EXPEDITION ADVISORY CENTRE

CAVING EXPEDITIONS

Edited by Dick Willis

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RGS-IBG Expedition Advisory Centre

The Royal Geographical Society (with The Institute of British Geographers) is the UK's main organisation for screening and funding small independent research expeditions. These assist in furthering geographical knowledge and the encouragement of life-long learning, leadership and team skills.

The Society's internationally acclaimed Expedition Advisory Centre provides information, training and advice to anyone planning an expedition overseas through a range of training seminars and workshops, publications and information resources. Details of these can be found on the EAC website: www.rgs.org/eac

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Cover photograph by Simon Fowler

Acknowledgements

Like many a project, this handbook began as a labour of love and, as deadlines grew close, became something else. No doubt each individual contributor has felt the same way at some point in the preparation of his or her section. Even so all were produced although not all were on time. However, the late contributions came from individuals who had themselves only recently returned from expeditions and were busy on the production of their expedition reports. There can be no better excuse and so their lateness is forgiven and my thanks are due to all for their considerable efforts.

My thanks are also due to the staff of the Expedition Advisory Centre for their good humoured tolerance and ready advice and in particular, to Fay Hercod and Deborah Boys for preparing this edition.

Although not directly concerned with the Handbook, Julie Wooldridge deserves considerable gratitude for organising the catering at the Caving Expeditions Seminar - the event which was the catalyst for the production of this book.

Caves are fragile environments; please remember,

Leave nothing but footsteps,
Take nothing but photographs,
Kill nothing but time.

Contents

FOREWORD

Favoured indeed is the cave explorer of today. Unlike the mountaineer, polar explorer or yachtsman, now forced into ever more circumscribed challenges in the search for new pastures, the speleologist has expanding horizons all around.

In our own small islands, caves are still being discovered and extended after nearly a century of ever-increasing effort. A simple extrapolation from the size and number of caves to be found in Britain's small and glacially scoured Karst areas indicates the almost limitless possibilities in the bigger and deeper limestone formations of the World. (Not to mention the lava, sandstone and ice-caves!) Actual exploration in the last decade have shown that this is far from a pipe-dream. Caves are indeed a much more important component of the Earth's crust than could have been imagined.

British cavers and cave scientists are in the vanguard - both at home and abroad. Back home, all the easy entrances were ferreted out years ago, but digging and diving, aided by an increasingly sophisticated knowledge of where and how caves form have produced generations of cavers ever better equipped to discover obscure, blocked, flooded and difficult underground byways. Armed with lightweigt equipment which allows the smallest team to tackle the deepest and longest cave, the best of British cavers are capable of meeting the challenge of caves anywhere in the World.

The annual odyssey takes different forms. Most accessible, and favoured by University teams, are the Karsts of Europe, where long-term projects involving detailed and painstaking exploration and recording of a small area over a number of years has produced internationally recognised results - particularly in Northern Spain. Time and time again such expeditions have confounded the law of diminishing returns, and as a result of the groundwork of previous years' work they have made ever bigger and more significant breakthroughs.

Further afield, British expeditions have now visited many parts of South-East Asia, Australasia, South America, Africa, Mexico, Canada and elsewhere. In a number of cases the first visit to an area has led to the start of more intensive and detailed work, as in New Guinea, Sarawak, and Canada. Discoveries made have ranged from the largest caves in the world to underground water sources vital to the local population. Some expeditions have been mammoth affairs, others very small. The fact is that there is scope for all. Given the drive, commitment, and ability, any caver can make his discoveries, be they sporting or scientific, near or far.

I would like to finish this foreword by stressing the opportunities which are open to all. Unlike some other countries, we do not choose our nationally-recognised caving expeditions by committee. It is open to any individual, group, or institution to research a project and produce a plan of action. This may then be put up for approval and sponsorship entirely on its merits. There is no charmed circle to break into: if you have the right plan and a capable team, you too will get support for your expedition!

Ben Lyon

Introduction

Caving is an activity which, perhaps more than any other, mixes motivations. Cavers are (to varying extents) sports fanatics, academics, photographers, logistics experts, demolition experts, diplomats, surveyers, biologists, archaeologists, geologists, boozers, gear freaks, athletes and so on and so forth.

Caving expeditions provide the opportunity to bring together all these various motivations towards one end and, in so doing, to introduce another driving force - the satisfaction of organising a successful and enjoyable trip, a process which can in itself become a major factor in the caving career of some individuals.

That satisfaction, and with it the desire to organise other successful trips, can be greatly increased by forethought and planning. The aim of this handbook is to provide a range of opinions from a number of individuals who have, between them, an enormous body of experience with regard to expeditions.

These opinions are not intended to provide a blueprint for the organisation of an expedition. There could be no such thing, all expeditions are different. They are intended to ensure that the reader is aware of the issues which must be faced when planning a caving trip overseas. It is for the expedition leader and the other team members to decide how those issues should be tackled in the light of their own, very individual, circumstances.

As such, this book is not a technical manual. The contributors were asked not to restate information which has been comprehensively published elsewhere, merely to draw attention to the relevant factors and to provide appropriate references. One result of this approach is that parts of this publication may seem thin whilst other parts may seem proportionately overweight. So be it.

Undoubtedly there will be items missing and, as time goes by, certain things will become out of date. If you have any constructive additions or comments please let me have them. If you have any information which is of relevance to a particular area please pass that on to the BCRA Foreign Secretary. Between us we will attempt to ensure that your information is as widely available as possible, to the benefit of others.

There are two additional ways in which you can help other cavers and which I would like to emphasise in this introduction.

Firstly, if you have a surplus of gear at the end of you trip please consider donating it to the BCRA (Mulu) Equipment Pool. Here it will be available for your future use should you require it but it will also be available for other groups. In this way it could make the difference between success or failure for another party.

Secondly, when you return from your trip do your best to raise some money by selling reports, photos, posters, doing lectures, writing articles etc. By this means you can raise the public profile of caving which will assist future groups to gain financial and practical support. In addition it may place you in a position to make a cash donation to the Ghar Parau Foundation. This money will be invested and the interest used to provide grant aid to caving expeditions.

Dick Willis
Editor

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SOURCES OF INFORMATION FOR CAVERS

Christine Bonner and Shane Winser

The aim of this chapter is to help you find the necessary information to plan your expeditions. There may, of course, be many other sources not mentioned here. Continue to use those sources that you have found useful in the past.

There are predominantly two kinds of information: primary and secondary. A primary source is the information itself; a secondary source should lead you to the information and exists in the form of abstracting and indexing services, directories, organisations and public and academic libraries.

Primary Sources

PEOPLE WITH PREVIOUS EXPERIENCE AND SPECIALISED KNOWLEDGE are highly used sources of information in the field of caving. First-hand knowledge may often be the only source of information, and an experienced individual should be able to make constructive comment on the viability of your plans. The best place to meet such individuals is through local clubs or by attending the British Cave Research Association's annual caving conference each September.

BOOKS tend to cover a stated area in depth. A good index is invaluable. Beware that the information a book contains is not out-of-date. To the caver wishing to venture abroad, guidebooks published by foreign clubs about their caving areas are well worth consulting. Even if they are written in a foreign language you do not understand, the maps, diagrams and tables may still be useful.

JOURNALS are collections of academic papers, and are produced by groups all over the world. Not all of these publications are widely available in Britain, but many can be obtained through the BCRA library or via inter-library loans through the British Library Lending Division. Any public or academic library should be able to arrange this for you. The major British journals often include reports on foreign expeditions, advice and news of contacts abroad. The current major British journals are:

BRITISH CAVER, (Formerly - Journal of the Mendip Exploration Society) 1 -, 1936 - . It is published by Anne Oldham quarterly and is available from her at Thychydwr, Crymych, Dyfed, Wales, SA41 3RB.

CAVES AND CAVING, 1 - , 1973 - . Published quarterly by the B.C.R.A. It is available from caving and outdoor pursuit shops throughout Britain and is sent free to all B.C.R.A. members. The editor is Mark Dougherty, 7 Edinburgh Terrace, Armley, Leeds LS12 3RH.

CAVE SCIENCE, (Transactions of the B.C.R.A.). 1 - , 1974 - . Published quarterly by the B.C.R.A. it is sent free to members of the B.C.R.A. The editor is Dr T.D. Ford, 21 Elizabeth Drive, Oadby, Leicester LE2 4RD

DESCENT, 1 - , 1969 - . Published by AMBIT, Descent is available bi-monthly from caving and outdoor pursuit shops or by subscription. The editor is Chris Howes, 51 Timbers Square, Roath, Cardiff CF2 3SH

MAPS AND AERIAL PHOTOGRAPHS. Both British and overseas maps may be consulted at the Royal Geographical Society, the British Library Map Library and in the national and copyright libraries of Scotland (Edinburgh), Wales (Aberysthwyth), and the Universities of Oxford and Cambridge.

Major map retailers include:

STANFORDS INTERNATIONAL MAP CENTRE, 12-14 Long Acre, London, WC2E 9LP.

EXPEDITION REPORTS are not always produced for circulation. Many have a limited circulation to sponsors, the organising club and expedition members. These reports can often be hard to track down but the Royal Geographical Society's Map Room houses over 3,000 which can be consulted Monday-Friday, 10am to 5pm without prior appointment.

Secondary Sources

ABSTRACTING AND INDEXING SERVICES are lists of references to books and journal articles on a specific subject. The references may be accompanied by a brief description or annotation which should allow easy location of the required item and thus access to the information needed.

The main two services in the field of caving are:

Current Titles in Speleology. 1 - , 1968 - . Published annually by B.C.R.A. it includes circa 2,700 journal articles and books published all over the world. A reference copy is available at the B.C.R.A. library based in the Local Studies Library, County Offices, Matlock, Derbyshire, or contact The Editor, R Mansfield, Downhead Cottage, Downhead, Shepton Mallet BA4 4LQ

Speleological Abstracts. 1 - , 1968 - . Published annually by the Commission of the Swiss Academy of Sciences and the Bibliography of the International Union of Speleology. It contains many foreign journals, books and papers from international conferences.

A list of abstracts of expedition reports held by the Society on a specified country may be obtained from the Expedition Advisory Centre on request. The EAC also publishes the "Expedition Yearbook" which provides details of expeditions planned each year. This includes the name and address of the leader, number of members, duration of expedition, objectives and achievements where known, and bibliographic information on their reports. Each Yearbook is published retrospectively i.e. the 1985 Yearbook is published in the Spring of 1986.

BIBLIOGRAPHIES are lists of references to specific subjects. They can be found at the end of books and journal articles and may be used to look at a subject in more detail. There are few published bibliographies for caving, but general national bibliographies will include caving books published.

The major bibliographies are:

THE BOOKSELLER, W.M. Heinemann. 1958 - .
BOOKS IN PRINT, R.R. Bowker Company. 1958 - .
BRITISH BOOKS IN PRINT, J. Whittaker and Sons. 1967 - .
BRITISH NATIONAL BIBLIOGRAPHY, British Library. 1940 - .

These are all available for reference use from most public and academic libraries.

THE NORWEGIAN CAVE CATALOGUE AND KARST BIBLIOGRAPHY has been collated by David St. Pierre since 1963. It includes a large amount of information relating to this area. For information contact him at Tennant House, Linghaw, High Bentham, via Lancaster LA2 7AH. (Please enclose a SAE).

DIRECTORIES can prove invaluable when looking for addresses of individuals or organisations.

DIRECTORY OF BRITISH CAVING CLUBS. Published annually by Anne Oldham. This lists all the caving clubs in the country, number of members and addresses for contact.

DIRECTORY OF B.C.R.C. CAVE RESCUE SERVICES AND CALL OUT LIST. In Judson, D. Caving Practice and Equipment. David and Charles, Revised 1991.

Useful Organisations

ORGANISATIONS are vital sources of information and help.

The major organisations in Britain include:

BRITISH CAVE RESCUE COUNCIL. 1967 - . The honorary secretary is Mr B Boardman, 8 Yeland Avenue, Giggleswick, Settle, North Yorkshire, BD24 OAY.

British Cave Research Association (B.C.R.A.). The objectives of the BCRA are the promotion of the study of caves and associated phenomena and the publication of research carried out on caves. These services include the publication of books, journals and booklists, advice on equipment and techniques, a comprehensive and accessible library for all members and arranging of conferences and meetings. A foreign secretary is also appointed to keep abreast of developments abroad and to give advice to groups intending to venture abroad.
All enquiries: BCRA, BCM BCRA, London WC1N 3XX
Library: Local Studies Library, County Offices, Matlock, Derbyshire. (0629 3411 ext 6840).
Librarian: Roy Paulson, Holt House, Holt Lane, Lea, Matlock, Derbyshire.

CAVE DIVING GROUP
Honorary Secretary: Julian Griffiths, 73 Panal Ash Drive, Harrogate, W. Yorks HG2 0HX

EXPEDITION ADVISORY CENTRE
Royal Geographical Society, 1 Kensington Gore, London, SW7 2AR. (0207-591-3030).
The EAC provides an information and training service for those planning overseas expeditions and a large amount of published material such as handbooks, directories and manuals.

NATIONAL ASSOCIATION OF MINING HISTORY ORGANISATIONS
Secretary: Mr C Jones, 3 Bell Hill Marton, Lindall-in-Furness, Ulveston, Cumbria LA12 0NS.
This organisation aims to further the study of mining history and membership is open to all societies and museums involved with mines.

NATIONAL CAVING ASSOCIATION
C/O British Monomarks Ltd, Monomark House, 29 Old Gloucester Street, London WC1N 3XX

ROYAL GEOGRAPHICAL SOCIETY
Map Room, 1 Kensington Gore, London SW7 2AR. (0207-591-3000).

