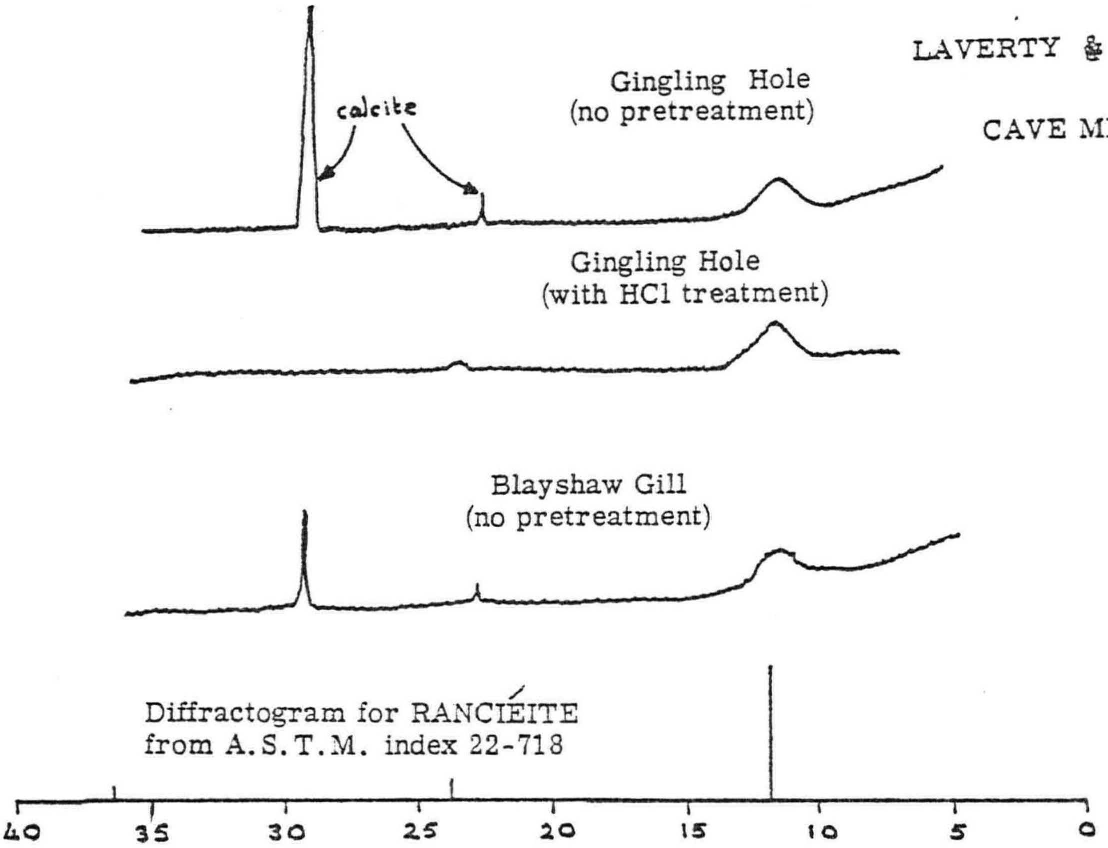


Fig. 1. X-ray diffractograms of speleothems with the peak for Ranciéite.
$^{o}2\ \theta$ For Cu Kα primary radiation

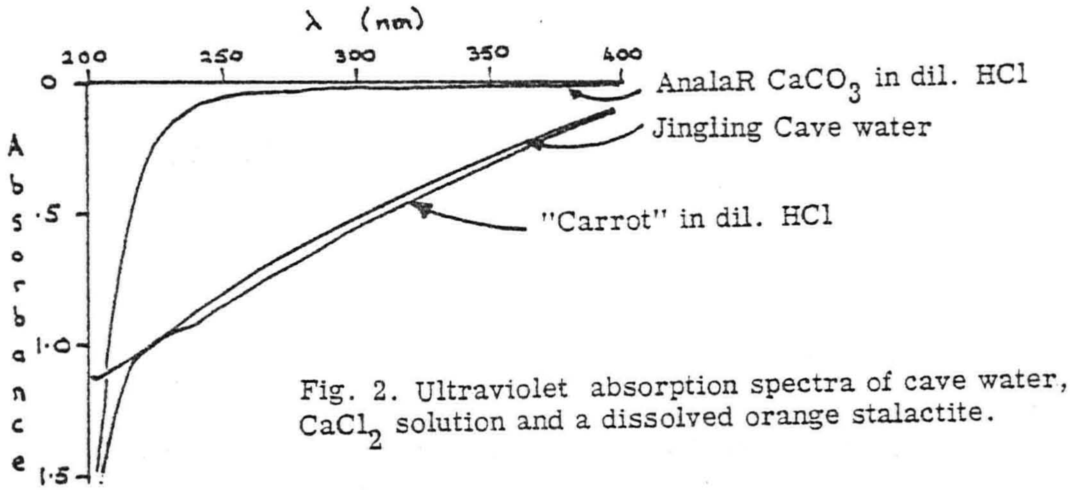


Fig. 2. Ultraviolet absorption spectra of cave water, $CaCl_2$ solution and a dissolved orange stalactite.

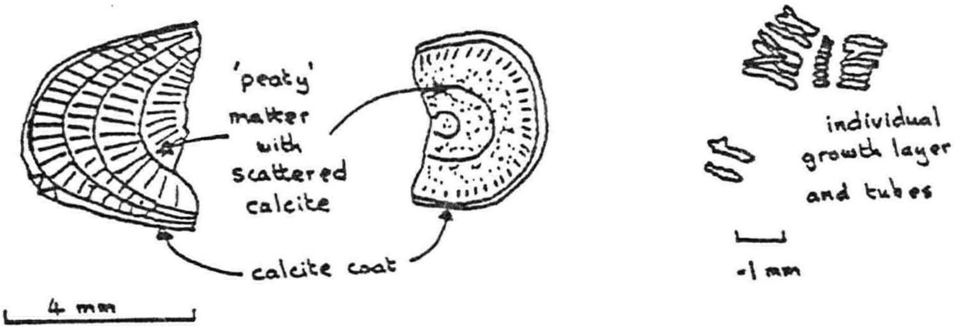
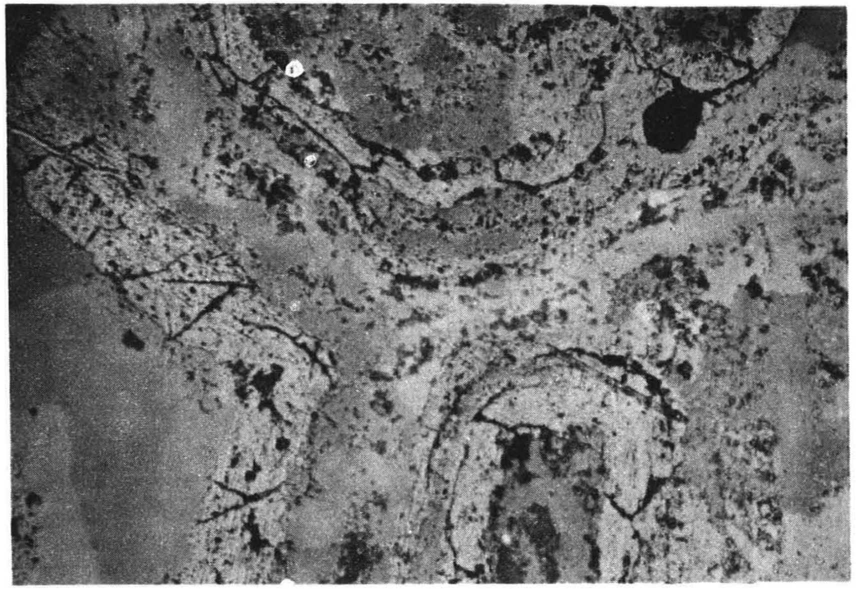
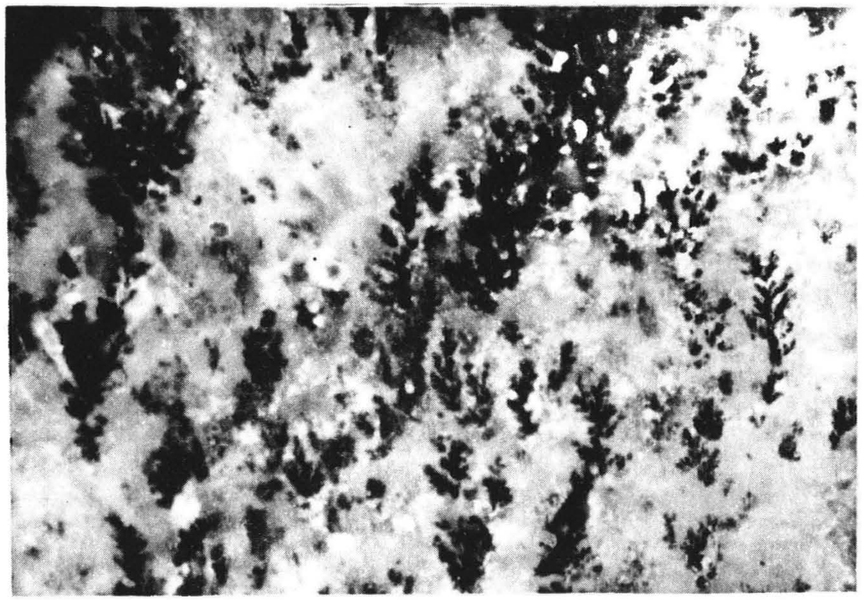


Fig. 3. Sketches of sections through stalactites showing'peaty'layers with radial tubules thought to manganese dendrites.

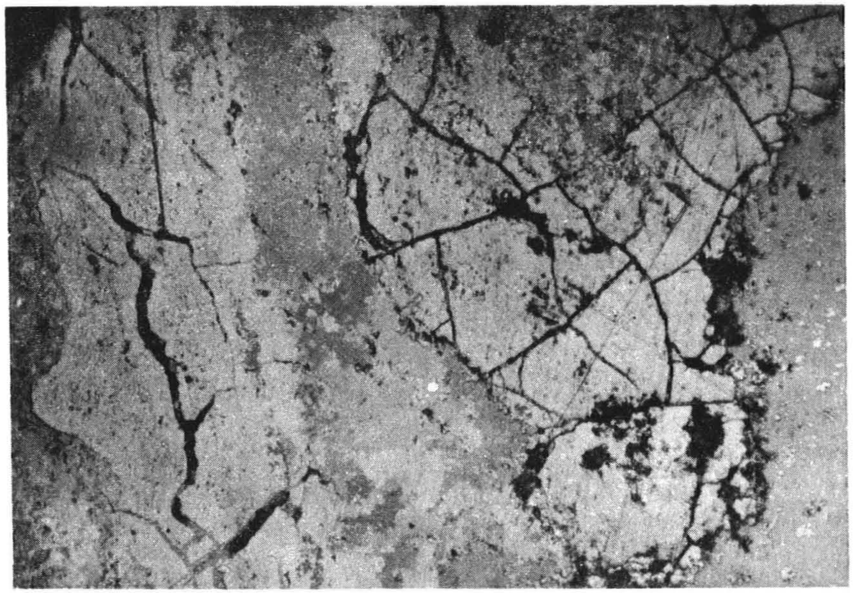
LAVERTY & CRABTREE PLATE 1 Reflected light micrographs of manganese mineral in speleothems.



1. Thin bands of manganese mineral (light grey with cracks) surrounded by calcite (clear grey). Polarized light x 250.

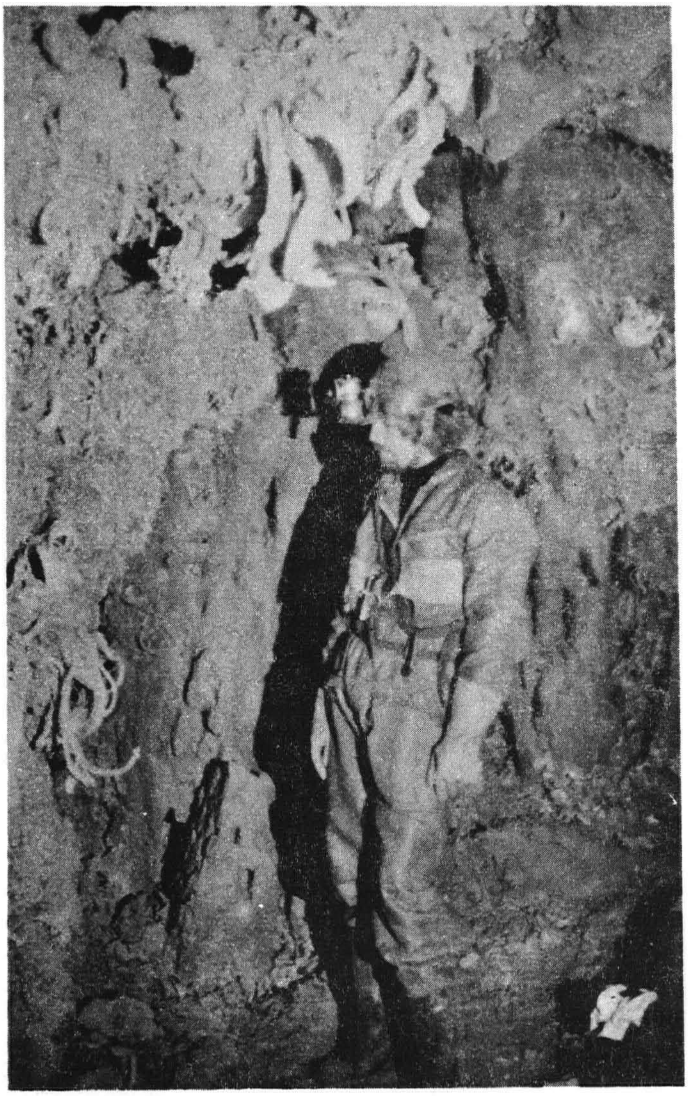


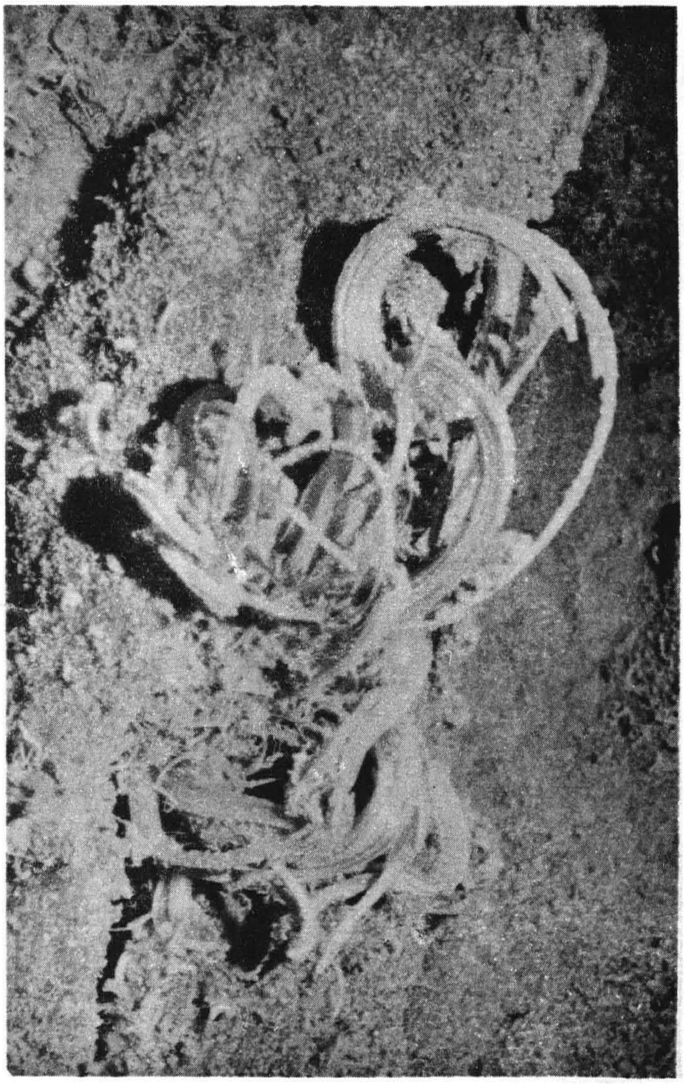
3. Manganese dendrites in calcite. Crossed polars. x 250.

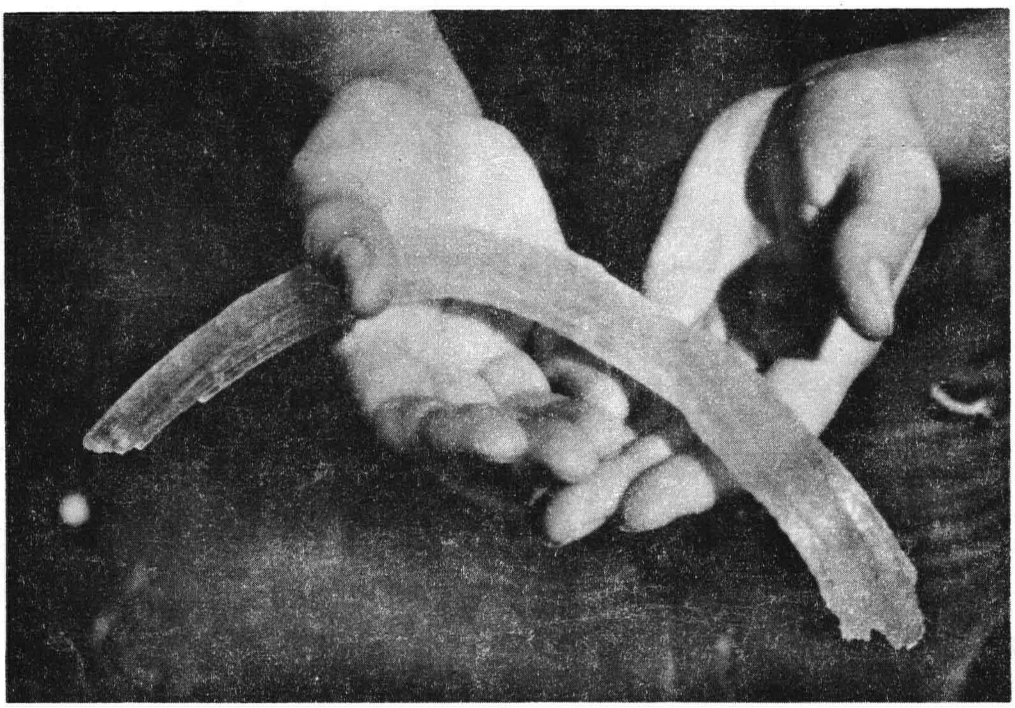


2. Detail of manganese mineral band with many cracks. Polishing scratches indicate softness. Cracks do not penetrate calcite. Polarized light x 250.

4. Magnified detail of manganese dendrites. Crossed polars. x 650.







Mirabilite in Torca la Barga, Picos de Europa, Spain interesting geochemical problems which remain to be studied closely. However, it seems reasonable to conclude that ranciéite can be a primary mineral deposited in a karst environment, although it can also be a secondary mineral formed by alteration of mineral deposits of primary manganese ores. These identifications appear to be the first reports of this mineral in Great Britain.

COLOURED CALCITE

Gascoyne (1977) has suggested that humic substances may play a significant role in the colouring of speleothems, but did not present any definite evidence, although his trace element studies have shown that calcite colour cannot easily be related to chemistry. However, direct evidence for the presence of humic substances in speleothems has been obtained in the case of the orange-brown 'Carrot', after which Carrot Passage in the West Kingsdale Cave System was named. Dissolution of a small sample of this in dilute HCl yielded a very faintly yellow solution which responded to the thiocyanite test for iron only after a significant period of time (about 10 hours), which suggested that the element was present in a complexed form. On prolonged standing, the solution became clear by precipitating a brownish-orange floc, typical of that deposited when peat-coloured waters flocculate. The material was shown to be very similar to the colouring matter in Jingling Cave water, Kingsdale, by examination of the ultraviolet spectrum of the solution (Fig. 2) and of the infra-red spectrum of the precipitate in a KBr disc. Thus, it is concluded that the brown-orange colour of this stalactite was due to the presence of the humic substance and only incidentally to the iron complexed by it. The presence of this organic matter encourages speculation that it may prove useful for dating purposes, but this remains to be seen.

REFLECTED LIGHT MICROSCOPY STUDIES

The ubiquitous coating of manganese on cave walls and formations has been investigated in two caves: Dow Cave and Gingling Hole, Yorkshire. The specimens were examined under reflected light microscopy.

The ore minerals of manganese constitute one of the most complex and difficult groups of minerals to study (Freund 1965). There are two reasons for this: firstly, the optical properties of individual ores overlap, and, secondly, the ores are frequently so fine-grained that they cannot be resolved on a normal optical microscope. Further problems have been encountered in attempting to polish specimens of the soft minerals. The mixing of optical properties is due to the variable oxidation states of Mn and flexible chemical substitution.

i) Dow Cave

A specimen was collected from a vein of barytes and calcite past the first boulder choke; the dark coating was identified as some form of manganese deposit in hand specimens. The specimen was mounted so the cross-section through the vein was maintained during the preparation of the specimen (Plate 1, fig. 1).

The manganese ore was not identified, but had a low reflectance of 1.01 - 1.10 in oil (about 9.0% in air) using 546 nm λ light. An attempt was made to measure the microhardness but because of the fine-grained nature the results were not reproducible. The mineral has a light-grey colour and very weak bireflectance (Photo 2). Apparent isotropic properties may be due to the small grain size.

The morphology of the mineral is in contrast with the Gingling Hole specimen (Plate 1, fig. 3). It occurs in thick blocky bands which are frequently cut be microcracks (Photo 2); even the small grains still maintain a blocky form. The bands are amorphous and individual crystals are irresolvable. Calcite surrounds the bands and it is found also in the cracks (Plate 1, fig. 2); the calcite in the cracks is in optical continuity with the surrounding calcite. This indicates that the manganese ore was solid before the calcite was precipitated.

ii) Gingling Hole

The specimen was part of a calcite flowstone and was banded. The block was polished so that a cross-section through the banding could be examined. The mineral showed similar optical properties to the Dow Cave specimen, but the grains were too small for reflectance and microhardness analysis.

Microscopically the bands were difficult to identify because they were found to consist of dendritic growths at right-angles to the banding (Plate 1, fig. 3). In one area the dendrites were accompanied by a blocky form. The dendrites consisted of a central, well-crystallised core which was visible in plane-polarised light; however, when the polars were crossed a much larger area around the core was found to be altered giving a more typical dendritic structure (Plate 1, fig. 4).

Manganese ores are commonly found with dendritic or "fern-like" growths, e.g. pyrolusite, commonly seen growing along bedding planes. In this case the dendrites were growing into solid calcite (Photo 6). From this evidence it is suggested that the manganese ore was precipitated in discrete particles on the surface of the formation and subsequent precipitation of calcite has entrapped the manganese mineral.

CONCLUSIONS

The ores are difficult to identify because of their chemical and physical properties.

The ores identified in the specimens are thought to be manganese oxides, probably with calcium present.

The two specimens have different morphologies due to the method of crystallisation from cave waters.

DISCUSSION

In the light of the reflecting microscopic studies it is possible to expand somewhat upon the 'Black calcite' notes above. This was deliberately brief in view of the limited nature of the studies carried out: X-ray diffractometry for mineralogical identification (Blayshaw Gill and Gingling Hole) and rapid electron microprobe examination of carbon-coated polished sections for chemical data (Gingling Hole and Ibbeth Peril), plus observation under a low-power binocular microscope. Acetate peels have also been tried as a means of studying the micromorphology of the samples.

It is hoped that the further application of these and other techniques will enable a far more detailed, better illustrated and more extensive study of manganese deposits in caves to be published in the future. This could be especially interesting because of its possible bearing on such subjects as:

Geochemical studies of trace element controls in cave waters.
Organic substances and/or processes in caves.
Controls on manganese mineralogy.
Depositional environment.

Observations

The dendritic forms so clearly revealed in Photographs 4 to 6 resemble the structure of the sample from Blayshaw Gill. However, the peaty material in this case appears to make up the bulk of the sample and the dendriform tubes, arranged axially perpendicular to old growth surfaces, are of the order of millimetres in length (Fig. 3).

The peaty nature of this sample suggests that a re-examination of the peat stalactites of Burke (1970) may be worthwhile since chemical or mineralogical analyses were not presented and the loss on ignition figures seem rather low for a wholly organic deposit (0.05% C in subsurface peat!).

The manganiferous grains in the Ibbeth Peril stalactite seem to be amorphous (blocky) but need to be looked at more closely. They are largely arranged along concentric arcs representing old stalactite growth surfaces and would, therefore, seem to have formed as surface encrustations, later buried by renewed calcite deposition.

The electron microprobe studies revealed that there were two manganiferous phases present in the calcite. One of these is much darker and the other much lighter than calcite in the electron image, the darkness being proportional to the average atomic number of the specimen under study. Thus, the light phase is either highly hydrated or organic, although which could not be shown by the microprobe used. In the Gingling Hole sample, dark grains were analysed with compositions up to 43 wt % Mn, 7 wt % Ca (ranciéite, the Ca end member is 46% Mn, 9% Ca), which seems fairly conclusive as the analyses were only semi-quantitative. Composition was not uniform and there appeared to be an increase in Mn and decrease in Ca towards the centre of the whole manganiferous grains, the dark phase always being surrounded by a larger area of the light phase. No trace elements (Fe, Ba, K, Na) were detected in the manganiferous grains in either specimen although in Ibbeth Peril there was a slight concentration of Al at grain boundaries with calcite, not associated with Si, and thus, presumably, present as the hydroxide. There was very little Mn in the calcite, although there was some Mg, which did not appear in the manganiferous phases.

From this data, it appears that the altered area around the well-crystallised dendrite core revealed under microscopic examination with crossed polars may be the presumed organic manganese phase. In a similar way, the tentatively identified hydrated iron/manganese oxide may be a larger and thus more coloured accumulation of organic matter - a combined chemical and optical study is really needed to decide on this (one very small grain containing iron and manganese was found in the microprobe sample from Gingling Hole).