WILLIAM PENGELLY CAVE STUDIES TRUST
Library: Hall Place, London Borough of Bexley Library, Bexley, Kent.
Librarian: Harry Pearman, 24 Sydney Road, Bexley Heath, Kent, DA6 8HG.

Collections Of Caving Materials

This list below includes individuals and clubs who have specialised collections built up over, in some cases, many years and make available the information to other cavers undertaking research. However, do not forget your local library.

BENTHAM, Keith, 11A George Mansions, 1 St Johns Road, Buxton, Derbyshire.
His collection is Derbyshire orientated and he is willing to provide photocopies where possible.

HUNT, B.M., 22 Mayfair Road, Newson, Lancs BB9 8JP.
The collection is heavily biased towards the Yorkshire Dales area. Items are for reference only, and there are limited photocopying facilities.

JOHNSON, P., 224 Albert Road, Aston, Birmingham, B6 8JP.

He has a collection of historical caving literature.

KELLY, J., 132 Dundee Avenue, Belfast 9, N Ireland.
He has a collection of Irish material on caving.

NASH, D., Glebe Cottage, The Hillock, Eyam, Derbyshire.
This collection contains many complete runs of journals, and books dating from 1675 including all the major works on Derbyshire. Items are for reference only.

NORTHERN PENNINE CLUB
Honorary recorder and Librarian: A.E.R. Waddington, Northern Pennine Club, Greenclose House, Clapham, Via Lancaster.
A substantial collection of material, much of which is accessible through a subject index.

UNIVERSITY OF BRISTOL SPELEOLOGICAL SOCIETY
The Librarian, University of Bristol Speleological Society, Students Union, Queen's Road, Clifton, Bristol BS8 1SP
This collection contains source materials for historical research dating from the 16th century; books on the history of caves and standard reference works, and runs of journals from the early 20th century.

FURTHER READING

BRITISH LIBRARY (1940) British National Bibliography. Available for reference use at most public and academic libraries.

HEMMING, John (annual) Reference Sources for Expeditions. Expedition Advisory Centre.

JUDSON, David (1973) Ghar Parau. Cassell Ltd.

LYON, Ben (1983) Venturing Underground: the new speleo's guide. EP publishing.

OLDHAM, Anne (annual) Directory of British Caving Clubs. Approx œ1.00. Available from Mrs Oldham at Rhychydwr, Crymych, Dyfed, Wales SA41 3RB.

Current Titles in Speleology. Available for reference at the BCRA library or can be purchased from BCRA, address above.

SPELEOLOGICAL ABSTRACTS (1986) Commission of Speleology of the Swiss Academy of Sciences and the Commission of Bibliography of the International Union of Speleology. Available for reference at the BCRA library.

WHITTAKER, J. and Sons (1967) British Books in Print. Available for reference from most public and academic libraries.

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PERMISSION AND ACCESS

Dave Checkley

Introduction

When applying for permission to go caving in another country it is vital to try and see your application from the point of view of the official or groups receiving your letters or approaches. Suppose you controlled access to areas of this country with big caving potential, but as yet unvisited. A foreign group writes to you in a foreign language about a proposed expedition to the area. They have even printed the name of the region on top of their letter paper. This seems presumptious to you. You struggle to understand the letter. The tone seems to be one of 'we plan to ..' not 'we would like to..'. There is no mention of your own caving group in their plans or even of collaboration. You are annoyed. That letter and a couple more from the same group go into the bin and you think nothing more about it. Then one day they appear. Fifteen foreign cavers roll up, not one of them speaks your language or even seems interested in talking to you. What would you do?

In asking for permission to go to a region, you are asking a big favour. Ask yourself what is in it for them, and in your letter try and point out the mutual benefits of the trip. There can be benefits in the form of:

Information about the caves, geology and hydrology being made available to all interested parties. This obviously means producing a good report and getting it sent out to people in the country. Taking photographs and giving slide shows in the country may also be possible.

Collaboration is normally a mutually beneficial experience. This may take the form of experienced visiting cavers and scientists teaching the local, less experienced groups. The danger is then of being patronising and underestimating the abilities of the hosts. On the other hand British cavers have benefited enormously from caving with their European counterparts, who have greater expertise in the exploration of deep alpine systems.

A *further* benefit to both parties is the understanding and friendship generated by joint expeditions.

It is hoped that these comments will form part of a background philosophy that will help to make your expedition an enjoyable experience. I would only add that the type of approaches described above are not rare. When English groups have behaved in this manner it has produced disastrous results and soured the expedition experience for the group. A further outcome of this sort of behaviour is that future groups find permission a problem and are coolly received. It can take years to undo such damage to international caving relationships.

Sources Of Information

Suppose you wish to go to a country or to a region which looks interesting on a topographical map. You have searched through all the English literature and found nothing on permission other than the odd acknowledgement to some committees. You have tried Current Titles in Speleology and either purchased from Tony Oldham the only journals on the country or been to the BCRA library at Matlock to see them. There are also the Pengelly and Bristol libraries to go to, plus back issues of 'Spelunca'. The International Union of Speleology may help. The BCRA Foreign Secretary (David St Pierre) will try and help and may be able to put you in touch with previous expeditions. Expedition reports are often the most valuable sources of information of all. May I add here that the Foreign Secretary's information is only as good as the information that he is given. Please let him know contact addresses and permission procedures for countries you have visited, after you return.

The Initial Contacts

I cannot stress too much that it is essential to write in the language of the country of interest. Remember you are asking a favour. Make the first approach at least one year in advance since you may have to go through various channels, and you are probably writing to busy people who will take a few weeks to reply. Certain parts of the world have very unreliable postal services so if you have not heard anything after a few months it is worth sending a copy of the original with a polite covering note. Stress collaboration, reports and photographs as positive benefits. Be specific about numbers, dates and objectives. If you are writing to someone who knows nothing about caving, or to a country where caving is not a sport, you will have to explain your motives clearly or they will produce suspicion. Previous publications with lots of cave photographs will help people understand why we do it or more seriously why we are prepared to travel half way round the world to do it!

Depending upon the country many of the initial contacts will be made through or with the help of the embassy in London. The British Council can also provide helpful introductions to local researchers and often guidance and practical everyday tips. They may be particularly helpful with customs problems and know whether or not to bribe and how much. They are also a useful link to emergency facilities should you have an accident. Large multinationals such as oil companies can also help in this way.

In countries where caving is a new activity or where access is limited, it may be essential to send out a small advance team. The advance party will probably want to go out the year prior to the main expedition. Their role is to confirm political clearance to the regions of interest and get a general feel of the lie of the land. In some cases a visit may be the only way of establishing a dialogue since letters often do not evoke replies. The other job of the early team is to make personal contacts with local cavers. These are not easy tasks and require tact, patience and diplomacy, characteristics that cavers are not renowned for. Choose the advance party carefully and try to include a fluent speaker of the local language or local person with English.

In countries where cavers are a well-known phenomenon, permission may take a variety of forms. Do not even in these cases, underestimate the time required. Applications may be considered by committees which meet infrequently. Both national and local permission may be required. Contact with local groups will always add to the pleasure and normally make life easier. To foster good international relations should be one of your fundamental objectives.

Every expedition passes a point of no return when tickets are bought and people committed. This may occur prior to getting full permission, however this is clearly undesirable. Plans should be developed such that at the very least an informal 'invitation' is received before reaching the point of no return. Word of mouth is not enough. You need documents to convince customs and other officials that you are a bona fide expedition. The more letters and official stamps you obtain the better - photocopy them.

On Arrival

Once you arrive in the country do not think that your diplomatic efforts are over. You may have a mass of official documents, but you now have to put them to work. You need to win the favour of local police, army and landowners to gain access to the entrance. These people can be very helpful if on your side, and very obstructive if against you - official documents or not. Remember these people may be genuinely frightened of you.

Hours will need to be spent in explanation of your interest. A little flattery goes a long way and people are delighted to find out that 'their caves' are some of the best in the

world. Go prepared with illustrative material to explain your life and your interests, which will break the ice. Don't try and rush this part. The generosity of the local people is best repaid by some gesture or gift. Simple payment devalues their generosity and can set unfortunate precedents. A photo with Polaroid camera is an effective way of saying 'thank you' in many parts of the world.

Follow-Up

On returning to this country it is vital to write some kind of report and to honour your promises. It is easy to forget the promised photographs of helpful contacts. It is all too easy to let report writing drag on for years and it is very expensive to send reports across the world. Good follow up is essential if people are to get permission to go again. It is bad manners not to send the information to the people whose country it is. It is their caves we are visiting and we are their guests.

Reference List Of National Caving Organisations

ARGENTINA: KARST ORGANIZACION ARGENTINA DE INVESTIGACIONES ESPELEOLOGICAS, Casilla de Correo 128 Suc 1, Buenos Aires, Argentina.

AUSTRALIA: AUSTRALIAN SPELEOLOGICAL FEDERATION, P.O. Box 388, Broadway, New South Wales 2007, Australia.

AUSTRIA: VERBAND OESTERREISCHER HOHLEN, Ober Donaustrasse 97/1/61, A1020 Wien, Austria.

BELGIUM: UNION SPELEOLOGIQUE DE BELGIQUE, D. Uytterhaegen, 10 Rue Jules Verne, B4900 Angleur, Liege, Belgium.

BRAZIL: SOC BRASILEIRA DE ESPELEOLOGIA, Av. Bridagerio Luiz Antonio, 4442 Ibirapuera, CEP 01042, Sao Paulo, Brasil.

BULGARIA: BULGARIAN FED OF SPELEOLOGY, c/o Bulgarian Tourist Union, 18 Tolbukhin Blvd, 1000 Sofia, Bulgaria.

CANADA: ALBERTA SPELEOLOGICAL SOC., P.O. Box 1175 Station G., Calgary, Alberta, T3A 363, Canada.

CHINA: INSTITUTE OF KARST RESEARCH, Guida Road, Guilin, Guangxi, Republic of China.

CUBA: COMITE CUBANO ESPELEOLOGIA, c/o Academia Ciencias Cuba, Istituto de Geografia, Calle 11 No 514 E/Dye, Vedada, La Habanna, Cuba.

CZECHOSLOVAKIA: CESKA SPELEOLOGICKA SPOLECNOST, Ustredni Vybor, Valdestejnske Nam 1, 118 01 Praha 1, C.S.S.R.

DENMARK: DANSK GROTTEFORENING, c/o C Aub-Robinson, Geologisk Institut, Aarhus Universitet, Langelandsgade Bygn, 521, KDK-8000 AArhus C, Denmark.

(EAST) GERMANY: KARSTMUSEUMS HEMKEHLE, DDR 4711 Uftrugen, Germany.

FRANCE: FEDERATION FRANCAISE DE SPELEOLOGIE, 130 Rue de Saint-Maur, 75011 Paris, France.

GREECE: GREEK SPELEOLOGICAL SOCIETY, 11 Rue Mantzarou, Athens 135, Greece.

HUNGARY: MAGYAR KARSZT ES BARLANGDUTATE, H-1061 Budapest, Anker Koz 1-3, Hungary.

IRELAND: IRISH SPELEOLOGICAL SOCIETY, 31 Grange Crescent, Kill of the Grange, Co. Dublin, Ireland.

ISRAEL: ISRAEL CAVE RESEARCH CENTRE, Exchange Service, OFRA, D.N. Mizrah Binyamin, Jerusalem, 90.906 Israel.

ITALY: SOCIETIA SPELEOLOGICA ITALIANA, Istituto Italiano de Speleologia, Via Zamboni 67, 40127 Bologna, Italy.

JAPAN: SPELEOLOGICAL SOCIETY OF JAPAN, c/o Kitakyushu Museum of Natural History, Yahata Station Building, 6 Nishihonmachi 3-Chome, Yahatahigashiku, Kitakyushu, 8905 Japan.

KOREA: KOREAN SPELEOLOGICAL SOCIETY, Dept of Geography, Kon Kuk Univeristy, 93-1 Mojindong, Seondong-ku, Seoul 133, South Korea.

LEBANON: SPELEO CLUB DU LIBAN, B.P. 70923, Antelias, Lebanon.

MEXICO: ASOCIACION MEXICANA DE ESPELEO, General Cano 10A, Mexica 18 DF, Mexico.

NETHERLANDS: NEDERLANDSE VERENIGING VOOR GROT-EN KARSTONDERZOEK, Laurens Smets, Bautseplein 22, 6367 Bx Voerendall, Netherlands.

NEW ZEALAND: NEW ZEALAND SPELEOGOCIAL SOC, P.O. Box 18, Waitomo Caves, New Zealand.

NORWAY: NORSK GROTTEFORBUND, Postboks 301,8601 MO, Norway.

POLAND: REDAKCJA DRAS I SPELEOLOGIA, Uniwersytitu Slaskiegom UL, Mielczarskiego 58, 41-200 Sosnowiec, Poland.

ROMANIA: CLUBULI DE SPELEOLOGIE EMIL RACOVITA, Clubul Actualitatilor, Calea Plevinei Nr 61, Bucaresti, Romania.

SOUTH AFRICA: S AFRICAN SPELEOLOGICAL SOC, P.O. Box 6166, Johannesburg 2000, Republic of South Africa.

SPAIN: COMITE NACIONAL ESPELEOLOGIA, c/o Vicente-BDO Julia Vives, Alberto Aguilera 3, Madrid 3, Spain.

SPAIN: Federacio Balear D'Espeleologia, C/Verge de Lluc, 10 Entresol, 0001 Ciutat de Majorca

SWEDEN: SVERIGES SPELEOLOGFORBUND, Box 4547, S-102 65 Stockholm, Sweden

SWITZERLAND: SOCIETE SUISSE SPELEOLOGIE, Boite Postale 755, CH-2301, La Chaux-de-Fonds, Switzerland.

TURKEY: BOGAZICI UNIVERSITESI MAGARA, Arastirma Kulubu, P.K. 2, Bebek, Istanbul, Turkey.

UNITED KINGDOM: BRITISH CAVE RESEARCH ASSOCIATION, BCM, BCRA, London WC1N 3XX.

U.S.A.: NATIONAL SPELEOLOGICAL SOCIETY, 1 Cave Avenue, Huntsville, Alabama 35810, U.S.A.

U.S.S.R.: THE GREAT CAVES COMMISSION, Alexander Klimchouk, President, Institute of Geological Sciences, 55B Chkalov Street, Kiev-54, 252054 USSR.

VENEZUELA: SOC VENEZOLANA DE ESPELEOLOGIA, Apartado 47334, Caracas 1041-A, Venezuala.

(WEST) GERMANY VERBAND DER DEUTSCHEN HOHLEN, U-Karstforscher E.V., Eugen Muller Strasse 21, D-4400 Munster, Germany.

YUGOSLAVIA: ACADEMIE SLOVENIE DE SCIENCE, Biblioteque, P.O. Box 323, Novi Trg 4, 61001 Ljubljana, Yugoslavia.

The address of the B.C.R.A Foreign Secretary is: David St Pierre, Tennant House, Linghaw, High Bentham, via Lancaster LA2 7AH, Tel: 05242 62176. He will be very grateful for any useful information which you feel may be of use to other cavers.

3

PERSONNEL

Andy Eavis

Probably the most important aspect of any expedition is the selection of the team members. It is very difficult indeed to try and write hard and fast rules as to how this should be done. Many different factors are important. The problems involved in team selection for caving expeditions are similar to team selection for other types of expeditions. Not only do you need people capable of carrying out the expedition field work, but you also need people capable and with sufficient motivation to carry out the pre and post expedition administrative work. Obviously, the personality of an expedition member is an extremely important factor. Not everybody makes a good expedition person, be it a caving expedition or any other type of expedition and, additionally, people who are excellent cavers in Britain are often appalling on expeditions.

It is very difficult to anticipate how somebody is going to behave in an expedition environment. The only true way of being certain of somebody's capability is to have experience of that individual in the field. Otherwise recommendations by other individuals whose capabilities are well known to yourself, are obviously a good indication. Good expedition members need to be determined and hard working people, but also of even temper and pleasant disposition who are not going to panic in a stressful situation and will work calmly and speedily towards the successful conclusion of whatever they are doing. They must also bear in mind the collective situation and not consider only their own particular position. In caving expeditions, it is particularly important that any individual member should be capable of weighing up the particular risks involved and not subject himself to unnecessary dangers. Irresponsible and dangerous caving in a remote area of Borneo is, for example, totally unnecessary and unacceptable. Very experienced individuals taking calculated risks are required rather than fiery extroverts hell-bent on personal glory and jeopardising the success and reputation of the entire expedition.

Some sort of expedition hierarchy is highly likely to prevail with a leader and probably, deputy leader sorting out the expedition personnel. Often this means that an expedition group works together for a number of different expeditions and gradually a team gets

moulded into a group whose individual abilities complement one another. An individual may have done a lot of work on a particular area and have a very strong claim for a place on any trip to that area. Jobs should be itemised and people recruited to fulfil those roles. For pre-expedition work, for example, the list of jobs could include,

(a) seeking sponsorship for, and organising:

1. Transport
2. Equipment
3. Insurance
4. Money

(b) investigating the project area,

(c) liaising with the host country and obtaining political permission,

(d) liaising with the media and getting the correct publicity.

Job roles during an expedition will depend on the type and scale of the expedition. If the target area is well known and is a specific type of cave or caving region, people experienced in a particular type of caving skill would be appropriate. For example, if the caves are known to be wet, horizontal and generally of the river cave type, people experienced in boat use, accomplished swimmers and probably divers would be appropriate.

Cave surveyors must always be included as all caves discovered must be surveyed. On any modern caving expedition, photographs should be an important part of the work, so adequate people capable of taking cave photographs should be included in the team. In addition, it may be felt that some science is necessary for pure interest or for the sake of the sponsors or for the sake of the interested parties within the host country. Sciences such as geology, geomorphology, cave biology, hydrology etc., could be chosen and particular specialists recruited. On some expeditions, training local people in caving skills and the use of western equipment has been part of the political permission and consequently, outdoor pursuits instructors have been appropriate members of the team.

Writers are also important and somebody who is prepared to take the responsibility of expedition reports and publication. This again, can be co-ordinated and shared between individual members. If the project is large enough and there are enough team members involved, a support section would seem appropriate with such things as doctors, nurses, cooks etc. being involved. Arguably, they should all be cavers who are also prepared to take on the responsibility of field administration. Safety aspects should also be borne in mind and the group should be capable of rescuing any injured members and performing first aid etc. This generally means that it is unwise to have an expedition of much less than 8 people. From personal experience once an expedition gets over 25 people, it

begins to be very difficult to administer, so somewhere between these figures is probably the correct number of caving members.

4

CONTRACTS

Andy Eavis

Introduction

Over the years the numbers of cavers taking part in expeditions has steadily risen, the complexity of expeditions, both financially and in terms of their objectives, has increased and, slowly but surely, the media interest in caving has grown. These different trends have combined to introduce a variety of pressures on the organisers and members of expeditions.

Bitter rivalries have been created and long-standing friendships destroyed by deliberate or unintentional misunderstandings of the mutual expectations and responsibilities of expedition members. Usually these problems do not arise until after the trip. The work of setting up the expedition and the explorations in the field keep people busy and issues which are not clear tend to be buried until after the trip is over.

At that point serious difficulties may arise. Disputes about how surplus gear is to be disposed of, about how income is to be shared or an overdraft paid off, about copyright issues on photographs, about money earned from the writing of articles etc. The list can be endless, the arguments fierce and the satisfaction of successful exploration completely destroyed.

Many of these points of dispute can be avoided by clearly stated arrangements made in advance of the expedition and agreed by the team members. These arrangements can take the form of a contract, either formal or informal.

Informal Contracts

If you have a series of pre-expedition meetings, make sure someone takes and circulates notes of the discussions and any decisions made. These notes can then form a point of reference at a later date and, if arguments do arise, the involved parties can check back to the agreed statement of the relevant discussion.

It is important to ensure that all points of potential conflict are discussed and noted in this way before the expedition is too far advanced. Such points could include:

(a) Arrangements for sharing financial liability (if you set up an expedition account and you are a signatory - make sure that you are not singly responsible for any debts).

(b) Arrangements for sharing the benefit from donations of money or equipment.

(c) Arrangements for sharing the income from talks, slideshows, articles, sale of photographs etc. Expeditions are team efforts and no single photographer could take their shots without the assistance of their colleagues who should therefore share in any benefits from those photographs.

(d) Commitments to use sponsors equipment and not alternatives. If you have been donated expensive gear by a manufacturer then the obligations from that donation should be honoured. Nothing is worse than presenting a major sponsor with photos of their gear in action when each photo includes an obdurate team member who is prominently modelling their main rival's kit.

(e) Agreement on who controls the various aspects of administration of the expedition. Who, for example, is responsible for the accounts, for arranging insurance etc.

(f) Who has responsibility for particular post-expedition chores such as editing the report, producing articles for sale, reports for sponsors etc.

Formal Contracts

In some cases, probably for high finance expeditions to the Americas or Asia where both initial costs and potential income are high, it may be appropriate to formalise the process of reaching agreement on the various possible points of contention. This is particularly important with regard to finance where, if something went wrong, the expedition leaders could find themselves saddled with major liabilities unless it has clearly been agreed, in advance, that such liabilities are shared between the team members.

In this case a Memorandum of Agreement can be drawn up, preferably by a solicitor, and signed by all members of the team. The degree to which this would be legally binding would, almost certainly, be open to argument in the event of a serious dispute. However the completion of such a document ensures that all members of the team are aware, in advance, of their shared responsibilities and obligations to their colleagues; this, in itself, should ensure that the potential for disputes is removed.

An Example Memorandum Of Agreement

This is based upon the document drawn up for signature by the members of the China Caves '85 expedition.

Memorandum of Agreement

Members of the Expedition (referred to as "XXX") are the persons whose names are subscribed below. Signature of this Memorandum will imply acceptance of all the terms of the memorandum of agreement:-

l. Each of the members jointly and severally covenant with the Expedition Leader and each of them that they will at all times hereafter indemnify the Expedition Leader and their respective estates and effects against all actions, claims, costs, demands and liability howsoever arising that the Expedition Leader may incur to YYY Bank plc in connection with XXX and such indemnity shall bind the estates and effects of each of the members.

2. The first priority in connection with the Expedition will be the publication of the official report which is to be edited by the Expedition Leader.

3. All photographs taken on the Expedition will be available free of charge to the Expedition in respect of any academic or official publication but appropriate credit shall be given in any documentation.

4. No article may be written or photographs sold in relation to the Expedition without specific consent of the Expedition Leader.

5. The first œ50 of any fee receivable by any member writing an article in respect of XXX will belong to the member and any balance of any fee over œ50 will belong as to two thirds to XXX and as to one third to the member.

6. In respect of photographs used in materials or articles about XXX the person having copyright in the photograph shall be entitled to retain one third of the reproduction fee and two thirds thereof shall be due to XXX.

7. In respect of photographs taken on XXX but used in relation to articles or material the specific content of which is not concerned with XXX the member will be entitled to retain two thirds of the reproduction fee with one third being due to XXX.

8. Paragraphs numbered three to seven (inclusive) shall bind the members of XXX for a period of three years after the return to Britain of XXX. After such period all

earnings and rights in respect of text and photographs will belong to the respective author or photographer.

9. Notwithstanding the above the copyright of all maps and surveys will rest and remain with XXX.

Name in full and address Signature

Name in full and address Signature

etc., etc.

5

FINANCE

Howard Jones

Budgets

The budget is the financial plan of the trip. Its headings of "Income and Expenditure" must reflect your planned activities; do not, for example, include an item of freight if you do not intend to freight gear. The budget can be drafted as soon as you have planned the trip in outline.

The budget must be realistic, not merely low. It can be used as a guide, not a straight-jacket, and must be researched. Get quotes on all items of expenditure and an idea of what the prices are like in the country to which you are travelling. This will help you to decide whether it is worth the trouble of taking certain items with you. Does it, for example, make sense to take toilet rolls to Spain?

Make allowances for inflation, particularly if your trip is more than six months away, and also for changes in exchange rates with respect to items you intend to buy abroad. Your Bank Manager can offer valuable advice on these matters. Compare your draft budget with those of past expeditions. This will help you to check if your assumptions are both realistic and comprehensive.

Budget Headings

Income

Personal contributions
Sponsorship income
Grants
Sale of publications, reports and equipment
Lectures and post expedition events.

(Sponsors will expect to see a personal contribution.)

Expenditure

Travel and transport
Food
Reconnaissance
Training
Equipment
Administration
Publications and reports
Insurance
Hire of labour
Contingency

Points To Remember

Contingency
Have a reserve and expect to use it. Make sure that you consider what will happen if you return to the UK in debt - you should be able to negotiate emergency overdraft facilities with your bank.

Monitoring
Monitor your budget as your plans proceed and amend your estimates accordingly. This will ensure that your financial planning stays relevant to your aims and objectives. It will also restrict the tendency to overspend...

Don't exaggerate
Many grant-giving bodies will ask you to submit your budget estimates with your application. They often have highly experienced personnel who can easily spot an exaggerated budget; if I may quote from the Mount Everest Foundation's notes - "It will not help you to make the 'costs' side unrealistically high in the hope of getting a bigger grant. For travel, put down the amount you expect to pay, not the full fare ticket cost". Being caught out in this way will do nothing for your credibility, or your income.

Insurance
Make sure that you are adequately insured (see Section 11).

Accounts
Ensure that you and all members of the team keep accurate account of both income and expenditure, nothing destroys a team faster than quibbles over money. Get an individual to act as Treasurer. Publish your accounts in your report - later expeditions will find them useful. Consider opening a bank account in the name of the expedition. This will avoid money passing through any individual's account and will also give you the opportunity to get the Bank Manager interested in what you are doing.

Carrying funds
Give some advance thought to the best way to take your money overseas - cash, travellers cheques, plastic cards, eurocheques etc. All have benefits, most have drawbacks, there is a good analysis in "Which", June 1985 [1] and June 1992. Your Bank Manager will be able to advise on making withdrawal arrangements with an overseas bank.

Keep your costs down
Always consider alternative, cheaper ways of doing things. Get alternative quotes for goods/services. Ask for sponsorship or reductions. Borrow equipment (and insure it).

Sources Of Finance

Two main sources of finance normally exist for expeditions: 1) the members' personal contributions and 2) everything else.

Members contributions
Calculate the maximum cost of the trip using a "worst case" scenario. Work out the most it would cost each participant and quote this figure when you invite people to join the trip. This means you will get a firm commitment from the outset from people who are unlikely to drop out because, they claim, the trip has got too expensive. All the money that you raise thereafter will reduce that contribution.

Sponsors will expect to see a fairly substantial contribution from the team itself. After all if you are not prepared to put the money forward, why should they?

In addition to a proportion of travel costs and some up-front money to cover initial costs, members should be charged an agreed rate per day to cover food, labour costs etc.