Some Ideas on Genesis

The most recent study of dendrites of (amorphous) Fe and Mn oxides, mainly found in association with limestones, classes them as internal or as formed on joint or bedding surfaces. Deposition is attributed to pH changes arising from limestone solution in an oxygenated environment, the metals having been introduced as soluble chelates. Scanning electron microscope studies show that the oxides form films on the sides of micropores and do not replace the rock as such (Van Straaten,1978). While pH and Eh are, undoubtedly, important controls on the transport, deposition and separation of Fe and Mn (Borchart 1970) the importance of organic matter and processes is probably greater in nature. Chelation has already been mentioned in connection with transport of metal ions and organic metabolism must now be considered for its highly specific and efficient chemical operations, much envied by mere mortal chemists. It is many years since Zapffe (1931) identified bacterial deposition as responsible for manganese oxide deposits in water supply pipes and we propose that many cave deposits could, similarly, be due to the action of Mn-oxidising bacteria. Thus, the dendrites found in the Gingling Hole flowstone may be genuine organic structures, or could be formed as envisaged by Van Staaten as precipitates (bacterial?) along the preferential supply routes for manganiferous solutions through the micropores. The Blayshaw Gill stalactite has a structure which certainly appears to be organic in origin, while the Ibbeth Peril stalactite seems to represent buried layers of manganese oxide encrustation.

Clearly, the occurrences show different morphological features which could be related to age or associated rate or type of calcite deposition. However, all contain a Ca, Mn oxide mineral in association with organic matter. It is not yet clear whether this is a primary precipitate, or crystallises from a matrix of organic matter and amorphous manganese oxides in an environment chemically dominated by $CaCO_3$ and its solution products. This latter hypothesis seems quite likely from the microprobe data and broad XRD lines, but requires further study to certify, preferably in association with structural and thermodynamic studies. Further structural studies should also help clarify the relationship of ranciéite to other oxides with similar XRD patterns. These include birnessite, $-MnO_2$, manganous manganite and calcium manganese oxide hydrate.

MIRABILITE FROM SPAIN

During the summer of 1977, the exploration of the Torca La Barga pothole near Sotres in the Eastern Massif of the Picos de Europa was completed (L.U.S.S. 1977). In the course of this exploration, an extremely well-decorated passage was found, the formations being thought to be made of gypsum, many occurring as very large, transparent, curved needles (up to 40 cm. long), which projected from walls, roof and floor (Plate 2). However, if exposed to air after being removed from the cave, the material rapidly became white and disintegrated, and it was also found to be extremely soluble. All became clear when a sample stored in a sealed polythene bag was examined by X-ray diffraction. The material is mirabilite ($Na_2SO_4 . 10 H_2O$) which dehydrates in a matter of minutes under normal surface conditions to form the white anhydrous mineral thenardite (Na_2SO_4). The only other large underground occurrences of this mineral are in the Mammoth-Flint Ridge Cave system in the U.S.A. and in the 'agglomerate caves' formed by solution of sulphates in the pyroclastic deposits of the soda-calcium rich Mt. Elgon volcano on the Uganda-Kenya border (Sutcliffe 1973). The geological implications for this occurrence in Spain are interesting. Sodium is not usually present in karst waters in quantities greater than about 20 ppm so the waters responsible for these formations must have had a very atypical composition. Two possibilities seem to present themselves; either the limestone sequence above the cave contains appreciable amounts of evaporite minerals such as rock salt or mirabilite itself, or the sodium was originally contained in the mineralising fluids which were responsible for deposition of the zinc minerals exploited in the nearby mines which have been partially explored by Nottingham and Lancaster University parties. The sulphate may likewise come either from evaporites or from the oxidation of sulphides. In either case, some very interesting geological and speleological work clearly remains to be done.

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THE PERI-GLACIAL VADOSE EFFECT; EVIDENCE FROM DEVON CAVES

by T.M. Bailey

ABSTRACT

Many of the Devon caves show an evolutionary sequence of passage morphology which can be categorized as (a) Upper phreatic; (b) vadose trenches; and (c) lower phreatic. The distribution of these in relation to catchments and to sea-level changes during the Pleistocene suggests that the classic theory of a gradual change from phreatic conditions to vadose is inadequate, and a new peri-glacial vadose hypothesis is proposed.

In this it is argued that vadose drainage with entrenchment and fill stages, could have taken place in limestones beneath a frozen ground cover under peri-glacial conditions. Sea-level would then have been low and the resurgences thus could have been below sea-level. Flooded freshwater resurgence potholes in the floor of Plymouth Sound may represent parts of a vadose system returned to phreatic conditions by the rise of sea-level in post-glacial times.

THE 'CLASSICAL' THEORY

The main cave systems in Church Hill, Buckfastleigh, are those of the Baker's Pit/Reeds systems and Pridhamsleigh caverns. These have been described as phreatic in origin and dendritic in plan, the vadose development being placed in a secondary and minor role related only to the drainage of the cave systems during the Hoxnian and Ipswichian interglacials. But the rapid drainage would have led to virtually no vadose development.

PROBLEMS

Problems are numerous if the classical theory of speleogenesis is applied. Firstly, there are the stalactites of Pridhamsleigh Lake which are 12 metres below the present water-table and supposedly 12 metres below any glacial water-tables. Furthermore the lake is now known to descend below sea-level and divers have reported that it still continues downwards. Secondly, a close look at the structure of the Baker's Pit/Reeds system reveals large vadose canyons, which, due to the later infill of much of the cave systems, have been somewhat disguised. The systems may be divided genetically into three levels:-

1. Upper Phreatic - small tubes of approximately 1/1.5 m diameter.
2. Extensive Vadose - entrenchment extending from these upper phreatic tubes downwards as mush as 20 metres.
3. Low Bedding Plane Chambers usually floored by the underlying impermeable dolerite. These chambers may be up to 30 metres in diameter and yet only 0.5 m to 1.2 m high.

A note should be made here about the more recently deposited sediments, Devon being notorious amongst cavers for its mud. These sediments have tended to fill large parts of the systems but especially the second level of vadose entrenchment and to a lesser extent the stage three bedding chambers. The reason is largely due to the narrowness of many of the canyons (Fig. 1). It is this later infill that 'disguises' the system so that it is difficult to tell exactly what one is observing; it leaves the first and third levels as air-cavities, whilst filling in the second level canyons leading to a false assumption of two phreatic levels only. For example, 'Crystal Corridor', a long, straight 'half-moon' phreatic passage formed on a fault shows its real nature at 'The Slabs' where a vadose entrenchment extends downwards following the tilt of the fault. This vadose section extends for 17 metres whereupon a stream coming down from above enters a pro-phreatic* conduit, which carries the water down a further 9 metres

*Pro-Phreatic flow is defined as:-'flow in water-filled passages carrying water above the general water level'. (after Glennie, E.A., 1954) to where it emerges downstream and east of Judge's Chamber in the floor of another stream. Two more abandoned pro-phreatic tubes, 'Dutch Oven Tunnel' and 'The Drain' extend from the same altitude as the present active one already mentioned, and these both lead to lower areas which are conclusively vadose developed.

The Drain comes out in what would have been a 6 metre pot, now Judge's Chamber, and Dutch Oven breaks out of past pro-phreatic confinement half-way up the so-called 'Fifty-foot Pot'. Suffice it to say that there are large areas of the Baker's Pit/Reeds system that sport an incredible complexity of vadose passages connected by abandoned phreatic tubes and pro-phreatic tubes, some of which are still active. Accepting the existance of vertical vadose development destroys the 'classical' theory on the grounds of the time factor. This large entrenching of the system could not have occurred during a relatively short period during which the caves were drained in inter-glacial times.

The problem is to find a period (or periods) in which vadose development of these systems could have occurred in the geological past, or an alternative explanation.

THE ROLE OF PERIGLACIATION

Periglaciated regions are defined as those that have undergone an episode of proximity to an icesheet without actually suffering the effects of glacierization. This part of south-west England is well-known for its periglacial features, but here consideration will be concentrated on likely or possible effects of periglaciation upon the limestone areas.

Accepting that for the most part, the ground surface is frozen solid in a periglacial phase so that surface streams and run-off will be conducted over the surface without appreciable percolation taking place, then the question is what happens beneath the frozen surface layer which is acting as an impermeable cover?

It seems that existing phreatic networks formed in the early Pleistocene faced with this situation began to drain. However, percolation is not the sole source of water to Devonian networks. One other major source at the present accounting for over 50% of water input is from artesian sources and it seems that these sources date back to the earliest phases of cave formation. (This estimate is conservative as an accurate assessment is not yet possible).

Thus, the improbable balance occurred with the periglaciated surface creating a perched surface water-table whilst a second water-table was maintained considerably lower. Between the lower table and the base of the frozen surface, artesian inputs continued permitting vadose down-cutting until the lower table was reached and phreatic activity was resumed. This is the essence of the *Peri-glacial Vadose Effect.*

EVIDENCE FOR THE PERI-GLACIAL VADOSE EFFECT

Firstly, it needs to be established clearly that massive vadose activity within the altitude ranges of 60 metres above present sea-level to 100 metres below present sea-level, could only have occurred during a glacial period and not during an interglacial. The Wolstonian and Devensian are the last two glacial phases in which the sea-levels dropped to 100-140 metres and 55 metres below present sea-level (Fairbridge 1961). Hence, these were the only times when a very low sea-level could have caused rapid underground drainage from the coastal limestone areas of south Devon.

Downcutting at such times of low sea-level could explain the large vadose pots of Pridhamsleigh lake. The lake's surface has an altitude

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Hypo-Phreatic flow is defined as:- 'artesian flow into the groundwater zone from a non-cavernous aquifer tapped by phreatic action'. (after Glennie, E.A., 1954) of approximately 40 metres above sea-level and is estimated to be about 42.7 metres deep, forming one of the deepest sumps in the country. Further west, there are the intriguing Millbay Blue Holes in Plymouth Sound. These holes, just off-shore, are in 40 metres of water and known to be at least 30 metres deep although no firm figure has been obtained owing to their being in a naval shipping lane! They issue fresh-water in quantity. The limestone in this area is, however, known to extend to 200 m below sea-level. Moorcroft Quarry, near Plymouth, extends below sea-level and when a cave was breached by quarrying, it was flooded with fresh-water to a depth of more than 10 m within a few hours, demonstrating the existence of a complex water-logged joint network. Phreatic solution is presumably going on but cannot be proved owing to lack of access.

Some parts of the water-logged fissure system are probably vadose in origin owing to the run-off during the Wolstonian glacial; after a period of return to phreatic conditions during the high sea-levels of the Ipswichian interglacial, vadose activity may well have been resumed during the Devensian, the last glacial period. Today, in post glacial conditions, these pots have again been returned to phreatic conditions, but the stalactites in Pridhamsleigh Lake confirm its former vadose state.

THE CONCEPT OF RE-PHREATICISM

It is important to establish that a 'drained system' or an 'active vadose system' possesses the ability to 're-phreaticise'. By its nature, it is difficult to prove since being in post-glacial conditions at present, most evidence will be underwater and also re-phreaticism over any lengthy period destroys features of a former vadose phase by re-solution.

With reference to Fig. 2, in the selection of cross-sections it may be seen that the canyons have a well-rounded nature. Note also the point of contact where the top pro-phreatic tubes (Level 1) meets the vadose canyons (Level 2 development). This point of contact is not sharp as often found in other areas but rounds in smoothly. This suggests a later overall solutional effect on the walls.

Joint Mitnor Cave has some interesting water-level marks. It has been suggested that these are levels of 'pause' as the water drained out of the caves with the entrenchment of the River Dart into its valley floor. It is true to say they are levels of 'pause' but are they pauses of existing waters or pauses of maximum reach of re-invading waters? The author suggests these may be interglacial invasion marks.

ARTESIAN INPUTS AND ASSOCIATED LANDFORMS

Fig. 3 shows the basis of artesian water input into the overlying limestones. It may be seen that artesian water rising up the hypo-phreatic feeder fails to disperse immediately upon first contact with the limestone but rises up the fault line to a higher level. Discharge then takes place, probably from several points, and gravity feeds back to base-phreatic conditions incurring vadose entrenchment on the vertical sections and using pro-phreatic conduits on the horizontal sections. A drop in pressure or a decrease in volume input will result in higher abandoned passages whilst the same erosive forces operate at a lower level. Fig. 3 is modelled upon the Baker's Pit main chamber stream (otherwise known as 1st chamber stream) although it is the basic model for some of the following arguments.

Continued vadose action beneath a peri-glacial cover relies on artesian sources supplying the water inputs. Today, many hundreds of springs and wells of artesian nature exist in South Devon on limestones, slates and other rocks. The question arises: would these have been as prolific in times of low sea-levels with water being tied up in ice-masses further to the north? The point is that the artesian sources must have inputs if they are to maintain supply. This is perhaps the great problem facing the peri-glacial vadose theory in that evidence cannot be produced from the past and hence the point cannot be conclusively proved. However, a look at some of the remarkable springs and wells of today in Devon may lead the rational reader to condone its possibility.

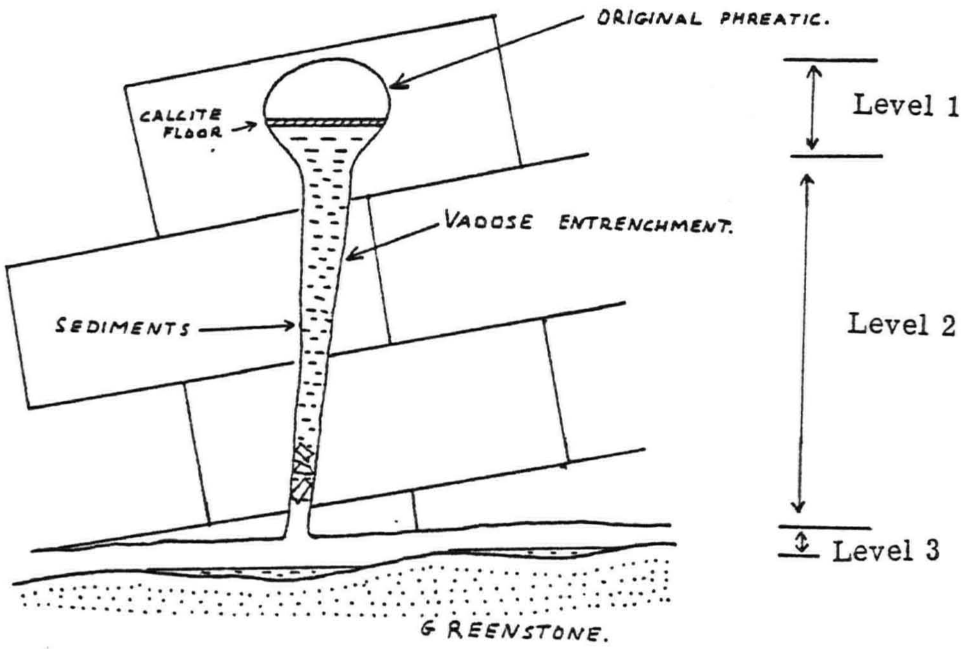

Fig. 1. Diagrammatic section of the Bakers Pit rifts.

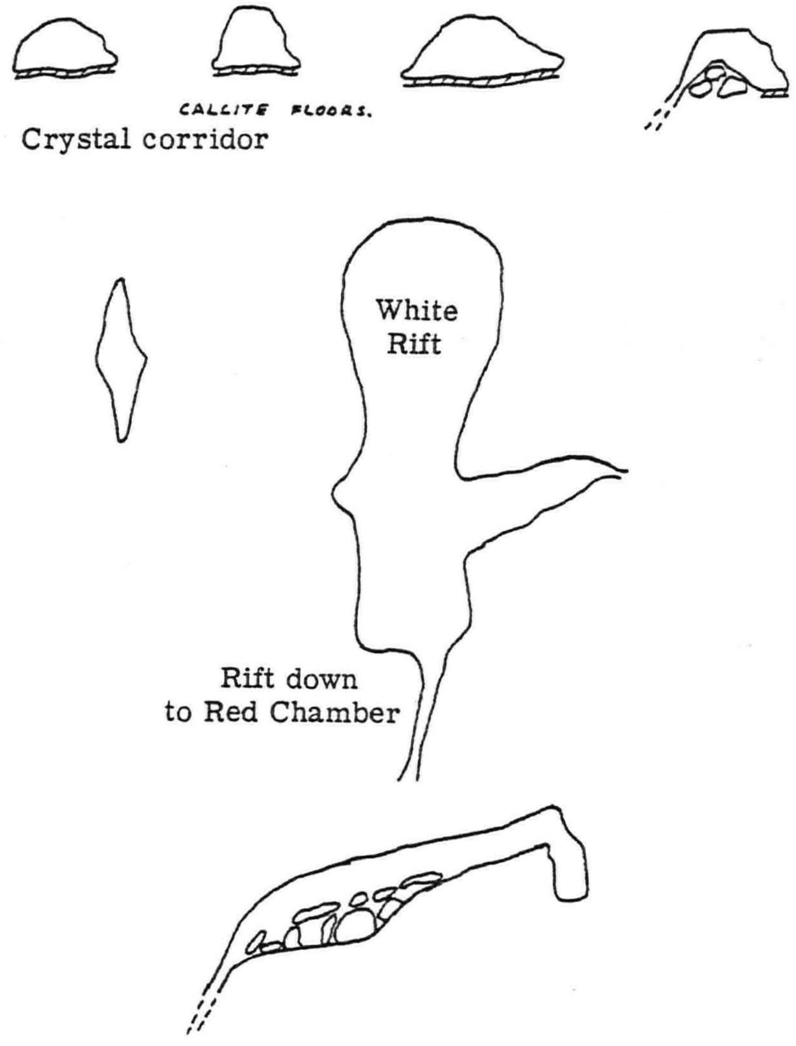

Fig. 2. Crystal corridor and other cross-sections in Bakers Pit.

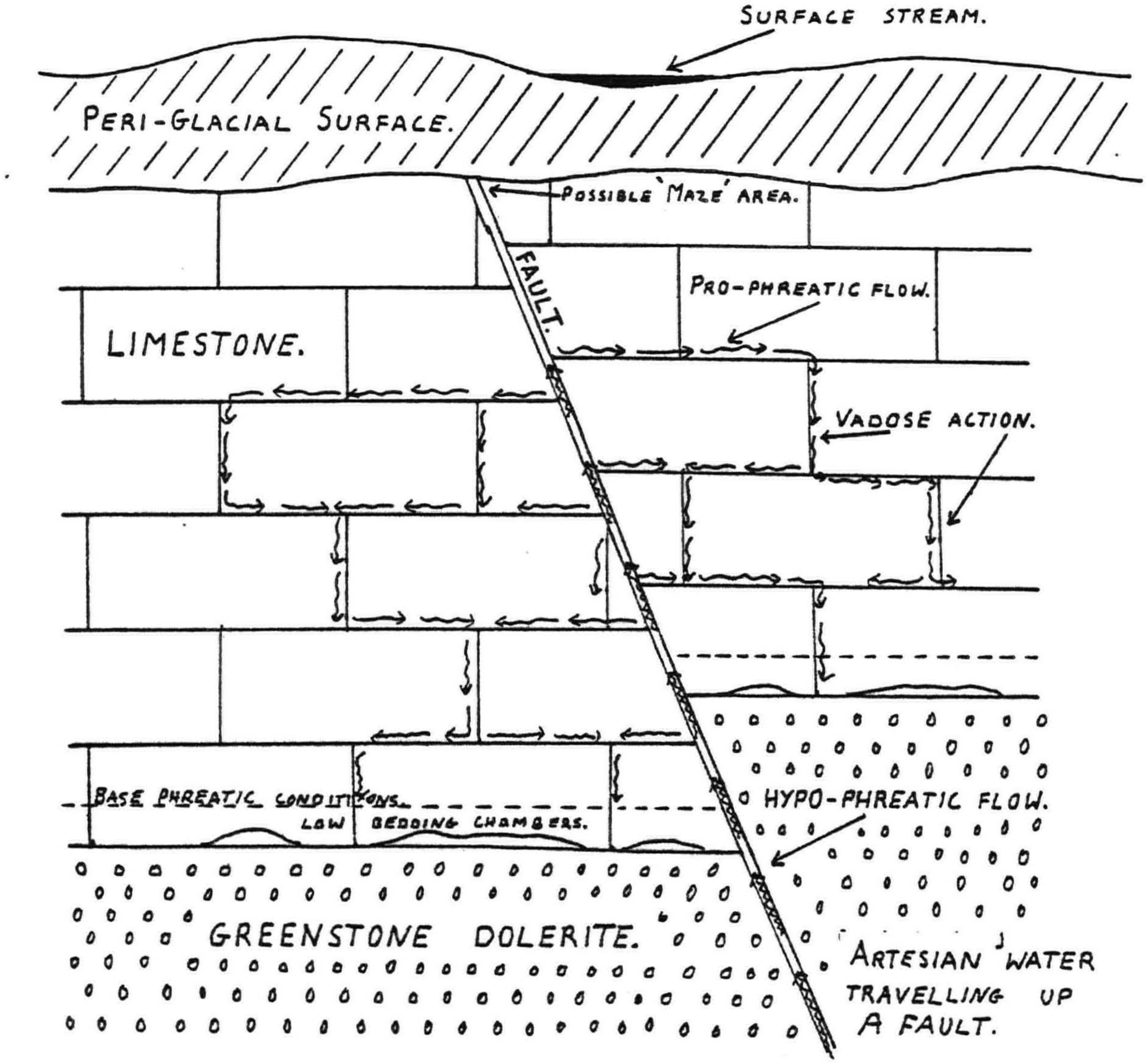

Fig. 3. The Peri-glacial vadose effect - water input into limestones via a fault beneath a frozen ground cover.

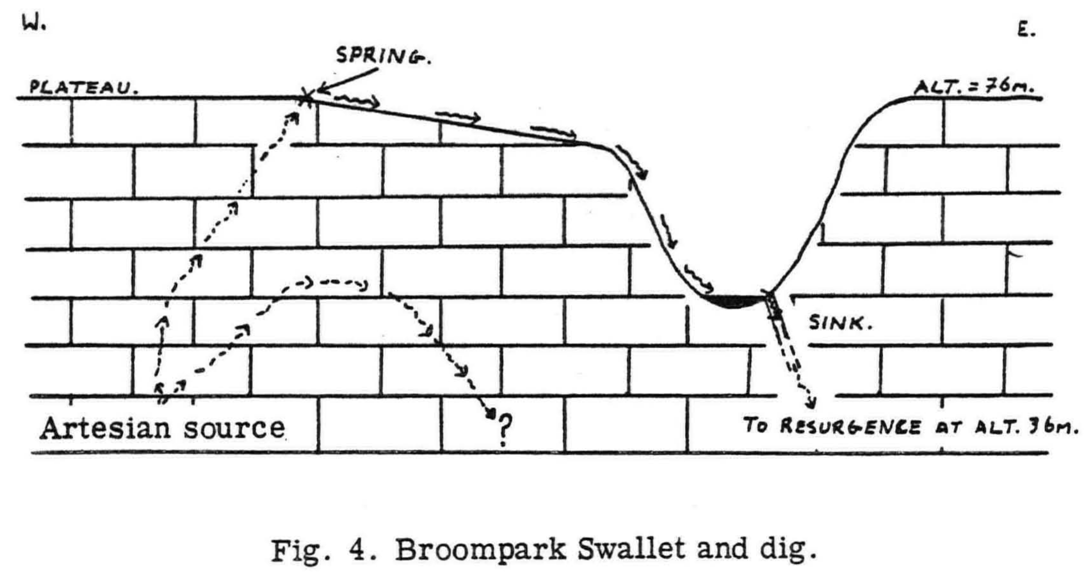

Fig. 4. Broompark Swallet and dig.

THE HIGH SPRINGS

1. Bigadon Hill is over the valley from Church Hill, Buckfastleigh, with its summit at the 188 metre mark. Four high-level springs issue on this hill at 137 m, 164 m, 145 m and 168 m. These flow in all weathers and in wet periods produce several subsidiary outlets. These are all in shales.

However, down the western flank of the hill limestone is encountered along a kilometre-wide belt running north/south. (The eastern extent into the hill is not yet known). Within this limestone, a number of 'resurgences' including Shakey cave and four other major issues in Potters Wood exist between the 61 and 76 metre contours. Their volume is considerable, indeed more water undoubtedly issues from beneath Bigadon Hill than ever falls on it by precipitation. The summit (and the high 'springs') overlook the whole area for miles excepting Dartmoor, lying west over the Dean Burn valley. The case is not uncommon.

2. Broompark Swallet is an unusual feature being a depression some 9 metres deep by 9 metres wide and 24 metres long with a central sinkhole (Fig. 4). It lies on a relatively flat limestone plateau with a steep escarpment to the south. The water supply to this sink is not, however, a local drainage stream but a spring rising at one end of the depression. The sink has been dye-traced to one of a series of springs at the base of the escarpment, 900 m distant and 40 m lower. The rising feeder-spring to Broompark swallet is probably on a fault and has caused the depression to form. With reference to Figs. 3 and 4 together it does not take any stretch of the imagination to realise that if this depression did not exist, a situation would emerge of water rising to a high-level and sinking underground with no visible surface appearance. Therefore it is worth noting that the re-emerging base-line escarpment springs (Broompark Resurgence 1; Broompark Overflow Resurgence, 5°C Spring; Mitpissnor spring and others) are discharging considerably more water than Broompark swallet can account for since this hypothetical situation certainly exists in other places on this plateau.

The water sampling programme at present being conducted by the Devon Karst Research group has shown that these artesian sources show very high saturation levels, and low temperature. For example the total water hardness of Baker's Pit 1 stream is 600 ppm, whilst the Shakey streamway has been recorded as high as 1000 ppm. The Broompark sinks and other similar swallets which derive their water from rising artesian sources in the near vicinity are generally around 300 ppm (Fig. 4) whereas percolation streams formed in wet weather such as the Plymouth Extension Streams of Baker's Pit have much lower values in the range of 150 ppm to 180 ppm.

THE EFFECT OF DARTMOOR

It has so far been suggested that artesian flows are rising on faults, but this should be expanded to include mineral veins of porous nature, metamorphic aureole rock boundaries and dykes. The southern slopes of Dartmoor, extending for some 10 km adjacent to the limestone areas, are well-endowed with these to such an extent that almost every cave, spring and dry valley owes its origin to their presence (see table 1).

THE LOW SPRINGS

1. Beneath a sea-fort in the middle of Plymouth Sound, approximately one kilometre off-shore, a bore-hole beneath the sea-bed supplied fresh-water under its own pressure.