'Scientists' going on the trip can often raise specific grants for relevant work, and they can then be charged a higher rate per day. This can be an important source of finance and is an additional reason for doing some serious science on the expedition.

Media
The media are mostly of importance with regard to establishing local and/or national image of the trip. However, money can be raised by writing articles for magazines and papers, if you have someone who can write well, this is worth considering. A number of publications are available giving advice on how, what and for whom to write [2]. If you have no-one who is competent to write, think about contacting a freelance writer. If you provide the information s/he may write and submit pieces for the media. You will not get any money this way but you will get coverage.

Commerce and industry
Can be a source of money as well as gear. If a Company will not actually give you anything they may at least consider a discount [3], [4].

Grant-giving bodies
Hundreds of Trusts and other organisations exist to give money away and some give money to expeditions.

The most comprehensive list of such organisations is published by the Charities Aid Foundation and is held in most libraries [5]. The Expedition Planners' Handbook and Directory (EAC) [6] contains a shorter and more useful list.

Research the organisations
Work out who gives for what reason, most have highly specific criteria. Target your applications accordingly. Plan this well in advance because they often have very long working schedules. Identify credible referees who are prepared to support you. Be prepared to attend interviews, and don't bullshit.

Local authorities
They sometimes give grants or practical support. This may be because a member of their staff is on your trip, because the Youth Service (or another Department) supports the activities of young people in their area or for some other reason. Ask the Public Relations Department (they may also give you some media coverage) or the Treasurer's Department.

Other sponsorship
It may not be direct financial support, but if you are all given a full set of SRT kit then you can spend the money you would have used to upgrade your personal rig on something else (you can also sell it when you get back).

Don't expect to raise thousands, it is hard work and the response rate is poor. More and more groups are competing for the available money each year. If 10% of your letters get a positive response, you are doing well.

References

[1] HOLIDAY MONEY: in 'Which', June 1985 and June 1992. Published by the Consumer's Association.

[2] THE MAGAZINE WRITER'S HANDBOOK: by Gordon Wells. Published by Allison and Busby.

[3] RAISING MONEY FROM INDUSTRY. Published by the Directory of Social Change, 9 Mansfield Place, London NW3 1HS. ISBN 0 907164 056

[4] A GUIDE TO COMPANY GIVING. Published by A Directory of Social Change Publications. ISBN 0 907164 145

[5] DIRECTORY OF GRANT MAKING TRUSTS: published by the Charities Aid Foundation. (It's expensive - consult the library copy).

[6] EXPEDITION PLANNERS' HANDBOOK AND DIRECTORY: Edited by Shane Winser and Nicholas McWilliam (1993-94). Published by the Expedition Advisory Centre, 1 Kensington Gore, London, SW7 2AR.

[7] FUND-RAISING: A COMPREHENSIVE HANDBOOK by Hilary Blume. Published by Routledge Keegan Paul.

6

IMAGE

Dick Willis

Introduction

If your expedition is entirely self contained, is wholly funded by the members, and is going to a place where you will not encounter any other people, then you don't need to worry about its image.

If, on the other hand, you are like the rest of us, reliant upon financial and material support and visiting areas where you are likely to meet either other cavers or local people, then you must give some thought to your expedition's image.

This doesn't mean that you need to ensure that every member wears a matching set of designer clothes and can sing in tune on Radio One. It does mean that you can take some simple steps to ensure that you maximise your chances of getting support and goodwill.

Before You Leave

Your Appeal

Are you a local expedition or is your trip of national importance? Think about this question carefully. If you decide that you are local then you can get away with local appeals which will probably only require good stationery, personal contacts and a simple written outline of your expedition's aims and objectives and other background information.

If you decide that your trip is of national importance, you will need to make a quantum leap. Unless you are rich you will be seeking finance and support from organisations which are receiving similar requests all the time. This process is highly competitive and you will need to present yourselves much more carefully, the simple written outline will need to be replaced by a glossy brochure with a corresponding increase in cost and effort.

Patron
If you can, get a Patron. S/he should be well known (locally or nationally, as above) interested in what you are doing and prepared to speak or write a little on your behalf. This person's name will add credibility to your proposals, try not to do anything which will bring it into disrepute. If you can get more than one suitably important person, then do so.

Stationery
In most cases your stationery, and the letter written on it, will be your first point of contact with potential sponsors. This initial image can make or destroy your chances.

Whether you are a local or a nationally important trip, it is worth spending a little money on good stationery. If you know a graphic design student then get some art work done for free or on the cheap. Don't make it over complicated, and steer clear of multi-coloured printing as it is expensive. The design and layout should be smart and clear. It should carry the name and address of a contact, for example the expedition leader, and leave space for the writer to add his or her own address. If you have Patrons, put their names on it prominently. Offer to put the name of major sponsors on the art work (or rename the expedition if necessary, e.g. Cathay Pacific Mulu '80). If any of the big grant awarding bodies support you, such as Ghar Parau, RGS etc., put this on the work as well; it all helps to establish your credibility.

Don't take up too much space. Beautiful art work is a delight to behold but it isn't much good if it doesn't leave you any room to write.

Consider getting matching compliment slips and you can then use the same art work; if you want to be, need to be, and can afford to be particularly flash, you can get matching envelopes.

When you get the paper etc. printed (shop around for quotes) make sure you get some plain sheets in the same colour, these are useful for when you need to carry on onto a second sheet of paper.

Check that the colour of paper you are going to use will photocopy OK. Some colours give a dirty copy. Try it, don't just take the printer's word.

If you don't know any graphic design students then pay to get the work done (but shop around for quotes). The art work for China Caves '85 cost œ37.00 plus VAT. at the time, the paper was extra. One successful scrounge can pay back that outlay. If you think that you won't want many sheets, consider getting the artwork photocopied onto good paper rather than printed. This may be cheaper for small quantities.

Getting all this done can take time - allow for it.

Leaflet/brochure
At the least you should produce a leaflet to accompany your begging letters. This should set out the aims and objectives of your trip, the whys and wheres, who is going and what their experience is (for the leaders at least), a map and an outline of your finances. This doesn't have to be flash but it must be neatly laid out, clear and factually accurate.

Depending on how you view your appeal, this leaflet can be upgraded by stages. At its simplest it can be done on A4 paper. Alternatively, it can be done on glossy paper with black and white photos or, going the whole hog, like the Mulu, China and Madagascar expeditions, it can be done on A3 folded, with colour photos on the outside and colour or black and white diagrams/photos on the inside. Needless to say, this can be expensive, the China Caves '85 brochure (which was in fact smaller than A4) cost œ220 for 500 copies. After the initial print run, additional copies cost peanuts.

Writing
Real hard graft. All letters should be personal ones, duplicated circular letters usually get binned. Word processing facilities are a real boon if you can get access to them (a bureau may sponsor you, or a typing/word processing training agency, or the local College, in return for advertising).

Type, don't write. If you genuinely can't get hold of a typewriter then for heaven's sake get someone who can write neatly, but it is usually easier to get a typist.

A bad typewriter and/or typist is as useless as a poor handwriter. Your beautiful headed papers won't be any use if the recipient can't read what is on it. If you can't type, consider learning, it is a useful basic skill and anyway at some stage in the future there will be a vacancy for a new BCRA Secretary.....

Think about what you want each letter to achieve. Let this determine how you structure the letter and what you say. Check the grammar and spelling, particularly the latter. Never, never send a letter without checking it for mistakes.

Keep copies of all your correspondence and make sure you can find them. You'll look a right wally if a potential sponsor phones you up and you can't remember what you asked for.

Events
If you run fund-raising events then these will also help to determine your image. If you go for a sponsored puking competition then don't be surprised if reputable organisations treat you like a bunch of lepers. If you do run events make sure they are done properly, the eye of the public will be upon you, and if you can't organise a sponsored swim it won't help to convince people of your ability to organise an expedition.

Media
Wonderful people. See Section 8.

Personal appearances
Personal appearance, interviews, visits to Patrons or sponsors, talks etc. Get someone who can perform well to do it, and not the least articulate or presentable member of the team, even if that person is the most knowledgeable. Think about what you want the appearance to achieve and therefore what you will need to say; be concise and accurate. Don't promise more than you will be able to deliver (if your photographic limitations are 35mm stills, don't promise 70mm movie film). Dress the part; if you are going to a meeting with a Company Director look tidy as your appearance could make all the difference.

Bureaucracy
It may be painful but try to do it right. Make sure you get access permission (one expedition to the Middle East in 1985 got refused entry to the country - after raising funds, printing a brochure etc.) and liaise in advance with any local cavers.

During The Expedition

Behaviour
By all means get drunk with the locals but try not to get into fights, pirate their caves, get busted for any one of numerous dubious offences, or have silly accidents and get rescued. All of these events lower your standing both in your host country and, if reported back in the UK, will do very little for your chances of getting backing for your next trip. They may also screw up someone else's chances of visiting the same place. Observe local laws and customs - not to do so can be highly offensive. Several weeks before you go, buy a copy of a good travellers' guide to the country (e.g. 'Lonely Planet' or 'Insight' guides) and read about the local etiquette. An hour spent with one of these books might prevent you from appearing totally offensive to an important official and might therefore save you days in the field.

Information
Try to get someone back home to agree to send a short newsletter around to your major sponsors while you are away. You send them the material and your volunteer writes it up and circulates it. This can generate considerable good will and helps to maintain the sponsors' sense of involvement. Press releases can also be sent out in your absence, if appropriate.

If you are going somewhere remote, consider taking some printed T-shirts/sweat shirts to give away as gifts as these can work wonders in gaining local good will. (If you get a job lot printed you can sell them before the trip to your long suffering mates). Another

useful trick is to take a Polaroid camera and give away photos.

After The Expedition

The work doesn't stop when you get home. Make sure that you promote your successes through the media. Honour your commitments to your sponsors and Patrons - let them know, as soon as you return, how you got on, provide them with the photos, reports and advertising you promised. If you don't do this, don't bother to approach them the next time you want help. Don't forget to send copies of your report to your contacts in the caving area and/or relevant Government Departments. They may never read them but the gift is relatively cheap and certainly won't do you any harm.

7

SPONSORSHIP

Dick Willis

Introduction

Very few expeditions, these days, could exist without sponsorship. The range of sponsorship varies from a discount at the local shops to free flights to the other side of the world. Whatever the scale of the sponsorship you are seeking, you must be clear about what you want, how much of it you want, when you want it, why you want it and what you will give in return.

The last point is very important. There are some organisations and individuals who will give money or goods to an expedition and expect nothing in return - but there aren't many of them. Most sponsors will give because they expect a return service, evaluation of new items or materials, good photos of their gear in action and/or free advertising on expedition publicity material and reports.

If you don't fulfil your part of the deal then it is unlikely that you will be given sponsorship in the future. This expedition may get by OK, but the next one will be more difficult. In addition there is a danger that all caving expeditions may get the brush-off because you let a sponsor down; so be clear about what the sponsor expects to get in return and make sure you provide it.

What do you want?

If you have worked out your expedition objectives you should have a pretty good idea, even if only in outline, about what equipment and materials your team will require. Get everyone together and brain-storm for possible needs. Get someone to act as a recorder and note down all the suggestions which are put forward, however absurd they may at first seem. When you have exhausted the ideas, start to critically evaluate the suggestions - throw out the wholly ridiculous, group together the ones that are appropriate, work through the ideas which at first may seem doubtful, as on closer inspection, they may be inspirational.

When you have a total view of what you need, do an inventory of what you've already got either as individuals or, if appropriate, as a club. Don't waste effort chasing sponsorship for gear which you have already got in abundance unless you wish to hand it over to the equipment pool or sell it to raise cash (which may not be acceptable to the sponsor). The things you need but you don't have are the things which you either need to buy or to scrounge.

When you have got this list, work out who is going to try to get which items. Be clear about this; if there is confusion over one item and no one ends up getting it then you can be certain that it will be the single item on which the whole trip will depend. Make one person responsible for coordination of the scrounging; all results of begging letters should be sent to that person, whether positive or negative, and a decision can then be made as to what other potential sponsors, if any, can be approached and by whom.

Carry out market research. Find out who produces alternative versions of particular items, scan trade journals, magazines, visit shops etc. A new company trying to penetrate the market may be more willing to give sponsorship than an established company which feels secure in its market share.

Work out your expedition's image (see Section 6), this will influence the types of potential sponsors you approach, whether national or local. It will also ensure that you can put forward a professional contact, whether by phone, letter or in person.

Obtaining sponsorship is a slow process. Start as far in advance as possible and keep an eye on your deadlines.

Don't forget:

IF YOU'VE SCROUNGED IT, YOU'VE GOT AN OBLIGATION TO TAKE IT WITH YOU.
(So think twice about some things...)

How Much, When, Why and Where?

Work out the obvious questions before you actually contact anyone. Get your brochure ready - that will explain what you are doing and give a general indication of why you are on the scrounge. This is a selling process in reverse - you need to be clear what you are going to say in response to the obvious queries.

How much
Work out how much of each product you want and be reasonable in your requests (at least be able to justify them). However, it is worth bearing in mind that the contact may

prove to be more generous than you anticipated, so keep a reserve figure up your sleeve of the most that you would possibly use. (In 1980 I made one call to scrounge a gas double burner for Mulu. I asked the Director for two, he offered more, so I said 6, he then asked if there was anything else we might need - in the end his company gave us over œ6000 worth of general camping gear, footwear and clothing).

If the items you want come in different sizes of packaging make sure that you know in advance what sizes you want. If you are scrounging clothes or footwear, get everyone's measurements in advance and set them out in a table. When the offer is made you can quickly send details of sizes and quantities required.

When
If you have deadlines for shipping or departure make sure that the sponsor knows these so that the gear can be sent to you in time. If someone is going to go to the trouble of giving you stuff, they'll almost certainly make sure they get it to you on time providing that you tell them.

Why
For each potential sponsor work out a reason why you want their particular products. If you can't give a good reason for wanting certain items then don't bother asking for them. If the Managing Director asks you your reasons for wanting X-sets of kit and you say that you are going to sell them to raise cash, don't be surprised when the phone is put down.

Where
You'll need a delivery address, which may be the club hut or rooms, a person's house or flat or a set of rooms borrowed for the occasion (e.g. in a University). Make sure that someone is going to be there. If it's a bulky delivery and no-one is available to accept it, the carrier may take it away and may not return for several days or weeks.

What do they get?

This varies according to the scale of your expedition and your resources. Don't promise if you can't provide. If you haven't got anyone who uses large format cameras, don't offer large format slides, for example.

The main options are:

Evaluation
You are in a position to critically evaluate new products or materials and report back to the supplier. If this is the case, make sure that your team know that this is expected of them before they go. It sounds obvious but make sure that they take the items with them.

A report
Any team that doesn't produce a report should be sentenced to drink keg beer for eternity. Give your sponsors a copy of the report and make sure that they are acknowledged in it (and that their names are spelt correctly).

Free advertising
If you are worth your salt you will do a series of lectures about your trip when you return. These can provide an ideal forum for giving low key advertising about donated items.
You may produce an expedition poster to sell; if so, major sponsors could be mentioned on the poster.

Major sponsorship may be rewarded by renaming the expedition after the sponsor and/or by featuring the sponsor on your stationery.

Photographs
For you: make sure that you get a spread of photos which feature your sponsors' items in use in the field. You can show these in lectures (more low key advertising) and publish them in the report (where the sponsor will see them and know they are being seen by others).

For them: most sponsors will want copies of photos of their products in use. They use these for promotional materials and events. Work out in advance what their requirements are going to be - b/w and/or colour, print and/or tranparency.

MAKE SURE THAT A NAMED INDIVIDUAL HAS THE RESPONSIBILITY OF PRODUCING THESE.

There's nothing worse than coming home, going through the slides and finding that no-one has got a good picture of your main sponsor's equipment. Work out what is needed in advance, work out who is going to do it and make sure it's done.

If you have an expedition photographer then that person should take responsibility for this chore and should have a subsidy to do so. The other members of the team must also make sure that they give that person the necessary support to produce the pictures, usually in the form of time and labour on photo trips.

Media coverage
If you know, in advance, that you are selling a film of the trip to the TV or an article to a Sunday Colour Magazine then let the sponsor know this as it may make all the difference between success or failure. However, bear in mind that the editorial policies of the media may prevent you from actually stating the name(s) of your sponsors.

IF YOU HAVE PROMISED A SPONSOR SOMETHING, MAKE SURE THAT YOU DELIVER IT, YOU ALMOST CERTAINLY WON'T GET A SECOND CHANCE.

Is it worth it?
In some cases you must ask yourself if it is worth the effort of producing photos etc. for a fairly small scrounge. If not, then buy the item instead and save your team's efforts.

THE SCROUNGE

Having worked out all the above points, you are in a position to actually make the approach. What is the best way to do this?

To a certain extent the answer to this question depends on your experience, confidence and status. Some individuals will, by virtue of their work or personality, have the confidence necessary to make a person to person approach over the phone. Others may prefer to make a first approach by letter. Do what ever you feel to be most appropriate for yourself, but do it right.

Target
Make sure that you know who to contact and be as specific as possible. This applies on the large scale, where you should have done your research in order to determine who produces what. It also applies within your sponsor's company. As far as possible make a personal approach. Phone up the Company receptionist and ask if there is a Sales/Marketing/Advertising Director, get the appropriate person's name and title and write/phone accordingly. This is quite easy and only rarely will you get the brush-off from the receptionist; after all you, might be a potential customer.

Telephone
If you are superconfident try a first approach by phone. This has the advantage of putting you in the position where you can quickly assess the amount of interest from the potential sponsor and carry on or cut your losses as appropriate. Know who you want to speak to, know what you want to say, say it clearly and concisely, be prepared for the obvious questions and think out how you want to follow up the call - do you want to visit in person, will you send an expedition prospectus, samples of photos and/or reports from previous trips etc.

If you think of this in terms of selling (after all you are selling your expedition) the skills you will require for such a call are:

- initiating a 'cold' call (think out how you open your conversation, quickly establishing yourself and putting the listener in the picture).

- stimulate interest (what's special about your trip, what can you offer the sponsor. Gain attention by stating a benefit: "We'll be able to provide you with...." Involve the listener: "This would be useful for your company, wouldn't it?..." Question politely to gather information. Don't be diverted from what you set out to achieve).

- deal with objections (put yourself in their shoes for a while before you make the call, try to imagine the objections they might come up with and work out your arguments to counter them). Do this by: Question - question the statement (why, what for?); Listen - let the other person blow off steam, try to understand the problem, establish the reasons for objecting: Agree - take away the argument, show you care; State benefits - offer what is wanted or needed if possible; Get a yes response - a commitment.

- close the call on a positive note - arrange a visit or alternative follow-up.

Make sure you record the response immediately. This is an important reference for when you, or someone else, follows up the call. Note the main objections and points of interest so that you can be prepared to go through them again quickly at a later date.

Letter
Read Section 6 on image. Write a good, well constructed neat letter to a named individual and mark it "personal". Include with it your brochure.

Make sure your letter establishes your credibility, why you are approaching the company, what you want etc., and what you are able to offer in return.

Give a contact name and address, your own, and if you are difficult to get hold of, another member of the team (warn them of course...)

Follow up after a few days by phone if no reply has been received: "May I speak to Mrs..."

"Mrs..., my name is xxxxx, I wrote to you recently in connection with..... I wondered if you had had time to consider my request and if there is any additional information I could provide..." etc. etc.

Keep copies of all correspondence. Keep an accurate record of all responses - they may be useful for your next expedition.

During The Expedition

Keep in mind the promises you made to the sponsors. Make sure your team are using the gear they have been given and are evaluating it if appropriate.

Make sure that the photographer (and others) is getting the required pictures. Don't let it be left to the last minute. Get shots of the gear when it is new and clean as well as some when it is dirty and used. Keep the intended use in mind. A super photo of a good looking caver modelling a shiny piece of gear will be no use for a magazine advert if it's got another caver's bare bum in the background.

Send back progress reports to the sponsors if you can, especially if you are in the field for a long time. This serves to keep them involved in what you are doing and allows you to remind them that you are going to come up with the goods.

After The Expedition

IF YOU PROMISED IT, DELIVER IT.

Write to your sponsors as soon as you return. Let them know how you got on, tell them your successes. Let them know how long it will be before they receive their copy of the report and their photos. Contact them again if there are delays.

Produce the reports, circulate the photos, sell the articles. Send back samples to the suppliers so that they can see how the gear lasted in use and send in the evaluation reports.

Give the sponsors the credit they deserve at every opportunity. Treat them as a good investment for the future. They are. You'll need them next time.

A Final Word

If you run a caving expedition, remember your obligations to other cavers who will be going through the same process in the future. Obviously, as I have stressed, this means fulfilling your obligations to sponsors.

In addition it means fulfilling your obligations to other cavers.

If you obtain a surplus of equipment and your expedition comes back without having made a loss, then rather than sell the gear and pocket the small amount of money which will result, why don't you consider donating the gear to the Expedition Equipment Pool? It will be available for you to use again in the future, if you need it, and it will also be available to other caving groups who may not have been as successful as you in scrounging gear.

Similarly, if you come back with a financial surplus, or generate one by sale of reports or doing lectures and writing articles (and every expedition should be able to do this) why don't you share your benefits amongst future cavers by making a donation to the

Ghar Parau Foundation? You almost certainly got some money from GPF, so why not treat it like a loan and return that money or a part of it to the fund to assist other groups in the future?

If you want details of either the Equipment Pool or the Ghar Parau Foundation please contact the Secretary of B.C.R.A whose address is in any issue of "Caves and Caving" or "Cave Science".

Ideas on obtaining financial assistance are covered in Section 5.

8

HANDLING THE MEDIA

Dick Willis

Introduction

The media image of caving, although improving, is still fairly poor. All too often we are seen as a bunch of muddy wierdos being hauled out of ridiculous holes in the ground into which no-one in their right mind would have gone, particularly in view of the awful weather conditions.

It matters not a jot to the popular media that this picture is highly unrealistic, providing that it is the only image which we portray. Unfortunately this is, all too often, the image which we do put forward.

Caving expeditions can play a major part in educating the public, via the media, that there is actually much more to the sport than the shock-horror headlines of the tabloids on the day after a rescue.

Like most other parts of expedition organisation, your task can be made much easier by a degree of forethought and planning. Think out your objectives for contacting the media - what do you want them to achieve for you and why; which media will be best to achieve these objectives and should you go national or local; what information in what format will they require in order to achieve this for you?

Broadly speaking, the benefits of dealing with the media are:

- publicity (good for your image, assists scrounging, pays back sponsors, helps morale etc.)

- income (you might get paid)

The options are:

- written media (newspapers, magazines, periodicals, journals etc.).

- radio

- TV

All of these can be, to a greater or lesser extent, used for news coverage and/or features.

In general, before the trip, and immediately afterwards, you will be interested in news coverage. As time goes on after the expedition your emphasis should shift to features. News rarely makes money, features can do so and should be considered by any expedition as a means of augmenting its income.

With regard to news - you'll be dealing with reporters and to make the most of any possible coverage you should take the time to become familiar with the ways in which they and their various media work.

Journalists are only as good as the information they are given so if you hand out lousy information, don't expect wonderful articles. It's also important to remember that journalists don't have full control over the stories they produce, the final versions are influenced by a number of people, even though the reporter is probably the only person with whom you will have dealings.

Newspapers

National papers

At the moment there is at least one caver working as a reporter on a national paper. David Rose works for 'The Observer' and has said that he is very interested in being kept informed about forthcoming expeditions. He is one point of contact - you may know of others. National papers may be worth direct approaches with stories of forthcoming expeditions but, on past form, don't be surprised if you do not get a good response. This may, of course, change if you have a good angle - "Rabid caver in straight-jacket to descend world's deepest shaft" might make it but beware the "Team in search of the deepest..." approach, it's been tried too many times before.

On the other hand, if you are successful in finding the world's deepest cave then you may very well have a story which could prove to be highly popular.

In most cases your value to the Nationals will be retrospective, if you do find something good they'll be prepared to print it. You probably won't get much coverage in advance.

Local papers
Your chances of getting into print locally are much higher and it's worth remembering that the Nationals have staff who scan the local press for good story leads (so do TV and Radio).

Your contact will almost certainly be the reporter with whom you make contact. This person's work will be controlled by a news editor who co-ordinates day to day coverage of stories and dishes out the assignments to the reporting staff. The news editor picks people to do specific jobs and may brief them on how the story should be covered. He or she might, for example, ask the reporter to pursue the line that your expedition is off to seek the "largest or deepest", even though you want to stress the importance of your work. Specialist reporters can have more freedom to cover stories as they see fit.

However the reporter's story may be changed, either through the newsdesk or on the sub-editor's desk and, as a result, your informed and sympathetic interview may produce an article which is not what you would have wished to see...

The sub-editors decide on the position of the story in the paper, its prominence etc. Their decisions are made in the light of the amount of available space. Other 'big' stories may crowd you out.

In dealing with reporters you must remember that their lives are guided by deadlines, the moments when stories have to be finished in time to be included in the next edition. These can vary - if you are important enough, you might make the 'stop press' section.

Give your information to the reporter as early as possible. This will increase your chances of getting a good, accurate story. An evening paper will have a deadline around mid-day so don't phone in the late morning because your effort will be too late for inclusion that day. If the article is to include photos, the time needed is likely to be longer due to processing time. If you have a forthcoming event (your departure, say) then give them plenty of warning. The editor will keep a news diary for placing reporters' work.

If you regularly read a local paper, try to research which reporter does what and, if you see one who seems to cover stories of some relevance, write to or phone that person. If you have no idea of a suitable individual - contact the newsdesk.

Reporters
If you can, build up a personal relationship with a reporter. It you regularly go on expeditions then feed the information to the same reporter on the local paper. Over a period of time he or she will become more informed about what you do and why and, as a result, the quality of articles about your activities will improve and so will the paper's willingness to print stories about your trips.

Don't expect too much. Journalists are writing the news and are subject to the views of their editors. They are influenced by what, in any given set of circumstances, makes the best news story.

When contacting, or being contacted by, a reporter think about what you want to say and why. You should have sorted out your expedition's image and have available the necessary background information - all these are necessary for raising sponsorship. Think out, in advance, the main points that you want to get across - where are you going, when, why and to do what? Who is going - are they local people, what are their backgrounds, what is your team's experience, what hazards are you likely to encounter, what are the people like, how much is it costing you, what help do you need etc., etc. All obvious points but ones which you need to rehearse rather than being in the position of thinking on your feet and forgetting something.

Provide black and white prints, if you can, providing they are of a relevant subject.

If there is anything at all controversial about your trip, think of the worst questions you could be asked and have the answers ready.

If you are asked a question that begins with "Would you agree that..." If you say "yes" the reporter will probably quote you as having agreed with the whole statement. Think how you should reply and say "Well that's not quite true but..." or something similar. This might occur with a question like, "Would you agree that your expedition will be a waste of time unless you discover the deepest cave in the world?"