2. At Moorcroft Quarry, Plymstock, during quarrying operations, a cave was broken into at 9 metres below sea-level. This issued enough fresh-water to flood the quarry-pit to a depth of 27.5 metres. The lake is now pumped to maintain it at 27.5 metres deep. This means that there is a hydraulic head at least 18.5 metres above sea-level in an as yet undefined catchment area.

TABLE 1 Geological and hydrological features of caves in Devon by T.M. Bailey & M. Lewarne

	FAULTS	LITHOLOGICAL BOUNDARIES	VOLCANIC DYKES	MINERAL VEINS	WATER-FLOW TYPES
BUCKFASTLEIGH AREA					
BAKERS PIT	✓	A.B.		✓	H.PH.PRO.IP.
REEDS CAVE	✓	B.	✓	✓	IP.
FAIRIES HALL	✓			✓	
RIFT CAVE	✓	B.			IP.
JOINT MITNOR	✓	B.			
SPIDERS HOLE	✓	B.			
SLOTHS HOLE		B.			IP.
SLOWPOKE		A.			
PRIDHAMSLEIGH	✓	A.B.		✓	H.PH.
BUNKERS	✓	A?		✓	IP.
SHAKEY	✓	A?		✓	H.PH.
TUCKERS ORCHARD CAVE		A.			
VALLEY SPRING		A.			H?
DART RIVER CAVE		B.			PRO.
LOVENTOR-TOTNES AREA					
AFTON	✓	✓			
CASTLE CAVE	✓				PRO.
BROOMPARK FEEDER SPRING	✓				H.
BROOMPARK RESURG.	✓				PRO.
LOVENTOR BOUNCE	✓	✓			VAUCLUSIAN.PRO.
DARTINGTON SUMP		✓			✓?
5°C SPRING	✓				H.PRO.
MITPISSNOR 5					H.PRO.
YEALMPTON AREA					
KITLEY SHOW CAVE					H?PH.
SMITHS S		✓			PRO.DISCHARGE?
SPARROWS GULLY S	✓	✓			PRO.DISCHARGE?
RAILWAY ARCH S	?				PRO.DISCHARGE?
KITLEY MEADOW S		✓			✓?
CATTEDOWN	✓				
RADFORD CAVE	✓				PH.INFLOW.
MOORCROFT LAKE & CAVE	?	? Probably			H.
PRYSTEN WELL		✓	✓		✓?
MILLBAY BLUE	?	? Probably			H.
ELBURTON SWALLETS		✓			
SPLINTERS POT		✓			H.

Abbreviations:-

	H.	Hypo-phreatic inflow
	PRO.	Pro-phreatic active conduits
	PH.	Phreatic. Either 'inflow' or lower system discharge
	A.	Vertical type boundary
Buckfast only	B.	Horizontal type (underlying impermeable strata)
	S.	Spring

3. It should be noted that Pridhamsleigh Lake, Pridhamsleigh Well and the Millbay Blue Holes all issue fresh-water in quantity from beneath the sea-floor.

Unfortunately, space does not permit a detailed examination of Devon's many karstic springs within this paper.

DRY VALLEYS AND FAULT-LINE VALLEYS

Numerous valleys in Devon appear either to lie on lithological boundaries or to follow fault lines. A geophysical survey across the Davey/Williams dry valley on the south side of Church Hill, Buckfastleigh, confirmed that this dry valley is formed on a shale/limestone interface (Thorman *et al.*, 1977). This probably represents the most westerly limestone boundary on Church Hill. Caves on the limestone side (now filled in), such as 'Slowpoke', may have resulted by artesian flow up this interface or alternatively, by influent waters flowing off the shale. The latter seems unlikely as the caves were exposed by quarrying and showed no evidence of any surface connection.

On the north side of Church Hill, opposite to the Davey/Williams boundary, the same interface occurs and a similar valley, this time with the high-level Tuckers Orchard Spring (70 metres O.D.) which flows in all weathers. This spring is indeed surprising since 30 metres underground and 60 metres southeast lie some of the main areas of Bakers Pit/Cave. The spring is also responsible for the Tuckers Orchard cave (now quarried away).

Finally, in the 'Loventor' area, 6 km. northeast of Totnes, the Gatcombe Brook and its tributaries follow a series of faults at 90^{o} to each other. A walk down the river bed with a thermometer reveals many cold rising springs in the river bed. Hence the name '5^{o} spring', named because of the difference between the stream and the spring water. Some of these are certainly artesian sources, whilst others are vauclusian in origin. In the drought of 1976, the deep artesian sources continued to flow whereas shallow ground-water discharge points ceased. It is obvious to the walker down the river bed that water volume is increasing rapidly all the time. In some cases, such as the 'Loventor' Manor spring (or 'King Bounce') water rises from limestone fissures with enough force to disturb the surface of the one metre deep pool. The Gatcombe Brook is important, because it suggests long-term discharge, a necessary condition for establishing vadose activity beneath periglacial conditions. This hypo-phreatic discharge supplies nearly all the water to the Gatcombe Brook and its associated tributaries and is the reason for the river network being fault-based. The apparent surface catchment area is incidental and relatively unimportant in terms of water collection and discharge.

JOINT NETWORK CAVES

A 'network maze' is defined as 'an angular grid of intersecting fissures formed by the solutional widening of nearly all major joints to roughly the same size, within a given area of soluble rock' (Palmer, 1975). The classic theory for the formation of such mazes requires limestones capped by impermeable strata. This is not a situation that occurs in Devon, and yet two, very small areas of network mazes occur in the Baker's Pit/Reeds system, namely, the area above Easter Chamber towards the Wessex series, and the area of the Plymouth Extension directly above Extension Rift. It is notable that these are both 'high' areas, relatively near the surface. The only possible explanation for their occurrence within the context of this theory is that the peri-glacial surface was acting as the impermeable surface cover. Also, these maze areas must have had direct supply of hypo-phreatic flow from below under considerable pressure. As the water diffused out of the source areas, faster drainage took place and vadose action was resumed.

These 'mazes' are not, however, a common occurrence, indeed they are not known to exist elsewhere in Devon. It should be noted that they are within the largest fault-based system in Devon and the 'maze' areas concerned are in close proximity to this fault which presumably was the hypo-phreatic feeder.

CONCLUSION

Peri-glacial vadose erosion is a product of a combination of factors:-

1. A continuous flow of artesian waters.
2. An area of limestone well-dissected by faults, mineral veins, lithological interfaces and igneous dykes to act as porous conduits for the artesian flow.
3. A close proximity to the sea, so as to attain rapid drainage in times of low sea-levels.
4. Long periods of peri-glacial climatic conditions.

It is highly unlikely, in the author's opinion, that this condition exists anywhere else in Great Britain and indeed the areas of the world in which periglacial vadose conditions might have existed or do exist are very limited.

The hypothesis presented herein is tentative: it will doubtless be rejected, re-iterated and, hopefully, improved. The author believes, however, for the present, that it offers more towards solving Devon's speleogenetic problems than other explanations. To the cave digger in Devon, a practical application of periglacial vadose theory may pay dividends!

What is available for examination in Devon at the present post-glacial time is very limited. The big pots in some of the considerable thicknesses of limestone are doubtlessly deep under-water.

ACKNOWLEDGEMENTS

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THE PROGRAMMABLE POCKET CALCULATOR IN CAVE SURVEYING

by Ivan Young

Abstract

Programmable scientific calculators can relieve the cave surveyor from much of the computational drudgery in survey plotting. Illustrated here by example programs for two particular calculators, the basic equations and methods described can be applied to any suitable device.

The consumer electronics industry produces a wide range of pocket calculators with correspondingly wide ranges of price and capability. For surveying use a minimum specification would call for trigonometric functions plus several storage registers for intermediate results and constants. Although avoiding the use of mathematical tables considerable pressing of buttons would ensue. Much more useful are those calculators which can also be programmed. The program is simply a series of instructions stored in memory that can be executed automatically with the press of a single button - one keystroke replacing many. Once correctly programmed a complex sequence of equations can be evaluated time after time with much less effort and in a much shorter time than operating the keys manually. The opportunity for human error to intervene is reduced to feeding in the data and reading out the results.

A programmable calculator gives a fast, accurate, easy to use method of reducing survey data to a plottable form. Closure errors can be found within minutes of reaching base camp whether in the heights of a mountain range or the depths of the local. Obviously bad sections of the survey can be discovered while still close or even inside the cave rather than several days and hundreds of miles later, allowing suspect results to be checked while still on the spot. The example programmes that follow are for two Hewlett-Packard calculators, but the general principles can of course be applied to any model or make.

THEORY

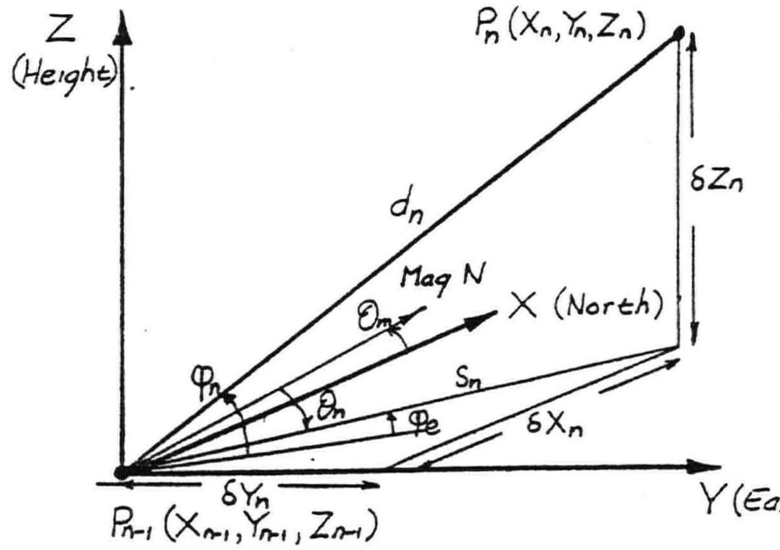
Caves are surveyed in spherical co-ordinates. Two angles, compass (θ) and inclination (ϕ), and one distance (d) define the vector from one station to the next. Before finding the absolute station position these must be converted into three incremental distances along the mutually perpendicular axes of the cartesian co-ordinate system - δX (N/S) δY (E/W), δZ (Height) (Libben, 1976). Figure 1 shows the relationship between the two systems. The survey station's absolute position is found by adding these increments onto the station co-ordinates of the previous station. Equations 1 to 7 (fig. 2) give the required transform. θ must be corrected for the magnetic deviation θ_m, and ϕ for the inclinometer error ϕ_e before use. θ_m is measured in degrees west of north. ϕ_e can be found by taking two accurate readings along the same line in opposite directions. If the results are ϕ_1 and ϕ_2 then:-

$$\theta_e = (\phi_1 + \phi_2)/2$$

Those whose mathematics are still fresh in their minds may question the definition of axes. X and Y appear to be interchanged. They are so defined because unlike angles in co-ordinate geometry that increase anti-clockwise, compass angles increase clockwise. By switching the X and Y axes the chosen nomenclature is also made consistent with the way calculator functions are labelled.

Program 1:

The first program (fig. 5) is written for my own calculator, the Hewlett-Packard model 55 (HP-55). Within its fifty lines of program memory it can easily store the equations of fig. 2 and more besides. The first and main program section from line 1 to 28 evaluates equations 1-7 and also accumulates total plan distance in register R3. Step 5b of the operating instructions should be followed after the position of



Spherical Co-ords

θ_n - compass bearing
φ_n - clino reading
d_n - slope distance

θ_m - magnetic deviation
φ_e - clino error

Cartesian Co-ords

δX_n, δY_n, δZ_n - three incremental distances along the orthogonal axes.
s_n - plan distance

FIG 1 Co-ordinate System and Nomenclature for survey leg from point P_{n-1} to point P_n.

$$\varphi'_n = \varphi_n - \varphi_e \quad (1) \qquad \theta_n = \theta_n - \theta_m \quad (4)$$

$$\delta Z_n = d_n \sin \varphi'_n \quad (2) \qquad \delta Y_n = s_n \sin \theta'_n \quad (5)$$

$$s_n = d_n \cos \varphi'_n \quad (3) \qquad \delta X_n = s_n \cos \theta'_n \quad (6)$$

$$X_n = X_{n-1} + \delta X_n \; ; \quad Y_n = Y_{n-1} + \delta Y_n \; ; \quad Z_n = Z_{n-1} + \delta Z_n \quad (7)$$

FIG 2 Equations for Co-ordinate Transformation

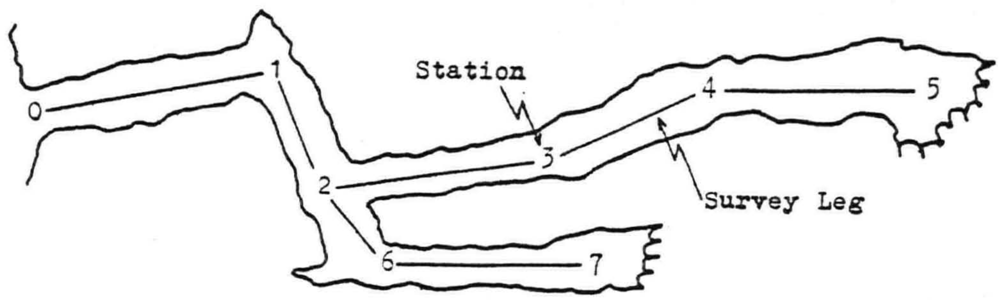


FIG 3 Survey with Junction

$\theta_m = 45^\circ$ $\varphi_e = 30^\circ$

Station		Compass	Clino	Slope Dist	Calculated Co-ordinates		
From	To				X	Y	Z
0	1	45	0	100	86.6	0.0	-50
1	2	135	60	100	86.6	86.6	10^{-8}
2	3	225	60	100	0.0	86.6	50
3	0	315	0	100	0.0	0.0	-2×10^{-8}

Total plan distance = 346.4

FIG 4 Test Data with results from Program 1

HP-55 User Instructions

Title: Survey Station Co-ordinates Calculation Page 1 of 1

Programmer: Ivan Young

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS				OUTPUT DATA/UNITS
1	Key in program						
2	Clear registers		f	CL R	g	CL.R	
	Set program counter to 00		BST				
3	Enter correction angles for compass and clino	θ_m	STO	0			
		φ_e	STO	1			
4	Enter start co-ords if non-zero	Height Z_o	STO	2			
		N/S X_o	STO	.	1		
		E/W Y_o	STO	.	3		
5a	Enter survey leg details	θ_n	↑				
		d_n	↑				
		φ_n					
	Compute and display co-ords		R/S				Z_n Height
			R↓				X_n N/S
			R↓				Y_n E/W
	OR						
5b	Store calculated co-ords for later use		R↓	R↓			Z_n
			GTO	2	9	R/S	Y_n
	OR						
5c	Recover stored co-ords		GTO	3	8	R/S	
	5a, b, c can be repeated any no. of times, in any order						
6	Recover total plan distance		RCL	3			$\sum_1^n S_k$

HP-55 Program Form

Title ______ Page ___ of ___

Press BST in RUN mode, switch to PRGM mode. Then key in the program

LINE	CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00.			φ_n	d_n	θ_n		Enter survey leg
01.	34	RCL					details
02.	01	1	φ_e	φ_n	d_n	θ_n	correct for clino
03.	51	−	φ_n'	d_n	θ_n		error
04.	22	X⇄Y	d_n	φ_n'			
05.	31	f				M	Polar to Rectangular
06.	00	R←P	S_n	δZ_n		a	transformation
07.	22	X⇄Y	δZ_n	S_n		i	
08.	33	STO				n	accumulate height
09.	61	+					
10.	02	2				P	
11.	23	R↓	S_n	θ_n		r	
12.	33	STO				o	accumulate total
13.	61	+				g	plan distance
14.	03	3				r	
15.	22	X⇄Y	θ_n	S_n		a	
16.	34	RCL				m	correct for
17.	00	0	θ_m	θ_n	S_n		mag. dev'n
18.	51	−	θ_n'	S_n			
19.	22	X⇄Y	S_n	θ_n'			
20.	31	f					Polar to Rect.
21.	00	R←P	δX_n	δY_n			transform
22.	33	STO					accumulate N/S
23.	11	Σ+					and E/W simult.
24.	34	RCL					recall N/S and E/W
25.	11	Σ+	X_n	Y_n			simultaneously
26.	34	RCL					recall height
27.	02	2	Z_n	X_n	Y_n		
28.	-00	GTO 00	Height	N/S	E/W		Return to 00; Stop
29.	33	STO	Z_n	X_n	Y_n		Store station
30.	09	9					co-ordinates in
31.	23	R↓	X_n	Y_n			registers R7 to 9
32.	33	STO					
33.	07	7					
34.	23	R↓	Y_n				
35.	33	STO					
36.	08	8					
37.	-00	GTO 00					Return to 00; Stop
38.	32	g					clear registers
39.	44	CL.R					R.0 to R.9
40.	34	RCL					
41.	08	8	Y_m				Recall stored
42.	34	RCL					co-ords from
43.	07	7	X_m	Y_m			R7 to 9 and
44.	34	RCL					restore to
45.	09	9	Z_m	X_m	Y_m		working registers
46.	33	STO					
47.	02	2					
48.	23	R↓	X_m	Y_m			
49.	11	Σ+					Returns to 00; Stop

REGISTERS	
R_0	θ_m
R_1	φ_e
R_2	Z_n Height
R_3	ΣS_n Total plan distance
R_4	
R_5	
R_6	
R_7	X_m stored N/S co-ord
R_8	Y_m stored E/W co-ord
R_9	Z_m stored height
$R_{.0}$	n no. of legs
$R_{.1}$	X_n accumulated N/S co-ord
$R_{.2}$	ΣX_n^2
$R_{.3}$	Y_n accumulated E/W co-ord
$R_{.4}$	ΣY_n^2
$R_{.5}$	$\Sigma X_n Y_n$
$R_{.6}$	
$R_{.7}$	
$R_{.8}$	
$R_{.9}$	

FIG 5

HP-25 Program Form

Title: Survey Station Co-ordinates Calculation — Page 1 of 1
Programmer: Ivan Young

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS				OUTPUT DATA/UNITS
1	Key in program replacing lines 01 to 05 with value of φ_e						
	e.g. for $\varphi_e = -1.5°$		[01] 1	[02] .	[03] 5	[04] 0	[05] CHS
2	Clear registers		f	REG			
3	Enter mag. dev'n	θ_m	STO	3			
4a	Store initial pos'n	E/W - Y_o	↑				
	(only nec. if non-zero)	N/S - X_o	↑				
	OR	Height - Z_o	GTO	4	3	R/S	0
4b	Initialize program counter		f	PRGM			
5a	Enter details of	θ_n	↑				
	next survey leg	d_n	↑				
		φ_n	↑				
	Compute and display	E/W	R/S				Y_n
		N/S	R↓				X_n
		Height	R↓				Z_n
	OR						
5b	Store present position		GTO	2	7	R/S	0
	for later use						
	OR						
5c	Recover stored position		GTO	3	5	R/S	Y_m
	5a, 5b and 5c can be repeated any number of times in any order						
6	Recover total plan distance		RCL	4			$\sum_{k=1}^{n} S_k$
	To change φ_e switch to PRGM mode and enter φ_e as for step 1		f	PRGM			

HP-25 Program Form

Title: ______ Page ___ of ___

Switch to PRGM mode, press [f] [PRGM], then key in the program.

LINE	CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00			φ_n	d_n	θ_n		Enter leg details
01	00	0					These five lines
02	00	0					are replaced by
03	00	0					actual clino error
04	00	0					when keying in
05	00	0	φ_e	φ_n	d_n	θ_n	program
06	41	−	φ_n'	d_n	θ_n		Clino correction
07	21	X⇄Y	d_n	φ_n'	θ_n		
08	14 09	f →R	S_n	δZ_n		M	Polar to Rect
09	21	X⇄Y	δZ_n	S_n		a	transform
10	23 51 02	STO+2				i	Accumulate height
11	22	R↓	S_n	θ_n		n	
12	23 51 04	STO+4					Accumulate total
13	21	X⇄Y	θ_n	S_n		P	plan distance
14	24 03	RCL 3	θ_m	θ_n	S_n	r	Correct for
15	41	−	θ_n'	S_n		o	mag. dev'n
16	21	X⇄Y	S_n	θ_n'		g	
17	14 09	f →R	δX_n	δY_n		r	Polar to Rect.
18	23 51 00	STO+0				a	Accumulate N/S
19	22	R↓	δY_n			m	
20	23 51 01	STO+1					Accumulate E/W
21	24 02	RCL 2	Z_n				Recall calculated
22	24 00	RCL 0	X_n	Z_n			co-ords to
23	24 01	RCL 1	Y_n	X_n	Z_n		stack
24	00	0	0	Y_n	X_n	Z_n	
25	22	R↓	Y_n	X_n	Z_n	0	
26	13 00	GTO 00	E/W	N/S	Height		Return to 00; Stop
27	24 02	RCL 2	Z_n				
28	23 07	STO 7					Store current
29	24 00	RCL 0	X_n	Z_n			position in
30	23 05	STO 5					registers R5÷7
31	24 01	RCL 1	Y_n	X_n	Z_n		
32	23 06	STO 6					
33	00	0	0	Y_n	X_n	Z_n	
34	13 00	GTO 00					Return to 00; Stop
35	00	0	0				
36	24 07	RCL 7	Z_m	0			Recall stored
37	23 02	STO 2					position in R5÷7
38	24 05	RCL 5	X_m	Z_m	0		to working
39	23 00	STO 0					registers R0÷2
40	24 06	RCL 6	Y_m	X_m	Z_m	0	
41	23 01	STO 1					
42	13 00	GTO 00					Return to 00; Stop
43	23 02	STO 2	Z_o	X_o	Y_o		
44	22	R↓	X_o	Y_o			Store initial
45	23 00	STO 0					position co-ords
46	22	R↓	Y_o				in working
47	23 01	STO 1					registers
48	14 34	f CLR STK	0	0	0	0	
49	13 00	GTO 00					Return to 00; Stop

REGISTERS
R_0 X_n accumulated N/S co-ord
R_1 Y_n accumulated E/W co-ord
R_2 Z_n accumulated height
R_3 θ_m magnetic deviation
R_4 ΣS_n total plan distance
R_5 X_m stored N/S co-ord
R_6 Y_m stored E/W co-ord
R_7 Z_m stored height

FIG 6

2 has been calculated before continuing the traverse to 5. After 5 has been found, step 5c will restore the co-ordinates of 2 into the working registers ready for calculating the positions of 6 and then 7.

The program in lines 5/6 and 30/21 uses the pre-programmed polar to rectangular co-ordinate transform. This calculates x = y cos y and y = x sin y simultaneously. Thus with d_n in the x register and ϕ_n in the y register, δZ_n and s_n are calculated by the instructions in lines 5 and 6 (equations 2 and 3 in fig. 2). Another function STO Σ + accumulates δX and δY in registers R.1 and R.3, and RCL Σ + recovers the accumulated totals into the x and y registers.

This program takes approximately six seconds to calculate the results for each survey leg.

Program 2:

Written for the Hewlett-Packard model 25 (HP-25) this program (fig. 6) is very similar to the first. Though program storage is more efficient this calculator has fewer storage registers - eight versus twenty for the HP-55. This is insufficient to store two sets of co-ordinates, the two correction angles, plus the total plan distance. By entering the inclinometer error as a constant when programming (lines 01 to 05) this limitation is overcome with one line of program to spare. The same polar to rectangular transform is used as in the previous program.

Program operation is faster than for the HP-55 at 3½ to 4 seconds per survey leg.

OPERATING NOTES

Once the calculator has been programmed I recommend that it be tested for possible errors using data with known answers such as figure 4. If during use a wrong value is entered and only discovered after being computed it can easily be cancelled out by entering exactly the same data again - including mistakes - except with the negative of the distance. Another use of negative distances is when the leapfrog method of surveying has been used. Because θ and ϕ are defined in the direction of the traverse, when a reverse bearing is taken they need to be converted to a forward bearing, i.e.: θ = 180 + θ; $\phi = -\phi$, or, much simpler and less accident prone, just enter the slope distance as a negative quantity. This short cut will, however, upset the total passage length calculated by the program.

Because calculations can be done so quickly, it becomes easy to project elevations along any desired heading θ_h. Change the magnetic deviation to $\theta_m + \theta_h$ and re-compute the station positions. The X axis coordinates will give the horizontal distances for the required elevation.

When using the program it is probably best for two people to be involved. One reading out the survey figures and writing down the results and the other operating the calculators. To minimise errors each should repeat back to the other what he has actually entered into the calculator or written down <u>not</u> what he thinks he did.

Other calculators:

Both calculators mentioned so far lose all their program and data when switched off. The Hewlett-Packard model 25c (HP-25c), otherwise identical to the HP25, retains both program and data indefinitely. The battery pack can even be changed without loss of memory provided it is done quickly. The HP-25c could be programmed, switched off, and taken underground installed in a protective transparent plastic bag. This would exclude water, mud, etc. , but allow the controls to be operated and the display read through the protective envelope. As each survey leg or section of the survey was completed the HP-25c could be switched on while the readings were entered and the results read off. Closure errors would be known before leaving the cave with a resultant increase of confidence in the survey.

Other more complicated calculators such as the Hewlett-Packard model 67 (HP-67) have more and better programming features and storage, plus a built-in magnetic card reader that can be used to store both programs and data. Looking to the future it could soon become possible to store all the survey results in a hand-held calculator-type device, making the survey record sheet obsolete for everything except sketches. Given a suitably rugged and reliable unit (Ellis, 1976) post-survey arguments over whether a particular muddy scrawl is a one or a seven, a nine or a zero, would also stop. This has yet to happen, and the calculators and programs just described are a major advance on the log-table and slide-rule era and have already proved their worth in the Glasgow Speleological Society explorations in Appin, Argyll.

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For more information on Hewlett-Packard calculators contact:

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IMPROVEMENTS TO THE ELECTRO-MAGNETIC LOCATION DEVICE

by M.S. Clark

ABSTRACT

Some minor improvements to the Smith and Stevens (1974) design of electro-magnetic location device are described and a new receiver design proposed.

Electro-magnetic location devices (also known as radio-surveying gear or inductive position finders) have been used on several occasions for locating and confirming the position relative to the surface of the further reaches of cave systems. New entrances have been found by such means, and in other cases it has been possible to correct surveys (see the articles by Lord, 1963; Christopher, 1968; Stevens, 1972 and Glover, 1973). Most of these have concentrated on the method of use and on field pattern theory, and only a few have given details of circuits. The technique involves generating a magnetic field underground by energizing a coil, and detecting this on the surface with a second coil, amplifier and headphones. The nature of the field pattern allows the axis and depth of the transmitting coil to be discovered with reasonable accuracy.