Don't get angry with a reporter. If they don't understand what you are trying to say, it is probably because you are not saying it clearly. Don't expect a non-caver to understand caving jargon, or cavers' motivations.

Don't get sidetracked. If you are there to talk about your expedition, try not to get involved in a discussion about the number of rescues that take place, for example.

The local free-press is often very good at taking short articles about forthcoming events.

Some areas have local versions of London's "Time Out". If so, they might be interested in a short piece of information about your trip.

Press releases

One way of getting information to a paper is by means of a press release. These are the biggest source of news information for most papers, they may receive hundreds and only give each one a very brief glance.

Do something eye-catching - put your own headline on top.

Be concise. If it's easy to read it may get in the paper. If it's convoluted and complicated it will probably go in the bin.

Answer the following questions in your press release:

- who is doing it?
- what is happening?
- where is it happening?
- when is it happening?
- why is it happening?
- how is it happening?

Always include a contact name and phone number.

You may wish to include an "embargo". This is an instruction not to use the material before a certain time. It may be useful if you have a big sponsorship deal and your sponsor wishes to release information at a certain point. Your press release can be coordinated with this.

Press conference
Don't bother in the UK, although this may be worthwhile in the host country if you find something really good.

Publicity person
It may be worth your assigning the responsibility for all media coverage to one person on the trip. This individual then becomes the first contact for all media representatives. S/He should know what they are talking about and be articulate and confident. A bad publicity person is worse than no-one at all.

TV and Radio

News
The same basic principles about establishing contact with journalists, sticking to deadlines and making yourself available, apply equally to any dealings you may have with TV and Radio. Remember that these media are very tight with their allocations of time.

Radio news is fast and brief. Newsrooms are constantly updating their coverage. Be simple and concise. You may get a mention on the hourly news summary if you have something good to report; here the maximum time for a story is about one minute, usually less.

Alternatively you may get a slot on one of the mixed music/speech programmes where an individual story may get two to three minutes.

TV peak viewing is in the evening. If you get on this you've done incredibly well (or had a spectacular disaster ...)

Radio news editors are often short of material early in the day and so will use stories more readily than later on.

Always be prepared to go to the studio. You'll get more time and the interview will sound better than over a phone. If you are not prepared to be interviewed in this way - don't bother with TV or radio.

Don't talk jargon or high powered scientific language. Radio in particular is about talking to 'normal' people.

Most areas have a freelance journalist who acts as a 'stringer' for local broadcasting. This person passes on a steady flow of news copy to a number of newsdesks and, as a result, can be a useful contact to make if you can find out their identity.

Features
Both local TV and Radio will be interested in features. Watch and listen to your local broadcasts. Spot the programmes that have local interest slots.
Local Radio will often have a morning general interest programme which mixes light music with a series of short interviews. Write to the presenter with some concise information and make it clear that you are available for interview.

The early evening (after the news) TV programmes have regional coverage - write to the relevant presenter enclosing suitable information. Again, be available for interview. Tell them if you have slides and/or movie footage.

Local Radio will often give you 'before and after' coverage. With the TV you are more likely to get an interview on return.

Article Writing

Don't underestimate the possibilities of earning money by writing short articles for magazines etc. You are extremely unlikely to earn a living at it but it can bring in some money to the expedition account. It could even help you to generate a financial surplus, in which case you could make a donation to the Ghar Parau Foundation in order to assist other caving expeditions ....

Article writing takes time; time to research the market, time to produce the copy, time to circulate it. If you have a member of the team who likes writing this may be an ideal way for him or her to contribute to the general effort. If you can get hold of a word processor then the task becomes both easier and faster.

There are over 600 magazines published in the UK which pay for factual articles and most rely on freelance contributors. Most will pay between œ15 and œ50 per thousand words, some less, some more. The Sunday Colour Magazines will pay substantially more but are extremely choosy and will require evidence of very high quality photographs and writing ability.

Two short books by Gordon Wells, "The Craft of Writing Articles" and "The Magazine Writer's Handbook", give a good account of what to do and what not to do in this field. I would advise you to read them if you are thinking of trying to get some income in this way.

Lecturing

Your own (and your colleagues') abilities as a lecturer may also be a way of promoting your expedition and gaining some money. School groups, W.I's, Townswomens' Guilds, Outdoor Activity Clubs, Youth groups, Luncheon Clubs, etc. all need visiting speakers. Some will pay for the privilege, others will only pay expenses. Even in the latter case you will be promoting the trip (and caving) and these events provide an ideal opportunity to sell your expedition report and an expedition poster, if you have taken the trouble to produce one. By such means the Mulu Expeditions have raised substantial sums of money and have become the largest donors to the Ghar Parau Foundation as a result.

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9

FOOD

Dave Checkley

Introduction

Good food is essential to good morale. On expeditions food becomes a group obsession and meal times are often the highlight of the day. Advance planning makes all the difference. The food officer has an important and often thankless job.

Before the expedition s/he must:- obtain information on food availability from the country of interest; sort out special customs' requirements; elucidate the features of the general plans of significance to the diet; organise menus, calculate quantities; write to sponsors; arrange discounts; calculate costs; sort out suitable packaging; repack and pack food items in line with field/caving plans and try to cater for everyone's likes and dislikes.

On arrival s/he will be:- buying and arranging local supplies; hiring cooks; repacking and recalculating. In the field half the group will expect the services of a chef; everyone will moan; s/he will have to physically guard supplies of 'goodies' so that they don't go in the first week; s/he will have to give imaginative culinary advice; find the missing bits and pieces and generally help sort out the cooking facilities. Think hard before taking the job on!

Nutrition

Nutritional details are not generally considered since they are not thought to be significant for most caving expeditions. The average expedition runs only for one to two months and nutritional deficiencies are therefore very unlikely. On longer expeditions multivitamins may be a useful daily addition to the diet. Tinned margarine is also a good source of vitamins. There are many excellent textbooks available in libraries on nutrition [1],[2]. If a few basic ideas are borne in mind then food related problems are unlikely to occur. These are:

(a) as big a variety as possible will ensure healthy appetites and promote a balanced diet;

(b) whenever possible efforts should be made to obtain fresh food;

(c) imaginative cooking and the use of flavourings can make a big difference to dietary interest and provide much needed expedition entertainment;

(d) in very hot conditions fluid intake must be encouraged and the best way of doing this, besides taking barrels of beer, is to take unlimited powder flavourings. These often have the advantage of containing significant quantities of vitamin C. Salt tablets are not advised but a more liberal use of salt in cooking is a good idea.

General Planning Considerations

Expedition food normally comes in the form of a substantial breakfast, a midday snack and the main evening meal. The cost per man week is currently œ30-35 in Europe and may be significantly less elsewhere. Sugar, dried milk, sweets and biscuits are not readily available in many countries. Before any form of food planning is possible a few basic items of information must be obtained:

(a) local food availability - try Embassies, companies working in the country, travel agents etc.

(b) import restrictions - try Embassies and shipping agents

(c) expedition transportation plans to and within the country

(d) the time to be spent in various locations involved in different activities

(e) the number of person weeks in the field

This information is difficult to obtain and is often guess-work when the food is first considered. As the departure date approaches the ideas should firm up. The more effort put into the advance planning the less rushing about in the field will be required.

Calculating Food Quantities

Even if you are going to Europe and just taking a few specialist caving food items, you will still have to spend some time working out how much you need. This part of the expedition planning will require a lot of advance thought and effort if you are to get it right. The starting point is to find out just what is available in this country. Go shopping, make notes on sizes, weights and packaging. Buy unusual items that you are not familiar with. Visit large city stores that have unusual and luxury food products. Go to outdoor shops. Note down the names of manufacturers. Obtain or borrow wholesaler's cards and make notes on their product ranges and compare prices.

At home when you make a meal, weight out the quantities of rice, flour, salt and other ingredients. Remember that these portion sizes will have to be increased by

approximately 50% in the field. Be adventurous in your choice of foods. Each new product you should categorise as: breakfast, snack or evening meal. Eventually you will have an enormous list of suitable food products, divided into the three meals of the day and by each a portion weight, cost, note on packaging and manufacturer's name. On this list should go all the drinks, herbs and spices you normally use, plus any you can imagine using. Packet sauce mixes are a useful addition to the list of flavourings.

These lists of foods will form the basis of the final shopping lists. However many factors will influence what you finally take with you from these lists, more particularly:

(a) Sponsorship in the form of donations or discount will substitute new products in the lists or tip the balance of choice. Sponsors will also need to know how much you want, so be ready when you talk to them on the 'phone.

(b) Cost will rule out many delicacies. However buying just a few luxury items for special occasions might be well worth considering as morale boosters.

(c) Weight will exclude many tinned foods. However, foil wrapped products are increasingly available as substitutes.

(d) Local availability will influence what is bought in this country and what is bought in the field. Staple foods such as rice are probably best bought in the country of destination. However taking limited amounts of staple foods may be useful for the advance party.

(e) Question members on what went down well on previous trips and cross out those items that were unpopular.

(f) A large variety will make the calculations more complex but it is well worth the extra work.

The next step is to decide out of the total number of days how often each food on the list will be eaten. For example, how often will people have muesli for breakfast? You decide say, two days out of three. There are 300 man days in the field, you therefore need 200 portions of muesli. Knowing the portion size will allow you to calculate the weight required. Packaging should then ideally reflect portion size and group size in the field. Do not be frightened by the often large quantities involved, and never underestimate the gluttony of the team, particularly when it comes to chocolate bars, sweets, biscuits and cups of tea. This step will depend upon the food officer having basic menu strategies in mind.

Expedition members should be made aware of menus, portion sizes and daily availability of different foods. This information will help in the field and can be included on information sheets in all the boxes of food.

Packaging
Tough cardboard boxes are surprising resistant to damp and to rough handling. They are expensive, but are cheaper then many alternatives and can be obtained such that, for example, two small boxes fit exactly into one large and four large on to one palette. The weight and contents of each box should reflect handling and porterage requirements. Do not put all you have of one product in one box. Individual portion polythene bagging may be useful and flame sealing between two metal strips is quite easy to perform. All products in glass should if possible be repacked in plastic. Heavy duty dustbin liner bags can be used to line boxes. Customs requirements may necessitate lists of contents of each numbered box to be placed inside the top of the box. A valuation may need to be given on these lists (don't forget to make a few copies). Numbering and marking boxes will facilitate division into sub-camp units in the field. An air drop will require particularly robust packaging in plastic or metal drums. Plastic drums with waterproof lids are invaluable in wet or humid climates for food storage.

Camp Hygiene
When catering for sometimes large groups with primitive cooking facilities it is difficult to maintain standards of hygiene. However the 'runs' can debilitate the whole expedition for weeks, so it is worth the extra effort of trying to be hygienic. Do not let people with diarrhoea prepare the food. Where possible, install a good, possibly chemical, toilet well away from camp and insist on hand washing. Isolate sick peoples' cups, plates and utensils. Wash dishes in hot water and try to keep flies off the food. Store food in waterproof containers and try to avoid rodent attack with tough boxes.

Expedition Types

We now consider expeditions of various types and list their special needs and problems under separate headings. These are:

- the European caving expedition
- the European expedition with underground or remote camps
- lightweight expeditions to distant countries
- heavyweight expeditions to distant countries

European Caving Expeditions

Food is widely available in great variety in most parts of Europe. Taking English foods to these countries would mean missing much of local interest. It may however be worth taking a few popular caving foods in the first instance, since it will take time to work out local alternatives.

Shopping may best be carried out in the nearest town, as an initial bulk purchase. Regular 'top-ups' with fresh meat, fruit and vegetables will take time and effort but can provide a welcome break. Advance recipe preparation using local foods can enhance variety and interest. A large tin buried in the ground makes a good oven and allows cakes and puddings to be made. Cooking can be fun on days off.

European Expeditions With Underground Or Remote Camps

Fortunately, camps in caves rarely last for more than a week at a time. They are often in deep, cold alpine systems where comforts are scarce. The food is therefore quite important. Variety will however be compromised by:

(a) robustness - many foods e.g. biscuits do not survive well in deep caves, but the crumbs are nice!

(b) bulk - in tortuous meanders light but bulky items will necessitate taking more tackle bags and significantly slow progress.

(c) fuel requirements for cooking - ideally all foods should require no more cooking than bringing water to the boil. This will minimise fuel requirements.

(d) cooking time - individuals will normally be cold and tired when they return to camp. They will not want to spend hours cooking.

(e) cooking facilities - the number of battered pans and stoves available will be limited. Two stoves means two hot components to a meal. Paraffin is not widely available in Europe so use petrol stoves.

(f) washing facilities - fried foods make a mess of pans and when water and fuel are short they may best be avoided. Scraping and wiping utensils with toilet paper are alternatives to washing.

Packaging For Underground Camps

(a) A one litre screw top container of petrol will last a four man camp for 2 to 3 days. Put them in several polythene bags.

(b) Everything must be repacked in double polythene bags - don't forget to label them in non-water soluble marker pen.

(c) Tinned foods usually survive but the labels may not.

(d) Line tackle bags with two thick plastic bags.

(e) Pack stoves inside sleeping bags.

(f) Prepacked stew mixes with added salt and spices can be prepared on the surface and save time and effort underground.

Popular food items
We have found that some of the most popular food items are:

dried stews or curries, rice, mash or pasta, dried soups, tinned meat or stew, cheese, tinned sardines, tinned tuna, tinned mackerel, cured ham or sausage, pate, mountains of tea bags, dried milk, syrup and sugar, condensed milk, rice pudding, flapjack, bread, muesli bars, nuts and raisins, chocolate bars, boiled sweets, halva, dried bananas and fruits, muesli, porridge, baked beans, chilli powder and don't forget salt.

Essential Considerations

(a) Obtain water from a rarely visited inlet and not the main stream which may become contaminated.

(b) Excrete downwind and well away from the camp. Excreta should be buried or taken out.

(c) Take out all rubbish.

(d) Prepare check lists of requirements for the underground camp and get everything on them laid out at the surface camp, well in advance.

Camps in remote areas have similar weight limitations to cave camps, but do not demand such care in packaging.

Lightweight Expeditions To Distant Countries

I am assuming here that there is no shipment of large air freight consignment and the expedition supplies consist essentially of what people carry with them on the aircraft. The normal weight limit for long haul flights is 20kg. It is worth finding out the weight limit for any small local flights en route, since this may be as low as 10kg and excess baggage charges can mount up.

Given the weight limits the only things you can conceivably take with you are herbs, spices and vitamin pills. It may be well worthwhile taking all these since caves are generally in remote areas where the variety of foods available can be severely limited. Rice and little else for weeks on end can be helped by an occasional flavouring and, if in the field for months, deficiencies are possible on such a diet.

Always enquire before leaving a town about the food availability in the region of interest. Even four extra mouths can place a severe strain on the resources of a small village. A bag of rice and a chicken go a long way, are a good insurance policy and a good diplomatic move.

If you go around a market you will almost certainly be charged higher prices than the locals. A good haggle can reduce these and provide entertainment. However, whenever possible, the local peoples' help should be enlisted, particularly if you plan to stay for a long period in one region. Hiring a cook will improve the food, save time and be an important link with the community. Food in most third world countries is inexpensive to us. However many very poor people will generously give food they can ill afford to give. Taking food with you from the local town will help them.

Heavyweight Expeditions To Distant Countries

The assumption here is that a major part of the expedition food will be shipped or flown out in advance of the team. This is expensive and must be justified logistically. Getting the supplies to the country is only half the problem, realistic transport must be available from the port to the caving area. There is little point in obtaining a mountain of food if transport turns out to be too expensive.

Sponsorship will be vital for such an expensive trip. Make use of trade directories and word processors and try to offer the companies realistic publicity in exchange for help. If publicity is offered it must be carried out and will take much effort on returning to this country. Printing photographs for sponsors will be expensive. Many companies are inundated with requests. An eye-catching booklet will help to make you stand out from the crowd. Companies producing luxury items may not be so popular with expeditions.

Sponsors will want to know where to deliver to. The expedition will need a number of lockable rooms, close to a loading bay, with someone in attendance all day. Universities or other institutions may provide these facilities.

A very clear idea of expedition plans will be required well in advance. Division into subcamps and underground camps will alter packing arrangements. You will need to cater for guides, porters and visiting officials. Don't forget that these people may not eat the same foods as we do for religious or other reasons. They will eat a lot so it is best to over cater on this part.

Import restrictions must be found out in advance. Do not forget to consider restrictions at ports of call. Consular agents and embassies should help. There may be significant port taxes to pay. These import duties and restrictions may be waived if it is made clear to the government that the goods are not for sale, simply for consumption. The cooking temperatures and times may be required for meat products. Organising this may be time consuming and you may therefore wish to limit the number of suppliers of meat products. Customs may require special packing arrangements e.g. all meats in one crate.

For packing, lots of people, polythene bags, scales, banding machines, tape machines, space and time will be required. Food may be required in man-day packs such as those used by the army. This is a massive effort. An easier alternative is to pack approximate weekly supply boxes. Each box will then contain, say, seven breakfasts, lunches and main meals for each person at that camp. This type of packing means that only a few boxes need be open at any time. It also has the advantage of not putting all your eggs in one basket. Don't subdivide all items equally between boxes - a new goody will be something to look forward to. Different foods at different camps will also help maintain interest. Don't forget thousands of extra polythene bags for use in the field. Keep things like disinfectant well away from the food.

A large trip will need an advance party to sort out customs, port duties etc. and to buy staple foods. There is little point buying rice here to take to rice growing countries. Local cash may be useful in the field to buy odd items of food. Local cooks will know what of the local vegetation can be eaten or animals hunted. However, even with cooks the expedition members may wish to get involved in cooking pancakes or other special items when they want a light day or are ill.

Perhaps I can end this section by wishing you all the best in your caving and suggest that at the very least you bear in mind the old maxim:

"Eat your greens and cave a lot!"

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10

EXPEDITION TRANSPORTATION

Dave Gill

Introduction

The transportation of personnel and equipment is probably one of the biggest headaches for any expedition organiser and also the most expensive part of the whole operation.

The major criteria governing choice of transport are:

(a) Cost
(b) Speed
(c) Availability
(d) Use of personal energy (There is no sense in 'burning out' your team)

The main methods of transport available are:

(a) Air
(b) Sea
(c) Land

In this section I shall review and comment upon the available methods in the light of the above criteria. I shall consider these firstly for transport between country of origin and country of destination, which I shall refer to as "outgoing". Secondly, I shall consider transport within the country of destination, which I shall refer to as "internal".

Outgoing Transportation Of Personnel

Transporting the team to the country where the objective lies, is going to be the most expensive item and expedition money is always at a premium. Therefore, the cheapest possible way must be found.

Air transportation of outgoing personnel
If the expedition is to a country at the other side of the planet, and time is an important factor, then the personnel must travel by air. At the present time, a team can get to every country in the world by air, and this need not cost a fortune. With the right kind of publicity and promotion, it is possible to get cheap or even free flights. Discounts are often on offer from the International companies. Cancellations, block bookings, Apex and charter flights, must all be explored in detail. This, however, can mean team members travelling out at different times which can pose a problem.

There are many cheap flights to Europe, so it is often far more convenient for just two team members to drive out with the equipment, and the rest of the team to fly. Search the National papers for the best deals. There are always numerous travel agents advertising. Do not choose the first one, but check a few before deciding. Visit the London "Bucket Shops", as they usually come up with some reasonable deals.

Outgoing sea transportation of personnel
The transportation of personnel by sea is a possibility for short distances; the costs are far less than by air but the time factor must be taken into consideration. The team has to live or eat on board which costs money. If the distance is too great, it is consequently far cheaper to fly. Flying is altogether more convenient.

Expeditions to Europe using road transport, need to cross the English Channel which is the most expensive seaway in the World. Fortunately, there are many ferries but with little to choose between them cost-wise.

The Hovercraft is fast and, depending upon the numbers travelling, can be cost-effective compared with the standard ferries. A new ferry company deserving consideration has started operating cross-channel ferries from Ramsgate at very competitive prices. Check for the cost of booking in different periods. Peak-period travel may substantially increase the cost. Travelling a few days earlier or later may save money.

Outgoing land transportation of personnel
Transportation by land is usually the least expensive of the methods of travel. There are a few firms that allow hired vehicles to be taken abroad. It is just a matter of finding out the best deal.

A legal requirement is to have insurance for the vehicle and a "bail bond" is sometimes a good idea for certain countries. Any insurance broker can supply details and can arrange for the "green card".

By carefully calculating costs, it can sometimes prove cheaper to hire or buy a large van or bus to transport the whole team rather than expedition personnel travelling out in a variety of smaller vehicles.

European railways are, on the whole, fast and efficient and are well worth consideration. The use of student travel permits or rail-cards, can work out inexpensive. Expect delays though, in Eastern European countries, owing to bureaucratic procedures.

A regular bus service from Victoria Coach Station in London through France and into Spain, can be very economical.
There are a number of "Magic Buses" to other countries. Details are available from any reputable travel agency.

Outgoing Transportation Of Equipment

The transportation of expedition equipment can be the greatest headache, especially if large quantities are to be transported to the other side of the world. Complications with import and export licences, quarantine regulations for food stuffs and suchlike can turn this aspect of an expedition into a nightmare.

The whole procedure must be carefully researched and planned. The relevant regulations must be strictly adhered to; if the equipment fails to reach its destination or is impounded by customs officials then the expedition is an absolute non-starter.

In the E.E.C. there should not be any problems, but in other countries, duty might have to be paid, unless a special licence can be obtained guaranteeing that the goods are not for sale and will be exported back to the U.K. after the expedition. A friendly shipping line might be persuaded to put up a bond guaranteeing the re-export. This can otherwise cost thousands of pounds.

Write to all the relevant government departments in the country to be visited. Addresses and information should be available at the relevant Embassies, so pay them a visit and enquire into the details of what can or cannot be taken into the country.

Outgoing air transportation of equipment
Obviously, the most efficient and quickest mode of transporting the expedition equipment is by air, but, unfortunately, it is the most expensive.

A well financed reconnaissance expedition, taking little equipment, should be able to pay excess baggage, or carry the maximum as hand luggage. If it is a full scale expedition with the usual mountain of equipment, it is going to cost a fortune, unless sponsorship from an airline is available. This is sometimes possible for an expedition to the other side of the world that can capture the imagination of the public.

Check with the airlines for prices.

Outgoing sea transportation of equipment

The transportation of the expedition equipment by sea is slow but reasonably priced; often reputable expedition sponsorship can be obtained. Contact the shipping lines and agencies. The outgoing agent will supply details of the documentation required and the way it should be packed. This can be quite complex; each and every item having to be listed, weighed and costed, and sometimes the country of manufacture has to be indicated. Have at least six copies of the shipping lists, as various departments will expect to have one.

It is a good idea to pack the equipment in bags, drums or boxes, each marked with a designatory letter, such as, "F1" "F2" and suchlike for food stuffs and "P2" for the personnel equipment and "E" for surface equipment and perhaps "M" for medical equipment. Underground equipment could be designated with a "UG". Distribute items between containers. If a container goes missing you will not then have lost all supplies of one article.

All dangerous goods must be listed and packed separately. These include inflammables, acids and suchlike. An example would be carbide and batteries which must be clearly marked "Dangerous Goods" and packed in care of the ship's officer. Unfortunately in some countries, these items can go astray when unloaded and stored in the customs sheds at the docks, so plan accordingly. Finding that all the carbide is missing and having no alternative can spell disaster.

The standard 35 cu. metre container is normally far too large for the average caving expedition, but a shared container can be arranged by the shipping agent. Some shipping lines not using container vessels, will need to have the equipment packed in crates. This too can be arranged by the shipping agent.

Important points to discuss with the shipping agent are:

a) The estimated time at sea (i.e. 19 weeks for South East Asia).

b) The procedure and name of the shipping agent at the port of unloading.

c) The documents needed (i.e. Bills of Lading and copies).

d) Anticipated delays, problems with the customs officials, possible incentives to government officials to speed things up, etc., especially in Third World countries. (Central and South America in particular).

e) Insurance of the cargo.

Outgoing land transportation of equipment
The most convenient and less complicated method of transporting the equipment is by land. All of Europe and most of Asia and Africa can be reached on good to moderate roads. A good sturdy truck ensures the rough tracks of North and Central Africa and India can be travelled. Carry plenty of spares and again you must do your homework regarding customs problems, especially in Eastern European countries where transit visas can cause many problems and long delays. Consult the Embassies of the countries to be visited and passed through, and make sure you have plenty of copies of all the relevant documentations. The more official-looking, complicated and bulky the documentation, the better, as officials are less likely to check it while in transit.

Internal Transportation Of Personnel

Once the team have arrived in the country where the objective lies the next major problem is to get them to the objective itself.

With the majority of caves in Europe it is simply a matter of "foot-slogging" to the base camp, but in the jungles of South America and South East Asia a walk in could take a month or so, depending on the distance and terrain. The four main criteria must be carefully considered and especially the last. There is no point in burning the expedition members out by "macho" behaviour before the objective is even reached.

In exceptional cases, all three forms of transport need to be used to reach the objective. For example, on the Untamed River Expedition, the team used air transport to New Britain, then went on by sea to shore base; by helicopter to the nearest clearing to base camp and then walking to base camp itself. A most complex arrangement!

Internal air transportation of personnel
If money is not a problem, then air-lift the team in. It is surprising the number of small grass landing strips there are in the Bush that can accommodate a small Cessna or Islander aircraft. Check the air navigation maps obtainable from Stanfords of Covent Garden, London, for the position of landing strips. Light aircraft can usually be chartered if there is not a regular service into the air strip in question. If there are no landing strips near the objective, and the expedition has money "to burn", then hire a helicopter. The details of working with helicopters and the construction of helicopter landing zones can be found in Jermy & Chapman (1993).

If it is possible, solicit the cooperation of the military, who might be able to help with internal transport.

At the time of going to press, hiring helicopters is a very expensive business. A Squirrel which can squeeze in 5 passengers, plus pilot, can cost anything, about œ600 an hour. The smaller seater Hughes 500, costing around œ400 per hour, depending on the

country it is operating in, can work out more economical. Remember that a 15 minute journey across jungle terrain, could take over a day's hard going on the ground.

It is surprising just how many helicopters are available for hire in jungle areas working on a subcontract basis for geological investigations.

Internal sea transportation of personnel

If money is at a premium, which is the usual case, then it is sometimes possible to utilize sea transport. Certainly in South East Asia there are a vast variety of leaky tugs, launches and freighters playing around the coasts and up rivers.

Coastal shipping agents can supply details. The only problem with this cheap method of travel, is that it can take a long time, as they tend to call at every coastal plantation en-route. It can sometimes take as long as four or five days to travel 100 miles, but it can be fun. Fishing for your breakfast en-route is very satisfactory. However, chartering a boat for a faster trip can be much more expensive.