The device described by Smith and Stevens (1974) was first built and tested. Some minor changes to the transmitter were then incorporated and a complete new receiver was built to an improved design as described below. These make initial setting up easier and improve the range of the device.

THE TRANSMITTER

The circuit used is given in Fig. 1. RV1 is used in place of a variable tapping on the output coil, L1. The tapping is set at a suitable ratio (Table one gives coil details) and RV1 used to set the feedback for the most reliable squegging. The prototype could be made to squegg with a supply ranging from 6 to 14 volts at the same setting of RV1. This is considerably easier than having to scrape the insulation from enamel wire only to find that the wrong place has been chosen. Component values have been modified in some cases to allow the use of more readily available or physically smaller devices. N1 flashes with the bursts of oscillation giving a visible indication of correct operation. C5 allows use of the circuit with dry batteries. Two lantern batteries in series are most effective although the larger transistor batteries have been used in times of need. Transmitter A (Plate 1, photo 1) was constructed on a stout paxolin board equipped with a stereo jack socket and crocodile clips for coil and battery connections. This was then encapsulated in paraffin wax to protect it from moisture and a neoprene pouch made for mechanical protection. The coil used with this circuit is of smaller diameter than that of Smith and Stevens (1974) thus allowing it to be used in smaller passages. Transmitter B was made to fit in the bottom half of a small ammunition box (Plate 1, photo 2)

Table 1. Details of coil construction (using GPO-type PVC trunking)

COIL	NO. TURNS	WIRE SIZE	COIL DIA.	COIL WEIGHT	TUNING CAP.
TX-1	∿120	20swg	30cm	1kg	0.5μF
TX-2	∿100	$1mm^2$ 19swg	40cm	1kg	0.85μF
RX	∿500	32swg	75x75cm	1kg	6.8nF

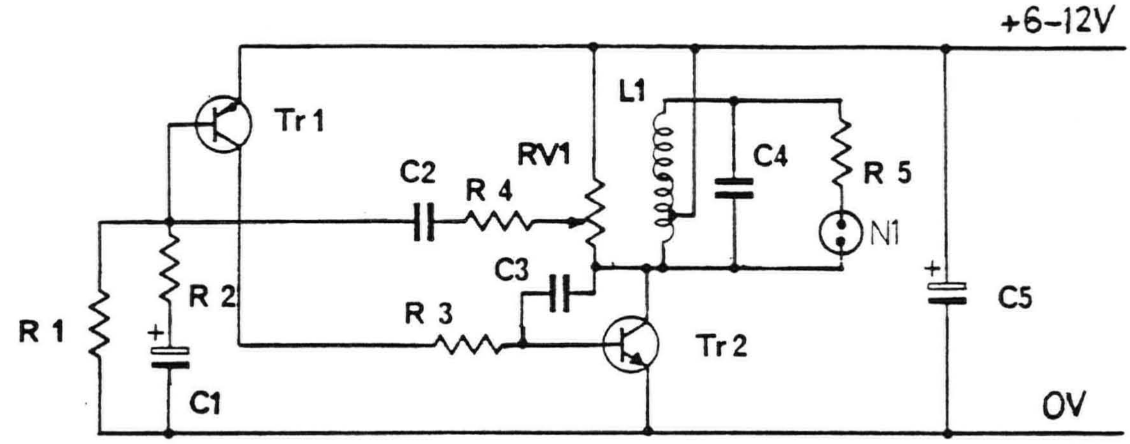

Fig. 1

TRANSMITTER CIRCUIT

R1	6K8	C1	2u2 16V tantalum	Tr1	BFX88
R2	120K	C2	220n met. polyester	Tr2	2N3055, TIP3055
R3	56R	C3	1000p polystyrene	N1	Wire ended neon
R4	1K0	C4	See table 1		
R5	120K	C5	2200u elect.		
RV1	470R	L1	See table 1		

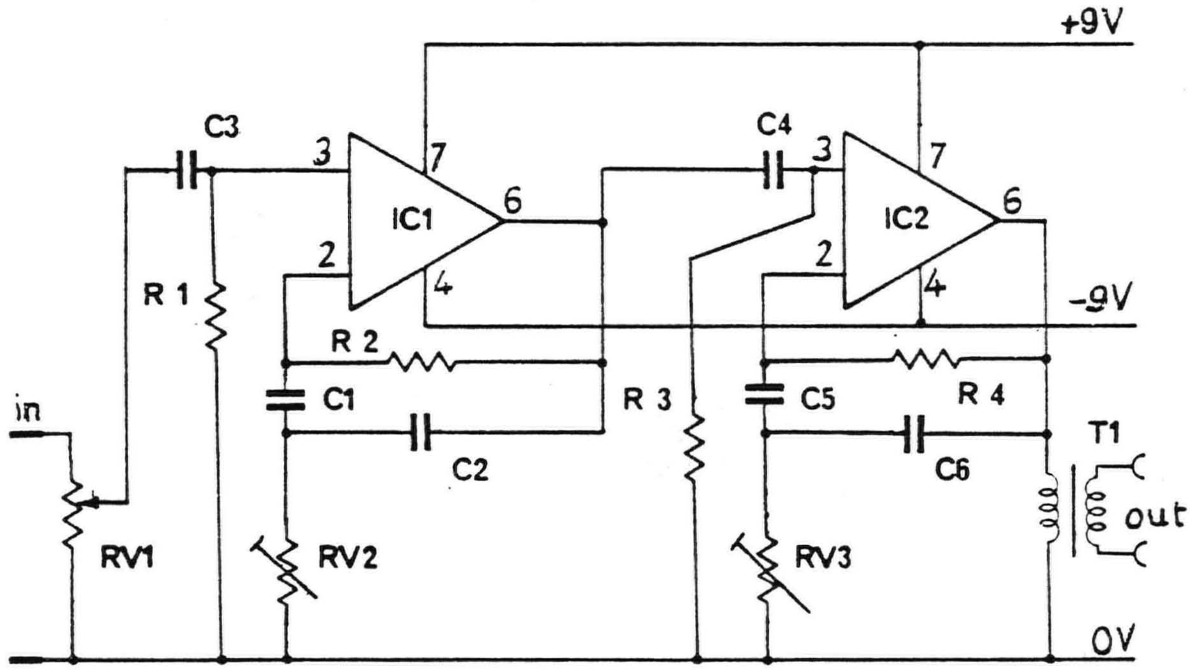

Fig. 2

RECEIVER CIRCUIT

R1, R3	68K
R2, R4	68K
RV1	100K W/Sw
RV2, RV3	470R

C1-C6	22n met. polyester
T1	10.1 miniature
IC1, IC2	741 op. amp.

when complete with dry batteries, or in a sealed lead acid accumulator. The larger coil requires more capacitance to tune to the same frequency as transmitter A - allowing the use of a single receiver.

THE RECEIVER

The receiver circuit of Smith and Stevens (1974) was found to be prone to pick up mains radiation and not altogether free from pick up of radio signals. A selective amplifier was obviously required. Various circuits were tried but the most useful one was found in Hibberd (1972). This has the advantage of being tunable over a reasonable band with a single control. Type 741 operational amplifiers can be used and two stages are cascaded to give a centre frequency gain of 10,000 with a bandwidth of 400Hz. The centre frequency used was about 2600Hz and the receiver coil was tuned to this frequency (details in Table 1). Full design details for other frequencies are given by Hibberd (1972). With careful layout a single '558' device (dual 741 in 8 pin d.i.l. package) may be used. The complete circuit was assembled in a small diecast box. Two PP3 size, nine volt batteries provide power - current drain is very low. The small output transformer enables low impedance 'stereo' headphones with comfortable, windproof, ear-muffs to be used. Unfortunately, an oscilloscope or AC millivoltmeter is essential for setting up this circuit if the best results are to be obtained. A proprietary ignition sealer or clear lacquer was used to protect the completed circuit from moisture. Fig. 2 shows the complete circuit.

RESULTS

On Plate 1, Photos 1, 2 and 3 show the transmitters A and B, also the receiver. The apparatus was assembled for use on the Hull University Speleological Expedition to County Fermanagh, 1975, where it was successfully used to 'survey' the Reyfad/Pollnacrom system.

The system lies about 100m below the moor surface. By pinpointing notable junctions and passage features on the surface and traversing round these with a theodolite we were able to twist the existing surveys into shape. Before and after sketches are given in Fig. 3. As

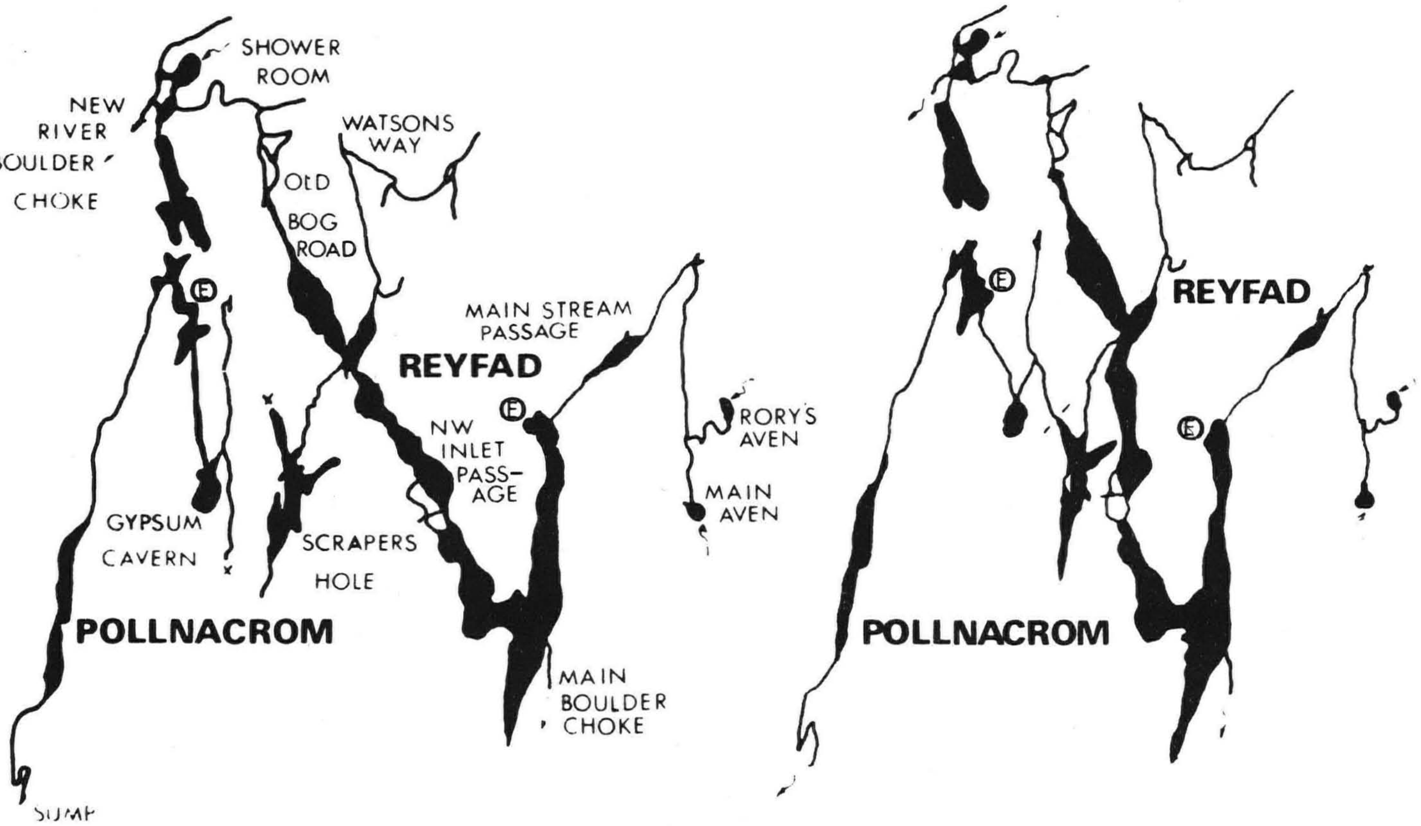

Fig. 3. Before and after sketch survey of the Reyfad-Pollnacrom system.

"Before" from "Caves of Fermanagh and Cavan" by G.L. Jones with Scrapers Hole added from a survey by H.U.S.S., 1974.
"After" sketch from a survey by J. Parkes, 1975.
X shows the point where the systems were joined.

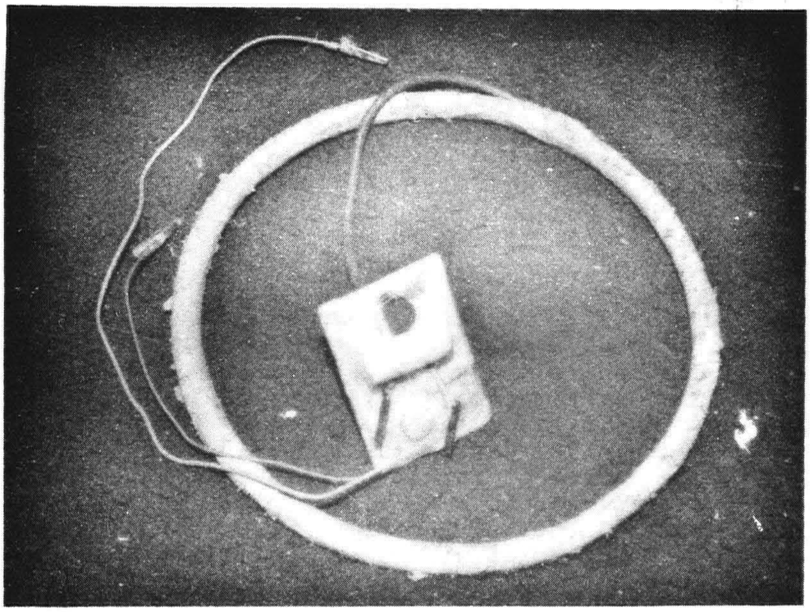

Fig. 1. **Transmitter** A with smaller coil (300mm diameter). The circuit board is carried in a neoprene pouch and connected to 2 or 3 Oldham or Nife batteries in series.

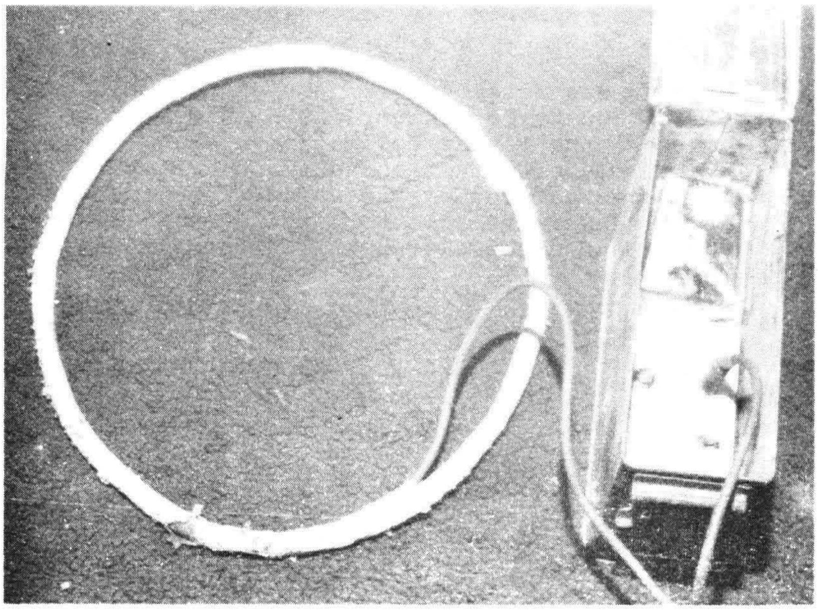

Fig. 2. Transmitter B in the base of a small ammunition box **complete** with batteries. The coil is 400mm in diameter.

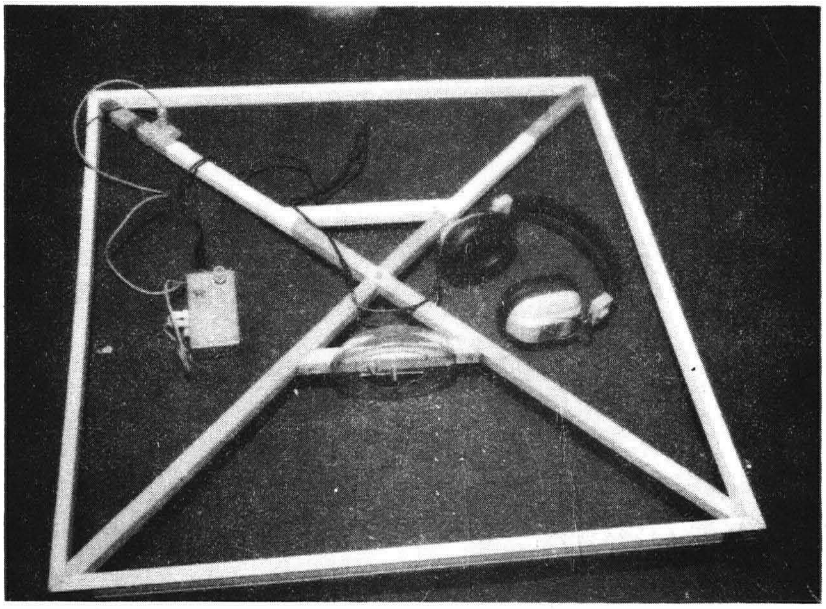

Fig. 3. The receiver coil, amplifier and headphones as used on **the surface. The protractor** mounted on the frame is used to **measure the angle of dip of the magnetic field.**

the system lies almost on one level once the entrance shafts have been negotiated, depth readings were not required and it proved possible to produce a 'fix' in about half an hour. By working to a pre-arranged schedule it was possible to fix several points in one day. Copies of the survey on A2 paper are available from the author. It will be interesting to compare this with Paddy O'Reilly's conventionally produced high-grade survey when available. Fuller details of the procedure are given in the Hull University Speleological Society Northern Ireland Expedition Report (1975).

The equipment was also used in White Scar Cave and although some problems were encountered near the Show Cave section, possibly as a result of the electricity supply, stations further away confirmed the location of the Sleepwalker Series.

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M.S. Received April 1978.

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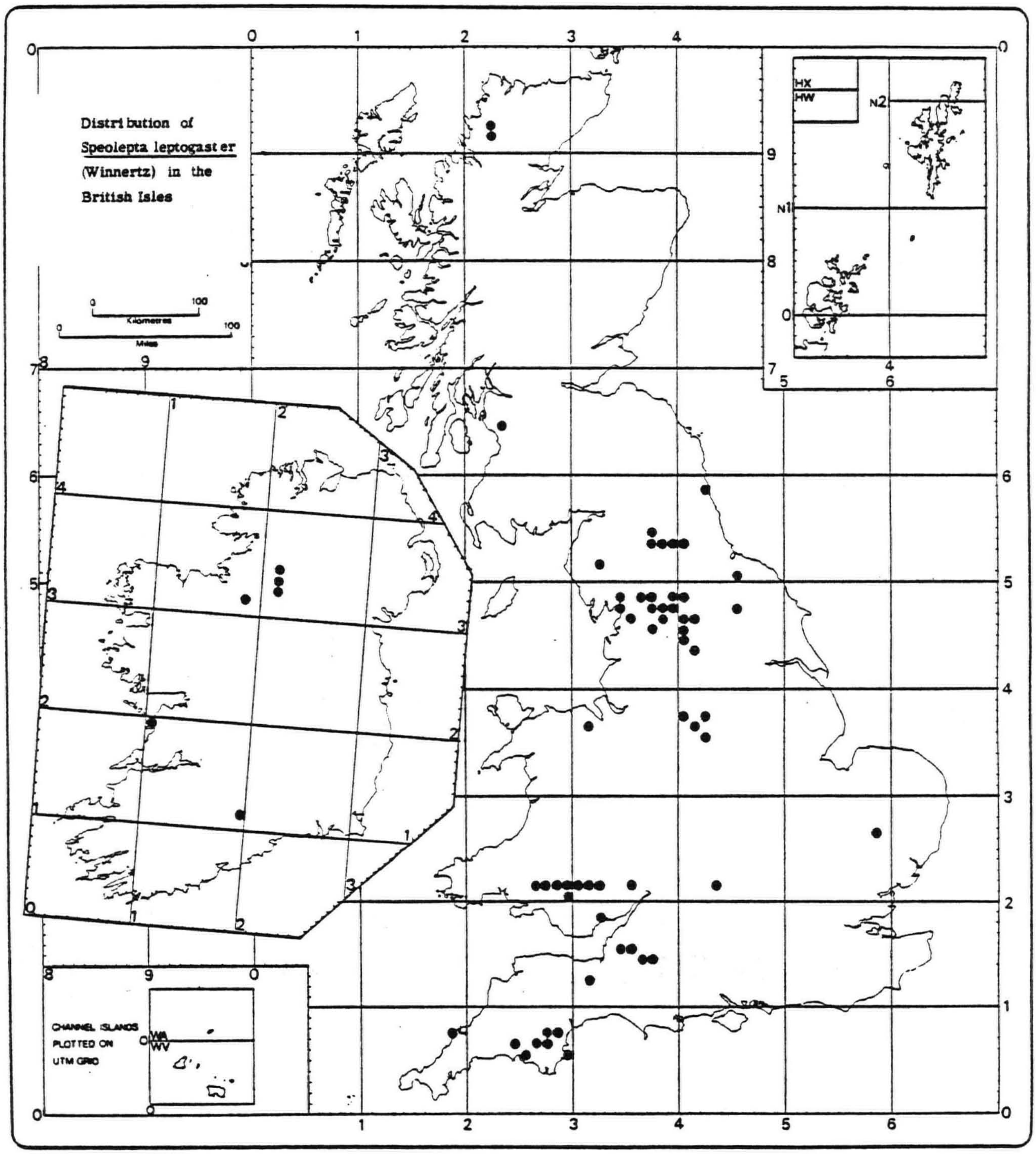
Distribution of
Speolepta leptogaster
(Winnertz) in the
British Isles
Kilometres
Miles
CHANNEL ISLANDS
PLOTTED ON
UTM GRID
WA
WV
HX
HW
N2
N1

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HYPOGEAN FAUNA

Biological Records No.16. 1972-1976

The presentation of the following lists of the fauna from caves and mines is different from those previously published by the Cave Research Group. It is in line with a policy agreed with the Council of the British Cave Research Association, that the fauna should be included under the Vice-county lists, and not in two sections- The Records and the Vice-county Lists. The records are of work carried out by speleobiologists between the years 1972 and 1976, though some earlier unpublished work has also been included. The minimum of information is given consistent with obtaining further data from the biological files held by the B.C.R.A. That is to say that a reference to each collector is given and the date of each collection. In the biological files will be found data supplied at the time by the collectors and the name of the authority who identified the specimen. The Vice-county name and number is given to the main entrance of the cave or mine, the National Grid reference and the height above sea level. It is therefore possible to draw up distribution maps for any of the recorded species. In most cases where determination is not taken to genus, the record is not shewn, but these incomplete records may be seen in the biological files. The British records are arranged alphabetically under the collectors' names. Records of exotic fauna may be found following and for those interested, other exotic records of fauna may be found in the following Cave Research Group publications:-

Biological Supplement.Part V.1950-1953.p.4.and 12.Malta.Hassans Cave. T.Shaw.
p.12. Gozo. Calipso's Own Cave.T.Shaw.
Ta Navo Cave T.Shaw
p.12,13.Gibraltar.Old St.Michaels Cave T.Shaw.
see also Trans.Cave Res.Grp.G.B.13(3)p.150

Biological Records.Part VI.1954-1956. p.11.Lebanon.Dog River Cave. T.Shaw
Algar Cave. T.Shaw.
see also Trans.Cave Res.Grp.G.B.13(3)p.150

Biological Records.Part VII.1957-1959.pp.11-13 Portuguese Caves.
University London.Spel.Exped.1957
see also Trans.Cave Res.Grp.G.B.5(2)David Cons.
Trans.Cave Res.Grp.G.B.13(3)p.149
pp.20-27 Gibraltar Caves Glennie Hazelton 1958
see also Trans.Cave Res.Grp.G.B.Vol.13(3) pp.131-159.
pp.39-40 Gibraltar Caves Arch.Soc.Gib.1959

Biological Records Part VIII.1960-62.p.20 France-Grotte de Guiers Vif.A.Ashwell.

British Hypogean Fauna Biological Records Part IX.1963
p.18,19.France.Le Petit Chourun Clot. V.M.Moseley.

Trans.Cave Res.Grp.G.B.Vol.12(1)Biological Records 1968.p.15.Belgium.Trou Bernard W.G.R.Maxwell.
pp.29-41 Bulgarian caves.Chelsea Spel.Soc.

Trans.Cave Res.Grp.G.B.Vol.13(3) Biological Records.p.150. Crete.Omalos Cave Birmingham Univ.Spel.Soc.
p.181 Czechoslovakia.Divina Preipast. Dr.P.Browne.

Trans.Cave Res.Grp.G.B.Vol.13(3) Biological Records.p.149-150 Spain.Gueva Dobros.Nottingham Univ.Spel.Soc.1970.

Trans.Cave Res.Grp.G.B.Vol.14(4) Biological Records.p.226. Swedish caves. A.and T.Oldham. 1970.

Republic of Ireland and Northern Ireland see Trans.Cave Res.Grp.G.B.Vol.15(4) 1974 for 1973.

The collections of fauna and the information obtained by cavers between 1972 and 1976 has been of great value. Over 1000 specimens were collected over a wide area thus spreading our knowledge of the distribution of species. In particular Mrs.Jean Dixon and members of the Northern Cavern and Mine Research Society in the north of England have collected in caves and mines at low and high levels often under very cold conditions. Bill Maxwell in southern England and in particular South Devon and South Wales, has developed a technique for collecting minute fauna without damaging their delicate structures. A comparative new-comer who has already made her mark, Miss Jane Wilson, has spread the net to North Wales, Anglesey, and even to the Shetland Isles. In the South of England a great number of Collembola have been collected to the advantage of Mr. Harold Gough who at times was almost overwhelmed with an 'embarras de richesse' waiting for determination, and, we hope of great help in his work with this complicated primitive order of Insects.

It is not easy to separate the density of collecting carried out from the true distribution of species, but it does appear, taking everything into consideration, that the beautiful little cave fly *Speolepta leptogaster* is more common in the caves of Northern England than in the Southern Counties (see chart, page). This species, like most of the fauna in British caves, is a troglophile, that is to say that it is capable of passing its whole life cycle underground, but it has been observed above ground too.

The distribution of the fauna in the caves of Great Britain is of particular interest because here we are the northernmost limit of distribution of much of the European fauna and any European species that is found for the first time in this country is an event worth noting; a heretofore undescribed species turning up in this country is a rarity that is front page news. No less exciting is the discovery of unknown species from caves overseas. Three cavers have enjoyed this success, a just reward for their efforts while on holiday. Malcolm Strath and members of the Nottingham University Students Union Speleological Society discovered a collembolan new to science, named in 1971 by Dr.da Gama, *Pseudosinella goughi*. Mike Ware of South Wales Caving Club on leave in Cape Town whilst serving with the Royal Navy, collected shrimps from a cave above Kalk Bay of an undescribed species. The determination was carried out by Mr.M.H.Thurston who named it *Paramelita barnardi* in 1972. From a cave in the Atlas Mountains, Chris Pugsley of Sheffield University Speleological Society collected hundreds of shrimps that proved to belong to an undescribed species. These were examined and named *Gammarus microps* in 1974. We look forward to further successes from these and other cavers in the near future.

This is the last time that I personally will submit an account of work done by our Speleobiologists, for on January 1st 1977 I handed my responsibilities to Mr. M.C. Day, and through him I hope to have good news from all those who have co-operated with me for so long and from many new members too. I wish you all good hunting and safe landings.

Mary Hazelton
Seaton House,
Shrublands Road,
Berkhamsted,
Herts.

December 1977

Collections here reported have been made in the following Vice-counties:-

3	South Devon	42	Brecon	65	North-west Yorkshire
4	North Devon	44	Carmarthenshire	66	Durham
6	North Somerset	46	Cardiganshire	67	South Northumberland
9	Dorset	50	Denbighshire	70	Cumberland
16	West Kent	52	Anglesey	72	Dumfriesshire
17	Surrey	57	Derbyshire	75	Ayrshire
20	Hertfordshire	60	West Lancashire	78	Peebleshire
23	Oxfordshire	61	South-east Yorkshire	86	Stirlingshire
26	West Suffolk	62	North-east Yorkshire	98	Argyll Main
35	Monmouthshire	63	South-west Yorkshire	108	West Sutherland
39	Staffordshire	64	Mid-west Yorkshire	112	Shetland Islands
41	Glamorganshire				

Fauna named by the following:-

TURBELLARIA	Dr. T.B. Reynoldson	The Brambell Labs., Bangor
MOLLUSCA	Dr. M.P. Kerney	Imperial College, London
	Dr. H. Schütt	Dusseldorf
	Dr. June Chatfield	Nat. Museum of Wales, Cardiff
ANNELIDA	Mr. E.G. Easton	B.M.N.H.
	Dr. G.T. Jefferson	University College, Cardiff
PAUROPODA	Dr. F.A. Turk	Exeter University
DIPLOPODA	Dr. F.A. Turk	Exeter University
	Dr. C. Fairhurst	University of Salford
CHILOPODA	Dr. F.A. Turk	Exeter University
SYMPHYLA	Dr. F.A. Turk	Exeter University
MICROCORYPHIA	Mr. C. Moreby	B.M.N.H.
COLLEMBOLA	Dr. T. Clay	B.M.N.H.
	Mr. P.N. Lawrence	B.M.N.H.
	Mr. Harold Gough	I.C.I., Reading
PLECOPTERA	Mr. P. Ward	B.M.N.H.
HEMIPTERA	Mr. W.R. Dolling	B.M.N.H.
PSOCOPTERA	Mr. P. Ward	B.M.N.H.
TRICHOPTERA	Mr. D.E. Kimmins	B.M.N.H.
	Mr. P.E.S. Whalley	B.M.N.H.
COLEOPTERA	Dr. Balfour Browne	B.M.N.H.
	Mr. P.M. Hammond	B.M.N.H.
	Mr. M.J.D. Brendell	B.M.N.H.
LEPIDOPTERA	Mr. D.J. Carter	B.M.N.H.
	Dr. K. Sattler	B.M.N.H.
DIPTERA	Dr. P. Freeman	B.M.N.H.
	Mr. A.M. Hutson	B.M.N.H.
	Mr. P.S. Cranston	B.M.N.H.
	Mr. J.P. Dear	B.M.N.H.
	Mr. R.P. Lane	B.M.N.H.
	Mr. K.G.V. Smith	B.M.N.H.
	Mr. J. Chainey	B.M.N.H.
	Dr. H. Disney	Malham Tarn Field Centre
CYCLOPOIDA	Dr. G. Fryer	Freshwater Biological Assoc., Ambleside
SYNCARIDA	Mr. T. Gledhill	Freshwater Biological Assoc., Wareham
ISOPODA	Dr. E.M. Sheppard	Ex. University College, Cardiff
	Dr. H. Dalens	Universite Paul Sabatier, Toulouse
	Mr. P.T. Harding	Inst. Terrestrial Ecology, Abbots Ripton
AMPHIPODA	Mr. M.H. Thurston	Nat. Inst. Oceanography, Godalming
	Mr. G.M. Spooner	The Laboratory, Citadel Hill, Plymouth
PSEUDOSCORPIONES	Dr. F.A. Turk	Exeter University
OPILIONES	Dr. F.A. Turk	Exeter University
	Mr. F.R. Wanless	B.M.N.H.
ARANEAE	Dr. A.F. Millidge	Lyme Regis, Dorset
ACARI	Dr. F.A. Turk	Exeter University
	Mr. K.H. Hyatt	B.M.N.H.

The following abbreviations and symbols are employed herein:-

National Grid References shown thus: 34/722 369
Vice-county references shown thus: 3. South Devon

♂	- male	oc.	- ocelli
♀	- female	OD	- Ordnance datum
cf.	- compare with	ov.	- ovigero s
D. Th.	- dark threshold	sp.	- species (singular)
D.Z.	- dark zone	spp.	- species (plural)
imm.	- immature	Subad.	- subadult
juv.	- juvenile	Th.	- threshold

BRITISH RECORDS

T.F. BARBOUR M.N. Carter K. Loze Plymouth Caving Group Ref. PCG/-

3. SOUTH DEVON

Bakers Pit Cave, Buckfastleigh 20/838 631 OD. 250' Additional records.

1.1.67	INS:	COLLEMBOLA	Isotomidae	*Tetracanthella britannica* Cassagnau, 1959 Th.
1.1.67	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835), see 1966, Ref: BM/-
1.1.67	INS:	COLEOPTERA	Staphylinidae	*Quedius mesomelinus* (Marsham, 1802) Adult, larva, D.Z.
1.1.67	ARACH:	ARANEAE	Linyphiidae	*Lessertia denticalis* (Simon, 1884) D.Z.

Haw Cave, Hooe Lake, Plymouth 20/545 267 OD. 28' Additional record.

27.5.65	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* Linnaeus, 1758 D.Z.

Radford Cave, Hooe Lake, Plymouth 20/503 527 OD. 28' Additional records.

27.3.65	INS:	COLLEMBOLA	Entomobryidae	*Entomobrya muscorum* (Nicolet, 1841) D.Z.
27.3.65	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
18.12.66	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes* sp. cf. *tenuis* (Blackwall, 1852).
25.2.67.	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) 1♂ D.Z.
25.2.67	ARACH:	ARANEAE	Argiopidae	*Meta* sp. probably *merianae* (Scopoli, 1763) D.Z.

Yealmpton Cave 20/578 513 OD. 100' Show Cave Additional records.

11.11.65	DIPL:	CHORDEUMIDA	Craspedosomidae	*Craspedosoma rawlinsi* Leach,1814 Th.

6. NORTH SOMERSET

Swildons Hole Priddy 31/531 513 OD. 779'

30.7.67	INS:	PLECOPTERA	Perlidae	*Dinocras cephalotes* (Curtis, 1827) see Stewart, 1947.

P. BAYNTUN Ref: PB/1

64. MID-WEST YORKSHIRE

Ingleborough Cavern Clapham 34/754 772 OD. 900' Correction

13.6.68	INS:	TRICHOPTERA	(Not DIPTERA)	*Trichocera* sp. Larva indet.

CHARLES CALDER Grampian Speleological Group Ref: GSG/-

75. AYRSHIRE

Cleaves Cove Dalry. 26/318 475

June 1975	INS:	HEMIPTERA	Veliidae	*Velia* sp. nymphs
June 1975	INS:	DIPTERA	Mycetophilidae	*Exechiopsis subulata* (Winnertz, 1863).

78. PEEBLESHIRE

Jeannie Barries Carlops. 36/153 553 OD. 900'

20.10.73	MOLL:	GASTROPODA	Arionidae	*Arion silvaticus* Lohmander, Th.
10.2.74	MOLL:	BIVALVIA	Sphaeriidae	*Pisidium casertanum* (Poli, 1791).
14.2.74	INS:	HEMIPTERA	Veliidae	*Velia (Plesiovelia) caprai* Tamanini, 1947 D.Z.
20.10.73	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Z.
20.10.73	INS:	COLEOPTERA	Dytiscidae	*Agabus* sp. D.Z.
15.12.73	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* (Linnaeus, 1758) D.Z.
10.2.74	INS:	DIPTERA	Chironomidae	*Macropelopia* sp. 2 larvae
10.2.74	INS:	DIPTERA	Chironomidae	*Prodiamesa olivacea* (Meigen, 1818) 2 larvae
15.12.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* Linnaeus, 1758 D.Z.
24.11.73	INS:	DIPTERA	Syrphidae	*Eristalis (Eristalis) tenax* (Linnaeus, 1758).
15.12.73 10.2.74	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) 2♂ juveniles, 2 2 ♂♂s, 1 (Ov.) ♀.
24.11.75	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

98. ARGYLL MAIN

Old Fox Hole. Glen Creran. 27/030 447.

June 1975	INS:	DIPTERA	Mycetophilidae	*Bolitophila spinigera* Edwards, 1925 .

Charles Calder (continued)

108. **WEST SUTHERLAND**

Allt nan Uamh Stream Cave. Inchnadamph. 29/275 173 OD. 1100' Additional records.

Oct. 1975	MOLL:	GASTROPODA	Arionidae	*Arion intermedius* Normand Th.
Oct. 1975	INS:	COLEOPTERA	Staphylinidae	*Myotoporus splendidus* (Gravenhorst, 1806) Th.
Oct. 1975	INS:	DIPTERA	Empidae	*Empis* or *Rhamphomyia* sp. larva Th.

Cnoc nan Uamch Inchnadamph. Traligill Valley. 29/276 206 OD. 750' Additional records

8.6.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva
8.6.74.	ARACH:	ACARI	Rhagidiidae	*Rhagidia* sp. D.Z.

Tobhar na Glaise Elphin. 29/210 105 OD. 500'

Oct. 1975	INS:	DIPTERA	Mycetophilidae	*Rymosia* sp.
Oct. 1975	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva
Oct. 1975	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) ♀

Uamh an Tartair Elphin. 29/217 092 OD.725' Additional records

Oct. 1975	MOLL:	GASTROPODA	Lymnaeidae	*Lymnaea truncatula* (Muller)

GRAHAM COLE Exeter University Speleological Group. Ref: EU

3. **SOUTH DEVON**

Pridhamsleigh Cave Buckfastleigh. 20/750 665 OD. 190' Additional record

19.3.61	CRUS:	CYCLOPOIDA	Cyclopidae	*Macrocyclops* sp.

M.D.H. COLLINS Gloucestershire Speleological Society Ref: GS/-

6. **NORTH SOMERSET**

Longwood Swallet Charterhouse. 31/486 557 OD. 700' Additional record

23.4.62	CRUS:	AMPHIPODA	Gammaridae	*Niphargus fontanus* Bate, 1859

St. Cuthberts Swallet Priddy. 31/542 504 OD. 780' Additional record

30.6.63	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus fimetarius* group

42. **BRECON**

Town Drain Ystradfellte 22/912 135 OD. 1300'

29.5.60	INS:	COLEOPTERA	Carabidae	*Abax ater* (Villers, 1790)

M. DALE

6. **NORTH SOMERSET**

Longwood Swallet Charterhouse. 31/486 557 OD. 700'

6.9.55	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758)

MRS. JEAN DIXON Ken & Ray Walls. Northern Cavern & Mine Research Society. Ref: NCMR/-

60. **WEST LANCASHIRE**

Ireby Fell Cavern Ireby. 34/673 773 OD. 1300'

15.4.74	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1815) Th.
15.4.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th & D.Th
15.4.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Adult & larva. D.Z.
15.4.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
15.4.74	INS:	DIPTERA	Phoridae	*Megaselia* sp. 2 ♀s cf. *cinerea* Schmitz, 1938 or *fusca* (Wood, 1909). D.Th
15.4.74	ARACH:	ARANEAE	Linyphiidae	*Cornicularia cuspidata* (Blackwall, 1833) Th ♂
15.4.74	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) ♀

Jack Scout Mine Silverdale 34/558 737 OD. 18'

12.5.74	INS:	COLEOPTERA	Carabidae	*Agonum albipes* Fabricius, 1796 D.Th
12.5.74	INS:	DIPTERA	Chironomidae	*Chironomus* sp. ♀ D.Th
12.5.74	INS:	DIPTERA	Anisopodidae	*Sylvicola fenestralis* (Scopoli, 1763) Th
12.5.74	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 D.Th
12.5.74	INS:	DIPTERA	Heleomyzidae	*Tephrochlamys rufiventris* (Meigen, 1830) D.Th

Jack Scout Mine
Mrs. Jean Dixon (continued)

12.5.74	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 Th.
12.5.74	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804)
12.5.74	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes mengei* Kulczynski, 1887 ♂ D.Th.

Moss House Mine Warton Crag. Carnforth 34/480 738 OD. 35' Additional records

25.3.73	DIPL:	IULIDA	Blaniulidae	*Blaniulus guttulatus* (Bosc, 1792) immature. D.Th.
25.3.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th. & D.Z. (Recorded by Moseley, 1962)
25.3.73	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) D.Th.
25.3.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758

61. SOUTH-EAST YORKSHIRE
South-east Sea Cave North Landing. Flamborough 54/239 721 OD. 0.0'

11.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
11.2.73	CRUS:	ISOPODA	Porcellionidae	*Porcellio scaber scaber* (Latreille, 1804) D.Z.

South-west Sea Cave North Landing. Flamborough 54/238 720 OD. 0.0'

11.2.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
11.2.73	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus violaceus* Lubbock, 1873 D.Th.
11.2.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
11.2.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th.

62. NORTH-EAST YORKSHIRE
Kirkdale Cave. Ryedale. Kirby Moorside. 44/678 857 OD. 200' Additional records

11.2.73	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1815) 2 ♀, D.Z.
11.2.73	INS:	HEMIPTERA	Psyllidae	*Psylla melanoneura* Forster, 1848 Th.
11.2.73	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Z.
11.2.73	INS:	DIPTERA	Culicidae	*Culiseta(Culiseta)annulata* (Schrank, 1776) D.Th.
11.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
11.2.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z.
11.2.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
11.2.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1757
11.2.73	ARACH:	ARANEAE	Nesticidae	?*Nesticus cellulanus* (Clerck,) Juvenile. D.Th.
11.2.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) 1 Juv. D.Th.

Un-named Trial Level. Cold Moor near Stoilesley. 45/549 033 OD. 1150'

16.6.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Th. & D.Th.
16.6.73	INS:	COLEOPTERA	Leiodidae	*Choleva glauca* Britten, 1918 D.Th.
16.6.73	INS:	COLEOPTERA	Staphylinidae	*Tachinus rufipennis* Gyllenhal, 1810 D.Th.
16.6.73	INS:	DIPTERA	Trichoceridae	*Trichocera maculipennis* Meigen, 1818 D.Th.
16.6.73	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 D.Th.
16.6.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th.
16.6.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) D.Th.
16.6.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 D.Th.

Un-named Trial Level
Mrs. Jean Dixon (continued)

16.6.73	ARACH.	OPILIONES	Nemastomidae	*Mitastoma chrysomelas* (Hermann, 1804) Th.
16.6.73	ARACH.	ARANEAE	Linyphiidae	*Lepthyphantes zimmermanni* Bertkau, 1890 1♂, 1♀

63. SOUTH-WEST YORKSHIRE

Cononley Lead Mine. 34/994 458 OD. 620' Additional records

20.6.65	INS:	COLEOPTERA	Staphylinidae	*Ancyrophorus aureus* Fauvel, 1869 D.Th.
20.6.65	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) 3 ♂s D.Z.
20.6.65	ARACH:	ACARI	Veigaiaidae	*Veigaia transislae* (Oudemans, 1901)

Hardcastle Crags Cave Hebden Bridge. 34/973 300 OD. 650'

13.1.73	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947 Th.
13.1.73	INS:	COLEOPTERA	Dytiscidae	*Agabus guttatus* (Paykull, 1798) Th.
13.1.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th.
13.1.73	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) Th.
13.1.73	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) Th.
13.1.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. 1 ♂, 1 ♀ 1 Juv.

Pan Hole Hardon Moor. Bingley. 44/084 391 OD. 785'

20.1.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th.
20.1.74	ARACH:	ARANEAE	Argiopidae	*Meta* sp. Juv.
20.1.74	ARACH:	ANAREAE	Linyphiidae	*Oreonetides abnormis* (Blackwall, 1841) D.Th.
20.1.74	ARACH:	ARANEAE	Linyphiidae	*Porrhomma egeria* Simon, 1884 D.Th. 1 ♂. 1 ♀.

Tom Bells Cave Hebden Bridge. 34/979 291 OD. 625'

13.1.73	INS:	DIPTERA	Trichoceridae	*Trichocera regelationis* (Linnaeus, 1758) D.Z.
13.1.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
13.1.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Z. 1 ♀. 1 subad.

64. MID-WEST YORKSHIRE

Alum Pot. Horton-in-Ribblesdale. 34/774 755 OD. 1125' Additional records

19.8.73	MOLL:	GASTROPODA	Lymnaeidae	*Lymnaea truncatula* (Muller) Th.
19.8.73	INS:	DIPTERA	Tipulidae	*Pedicia(Crunobia)straminea* (Meigen, 1838) Th.
19.8.73	INS:	DIPTERA	Tipulidae	*Dicranota (Paradicranota)* sp. Th.
19.8.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th.
19.8.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
19.8.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)migra* (Meigen, 1830) D.Th.
19.8.73	INS:	DIPTERA	Chironomidae	*Polypedilum* sp. D.Th.
19.8.73	INS:	DIPTERA	Trichoceridae	*Trichocera regelationis* (Linnaeus, 1758) D.Z.
19.8.73	CRUS:	CYCLOPOIDA	Cyclopidae	*Acanthocyclops venustus* (Norman & Scott, 1906) D.Z.
19.8.73	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861)

Almscliff Crag Cave Pool-in-Wharfedale. 44/268 989 OD. 650'

14.6.73	INS:	COLEOPTERA	Leiodidae	*Choleva glauca* Britten, 1918 ♀
14.6.73	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 Th. & D.Th.
14.6.73	INS:	DIPTERA	Mycetophilidae	*Macrocera stigma* Curtis, 1837 D.Th.
14.6.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.

Almscliff Crag Cave
Mrs. Jean Dixon (continued)

14.6.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)niger* (Meigen, 1830) D.Th.
14.6.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th. V.Juv.
14.6.73	ARACH:	ARANEAE	Lycosidae	*Tarentula pulverulenta* (Clerck, 1757) Th.

Albert Cave Settle. 34/838 651 OD. 1449'

24.12.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) Th.
24.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) Th.
24.12.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th.

Blockley Level. Hebden Gill, near Grassington. 44/026 650. OD. 875'

13.5.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th. & D.Th.
13.5.73	INS:	DIPTERA	Mycetophilidae	*Exechiopsis* sp. D.Th.
13.5.73	INS:	DIPTERA	Calliphoridae	*Calliphora vicina* Robineau-Desvoidy, 1830 Th.
13.5.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.
13.5.73	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) D.Z.

Bolton Abbey Cave Bolton Abbey. 44/076 555 OD. 375'

23.3.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller) D.Z.
23.3.73	DIPL:	IULIDA	Blaniulidae	*Blaniulus guttulatus* (Bosc, 1792) D.Z. 1 ♀.
23.3.73	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) D.Th. imm.
23.3.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Z.
23.3.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
23.3.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th.
23.3.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 D.Z.
23.3.73	ARACH:	ARANEAE	Therididae	*Theridion* sp. 1 ♂. D.Th.
23.3.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille) D.Z. juv.
23.3.73	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) D.Z. 1 ♀ & juv.

Boston Spa Cave. Wetherby. 44/425 462 OD. 45'

14.1.73	INS:	HEMIPTERA	Cimicidae	*Anthocoris confusus* Beuter, 1884 Th.
14.1.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) Th. & D.Th.
14.1.73	INS:	DIPTERA	Culicidae	*Culiseta(Culiseta)annulata* (Schrank, 1776) D.Th.
14.1.73	INS:	DIPTERA	Syrphidae	*Eristalis tenax* (Linnaeus, 1758) D.Th.
14.1.73	ARACH:	ARANEAE	Argiopidae	*Meta?merianae* (Scopoli, 1763) D.Th. juv.

Boulder Cave. Caley Crags. East Chevin. Otley. 44/225 445 OD. 575'

23.3.73	INS:	DIPTERA	Culicidae	*Culiseta(Culiseta)annulata* (Schrank, 1776) Th.

Buckden Gavel Mine. Buckden. 34/955 782 OD. 160' Additional records

19.11.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th. & D.Th.
19.11.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th. larva.
19.11.72	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Z.
19.11.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
19.11.72	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) D.Z.

Buckden Gavel Mine
Mrs. Jean Dixon (continued)

19.11.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

Cave Hole (East) Giggleswick. 34/789 622 OD. 825'

24.4.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus helveticus* (Blum) Th.
24.4.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Th.
24.4.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th. Adult & pupa.
24.4.73	INS:	DIPTERA	Mycetophilidae	*Macrocera* sp. larva.

Clough Head Level. Sutton-in-Craven. 44/003 426 OD. 850'

27.5.73	INS:	COLEOPTERA	Dytiscidae	*Agabus guttatus* (Paykull, 1798) D.Th.
27.5.73	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 D.Th.
27.5.73	INS:	DIPTERA	Cecidomyiidae	*Mycodiplosis* sp. D.Th.
27.5.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) Th. & D.Th.
27.5.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Fungobia)fimetaria* (Meigen, 1830) Th.
27.5.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. 2 ♀s, subad. 1 juv.

Foss Gill Lower Cave. Starbottom. 34/948 744 OD. 935'

25.2.73	INS:	PLECOPTERA	Perlidae	*Dinocras cephalotes* (Curtis, 1827) D.Th. Nymphs.
25.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th.
25.2.73	INS:	DIPTERA	Empidae	*Clinocera(Kowarzia)bipunctata* (Haliday, 1833) D.Th.
25.2.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
25.2.73	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) D.Th. 1♂. 1(ov.)♀.
25.2.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. 1♀, 1 juv.

Gaping Gill. Ingleborough. 34/751 726 OD. 1300' Additional records

15.5.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. ad. larva.
15.5.74	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Z.
15.5.74	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) ♀

Greensett Cave. Whernside. 34/747 821 OD. 1825'

3.2.74	INS:	COLEOPTERA	Leiodidae	*Choleva jeanneli* Britten, 1922 Th.
3.2.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th.
3.2.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th.
3.2.74	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

Heights Cave. near Threshfield. 34/964 646 OD. 1100'

21.10.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th.
21.10.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) Th.
21.10.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 Th.
21.10.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. ♀ juv.

Hell Hole. Wharfdale 44/065 622 OD. 900'

26.11.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
26.11.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th.
26.11.72	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) Th. subad. ♀
26.11.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. 1 ♂ 1 juv.

Mrs. Jean Dixon (continued)

Holm Hill Cave. Ribblehead. 34/785 903 OD. 1025' Additional Records

4.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
4.2.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. larva.
4.2.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. 1♂

Jubilee Cave. near Settle. 34/837 656 OD. 1300'

24.12.72	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1814) D.Z.
24.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th.
24.12.72	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 D.Z.
24.12.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
24.12.72	ARACH:	ARANEAE	Linyphiidae	*Cornicularis cuspidata* (Blackwall, 1833) Th.

Kirk Gill Cave. Hubberholme 34/925 778 OD. 1075'

10.7.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z.
10.7.72	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758
10.7.72	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) ♀

Marble Steps Pot. Gragareth. 34/680 770 OD. 1280' Additional record

Oct. 1972	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Z.

Mongo Gill Hole. North Shaft, Greenhow. 44/096 632 OD. 1225'

11.11.72	INS:	MECOPTERA	Boreidae	*Boreus hyemalis* (Linnaeus, 1767) D.Z.
11.11.72	INS:	DIPTERA	Trichoceridae	*Trichocera regelationis* (Linnaeus, 1758) D.Z.
11.11.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) D.Z.
11.11.72	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) D.Z.

Nathwaite Bridge Stone Mine. 44/066 837 OD. 675'

29.12.72	MOLL:	BIVALVIA	Sphaeridae	*Pisidium casertanum* (Poli, 1791) Th.
29.12.72	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817)
29.12.72	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus* sp. Th.
29.12.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus* sp. Th.
29.12.72	INS:	COLEOPTERA	Tenebrionidae	*Tribolium castaneum* (Herbst, 1797) Th.
29.12.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th. larva
29.12.72	INS:	DIPTERA	Mycetophilidae	*Exechiopsis* sp. Th.
29.12.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

Nick Level. Wharfedale. 44/069 620 OD. 800'

26.11.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
26.11.72	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 Th.
26.11.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. ♀

Quarry Cave. Hebden Bridge 34/973 281 OD. 850'

31.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
31.12.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th.
31.12.72	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes zimmermanni* Bertkau, 1890 D.Th.

Sell Gill Holes. Horton-in-Ribblesdale. 34/811 743 OD. 1160' Additional records

25.2.73	INS:	DIPTERA	Trichoceridae	*Trichocera maculipennis* Meigen, 1818 D.Th.
25.2.73	INS:	DIPTERA	Chironomidae	*Eukiefferiella* sp. cf *coerulescens* (Kieffer, 1926) D.Th.
25.2.73	INS:	DIPTERA	Calliphoridae	*Calliphora vomitoria* (Linnaeus, 1758) D.Th.
25.2.73	INS:	DIPTERA	Sphaeroceridae	*Limosina* sp.
25.2.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. ♀

Mrs. Jean Dixon (continued)

St. Roberts Cave. Knaresborough. 44/361 561 OD. 100'

17.2.73	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura(Hypogastrura) purpurescens* (Lubbock, 1867) Th.
17.2.73	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus lignorum* (Fabricius, 1775) Th.
17.2.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Th. & D.Th.
17.2.73	INS:	DIPTERA	Culicidae	*Culiseta(Culidseta)annulata* (Schrank, 1776) D.Th.
17.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
17.2.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758
17.2.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. ♀
17.2.73	ARACH:	ARANEAE	Linyphiidae	*Diplocephalus latifrons* (Cambridge, 1863) Th. ?Not a cave species?

Storrs Cave Ingleton. 34/703 732 OD. 650'

19.2.74	INS:	DIPTERA	Trichoceridae	*Trichocera regelationis* (Linnaeus, 1758) D.Th.
19.2.74	INS:	DIPTERA	Sciaridae	*Lycoriella* sp. D.Th.
19.2.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z.
19.2.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
19.2.74	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Z. ♂
19.2.74	ARACH:	ARANEAE	Nesticidae	*Nestidus cellulanus* (Clerck, 1757) Th. ♀
19.2.74	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) D.Z. ♀
19.2.74	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes mengei* Kulcznski, 1887 ♀

Trollers Gill Cave. Wharfedale. 44/067 614 OD. 675' Additional records

26.11.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) Th.
26.11.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th. & D.Z.
26.11.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th. larva
26.11.72	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) Th.
26.11.72	INS:	DIPTERA	Mycetophilidae	*Mycetophila ruficollis* group. D.Z.
26.11.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th. & D.Z.
26.11.72	INS:	DIPTERA	Sphaeroceridae	*Leptocera(Limosina)* sp. D.Z.
26.11.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. subad. juv.
26.11.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) Th. & D.Z. 1 ♀, 1 juv.

Twin Bottom Scar Cave. Malham. 34/877 642 OD. 1600' Additional records

7.4.74	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) Th.
7.4.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th. & D.Z.
7.4.74	INS:	DIPTERA	Psychodidae	*Psychoda* sp. Th.
7.4.74	INS:	DIPTERA	Mycetophilidae	*Exechia* sp. cf *festiva* (Winnertz, 1863) Th.
7.4.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.

Un-named Mine Level. Lead Mine, Kex Hill Moor, Blubberhouses. 34/138 554 OD. 950'

5.5.74	INS:	DIPTERA	Chironomidae	*Paratanytarsus austriacus* Kieffer, 1924 D.Th.
5.5.74	INS:	DIPTERA	Mycetophilidae	*Exechiopsis* sp. D.Th.
5.5.74	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) D.Th.

Mrs. Jean Dixon (continued)

Victoria Cave. Settle. 34/835 650 OD. 1025'

24.12.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
24.12.72	INS:	DIPTERA	Trichoceridae	*Trichocera maculipennis* (Meigen, 1818) Th.
24.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) D.Z.
24.12.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)

Yordas Cave Kingsdale. 34/705 791 OD. 1025' Additional records

22.7.73	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947. D.Th.
22.7.73	INS:	COLEOPTERA	Staphylinidae	*Lesteva pubescens* (Mannerheim, 1831) Th.
22.7.73	INS:	DIPTERA	Empidae	*Wiedemannia* sp. D.Th.
22.7.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. larva
22.7.73	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Th.
22.7.73	INS:	DIPTERA	Sciaridae	*Lycoriella* sp. D.Th.
22.7.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
22.7.73	INS:	DIPTERA	Tipulidae	*Pedicia(Crumobia)straminea* (Meigen, 1838) D.Z.
22.7.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* (Linnaeus, 1758) D.Th.

65. NORTH-WEST YORKSHIRE

Hackergill Cave (Lower). 34/736 862 OD. 525'

16.9.73	INS:	DIPTERA	Chironomidae	*Diamesa* sp. near *bohemain* Goetgeb er, 1932

Hackergill Cave (Upper). 34/741 862 OD. 625'

24.7.73	MOLL:	GASTROPODA	Endodontidae	*Discus rotundatus* (Muller) D.Th.
24.7.73	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) D.Th. imm.
24.7.73	INS:	COLEOPTERA	Carabidae	*Nebria brevicollis* (Fabricius, 1792) D.Z.
24.7.73	INS:	COLEOPTERA	Staphylinidae	*Lesteva pubescens* Mannerheim, 1831 D.Z.
24.7.73	INS:	DIPTERA	Tipulidae	*Molophilus curvatus* (Tonnoir, 1920) D.Th.
24.7.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th.
24.7.73	INS:	DIPTERA	Mycetophilidae	*Mycetophila ornata* Stephens, 1829 Th.
24.7.73	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Z.
24.7.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 Th.
24.7.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. 1 subad.
24.7.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) Th. 1 ♀
24.7.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) Th. 1 ♀. 1 juv.

Ray Gill Sike. Stone Mine, near Burtersett. 34/905 885 OD. 1175'

4.2.73	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Th.
4.2.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) D.Th.
4.2.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. larva
4.2.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th. & D.Th.
4.2.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) ♀ D.Z.

Richmond Copper Mine. Swaledale. 45/164 006 OD. 350' Additional Records

29.12.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758)
29.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th.
29.12.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th.
29.12.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

Mrs. Jean Dixon (continued)

Wet Groves Mine, Woodhall, Wensleydale. 34/986 903 OD. 950'

8.4.73	INS:	COLEOPTERA	Silphidae	*Catops* sp. D.Th.
8.4.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th.
8.4.73	INS:	DIPTERA	Culicidae	*Culiseta(Culiseta)annulata* (Schrank, 1776) D.Th.
8.4.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
8.4.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. ♀
8.4.73	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes zimmermanni* Bertkau, 1890 D.Th.

67. **SOUTH NORTHUMBERLAND**

Barnry Craig Mine, Horse Lavel, Carr Shields. 45/803 467 OD. 1321'

3.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
3.12.72	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758
3.12.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) 1 ♀ 1 juv.

Scrait Hole Mine Carr Shields. 45/803 469 OD. 1308' Low Level

3.12.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
3.12.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 Th. D.Z.
3.12.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva.
3.12.72	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
3.12.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. ♀

70. **CUMBERLAND**

Dosey Level. Tynhead. 35/754 356 OD. 1750'

30.7.72	INS:	TRICHOPTERA	Polycentropidae	*Plectrocnemia conspersa* (Curtis, 1834) D.Z.
30.7.72	INS:	DIPTERA	Tipulidae	*Pedicia(Crunobia)straminea* (Meigen, 1838) D.Z.
30.7.72	INS:	DIPTERA	Chironomidae	*Macropelopia goetghebueri* (Kieffer, 1918) D.Z.
30.7.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z.

Gilbert Level. Plumbago Mine, Borrowdale. 35/233 125 OD. 850'

7.1.73	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Th.
7.1.73	INS:	DIPTERA	Chironomidae	*Diamesia bohemani* Goetgebuer, 1932 D.Th.
7.1.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th. & D.Z.
7.1.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva.
7.1.73	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) D.Th.
7.1.73	INS:	DIPTERA	Mycetophilidae	*Boletina* sp. D.Th.
7.1.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Th.
7.1.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 Th.
7.1.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. 2 ♀s.

Ramp Gill Mine. Horse Level, Nent Head. 35/782 435 OD. 1432'

8.7.73	INS:	COLLEMBOLA	Isotomidae	*Folsomia candida* Willem, 1902 5 spm. D.Th.
8.7.73	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 Th. & D.Th.
8.7.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) Th.
8.7.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) Th.
8.7.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza modesta* (Meigen, 1835)
8.7.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) Th.

Mrs. Jean Dixon (continued)

Small Clough Level Nent Head, Alston. 35/788 429 Od. 1600'

28.1.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
28.1.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th.
28.1.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
28.1.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. & D.Th.

72. DUMFRIESSHIRE

Barjarg Mine. 25/882 903 OD. 250'

3.9.72	INS:	COMMEMBOLA	Onychiuridae	*Onychiurus* sp., *?dunarius?* Gisin, 1956 D.Z. (in moult).

J. DOMAN Chelsea Speleological Society. Ref: BM/-

17. SURREY

Hearthstone Mine, Godstone. Main Series. 51/351 525 OD. 500' <u>Additional record</u> (Maxwell, 1970)

31.10.76	CRUS:	AMPHIPODA	Gammaridae	*Niphargus fontanus* Bate, 1859 D.Z.

D.B. DRIVER Ref: DD/-

64. MID-WEST YORKSHIRE

Pete's Pot. East face of Gordale Scar, Malham. 34/91 64 OD. 1600'

8.11.58	CRUS:	SYNCARIDA	Prohalacaridae	*Soldanellonyx chappuisi* Walton, 1917 D.Th.
8.11.58	CRUS:	SYNCARIDA	Prohalacaridae	*Soldanellonyx monardi monardi* Walton, 1919

DAVE EVERETT, Westminster Speleological Group. Ref: WSG/1

42. BRECON

Ogof Triachwech. Ystradfellte. 22/9015 1605 OD. 1355'

2.6.72	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871

SUSAN GODDARD, Sheffield University Speleological Society. Ref: SUS/-

64. MID-WEST YORKSHIRE

Borrins Moor Cave. 34/770 754 OD. 1245' <u>Additional record</u>

6.2.65	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Z. ♀

Rift Pot Allotment area 34/760 728 OD. 1340' <u>Additional record</u>

11.3.65	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758)

Kingsdale Head Cave. 34/695 775 OD. 1000' <u>Additional record</u>

12.6.66	INS:	PLECOPTERA	Perlidae	*Dinocras cephalotes* (Curtis, 1827) ♀

HAROLD GOUGH. Ref: HG/-

3. SOUTH DEVON

Radford Cave. Plymouth. 20/503 527 OD. 85' <u>Additional records</u>

17.3.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
17.3.74	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. *armatus* gp. (Recorded by Plymouth Caving Group, 1965).
17.3.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella dobati* (Gisin, 1956) D.Z.
17.3.74	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z. (Recorded by Plymouth Caving Group, 1966).
17.3.74	INS:	COLLEMBOLA	Neelidae	*Neelus* sp. D.Z.
17.3.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites caecus* (Tullberg, 1871) D.Z.

6. NORTH SOMERSET

Eastwater Cavern. Priddy. 31/538 506 OD. 780' <u>Additional record</u>

16.9.72	INS:	COLLEMBOLA	Isotomidae	*Isotoma agrelli/notabilis* gp. D.Z.

BILL HARVEY. Glasgow Speleological Society. Ref: GSS/-
72. **DUMFRIESSHIRE**
Glenclach Level. Wanlockhead. 25/869 115 OD. 1425'

29.9.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
30.9.74	FLORA:	FUNGI IMPERFECTI	Moniliaceae	*Beauvaris basiana* (Bals) Vuillemin Growing on dead Dipteron.

86. **STIRLINGSHIRE**
Airthray Silver Mine, Ochil Hills. 26/815 972 OD. 290'

18.3.73	DIPL:	IULIDA	Iulidae	*Cylindroiulus punctatus* (Leach, 1817) D.Z. imm.

Bridge of Alan, Copper Mine, Ochil Hills. 26/798 972 OD. 60'

29.8.74	FLORA:			*Phoma outaminum* Speg. D.Z.

A.M. HUTSON, British Museum (Natural History)
26. **WEST SUFFOLK**
Chalk Mine, Horringer, near Bury St. Edmunds. 52/83 62 OD. 200'

10.4.73	INS:	DIPTERA	Mycetophilidae	*Bolitophila saundersi* (Curtis, 1836) ♀
10.4.73	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) 6 ♂s 7 ♀s
10.4.73	INS:	DIPTERA	Mycetophilidae	*Tarnania fenestralis* (Meigen, 1818) 5 ♂s & 2 ♀s.
10.4.73	INS:	DIPTERA	Mycetophilidae	*Exechiopsis(Exechiopsis)hammi* (Edwards, 1925) ♂
10.4.73	INS:	DIPTERA	Mycetophilidae	*Exechiopsis(Exechiopsis)* sp. cf *intersecta* (Meigen, 1818) ♀

Dr. G.T. JEFFERSON, University College, Cardiff. Ref: SWCC/-
6. **NORTH SOMERSET**
Eastwater Cavern. Priddy. 31/538 506 OD. 780' Additional records (Collector: Miss A. Franklin)

15.8.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.

Manor Farm Swallet. Charterhouse. 31/4982 8566 OD. 750' (Collector: C.F. Cartner)

20.1.74	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)agrelli* Delamare, 1950 D.Z.
20.1.74	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871 D.Z.
20.1.74	CRUS:	AMPHIPODA	Gammaridae	*Niphargus fontanus* Bate, 1859 D.Z.

35. **MONMOUTHSHIRE**
North of Pontypool. 32/270 068 OD. 900' (Collector: Dr. B.W. Staddon)

23.3.60	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 In spring water; 3 ♂s.
23.3.60	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871 In spring water.

Afon Lwyd North West of Blaenavon. 32/244 089 OD. 1300', 1050' & 950'

27.7.60	CRUS:	AMPHIPODA	Gammaridae	*Niphargus aquilex aquilex* Schiodte, 1855. Among stones in river bed.

41. **GLAMORGAN**
Afon Pelenna. North East of Aberavon. 21/793 043 OD. 200-600' (Collector: Miss M. Jeffries)

Nov. 70/71	CRUS:	AMPHIPODA	Gammaridae	*Niphargus aquilex aquilex* Schiodte, 1855 From gravels in stream beds.

Nant Craig-yr-Aber North East of Pyle 21/856 848 OD. 270'

Nov. 71	CRUS:	AMPHIPODA	Gammaridae	*Niphargus aquilex aquilex* Schiodte, 1855. Gravels in stream bed.

42. **BRECON**
Agen Allwedd Llangattock 32/188 158 OD. 1300' Additional records

28.6.58	INS:	TRICHOPTERA	Polycentropidae	*Plectrocnemia conspersa* (Curtis, 1834) larva
28.6.58	CRUS:	AMPHIPODA	Gammaridae	*Niphargus ?fontanus* Bate, 1859

Dr. G.T. Jefferson (continued)

Ogof Ffynnon Ddu 2 Glyntawe. 22/848 685 OD. 670' Additional records

15.7.72	ANN:	OLIGOCHAETA	Aelosomatidae	*Aeolosoma hemprichi* Ehrenberg, 1831 D.Z.
15.7.72	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Th.
15.7.72	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)agrelli* Delamare, 1950 D.Z.
15.7.72	INS:	COLEOPTERA	Carabidae	*Trechus(Trechoblemus)micros* (Herbst, 1784) D.Z.

Ogof-y-Ci Vaynor. 32/040 104 OD. 750' Additional records

13.7.72	MOLL:	GASTROPODA	Cochlicopidae	*Axeca goodalli* (Ferussac) D.Z.
13.7.72	MOLL:	GASTROPODA	Cochlicopidae	*Cochlicopa lubrica* (Muller, 1774) D.Z.
13.7.72	MOLL:	GASTROPODA	Zonitidae	*Discus rotundatus* (Muller, 1774) D.Z.
13.7.72	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Z.
13.7.72	MOLL:	GASTROPODA	Zonitidae	*Cepea hortensis* (Muller) D.Z.
13.7.72	DIPL:	POLYDESMIDA	Polydesmidae	*Polydesmus gallicus* Latzel, 1884 D.Z. ♀
13.7.72	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 D.Z.
13.7.72	INS:	DIPTERA	Chironomidae	*Metriocnemus* sp. D.Z.
13.7.72	INS:	DIPTERA	Chironomidae	?*Stictochironomus* sp. D.Z.
13.7.72	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908

Porth-yr-Ogof, Ystradfellte. 22/927 124 OD. 800' Additional records

17.7.72	ANN:	OLIGOCHAETA	Lumbriculidae	*Stylodrilus heringianus* (Laparede 1862) D.Z.
17.7.72	INS:	COLEOPTERA	Dytiscidae	*Platambys maculatus* (Linnaeus, 1758) D.Z.
17.7.72	INS:	COLEOPTERA	Staphylinidae	*Quedius mesomelinus* (Marsham, 1802) D.Z. Found here by Hazelton, 1947.
17.7.72	INS:	DIPTERA	Tipulidae	*Limonia(Dicranomyia)fusca* (Meigen, 1804) D.Z.
17.7.72	INS:	DIPTERA	Chironomidae	*Prodiamesa olivacea* (Meigen, 1818) D.Z.
17.7.72	INS:	DIPTERA	Ragionidae	?*Ragio* sp. D.Z. larva.
17.7.72	CRUS:	OSTRACODA	Cypridae	*Potamocypris* sp.
17.7.72	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871 D.Z. Found here by the late D. Coase in 1945.
17.7.72	CRUS:	AMPHIPODA	Gammaridae	*Niphargus fontanus* Bate, 1859 D.Z. Found here by Hazelton in 1947.

DAVID JENKINS, South Wales Caving Club. Ref: XDWJ/-

46. CARDIGANSHIRE

Cwm Ystwyth. Lead Mine. 22/804 747 OD. c1000'

9.7.58	ANN:	OLIGOCHAETA	Lumbricidae	*Bimastus tenuis* (Eisen, 1884) D.Z.

J.K. LAMB. Ref: JL/-

6. NORTH SOMERSET

Dundry Stone Mine. near Bristol. 31/553 667 OD. 67' Additional records

27.5.68	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758

P.N. LAWRENCE, British Museum (Natural History)

16. WEST KENT

Chislehurst Caves. Chislehurst. 51/431 626 OD. 400' Additional records

22.1.72	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura(Hypogastrura)purpurescens* (Lubbock, 1876)
22.1.72	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura bengtssoni* (Agren, 1904)
22.1.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus fimetarius* gp.
22.1.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus krausbaueri* (Börner, 1901)
22.1.72	INS:	COLLEMBOLA	Isotomidae	*Folsomia garretti* Bagnall, 1939
22.1.72	INS:	COLLEMBOLA	Isotomidae	*Proisotoma minuta* (Tullberg, 1871)
22.1.72	INS:	COLLEMBOLA	Isotomidae	*Isotoma notabilis* Schaffer, 1896
22.1.72	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus cyaneus* Tullberg, 1871

Chislehurst Caves
P.N. Lawrence (continued)

22.1.72	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella* sp.
22.1.72	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) Recorded from here by Maxwell, 1958.
22.1.72	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* (Folsom, 1896)
22.1.72	INS:	COLLEMBOLA	Sminthuridae	*Sminthurus* sp.
22.1.72	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* gp.

DR. O.C. LLOYD, Wessex Caving Club. Ref: L/-
6. NORTH SOMERSET
St. Cuthberts Swallet. Priddy. 31/542 504 OD. 780' Additional record

20.1.54	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871

Swildons Hole. Priddy. 31/531 513 OD. 779' Additional record

Oct. 65	CRUS:	ISOPODA	Asellidae	*Proasellus cavaticus* Leydig, 1871

BRUCE LYNN, Ref: BL/-
42. BRECON
Ogof Ffynnon Ddu 1. Glyntawe. 22/848 153 OD. 670'

9.7.60	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella immaculata* gp.
9.7.60	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites caecus* (Tullberg, 1871) ♀

R.W. MARTIN, Leicester University Speleological Society. Ref: LU/-
57. DERBYSHIRE
Carlswark Cavern. Stoney Middleton. 43/221 758 OD. 600' Additional record

19.3.61	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring, 1861) ♂

W.G.R. MAXWELL, Chelsea Speleological Society. Ref: BM/-
1. WEST CORNWALL
Un-named Cave. Porthcothan Beach, near Trevethen. 10/855 733 OD. 10' (Collector: Pat Browne)

25.12.67	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758)
25.12.67	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908)

3. SOUTH DEVON
Bakers Pit Cave. Buckfastleigh. 20/838 631 OD. 250' Additional records

10.3.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus draparnaldi* (Beck, 1837) D.Th.
10.6.72	DIPL:	IULIDA	Blaniulidae	*Blaniulus guttulatus* (Bosc, 1792) D.Z.
10.3.73	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847) Recorded by Maxwell, 1968.
10.3.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.
10.3.73	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella* sp. cf *dobati* Gisin, 1965 D.Z.
10.3.73	INS:	COLLEMBOLA	Entomobryidae	*Heteromurum nitidus* (Templeton, 1835) Recorded by Glennie, 1948.
10.6.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Recorded by Reynolds, 1960.
10.3.73	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* (Folsom, 1896) D.Z.
10.3.73	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites caecus* (Tullberg, 1871) D.Z.
10.3.73	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860)
10.3.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th. & D.Z.
10.3.73	INS:	DIPTERA	Phoridae	*Megaselia* sp. larva. D.Z.
10.3.73	ARACH:	OPILIONES	Nemastomatidae	*Mitostoma chrysomelas* (Hermann, 1804) Recorded by Reynolds, 1960.
10.3.73	ARACH:	ARANEAE	Pholcidae	*Pholcus phalangioides* (Fuesslin, 1775) D.Th.
10.3.73	ARACH:	ARANEAE	Agenelidae	*Tegenaria* sp. D.Th.

Bakers Pit Cave
W.G.R. Maxwell (continued)

10.3.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th.
4.8.68 10.3.73	ARACH:	ACARI	Parasitidae	*Eugamasus loricatus* (Wankel, 1861) D.Z. ♀

Bickington Pot. near Newton Abbot. 20/8018 7273 OD. 400'

28.7.74	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Z.
28.7.74	INS:	COLLEMBOLA	Isotomidae	*Folsomia candida* Willem, 1902
28.7.74	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896
28.7.74	INS:	COLLEMBOLA	Sminthuridae	*pygmaeus* (Wankel, 1860) ♀
28.7.74	INS:	COLEOPTERA	Chrysomelidae	*Chrysolina polita* (Linnaeus, 1758) D.Z.
28.7.74	INS:	DIPTERA	Tipulidae	*Molophilus ochraceus* (Meigen, 1818) D.Z.
28.7.74	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* (Meigen, 1804) D.Z.
28.7.74	INS:	DIPTERA	Sciaridae	*Sciara* sp. D.Z.
28.7.74	INS:	DIPTERA	Phoridae	*Megaselia(Megaselia)rufipes* (Meigen, 1804) D.Z.
28.7.74	INS:	DIPTERA	Heleomyzidae	*Heteromyza commixta* (Collin, 1901) D.Z.
28.7.74	INS:	DIPTERA	Sphaeroceridae	*Leptocera(Limosina)sylvatica* (Meigen, 1830) D.Z.
28.7.74	ARACH:	OPILIONES	Nemastomatidae	*Mitostoma chrysomelas* (Hermann, 1804) D.Z. ♀

Brixham Cavern. Brixham. 20/926 561 OD. 100'

30.5.72	ANN:	OLIGOCHAETA	Lumbricidae	*Eisenia tetraedra* (Savigny, 1826) D.Z.
30.5.72	MOLL:	GASTROPODA	Helicidae	*Helix aspersa* (Muller, 1774) D.Z.
30.5.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862).
30.5.72	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896 D.Z.
30.5.72	INS:	DIPTERA	Sciaridae	*Lycoriella* sp. D.Z.
30.5.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z. larva.
30.5.72	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Z.
30.5.72	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758 D.Th.

Bulkamore Iron Mine. Near Rattery. 20/749 631 OD. 525'
Lower Wet Adit

7.4.72	MOLL:	GASTROPODA	Zonitidae	*Retinella nitidula* (Draparnaud, 1805) D.Th.
7.4.72	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Th.
7.4.72	MOLL:	GASTROPODA	Zonitidae	*Oxychilus alliarus* (Miller, 1882) D.Th.
7.4.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) 3 spm. D.Th.
7.4.72	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* (Folsom, 1896) D.Th.
7.4.72	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947 D.Th.
7.4.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Th.
7.4.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. , larva.
7.4.72	INS:	DIPTERA	Mycetophilidae	*Bolitophila(Bolitophila)saundersi* (Curtis, 1836) D.Th.
7.4.72	INS:	DIPTERA	Heleomyzidae	*Scoliocentra villosa* (Meigen, 1830) D.Th.

W.G.R. Maxwell (continued)

7.4.72	INS:	DIPTERA	Sphaeroceridae	*Leptocera(Limosina)* sp. cf *sylvatica* (Meigen, 1830) D.Th.
7.4.72	CRUS:	AMPHIPODA	Gammaridae	*Niphargellus glenniei* (Spooner, 1948) 1 ov. D.Th. 3 ♀♀
7.4.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th. ♀
7.4.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. juv. ♂ ♀

Bulkamore Iron Mine. Near Rattery. 20/749 631 OD. 525'
Upper Dry Adit

7.4.72	ANN:	OLIGOCHAETA	Enchytraeidae	*Fridericia* sp. D.Th.
7.4.72	DIPL:	CHORDEUMIDA	Graspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) D.Th.
7.4.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. cf *latus* Gisin, 1956 D.Th.
7.4.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
7.4.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnàeus, 1758 D.Th.
7.4.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th.
7.4.72	INS:	DIPTERA	Mycetophilidae	*Tarnania fenestralis* (Meigen, 1818) D.Th.
7.4.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. ♂, 2♀♀
7.4.72	ARACH:	ARANEAE	Linyphiidae	*Centromurus prudens* (Cambridge, 1873) D.Th. ♀

Bulkamore Iron Mine. Near Rattery. 20/749 631 OD. 525'
Main Workings

7.4.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Z.
7.4.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758) D.Z.
7.4.72	ARACH:	ARANEAE	Linyphiidae	*Linyphia* sp. D.Z.

Bunkers Hole. Buckfastleigh. 20/735 652 OD. 230' Additional records

16.3.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
16.3.74	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Kalaphorura)burmeisteri* (Lubbock, 1873) D.Z.
16.3.74	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus curvicollis* (Bourlet, 1839) D.Z.
16.3.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
16.3.74	INS:	DIPTERA	Mycetophilidae	*Exechiopsis* sp. D.Z.
16.3.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
16.3.74	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) ♂
16.3.74	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Z. ♂, 2 ♀♀, 2 juv.

Dart Garage Cave. Buckfastleigh. 20/744 663 OD. 150' Additional records

7.3.73	TURB:	TRICLADIDA	Planariidae	*Phagocata vitta* (Dugés, 1930) D.Z.
7.3.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus draparnaldi* (Beck, 1837) D.Z.
7.3.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus* sp. D.Z.
7.3.73	MOLL:	GASTROPODA	Helicidae	*Helix aspersa* Muller, 1774 D.Th.
7.3.73	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Z.
7.3.73	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896 D.Z.
7.3.73	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z. 2 ♀♀
7.3.73	INS:	LEPIDOPTERA	Plutellidae	*Acrolepia pulicariae* (Klimesch, 1956) D.Z.
7.3.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
7.3.73	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva D.Z.

W.G.R. Maxwell (continued)

7.3.73	INS:	DIPTERA	Phoridae	*Megaselia* sp. D.Z.
7.3.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
7.3.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza* sp. D.Z.
7.3.73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908) D.Th.
7.3.73	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* (Linnaeus, 1758) D.Th.
7.3.73	ARACH:	OPILIONES	Phalangiidae	*Phalangium opilio* (Linnaeus, 1758) D.Th. juv.
7.3.73	ARACH:	OPILIONES	Nemastomatidae	*Mitostoma chrysomelas* (Herman, 1804) D.Z. imm.
7.3.73	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th.
7.3.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Z. ♂

Dog Hole. Pridhamsleigh. 20/4687 6790 OD. 200' Additional records

15.12.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962
15.12.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella dobati* Gisin, 1956
15.12.74	INS:	COLLEMBOLA	Isotomidae	*?Folsomia? candida* Willem, 1902 imm.
15.12.74	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896
15.12.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites* sp. *?pygmaeus?* (Wankel, 1860) imm.
15.12.74	INS:	COLEOPTERA	Staphylinidae	*Anotylus sculpturatus* (Gravenhorst, 1806) larva.
15.12.74	INS:	DIPTERA	Phoridae	*Megaselia(Megaselia)rufipes* (Meigen, 1804)
15.12.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
15.12.74	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804)
15.12.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) larva.
15.12.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)

Fairy Hall Quarry Cave. 20/744 666 OD. 200' Additional records

23.5.69	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Th.
23.5.69	INS:	COLLEMBOLA	Dytiscidae	*Agabus guttatus* (Paykull, 1798) D.Z.

Goodstone Wood Mine. Lower adit. 20/7838 7343 OD. 818' Additional record

7.4.69	INS:	COLEOPTERA	Chrysomelidae	*Longitarsus* sp. Th.

Great Rock Mine. Henrock, near Chudleigh. 20/822 818 650'

25.6.72	CHIL:		Himantariidae	*Strigamia crassipes* (Koch, 1835) D.Th. ♂
25.6.72	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura(Ceratophysella)denticulata* (Bagnall, 1941) D.Z.
11.9.70	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847)
25.6.72	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus curvicolis* Bourlet, 1939 D.Z.
25.6.72	INS:	COLLEMBOLA	Isotomidae	*Folsomia candida* Willem, 1902 D.Z.
25.6.72	INS:	COLLEMBOLA	Isotomidae	*Proisotoma(Proisotoma)minuta* (Tullberg, 1871) D.Z.
25.6.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862)
25.6.72	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947 D.Th.
25.6.72	INS:	TRICHOPTERA	Polycentropidae	*Plectrocnemia conspersa* (Curtis, 1834) D.Th. larva
25.6.72	INS:	COLEOPTERA	Staphylinidae	*Lesteva longelytrata* (Goeze, 1777) D.Th.
25.6.72	INS:	COLEOPTERA	Dytiscidae	*Agabus guttatus* (Paykull, 1798) D.Th.
25.6.72	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* (Meigen, 1804) D.Th.
25.6.72	INS:	DIPTERA	Dixidae	*Dixella martinii* Peus, 1934 D.Th. ♂
25.6.72	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th. ♂, ♀
25.6.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th. juv.

Great Rock Mine
W.G.R. Maxwell (continued)

25.6.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Scopoli, 1763) D.Th. ♂, ♀

Haytor Iron Mine. Haytor Vale. 20/774 772 OD. 975'

25.3.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) D.Z.
21.5.69	INS:	COLEOPTERA	Dytiscidae	*Agabus guttatus* (Paykull, 1798) D.Z.
25.3.72	INS:	DIPTERA	Sciaridae	*Lycoriella* sp. D.Z.
25.3.72	ARACH:	ARANEAE	Linyphiidae	*Porrhomma* sp. D.Z. ♂, subad.

Kitley Cave. Yealmpton, Plymouth. 20/527 515 OD. 30' Show Cave

5.4.72	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
5.4.72	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1817) D.Z.
5.4.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Protaphorura)* sp. cf *latus* Gisin, 1956 D.Z.
5.4.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.
5.4.72	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella boneti* (Bagnall, 1941) D.Z.
5.4.72	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus curvicollis* (Bourlet, 1939) D.Z.
5.4.72	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896 D.Z.
5.4.72	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z. 2 ♀♀
5.4.72	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758) D.Z.
5.4.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.
5.4.72	INS:	DIPTERA	Sciaridae	*Sciara* sp. D.Z.
5.4.72	INS:	DIPTERA	Heleomyzidae	*Scoliocentra villosa* (Meigen, 1830) D.Z.
5.4.72	INS:	DIPTERA	Sphaeroceridae	*Leptocera* sp. D.Z.
5.4.72	INS:	DIPTERA	Piophilidae	*Piophila(Allopiophila)vulgaria* Fallen, 1820 D.Z.
5.4.72	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Z.
5.4.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1904) D.Z. ♀, 1 subad., o juv.
5.4.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Z. subad.
5.4.72	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes pallidus* (Cambridge, 1871) D.Z.

Lambs Down Mine Level. Eastern Edge of Dartmoor. Buckfastleigh. 20/696 657 OD. 1125'

2.6.72	TURB:	TRICLADIDA	Planariidae	*Phagocata vitta* (Dugés, 1930) D.Th.
2.6.72	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Th.
2.6.72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Th.
2.6.72	INS:	TRICHOPTERA	Limnephilidae	*Stenophylax permistus* McLachlan, 1895 D.Th. ♂, ♀
2.6.72	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. ad. & larva.

Loo Cave. Buckfastleigh. Behind Dart Garage, near Dart Garage Cave. 20/744 662 OD. 150'

19.11.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus* sp.
7.3.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Kalaphorura)burmeisteri* (Lubbock, 1878) D.Z.
7.3.73	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896 D.Z.
7.3.73	INS:	COLLEMBOLA	Sminthuridae	*Sphyrotheca patritzii* (Gisin, 1960) D.Z. ♀, imm.
7.3.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Th. & D.Z.
21.7.73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908) D.Th. & D.Z. ♂, ♀
19.11.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) ♂, juv.

Loo Cave
W.G.R. Maxwell (continued)

19.11.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) ♀

Old Tunnel. Haccombe House, Newton Abbot. 20/2898 0702 OD. 175'

25.8.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Th.
28.8.73	MOLL:	GASTROPODA	Helicidae	*Hygromia(Hygromia)limbata* (Draparnaud) D.Th.
25.8.73	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* (Folsom, 1896) D.Th.
25.8.73	INS:	PSOCOPTERA	Epipsocidae	*Epipsocus lucifugus* (Rambur, 1842) D.Th.
25.8.73	INS:	COLEOPTERA	Carabidae	*Trechus quadristriatus* (Schrank, 1781) D.Th.
25.8.73	INS:	COLEOPTERA	Staphylinidae	*Proteinus ovalis* (Stephens, 1834) D.Th.
25.8.73	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubecolosa* Meigen, 1804 D.Th.
25.8.73	INS:	DIPTERA	Phoridae	*Megaselia* sp.
25.8.73	INS:	DIPTERA	Mycetophilidae	*Tarnania fenestralis* (Meigen, 1818) D.Th.
25.8.73	INS:	DIPTERA	Sphaeroceridae	*Leptocera(Limosina)silvaticus* (Meigen, 1830) D.Th.
25.8.73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908) D.Th. juv.
25.7.73	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th.
25.8.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th.
25.8.73	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes* sp. D.Th.

Pen Recca Slate Mine 20/763 673 OD. 320-440' Additional record

25.10.70	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp.

Polletts' Wood Iron Mine. Buckfastleigh. 20/736 654 OD. 230'

16.3.73	DIPL:	IULIDA	Iulidae	*Iulus(Micropodoiulus)scandinavius* (Latzel, 1884) S.Th. ♂
16.3.73	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Th.
16.3.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Kalaphorura)burmeisteri* (Lubbock, 1873) D.Th.
16.3.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Protaphorura)* sp. not *armatus* (Tullberg, 1869) D.Th.
16.6.73	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Th.
16.3.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Th.

Pridhamsleigh Cavern. 20/750 678 OD. 190' Additional record (Collector: Paul Cornelius)

8.6.69	TURB:	RHABDOCOELA	Typhloplanidae	*Castrada* sp. D.Z.

Radford Cave, Plymouth. 20/503 527 OD. 85' Additional Records

17.3.74	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Z.
17.3.74	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) D.Z.
17.3.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
17.3.74	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
17.3.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella dobati* Gisin, 1965 D.Z.
17.3.74	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* (Folsom, 1896) D.Z.
17.3.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z. ♀
17.3.74	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758 D.Z.

Radford Cave
W.G.R. Maxwell (continued)

17.3.74	INS:	DIPTERA	Phoridae	*Megaselia* sp. D.Z.
17.3.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758) D.Z.
17.3.74	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Z.
17.3.74	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Z. juv.

Reeds' Cave. Buckfastleigh. 20/743 665 OD. 250' Additional records

3.8.68	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1815)
20.10.70	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. cf *dunarius* Gisin, 1956 D.Z.
26.1.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella dobati* Gisin, 1965 D.Z. imm.
22.10.70	INS:	COLLEMBOLA	Isotomidae	*Isotoma* sp. cf *agrelli* Delamare, 1950 D.Z.
2.11.68	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862) Th.
26.1.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z. ♀
22.10.70	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes pallidus* (Cambridge, 1871) D.Z. ♂

Spider Hole. Buckfastleigh. 20/743 664 OD. 200'

18.11.73	MOLL:	GASTROPODA	Cochlicopidae	*Cochlicops lubrica* (Muller, 1774)
18.11.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus draparnaldi* (Beck, 1837)
18.11.73	MOLL:	GASTROPODA	Zonitidae	*Oxychilus* sp.
18.11.73	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) ♀
18.11.73	INS:	MICROCORYPHIA	Machilidae	*Trichoniopthalmus alternatus* (Silvestri, 1904)
18.11.73	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus curvicollis* Bourlet, 1839
18.11.73	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860)
18.11.73	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758)
18.11.73	INS:	COLEOPTERA	Staphylinidae	*Proteinus macropterus* (Gyllenhal, 1810)
18.11.73	INS:	DIPTERA	Culicidae	*Culiseta(Culiseta)annulata* (Schrank, 1776)
18.11.73	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
18.11.73	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* Meigen, 1804
18.11.73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
18.11.73	INS:	DIPTERA	Phoridae	*Megaselia* sp.
18.11.73	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Fungobia)nitida* (Meigen, 1830)
18.11.73	INS:	DIPTERA	Sphaeroceridae	*Leptocera(Limosina)silvatica* (Meigen, 1830)
18.11.73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908
18.11.73	ARACH:	PSEUDOSCORPIONES	Chthonidae	*Chthonius(Chthonius)orthodactylus* (Leach, 1817)
18.11.73	ARACH:	OPILIONES	Nemastomatidae	*Milostoma chrysomelas* (Hermann, 1804)
18.11.73	ARACH:	ARANEAE	Nesticidae	*Nesticus* sp. damaged.
18.11.73	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) imm.

Torr Bridge Cave. Yealmpton. 20/578 515 OD. 55' Additional records

5.4.72	MOLL:	GASTROPODA	Zonitidae	*Zonitoides nitidus* (Muller) D.Z.
5.4.72	MOLL:	GASTROPODA	Helicidae	*Cepea hortensis* (Muller) D.Z.
5.4.72	MOLL:	GASTROPODA	Helicidae	*Helix aspersa* Muller D.Z.
5.4.72	INS:	COLLEMBOLA	Neelidae	*Neelus(Neelus)murinus* Folsom, 1896
5.4.72	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
5.4.72	INS:	DIPTERA	Heleomyzidae	*Scoliocentra villosa* (Meigen, 1830) D.Th.
5.4.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) D.Z.♂
5.4.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Z. subad.

W.G.R. Maxwell (continued)

Un-named Cave near Levaton. 20/809 679. OD. 240' Additional records.

6.4.69	MOLL:	GASTROPODA	Zonitidae	*Retinella nitidula* (Draparnaud) Th.
6.4.69	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. ♀ imm.
6.4.69	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) Th. 3 juv.

West Ogwell Cave. Right hand tunnel. near Newton Abbot. 20/829 700 OD. 220' Additional records

27.1.74	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774)
27.1.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1965
27.1.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia* sp.
27.1.74	INS:	COLLEMBOLA	Onychiuridae	*Tullbergia (Mesaphorura) krausbaueri* (Börner, 1901)
27.1.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites sericus* Gisin, 1947 ♀
27.1.74	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* Linnaeus, 1758
27.1.74	INS:	DIPTERA	Phoridae	*Megaselia* sp.
27.1.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
27.1.74	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804)

West Ogwell Cave. Left hand tunnel. near Newton Abbot. 20/829 700 OD. 220'

27.1.74	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774)
27.1.74	CHIL:	LITHOBIOMORPHA	Lithobiidae	*Lithobius forficatus* (Linnaeus, 1758)
27.1.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962
27.1.74	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia* sp.
27.1.74	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847)
27.1.74	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835)
27.1.74	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus curvicollis* Bourlet, 1835
27.1.74	INS:	COLLEMBOLA	Neelidae	*Neelus (Neelus) murinus* (Folsom, 1896)
27.1.74	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758)
27.1.74	INS:	HYMENOPTERA	Proctotrupidae	*Codrus longicornis* (Nees, 1834)
27.1.74	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* Linnaeus, 1758
27.1.74	INS:	DIPTERA	Chironomidae	*Brillia modesta* (Meigen, 1830)
27.1.74	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908

Wheal Caroline. Disused Mine. Eastern Edge of Dartmoor, Buckfastleigh. 20/701 659 OD. 750' Additional records

2.6.72	DIPL:	IULIDA	Blaniulidae	*Proteroiulus fuscus* (Am Stein, 1857) D.Z.
2.6.72 2.4.75	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
2.6.72	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847) D.Z.
2.6.72	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella efficiens* gp. D.Z.
2.6.72	INS:	COLLEMBOLA	Isotomidae	*Isotoma (Isotoma) agrelli* Delamare, 1950 D.Z.
2.6.72 2.4.74	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus (Tomocerus) minor* (Lubbock, 1862)
2.6.72	INS:	TRICHOPTERA	Limnephilidae	*Stenophylax permistus* McLachlan, 1895 ♀
2.6.72	INS:	DIPTERA	Tipulidae	*Lipsothrix remota* (Walker, 1848) D.Z.
2.6.72	INS:	DIPTERA	Mycetophilidae	*Bolitophila (Bolitophila) spinigera* Edwards, 1924 D.Th.
2.6.72	INS:	DIPTERA	Mycetophilidae	*Tarnania fenestralis* (Meigen, 1818) D.Th.
2.4.75	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z. larva.
2.6.72	ARACH:	PSEUDOSCORPIONES	Chthonidae	*Chthonius (Chthonius) ischnocheles* (Hermann, 1804) Th.
2.6.72	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804) Th. 4 juv.
2.6.72	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th.

6. NORTH SOMERSET

Browns' Hole. Stoke St. Michael. 31/669 475 OD. 475' Additional record

26.12.69	ARACH:	ACARI	Rhagidiidae	*Rhagidia saxonica* (Willmann)

W.G.R. Maxwell (continued)

Goatchurch Cavern. Burrington Combe. 31/476 582 OD. 530' Additional records

27.12.69	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* gp. D.Z.
27.12.69	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.

St. Cuthberts Swallet. Priddy. 31/542 504 OD. 280' Additional records

20.4.69	INS:	COLLEMBOLA	Isotomidae	*Folsomia* sp. D.Z.
20.4.69	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus fimetarius* gp. D.Z.

9. DORSET

New Passage. Portland. (Collector: Dr. Pat Browne)

12.7.69	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908) D.Z.
12.7.69	ARACH:	ARANEAE	Nesticidae	*Nesticus cellulanus* (Clerck, 1757) D.Th. ♂

Quarry, Swanage. 40/014 785 Additional record

23.3.68	INS:	SIPHONAPTERA	Hystrichopsyllidae	*Hystrichopsylla talpae* (Curtis, 1836) D.Th.

16. WEST KENT

Westerham Mine. Hosey Common. 51/454 531 OD. 450' Additional record (Collector: R. Thompson)

25.8.69	INS:	DIPTERA	Mycetophilidae	*Bolitophila (Bolitophila) cinerea* (Meigen, 1818) D.Z.

17. SURREY

Godstone Mine. Carthorse series. 51/352 535 OD. 700' Additional records

21.1.68	MOLL:	GASTROPODA	Zonitidae	*Retinella pura* (Alder)
22.3.69	PAUR:		Pauropodidae	*Allopauropus danicus* (Hansen, 1901) D.Th.

20. HERTFORDSHIRE

Roughdown Common Mine. Hemel Hempstead. 51/046 056 OD. 250' Additional record

9.10.71	CRUS:	ISOPODA	Trichoniscidae	*Trichoniscus pygmaeus* Sars D.Z.

23. OXFORDSHIRE

Spratts Barn Mine. 42/387 172 OD. 315' Additional record

10.5.69	INS:	DIPTERA	Sphaeroceridae	*Copromyza (Crumomyia) ?nigra* (Meigen, 1830) D.Z.

26. WEST SUFFOLK

Chalk Mine. Horringer, South of Bury St. Edmunds. 52/83 62 OD. 200'

12.3.74	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817) D.Z.
12.3.74	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1817) D.Z.
12.3.74	CHIL:	LITHOBIOMORPHA	Lithobiidae	*Lithobius duboscqui* Brolmann, 1896 D.Z.
12.3.74	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtys curvicollis* Bourlet, 1839 D.Th. & D.Z.
12.3.74	INS:	COLLEMBOLA	Entomobryidae	*Lepidocyrtus violaceus* Lubbock, 1873 D.Th. & D.Z.
12.3.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella* sp. ? *alba* (Packard, 1873) D.Z.
12.3.74	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
12.3.74	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z.
12.3.74	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* Linnaeus, 1758 D.Th.
12.3.74	INS:	DIPTERA	Mycetophilidae	*Bolitophila (Bolitophila) saundersi* (Curtis, 1836) D.Th.
12.3.74	INS:	DIPTERA	Mycetophilidae	*Rymosia fasciata* (Meigen, 1804) D.Th.
12.3.74	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Th. larva.

Chalk Mine, Horringer
W.G.R. Maxwell (continued)

12.3.74	INS:	DIPTERA	Phoridae	*Megaselia* sp. D.Th.
12.3.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
12.3.74	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* (Linnaeus, 1758) D.Z.
12.3.74	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Z. 2 ♀♀, juv.
12.3.74	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes* sp. D.Z. ♂ imm.

42. BRECON

Agen Allwedd. Llangattock. 32/188 158 OD. 1300' Additional records

8.10.66	INS:	COLLEMBOLA	Isotomidae	*Isotomina* sp. D.Z.
11.3.61 4.11.63 6.8.67	INS:	COLEOPTERA	Leiodidae	*Choleva agilis* (Illiger, 1798) D.Z. ♂, 2 ♀♀
2.12.61 6.8.67	INS:	DIPTERA	Trichoceridae	*Trichocera maculipennis* Meigen, 1818 D.Z.
31.3.62 17.9.66	INS:	DIPTERA	Trichoceridae	*Trichocera* sp. D.Z.
4.11.63	ARACH:	ACARI	Rhagidiidae	*Rhagidia terricola* (Koch, 1836)
15.6.67	ARACH:	ACARI	Rhagidiidae	*Rhagidia spelaea* (Wankel, 1861) D.Z. (Collector: Dr. P. Browne)

Little Neath Cave. Ystradfellte. 22/912 140 OD. c750' Additional records

18.6.67	MOLL:	GASTROPODA	Zonitidae	*Retinella nitidula* (Draparnaud) D.Z.
18.6.67	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* gp. D.Z.
18.6.67	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847) D.Z.
18.6.67	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)notabilis* (Schäffer, 1896) D.Z.
18.6.67	INS:	EPHEMEROPTERA	Baetidae	*Baetis* sp. nymph D.Z.
18.6.67	INS:	PLECOPTERA	Chloroperlidae	*Chloroperla torrentium* (Pictet, 1841) D.Z. ♀
18.6.67	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947 D.Z.
18.6.67	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) D.Z. ♂, 1 (ov) ♀

Ogof Ffynnon Ddu Glyntawe. **Cwn Dwr.** 22/857 156 OD. 1100' Additional records

29.7.67	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Oligaphorura)schoetti* (Lie Pettersen, 1896) D.Z.
29.7.67	INS:	COLLEMBOLA	Isotomidae	*Folsomia candida* Willem, 1902 D.Z.
29.7.67	INS:	COLLEMBOLA	Isotomidae	*Folsomia* sp.
29.7.67	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860) D.Z.

Ogof Gam. Llangattock 32/187 158 OD. 1300' (Collector: Pat Browne)

4.11.63	INS:	LEPIDOPTERA	Geometridae	*Triphosa dubitata* (Linnaeus, 1758) Th.
8.4.67	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) D.Th.

Ogof-y-Ci Vaynor. 32/040 104 OD. 900' Additional records

24.7.71	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
24.7.71	INS:	TRICHOPTERA	Philopotamidae	near *Philopotamus montanus* (Donovan, 1813) D.Z. nymph.
24.7.71	CRUS:	ISOPODA	Oniscidae	*Oniscus asellus* Linnaeus, 1758

Ogof-y-Daren-Cilau Llangattock. 32/206 153 OD. 1300' Additional records (Collector: Dr. Pat Browne)

9.7.67	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)* sp. cf *agrelli* Delamare, 1950 D.Z.
9.7.67	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* gp. D.Z.
9.7.67	INS:	DIPTERA	Mycetophilidae	*Speolepta leptogaster* (Winnertz, 1863) D.Z.
9.7.67	INS:	DIPTERA	Sciaridae	*Bradysia* sp. D.Z.
9.7.67	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) Th.
9.7.67	CRUS:	AMPHIPODA	Gammaridae	*Niphargus fontanus* Bate, 1859

W.G.R. Maxwell (continued)

Pen Eryr. Llangattock. 32/208 152 OD. 1300'

30.8.69	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia* sp.
30.8.69	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus (Oligaphorura) schoetti* (Lie Pettersen, 1896)
30.8.69	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* (Wankel, 1860)

57. DERBYSHIRE

Jack Pot (P.8.) Castleton. 43/108 818 OD. 1080' Additional record

11.2.67	ARACH:	ACARI	Rhagidiidae	*Rhagidia terricola* (Koch, 1836) D.Z.

64. MID-WEST YORKSHIRE

Alum Pot. Horton. 34/774 755 OD. 1125' Additional record

4.1.64	INS:	TRICHOPTERA	Limnephilidae	*Plectrocnemia* sp. D.Z. larva.

Gaping Gill. Ingleborough. 34/751 726 OD. 1300' Correction (BM/652)

29.8.68	ANN:	OLIGOCHAETA	Lumbricidae	*Dendrobaena veneta* Mitchelson D.Z.

Ingleborough Cave Clapham. 34/754 772 OD. 900' Additional records

26.8.68	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1847) D.Z.
26.8.68	ARACH:	ACARI	Rhagidiidae	*Rhagidia* sp. indet. D.Z.

DR. GEORGE MORRISON Aberystwyth University.

44. CARMARTHENSHIRE

Llygad Llwchwr Llandeilo Fawr Rural. 22/669 178 OD. 780' Additional record

1947	INS:	COLEOPTERA	Carabidae	*Nebria brevicollis* (Fabricius, 1792)

D.A. NASH, Operation Mole. Ref: XN/- OM/-

57. DERBYSHIRE

Nicker Grove Mine. 43/215 761 OD. 700' Additional record

10.9.50	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus fimetarius* gp.

JACK NEWRICK

66. DURHAM

Elpha Green Cave Sparty Lea Allendale. 35/84 49

24.11.58	ARACH:	ARANEAE	Linyphiidae	*Theridion* sp. juv.

H. PARKER, Ilfracombe Grammar School Field Club. Ref: IGS/-

4. NORTH DEVON

Napps Cave. Berrynarbor. 21/562 475 OD. 300'

1956	TURB:	EULECITHOPHORES	Typhloplanidae	*Opistomum pallidum* O. Schmidt, 1848
1956	MOLL:	GASTROPODA	Zonitidae	*Oxychilus helveticus* (Blum)
1956	MOLL:	GASTROPODA	Helicidae	*Helix aspersa* (Muller)
1956	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* gp.
1956	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus fimetarius* gp.
1956	INS:	LEPIDOPTERA	Plusiidae	*Scoliopteryx libatrix* (Linnaeus, 1758)
1956	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908
1956	CRUS:	AMPHIPODA	Gammaridae	*Niphargellus glennei* (Spooner, 1948)
1956	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763)
1956	ARACH:	ARANEAE	Argiopidae	*Meta menardi* (Latreille, 1804)
1956	ARACH:	ACARI	Ixodidae	*Ixodes vespertiliones* (Koch, 1844)

A.E.McR. PEARCE Ref: AP/-

7. NORTH WILTSHIRE

Limpley Stoke Mine. Bath-Box area. 31/78 60 OD. c500' Additional record

12.4.70	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Th.

GRAYHAM PROUDLOVE. Manchester University

64. MID-WEST YORKSHIRE

White Scar Cave Ingleton. 34/712 745 OD. 850' Additional records

20.3.76	INS:	TRICHOPTERA	Philopotamidae	*Philopotamus montanus* (Donovan, 1813)
19.4.76	INS:	DIPTERA	Trichoceridae	*Trichocera regelationis* (Linnaeus, 1758) D.Z.
24.4.76	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* (Linnaeus, 1758) D.Z.

G.W. PUGSLEY Ref: CWP/-
57. **DERBYSHIRE**
Bagshaw Cavern. Bradwell. 43/172 809 OD. 788' Additional record

12.5.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. cf *arans* (Gisin, 1952) D.Z.

Dido's Cave Matlock Bath. 43/296 575 OD. 399' Additional records

18.2.73	DIPL:	IULIDA	Blaniulidae	*Blaniulus guttatus* (Bosc, 1792) D.Z.
18.2.73	DIPL:	IULIDA	Iulidae	*Tachypodoiulus niger* (Leach, 1815) D.Z.
18.2.73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* (Verhoeff, 1908) D.Z.

Jack Pot Castleton. 43/108 818 OD. 1080' Additional records

10.2.73	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Oligaphorura)schoetti* (Lie Pettersen, 1896) D.Z.
10.2.73	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
18.3.72	ARACH:	ACARI	Rhagidiidae	*Rhagidia* sp. D.Z.

Knotlow Mine. Monyash. 43/144 674 OD. 960'

12.2.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* (Gisin, 1956) D.Z.
12.2.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Oligaphorura)schoetti* (Lie Pettersen, 1896) D.Z.

Mam Tor Swallet. Castleton. 43/296 575 OD. 300' Additional records

25.3.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Protaphorura)furciferus* (Borner, 1901) D.Z.
23.3.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.
23.3.72	INS:	COLEOPTERA	Dytiscidae	*Agabus* sp. larva

Windy Knoll Cave. Castleton. 43/126 830 OD. 1080'

25.3.72	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* (da Gama, 1962) D.Z. & D.Th.
25.3.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.
25.3.72	ARACH:	ARANEAE	Linyphiidae	*Porrhomma* sp. ♂ imm. D.Th.

G.W. RIDYARD Ref: XR/-
6. **NORTH SOMERSET**
Stoke Lane Slocker 31/668 474 OD. 570' Additional record

18.8.48	MOLL:	GASTROPODA	Zonitidae	*Retinella nitidula* (Draparnaud)

DAVID ROBERTSON Ref: DR/-
42. **BRECON**
Pant Mawr Ystradfellte 22/891 162 OD. 1420'

19.8.65	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)notabilis* Schäffer, 1896
19.8.65	ARACH:	ACARI	Veigaiaidae	*Veigaia* sp.

R.J. SELLARS Cathedral School, Wells. Ref: R/-
6. **NORTH SOMERSET**
Eastwater Cavern. Priddy. 31/538 506 OD. 780'

3.6.52	CRUS:	CYCLOPOIDA	Cyclopidae	*Cyclops languidus* Sars, 1862

Downside Mineshaft Nettlebridge Valley, Downside School, Stratton-on-the-Fosse, Bath 31/644 496

3.6.51	CRUS:	CYCLOPOIDA	Cyclopidae	*Cyclops pulchellus* Sars

Passage at Street Behind Clarks Shoe Factory

1951	ARACH:	ACARI	Ixodidae	*Ixodes vespertilionis* Koch, 1844

64. **MID-WEST YORKSHIRE**
Ingleborough Cavern (Clapham Cave) 34/754 772 OD. 900'

4.4.53	INS:	DIPTERA	Sciaridae	*Bradysia* sp.
4.4.53	CRUS:	AMPHIPODA	Gammaridae	*Gammarus* sp.

J.N. SCHOFIELD Ref: SS/-

50. **DENBIGHSHIRE**

Minera Cave (Lime Works and natural cave) 33/255 523 OD. 875' Near Wrexham

19.9.62	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* gp. (2,3 X 4 oc, gp.)
19.9.62	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* (2, 4 X 4 oc. gp.) gp.
19.9.62	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia emucronata* (3 X 3 oc. gp.) gp.
19.9.62	INS:	COLLEMBOLA	Neanuridae	*Neanura muscorum* (Templeton, 1835)
19.9.62	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Oligaphorura)schoetti* (Lie Petersen, 1896)
19.9.62	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella immaculata* gp.
19.9.62	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862)
19.9.62	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* Linnaeus, 1758
19.9.62	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
19.9.62	INS:	DIPTERA	Sphaeroceridae	*Copromyza(Crumomyia)nigra* (Meigen, 1830) 3 ♂♂s, 5 ♀♀s

R.W. SMITH Red Rose Pothole Club. Ref: RWS/-

42. **BRECONSHIRE**

Bridge Cave. Ystradfellte 22/912 140 OD. 750' Additional record

25.6.72	INS:	DIPTERA	Chironomidae	*Rheotanytarsus* sp. D.Z. larval cases

Ogof Rhyd Sych. Vaynor 32/041 102 OD. 900' Additional records

24.6.72	INS:	COLLEMBOLA	Hypogastruridae	*Schaefferia lindbergi* da Gama, 1962 D.Z.
24.6.72	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1835) D.Z.
24.6.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)dunarius* Gisin, 1956 D.Z.
24.6.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Protaphorus)armatus* (Tullberg, 1869) D.Z.
24.6.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Oligaphorura)schoetti* (Lie Pettersen, 1896) D.Z.
24.6.72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus(Onychiurus)* cf *arans* Gisin, 1952 D.Z.
24.6.72	INS:	COLLEMBOLA	Isotomidae	*Isotoma(Isotoma)agrelli* Delamare, 1850 D.Z.
24.6.72	INS:	COLLEMBOLA	Isotomidae	*Folsomia* sp. cf *monoculata* (Bagnall, 1949) D.Z.
24.6.72	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites pygmaeus* gp. D.Z.
24.6.72	INS:	TRICHOPTERA	Polycentropidae	*Plectrocnemia* sp. *?geniculata* (McLachlan, 1871) larva D.Z.
24.6.72	INS:	COLEOPTERA	Dytiscidae	*Hydroporus nigrita* (Fabricius, 1792) D.Z.
24.6.72	INS:	COLEOPTERA	Dytiscidae	*Oreodytes rivalis* (Gyllenhal, 1827) D.Z.
24.6.72	INS:	DIPTERA	Chironomidae	*Xenopelopia felcigera* (Keiffer, 1911) D.Z.
24.6.72	INS:	DIPTERA	Mycetophilidae	*?Speolepta leptogaster* (Winnertz, 1863) pupal cases, D.Z.
24.6.72	CRUS:	AMPHIPODA	Gammaridae	*Niphargus* sp.

Ogof-y-Ci. Vaynor. 32/040 104 OD. 980' Additional records

10.12.72	MOLL:	GASTROPODA	Zonitidae	*Oxychilus cellarius* (Muller, 1774) D.Th.
10.12.72	CHIL:	GEOPHILOMORPHA	Geophilidae	*Geophilus electricus* (Linnaeus, 1758) D.Z.
10.12.72	INS:	COLEOPTERA	Staphylinidae	*Lesteva pubescens* Mannerheim, 1831 D.Z.
10.12.72	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908 D.Z.
10.12.72	ARACH:	ARANEAE	Linyphiidae	*Porrhomma convexum* (Westring) D.Z. ♂
10.12.72	ARACH:	ARANEAE	Linyphiidae	*Porrhomma* sp. D.Z. ♂ & ♀♀s

JOSEPH SHEVELAN. Moorland Ramblers Club. Ref: MRC/-
64. MID WEST YORKSHIRE
Pikedaw Calamine Mine. Attermire Area. 34/875 640 OD. 1650'
9.5.59 INS: DIPTERA Trichoceridae *Trichocera regelationis* (Linnaeus, 1758) D.Z.

Sherwood House Farm. Horton-in-Ribblesdale.

24.9.60 CRUS: AMPHIPODA Gammaridae *Gammarus pulex* (Linnaeus, 1758) From tap water in farm.

T.H. STANBURY Ref: AR/-
6. NORTH SOMERSET
Radcliffe Cave. Bristol.
18.12.48 INS: COLLEMBOLA Entomobryidae *Heteromurus nitidus* (Templeton, 1835)

PETER STOTT. Ref: S/-
57. DERBYSHIRE
Calesdale Cave. Lathgilldale. 43/176 653 OD. 650' Additional record
10.11.46 INS: DIPTERA Heleomyzidae *Heleomyza serrata* (Linnaeus, 1758)

Lathgill Head Cave. Lathgilldale. 43/171 659 OD. 700' Additional records
10.11.46 ANN: OLIGOCHAETA Lumbricidae *Dendrobaena subrubicunda* Eisen D.Th.
10.11.46 INS: DIPTERA Sphaeroceridae *Copromyza (Crumomyia) nigra* (Meigen, 1830) Th.
10.11.46 INS: DIPTERA Heleomyzidae *Heleomyza serrata* (Linnaeus, 1758)

J.N. STRACHAN Ref: Strachan
64. MID-WEST YORKSHIRE
Gaping Gill. Ingleborough. 34/751 721 OD. 1300'
1939 INS: COLEOPTERA Staphylinidae *Dianous coerulescens* (Gyllenhal, 1810)
1939 INS: DIPTERA Trichoceridae *Trichocera maculipennis* Meigen, 1818
1939 INS: DIPTERA Mycetophilidae *Speolepta leptogaster* (Winnertz, 1863)

MALCOLM STRATH
6. SOMERSET
Swildons Hole Priddy. 31/351 513 OD. 779' Additional records
15.11.71 TURB: TRICLADIDA Planariidae *Polycelis felina* (Dalyell, 1814) D.Z.
13.11.71 INS: COLLEMBOLA Neanuridae *Anurida granaria* (Nicolet, 1847) D.Z.
13.11.71 INS: TRICHOPTERA Philopotamidae *Wormaldis occipitalis* Pictet, 1834 D.Z.
13.11.71 INS: COLEOPTERA Dytiscidae *Ilybius fuliginosus* (Fabricius, 1792) larva.
13.11.71 CRUS: CYCLOPOIDA Cyclopidae *Acanthocyclops vernalis* Fischer, 1893

MIKE WARE South Wales Caving Club. Ref: RW/-
42. BRECON
Dan-yr-ogof Craig-y-nos. 22/838 160 OD. 790' Additional records
2.7.71 INS: COLLEMBOLA Onychiuridae *Onychiurus (Oligaphorura) schoetti* (Lie Pettersen, 1896) D.Z.
2.7.71 INS: COLLEMBOLA Neanuridae *Anurida* sp. *?granaria* (Nicolet, 1847) ♀
2.7.71 CRUS: AMPHIPODA Gammaridae *Niphargus fontanus* Bate, 1859

DR. GORDON WARWICK
39. STAFFORDSHIRE
Dudley Mine. West 32/945 913
1959 INS: HEMIPTERA Aphidadae *Rhopalosiphoninus (Rhopalosiphoninus) staphyleae* (Koch, 1854)

THEO WILD Ref: XW/-
64. MID WEST YORKSHIRE
Gaping Gill. Ingleborough. 34/751 726 OD. 1300' Additional records
30.12.48 INS: COLEOPTERA Dytiscidae *Hydroporus ferrugineus* Stephens, 1829
30.12.48 INS: COLEOPTERA Dytiscidae *Agabus guttatus* (Paykull, 1798) larva
30.12.48 CRUS: AMPHIPODA Gammaridae *Gammarus pulex* (Linnaeus, 1758)

JANE WILSON Ref: JMW/-

3. SOUTH DEVON

Bakers Pit Cave. Buckfastleigh. 20/839 531 OD. 250' Additional records

2.7.74	DIPL:	IULIDA	Iulidae	*Ophyiulus pilosus* (Newport, 1842) D.Z.
5.10.74	DIPL:	CHORDEUMIDA	Brachychaeteumidae	*Brachychaeteuma* sp. cf *bagnalli* (Verhoeff, 1911) 3♀♀
2.7.74	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella dobati* Gisin, 1965
2.7.74	SYM:		Scutigerellidae	*Symphyla isabellae* (Grassi, 1886)
2.7.74	INS:	DIPTERA	Phoridae	*Triphleba antricola* (Schmitz, 1918)
2.7.74	ARACH:	ACARI	Parasitidae	*Eugamasus loricatus* (Wankel, 1861) 2 ♀♀

Radford Cave. Plymouth. 20/503 527 OD. 85' Additional records

Nov. 73	ANN:	OLIGOCHAETA	Lumbricidae	*Eiseniella tetraedra f. typica* (Savigny, 1886)
Nov. 73	INS:	PROTURA	Campodeidae	Damaged specimen - unlike those commonly found
Nov. 73	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817)
Nov. 73	INS:	DIPTERA	Phoridae	*Megaselia (Megaselia) tenebricola* Schmitz, 1934
Nov. 73	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
Nov. 73	INS:	DIPTERA	Sphaeroceridae	*Leptocera (Limosina) sylvatica* (Meigen, 1830)
Nov. 73	CRUS:	ISOPODA	Trichoniscidae	*Androniscus dentiger* Verhoeff, 1908
Nov. 73	ARACH:	ACARI	Parasitidae	*Eugamasus loricatus* (Wankel, 1861) ♀

17. SURREY

Godstone Mine. Carthorse series. 51/352 536 OD. 700'

22.12.74	DIPL:	IULIDA	Blaniulidae	*Isobates varicornis* (Koch, 1847)
22.12.74	INS:	DIPTERA	Culicidae	*Culex (Culex) pipiens* Linnaeus, 1758
22.12.74	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)

49. CAERNARVONSHIRE

Parc: Llanrwst: Cuffty: 3 interconnecting mines.

Level 2. 23/778 584 (c 1½ miles from adit entrance)

29.9.74	ANN:	OLIGOCHAETA	Lumbricidae	*Dendrobaena rubida* (Savigny, 1826)

Level 3. 23/773 588 (approximate depth 130' from shaft)

29.9.74	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus (Tomocerus) minor* (Lubbock, 1862)

50. DENBIGHSHIRE

Ogof Hesp Alyn 33/108 656 OD. 400' Near Cilain

31.8.75	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. *ambulans* gp.
31.8.75	INS:	COLLEMBOLA	Isotomidae	*?Folsomia* sp.
31.8.75	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus (Oligaphorura) schoetti* (Lie Pettersen, 1896)

Ogof Nadolig Cilain. 33/1930 6555 OD. 500'

30.8.75	DIPL:	CHORDEUMIDA	Craspedosomidae	*Polymicrodon polydesmoides* (Leach, 1817)
30.8.75	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp.
30.8.75	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835)
30.8.75	INS:	DIPTERA	Tipulidae	*Limonia (Limonia) nubeculosa* (Meigen, 1804)
30.8.75	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
30.8.75	INS:	DIPTERA	Heleomyzidae	*Scoliocentra villosa* (Meigen, 1830)

Waen Las Mine. near Cilain. 33/193 608 OD. 500'

21.9.75	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. *fimitarius* gp.
21.9.75	INS:	HEMIPTERA	Veliidae	*Velia (Plesiovelia) caprai* (Tamanini, 1947)
21.9.75	INS:	HEMIPTERA	Veliidae	*Velia* sp. nymph
21.9.75	INS:	COLEOPTERA	Dytiscidae	*Hydroporus obsoletus* Aubé, 1838
21.9.75	INS:	DIPTERA	Sciaridae	*Lycoriella* sp.
21.9.75	INS:	DIPTERA	Heleomyzidae	*Heleomyza serrata* (Linnaeus, 1758)
21.9.75	INS:	DIPTERA	Sphaeroceridae	*Leptocera (Limosina) silvatica* (Meigen, 1830)
21.9.75	CRUS:	AMPHIPODA	Gammaridae	*Gammarus pulex* Linnaeus, 1758

52. ANGLESEY

Copper Mine. Pary's Mountain, near Amlwych. 23/440 903 OD. 400'

29.8.75	INS:	DIPTERA	Culicidae	*Culex(Culex)pipiens* (Linnaeus, 1758)

112. SHETLAND ISLANDS

Small Mine near Sulom on the Mainland. HU/341 736 (N.B. Now quarried away)

Aug. 74	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura(Hypogastrura)purpurescens* (Lubbock, 1867)
Aug. 74	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862)

EXOTIC RECORDS

C.W. PUGSLEY Ref: CWP/-

MOROCCO TAZA REGION. MIDDLE ATLAS MOUNTAINS

Kef Navarine 4° 2' 40" W. 34° 6' N. OD. 1380m

Aug. 72	ANN:	HIRUDINEA	Gnathobdellidae	*Haemopsis sanguisuga* (Linnaeus, 1758)
Aug. 72	INS:	COLLEMBOLA	Neanuridae	*Friesea ?oligopala*
Aug. 72	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835)
Aug. 72	INS:	HEMIPTERA	Veliidae	*Velia* sp.
Aug. 72	INS:	COLEOPTERA	Dytiscidae	*Hydroporus* sp.
Aug. 72	INS:	COLEOPTERA	Dytiscidae	*Stictonotus ?lepidus* (Olivier, 1795)
Aug. 72	INS:	COLEOPTERA	Dryopidae	*Dryops* sp.

Kef Arba near Dr Ain Bechar. 4° 5' 30" W. 34° 4' 50" N. OD. 1350m

Aug. 72	ANN:	OLIGOCHAETA	Lumbricidae	*Eiseniella tetraedra* (Savigny, 1826)
Aug. 72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus pseudostachianus* Gisin, 1952 ♀
Aug. 72	INS:	HEMIPTERA	Veliidae	*Velia* sp.
Aug. 72	INS:	HEMIPTERA	Nepidae	*Nepa* sp. Nymphs
Aug. 72	INS:	COLEOPTERA	Carabidae	*Agonum* sp.
Aug. 72	INS:	COLEOPTERA	Dytiscidae	*Agabus* sp.
Aug. 72	INS:	COLEOPTERA	Dytiscidae	*Colymbetes* sp.
Aug. 72	INS:	COLEOPTERA	Dryopidae	*Dryops* sp.
Aug. 72	CRUS:	AMPHIPODA	Gammaridae	*Gammarus gauthieri* Karaman, 1935

Ikhfou ouan near Kab Ticharh. 4° 13' 40" W. 34° 56' 40" N. OD. 1330m

Aug. 72	TURB:	TRICLADIDA	Planariidae	*Polycelis felina* (Dalyell, 1822) D.Th.
Aug. 72	INS:	COLLEMBOLA	Hypogastruridae	*Typhlogastrura altantes* Gisin, 1952 Th. ♂
Aug. 72	INS:	COLLEMBOLA	Hypogastruridae	*Hypogastrura* sp. cf *similis* (Absolon, 1901) imm.
Aug. 72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus* sp. cf *paucituberculatus* gp: *obsiones* Cassagnau, 1957 Th. imm.
Aug. 72	INS:	COLLEMBOLA	Onychiuridae	*Onychiurus paucituberculatus* gp. Th.
Aug. 72	INS:	COLLEMBOLA	Isotomidae	*Subisotoma* sp. ?Gen. & sp. nova. Th.
Aug. 72	INS:	COLLEMBOLA	Isotomidae	*Cryptopygus zenderi* (Winter, 1967) Th.
Aug. 72	INS:	COLLEMBOLA	Sminthuridae	*Arrhopalites giovannensis* Cassagnau & Delamare, 1953 Th.
Aug. 72	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) Th.
Aug. 72	INS:	HEMIPTERA	Notonectidae	*Notonecta meinertzhageni* Poisson, 1933 D.Th.
Aug. 72	INS:	TRICHOPTERA	Limnephilidae	*Halesus* sp. D.Th. ♀
Aug. 72	CRUS:	AMPHIPODA	Gammaridae	*Gammarus microps* Pinkster & Goedmakers, 1974 D.Th. & D.Z. Many thousands seen.
Aug. 72	AMPH:	CAUDATA	Salamandridae	*Salamandra salamandra* (Linnaeus, 1758)
Aug. 72	FLORA	seed	Papilionaceae	*Medicago denticulata* (Willd)

Bat Cave near Bab Tahar. 4° 8' 40" W. 33° 59' 50" N. OD. 1130m

Aug. 72	MAMM:	CHIROPTERA	Vespertilionidae	*Myotis blithii oxygnathus* Monticelli

FRANCE ATLANTIC PYRENEES

Trou de Renard near Moulis

17.8.73	DIPL:	IULIDA	Blaniulidae	*Typhloblaniulus* sp. imm.
17.8.73	INS:	COLLEMBOLA	Isotomidae	*Folsomia candida* Willem, 1902

C.W. Pugsley (continued)

BULGARIA

Temna Dupka near Lakatnik

3.8.74	MOLL:	GASTROPODA	Hydrobiidae	*Iglica acicularis* Angelov

Popova Peshtera near Krushuna

6-7.8.74	AMPH:	CAUDATA	Trituridae	*Triturus cristatus* (Laurent, 1768)
6-7.8.74	AMPH:	SALIENTIA	Bufonidae	*Bufo bufo* (Linnaeus, 1758)

MALCOLM STRATH and members of Nottingham Univ. S.U. Speleological society. Ref: NU/0.

NORTH SPAIN. Pica de Europa

Guev Dobros

Aug. 72	TURB:	TRICLADIDA	Planariidae	*Polycelis felina* (Dalyell, 1814) Th.
Aug. 72	DIPL:	STRONGYLOSOMIDEA	Strongylosomidae	*Devilles tuberculata* Brolemann, 1902
4.8.70	DIPL:	LYSIOPETALOIDEA	Callipodidae	*?Cyphocallipus* sp. D.Z.
27.7.70	INS:	MICROCORYPHIA	Machilidae	*Dilta* sp. juv. Th.
Aug. 72	INS:	COLLEMBOLA	Neanuridae	*Anurida granaria* (Nicolet, 1835) No ocelli.
Aug. 70	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella goughi* da Gama, 1971 D.Z.
Aug. 72	INS:	COLLEMBOLA	Entomobryidae	*Heteromurus nitidus* (Templeton, 1835) D.Z.
Aug. 72	INS:	COLLEMBOLA	Tomoceridae	*Tomocerus(Tomocerus)minor* (Lubbock, 1862)
27.7.70	INS:	HEMIPTERA	Gerridae	*Gerris* sp. Th.
12.8.70	INS:	HEMIPTERA	Veliidae	*Velia(Plesiovelia)caprai* Tamanini, 1947 Th. D.Z.
2.8.70	INS:	HEMIPTERA	Aphidae	*Macrosiphum(Macrosiphum)* sp. *?funestum* (Macchiatti, 1885) Th.
16.8.70	INS:	COLEOPTERA	Silphidae	*Breuilia triangulus* (Sharp) D.Z.
2.8.70	INS:	COLEOPTERA	Chrysomelidae	*Apteropeda* sp. Th.
Aug. 72	INS:	COLEOPTERA	Scydmaenidae	*Mastigus* sp. D.Z.
14.8.70	INS:	COLEOPTERA	Staphylinidae	*Drusilla canaliculata* (Fabricius, 1787) Th.
2.8.70	INS:	COLEOPTERA	Scarabidae	*Serica brunnea* (Linnaeus, 1758) Th.
30.7.70	INS:	DIPTERA	Fanniidae	*Fannia polychaeta* (Stein, 1895) Th. ♀, larvae
6.8.70 8.8.72	INS:	DIPTERA	Tipulidae	*Limonia(Limonia)nubeculosa* Meigen, 1804 D.Th.
6.8.70	CRUS:	CLADOCERA	Bosminidae	*Bosmina longirostria similia* (Lilljeborg, 1900) Th., D.Th.& D.Z.
6.8.70	CRUS:	CYCLOPOIDA	Cyclopidae	*Eucyclops agilis* (Koch, 1838) Th. D.Z.
10.8.70	CRUS:	CYCLOPOIDA	Cyclopidae	*Acanthocyclops venustus* (Norman & Scott, 1906)
Aug. 72	CRUS:	CYCLOPOIDA	Cyclopidae	*Eucyclops serrulatus* (Fischer, 1851) D.Z.
Aug. 72	CRUS:	CYCLOPOIDA	Cyclopidae	*Cyclops(Tropocyclops)prasinus* Fischer, 186C D.Z.
27.7.70	CRUS:	HARPACTICOIDA	Canthocamptidae	*Atteyella crassa* (Sars, 1862) Th.
14.8.70	CRUS:	ISOPODA	Trichoniscidae	*Trichoniscoides* sp. D.Z. 2 ♀♀s.
9.8.70	ARACH:	PSEUDOSCORPIONES	Neobisidae	*Neobisium(Blothrus)jeanneli* (Ellingson, 1912) D.Z.
9.8.70	ARACH:	ARANEAE	Argiopidae	*Meta merianae* (Scopoli, 1763) Th. & D.Th. imm.
2.8.70	ARACH:	ARANEAE	Linyphiidae	*Lepthyphantes zimmermanni* Berkau, 1890 Th. ♀
30.7.70	ARACH:	ARANEAE	Pisauridae	*Pisaura mirabilis* (Clerck, 1757) Th. ♀

Gueva del aqua

4.8.70	ARACH:	ARANEAE	Argiopidae	*Meta antrorum* Simon, 1907 ♀ imm.

MIKE WARE. South Wales Caving Club. Ref: RW/-

SOUTH AFRICA

Boomslang Cave Cave Peak, above Kalk Bay, Cape Town. OD. 1200'

23.6.69	DIPL:	POLYDESMIDA	Sphaerotrichopidae	*Philocaffrus* sp. af. *bifalcatus* Attems, 1928 D.Z. ♂

Boomslang Cave
Mike Ware (continued)

23.6.69	INS:	COLLEMBOLA	Entomobryidae	*Pseudosinella* sp. D.Z.
23.6.69	INS:	DIPTERA	Phoridae	*Megaselia ?natalicola* (Beyer, 1960) D.Z. ♀
23.6.69	CRUS:	AMPHIPODA	Gammaridae	*Paramelita barnardi* Thurston, 1973 D.Z.

MALAYSIA
Bukit Chinte Maive. Kuala Lumpur.

Feb. 70	INS:	DICTYOPTERA	Physoscelidae	*Physoscelus* sp. nymphs. D.Th.

GIBRALTAR
Judges Cave. Additional records

21.3.72	DIPL:	CHORDEUMIDA	Opiathocheiridae	*Opisthocheiron* sp. imm. 19 segments. D.Z.
21.3.72	CRUS:	ISOPODA	Trichoniscidae	*Iberioniscus breuili* Vandel D.Z. 4 ♀♀s, 2 ♂♂s.
21.3.72	CRUS:	ISOPODA	Trichoniscidae	*Trichoniscus* sp.
21.3.72	CRUS:	ISOPODA	Trichoniscidae	*Trichoniscus* sp. larva. D.Z.
21.3.72	ARACH:	OPILIONES	Phalangodidae	*Scotoleman roeweri* Kraus, 1961 D.Z.

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