Internal land transportation of personnel

If it is possible, go by land. The majority of expeditions to Mexico buy trucks in the U.S.A. and drive down to the area of interest. This is because of the difficulty in obtaining suitable transport in Mexico itself.

There are problems in the Eastern European countries and in Latin America, where there are strict regulations on the return of the vehicle out of the country before a specific date. If the vehicle is written off, then you might well find yourself liable to pay duty, such as the value of the vehicle to customs. This is to prevent the illegal sale of vehicles.

If there are no road or railways, then it is a simple choice of walking, unless mules are available.

Travelling on horse-back can be great fun, but make sure you are well conversant with controlling horses before setting out on such a venture.

Details of movement and navigation through tropical rain forests can be found in Jermy & Chapman (1993). This publication also details river transportation, utilizing inflatables and dug-out canoes, so little needs to be said about it here, except to say that this is a very efficient and inexpensive method of transporting people and supplies through difficult terrain.

Another form of land transportation which is worth considering in winter conditions is skiing. This is often used in the high altitude karst areas of France, Austria and Canada. Baggage may be moved in this way by using sledges.

Internal Transportation Of Equipment

Once the equipment has arrived, and hopefully, passed through customs, the next major obstacle is to transport it to base camp with the minimum of trouble and expense. Depending on tonnage, this can be a very time consuming and expensive business; especially in a Third World country.

European expeditions present few problems but in more difficult terrain or more bureaucratic areas, this may well take a great deal of planning.

Internal air transportation of equipment
As with the transportation of personnel, the movement of freight to base camp may be best achieved using air transport.

Helicopters can save weeks of hard work and can be very cost-effective. There are a number of different types in world-wide operation and they are plentiful in certain countries, especially where geological prospecting is taking place. The pilots and companies are only too willing to help for a price, providing clear and precise instructions and map-references are given. Make sure the pilot knows exactly what he has to do, as wasted minutes means wasted pounds. Check up on the availability of helicopters and their cost. As a rough guide a four to five-seater "Jet Ranger" or "Hughes 500", has a payload of about 500 kilogrammes. At today's prices this can cost upwards of œ500 per "plus" fuel.

The larger "Squirrel" has a payload of 650 kilogrammes, can seat six and can cost œ600 per hour plus fuel. Sometimes Government rates can be negotiated for a saving of about 20%. Chapman (1984) details safety, hand signals and landing zones for helicopters with which you must be conversant.

The majority of helicopters carry their own nets for transporting equipment but remember the regulations are that no passengers can be carried if the helicopter is carrying a loaded net. Make sure you take along some kind of weighing device so that each box can be weighed. The loads can be approximately calculated, thus ensuring that the helicopter is not overloaded which can be dangerous, and very annoying for the pilot. There is some lee-way of course; maybe as much as 100 kilogrammes, depending upon the type of helicopter, the skill of the pilot and weather conditions.

The hire of light aircraft can also be cost-effective for transporting expedition equipment into remote areas. The majority of countries operate Government or privately-owned light air transport. If it is not possible to utilize local airstrips, which can be unreliable owing to weather conditions, think about supplying your camp by airdrops. (See Jermy & Chapman, 1993).

One of the major problems in using light aircraft in jungle terrains is the weather and the sometimes appalling state of the runways. In the rainy season the runways become waterlogged and landing is impossible. Even in the dry season, the grass landing strips can soon become unserviceable. In Papua New Guinea, for example, they have a special problem with pigs digging up the runways. Beware, jungle airstrips are dangerous! Some of the local pilots, besides being highly-skilled are also quite courageous, as one might say. Accompany these pilots only if you have equal "courage". In some areas, the landing strips are littered with crashed planes.

Internal sea transportation of equipment

If you have time to spare, and a shortage of capital, explore the possibilities of coastal shipping. Rates vary from country to country but in Papua New Guinea during 1984/85, the rates worked out at about thirty to forty pounds per ton or cubic metre whichever was the greater. The rates per cubic metre are slightly less than the cost per ton, but as with most expeditions, the cubic capacity of the freight is far more than the tonnage. For example, The Untamed River Expedition 1984/85, had 23 cubic metres of freight weighing 5 tons, so we were charged by the cubic metre.

Rather than charter a boat, try to find a coastal vessel on a regular scheduled run going your way. It will most probably be far cheaper. Make sure a couple of expedition members accompany the equipment, and help to load and unload as an added security check.

Internal land transportation of equipment

On the majority of caving expeditions equipment will normally be transported by land. This will usually be by mules, motor vehicles or on foot. In Europe, Africa, South and Central America, mules can be a most useful form of cheap transport. Being slightly conversant with the ability to look a gift horse in the mouth saves the heartbreak of retrieving lost equipment and injured animals. Make sure the loads are not too heavy and are well secured.

In South East Asia, mules are in short supply and the team will be forced to hire porters. A useful section on carriers and interpreters, can be found in Chapman (1984) which should be consulted.

A few points need to be emphasised.

(a) Appoint a Head porter.

(b) Make sure you negotiate and make it very clear on rates of pay and bonuses, e.g. tobacco, machetes, food and suchlike.

(c) Hours to be worked and distance to be travelled. Rates vary from country to country but in Papua New Guinea at the present time are four pounds per day.

(d) Some carriers will not be welcome by other tribes and other villages and it might be necessary to change porters in different tribal areas.

(e) Make sure you take plenty of coins in small change to pay the porters.

(f) Do not walk too fast ahead of your porters, even if you know the tracks. Stay with them as this is the polite thing to do. If an injury occurs to any one of your carriers someone should be on hand to administer first aid. Alternative arrangements can then be made for the load to be redistributed. This is far more preferable to loads being dumped somewhere in the forest.

(g) Do not fight shy of hiring women, as they are often better carriers than men. Women will normally prefer to carry loads on their heads rather than carry a sack on their backs.

(h) Try to sort out the loads into equal weights, 15 kilogrammes to 20 kilogrammes being the maximum in tropical karst areas. Heavy loads can be shared between two carriers. They will normally cut a pole and secure the load to it, carrying it between them. Children will often want to carry something, so sort out a load for half the price.

Karst terrain in tropical rain forests is probably the most difficult type of terrain in the world to walk on. Even on good tracks the going is extremely difficult. Do not expect your carriers to walk more than 20 kilometres in a day. If tracks need to be cut on a compass bearing, then do not expect to make more than one or two kilometres per hour. Porters like to start work at daybreak so get your loads ready the night before.

In Europe, and the American Continent, where there are plenty of good roads and rough tracks, equipment can normally be transported using trucks or four-wheel drive vehicles. The main problems are availability and the cost of hire. A lightweight expedition might consider using public transport.

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11

INSURANCE FOR EXPEDITIONS

Geoff Wells and Sam Moore

What insurance is required?

Expeditions going abroad are advised to insure against:

(a) illness/accident to individuals
(b) loss/theft or damage to equipment
(c) cancellation of whole expedition/participation of individual members
(d) loss or theft of money, travel cheques, petrol vouchers
(e) loss, theft or destruction of personal effects
(f) public liability resulting from injury to others or loss or damage of their property
(g) loss or damage to road vehicles, and liability to other road users
(h) recovery of road vehicles/compensation for having to hire other road vehicles
(i) rescue fees
(j) death of individual
(k) bankruptcy of travel agent

How much insurance is required?

This will depend upon the circumstances of the individual and the area to which the expedition is travelling. The following may help:

Illness/accident
Although the UK has reciprocal arrangements (See DHSS leaflet SA30 for list of agreements) with the EEC, most of the former Comecon countries and some Commonwealth countries, it is advisable to effect medical cover. This is because:

(i) not all costs are covered where there is a reciprocal agreement.

(ii) Reciprocal agreements usually only cover treatment in the country of destination. In cases of severe injury repatriation may be necessary and this is not

available under the reciprocal agreements. As a last resort the British Embassy will arrange repatriation but you will be charged and, if necessary, sued for the cost on your return to the UK. Your passport will be confiscated until the full bill is paid.

(iii) Public hospitals may not keep to the requisite standard. Specialist treatment may only be available in private hospitals. The customs of some countries may make public hospitals unsuitable, e.g. relatives may be expected to provide bedding, food and nursing.

(iv) Persons who do not pay N.I. contributions in the UK may be excluded from the agreements, e.g. students and those who have always been self-employed.

If you are going to a country in which the UK has a reciprocal agreement you should obtain Form E111 from the DHSS. It is advisable to take this even if you insure as well. If you do not have an E111 the reciprocal agreement may not be valid. Even if it is, you will still have to pay and then reclaim back from the DHSS.

For travel to the USA and Canada, medical cover of at least œ1 million is advised. Lower amounts, but at least œ100,000, may be adequate elsewhere.

Loss, theft or damage to equipment

The amount required will depend on the value of the equipment. Cover while in use underground is difficult to obtain. If available, go for new for old basis rather than an indemnity basis, i.e. insurer pays out cost of new item rather than value of the item lost/damaged.

Where equipment is shipped abroad separately it should be noted that, in general, insurers will not cover damage in transit unless the equipment has been packed (at both ends) by a professional packaging firm.

Cancellation

Ferry/plane tickets will be purchased in advance and refunds may not be possible at all or the amount of refund will be on a sliding scale based on the time up to departure, when cancellation takes place.

You should insure the cost of the tickets plus other cost paid in advance or promised as soon as you make the travel arrangements.

The cover should always include the death or sickness of each individual or death or sickness of their close relatives. Where possible cover should extend to political risks and catastrophe risks. These would include strikes, revolution, the grounding of all 747's or war at the UK end and strikes, revolution, war or catastrophe at the other end.

If your gear is going by separate means try to insure against such risks.

Loss or theft of money etc.
Again you should insure up to the value of the money you take. Most insurers will impose a limit.
Loss, theft or destruction of personal effects
Each member of the expedition should insure their own personal effects for their full value. Cameras, watches and jewellery are the items most often stolen/lost. Many insurers place a limit on any one item. If items exceed that limit special cover may be required.

Many insurers will either not insure or will only partially compensate for theft from unattended motor vehicles.

Those who insure their belongings in the UK may find that their UK policy extends overseas for up to 30 days per year.

Public liability
The cover required here will depend on the likely level of compensation in the country of destination and the traditions or laws of that country. In India for example personal injury/death claims are limited to about $15,000. In the United States of America this runs into millions of dollars.

Cover should be at least œ1 million.

Loss or damage to road vehicles
If you are driving abroad you should ensure that you comply with the insurance laws of that country. If the compulsory law is inadequate compared with potential claims you should ensure for the potential claims. For example in the UK you are required by law to insure against bodily injury to third parties. Most people however insure against bodily injury and damage to the property of third parties; - normally their vehicles.

Recovery of road vehicles
If your vehicle is disabled abroad you will want to be insured for its recovery and hire of another vehicle. You may also wish to insure for the cost of repairs. If you write off a car abroad you will have to pay import duty on the vehicle if it stays there. This cost should be insured.

Rescue fees
Many European countries will charge for a rescue, (e.g. France, Switzerland, Austria and sometimes in Spain). In France a simple rescue call-out using a helicopter starts at œ750. A full rescue will run into many thousands. The amount required will depend on the area visited, local custom and normal fees.

Death
Individuals should decide whether their life cover is sufficient to maintain dependants if they die. It is best to do this before an expedition is planned as life assurers will normally rate someone who is about to go caving in dangerous conditions.

All members should insure against the cost of bringing their body home. This is higher than expected as sealed coffins and special customs requirements apply. The cost will be several thousand pounds. BCRA's experience is that a "simple" return of a body from France cost œ1,100 in 1983.

You should check whether a body must be produced before payment is made. Some insurers do not pay out if there is no body. This can be a problem with cave divers and cavers lost in floods or where recovery is too dangerous.

Bankruptcy of travel agent/airline
This is a problem. If you book through an ABTA travel agent or pay by credit card, ABTA or the credit card company will eventually reimburse you if the agent goes bust.

How do you obtain insurance?

For a large expedition to somewhere exotic an Insurance Broker can come up with a deal covering all these points.

However, be warned. What is exciting, dangerous and important to you looks risky to insurers. If you've got leaflets for sponsorships which portray the expedition as being hard, tough and exciting, do not send them to the insurer! Instead stress the experience and safety record of the participants. Most insurers/brokers will not work on individual packages unless premiums are œ1,000 plus.

Even large "respectable" expeditions, such as MULU, have had trouble getting cover at a reasonable cost.

The alternative is to approach someone who packages this sort of insurance. These are:

ALEXANDER AND ALEXANDER (UK) LTD, Richmond House, College Street, Southampton SO9 4AB (0703-225616) - prepared Expeditions Travel Insurance Scheme in consultation with the EAC (1993): further details and applications, and a paper by John Berridge, Insurance for Expeditions, available from EAC office.

BCRA Insurance Manager: Sam Moore, 27 Parc Gwelfor, Dyserth, Clwyd, LL18 6LN (Tel: 0745-570230).

CAMPBELL IRVINE LTD, 48 Earls Court Road, London W8 6EJ (tel:01-937-6981, telex: 919670)

ENDSLEIGH INSURANCE SERVICES LTD, 97 Southampton Row, London WC1 (01-580 4311)

WEST MERCIA INSURANCE BROKERS, High Street, Wimbourne, Near Wolverhampton, WV5 9DN (0902-892-661)

There may be others but the writer is not aware of them.

BCRA and Endsleigh offer a travel policy which covers caving (most ordinary policies exclude "dangerous sports"). In particular, rescue and medical claims from caving are covered.

The standard BCRA package covers items (a), (b), (c), (d), (e), (f), (i), (j), (body home plus œ10,000) of 1. above.
(g) and (h) can be obtained from your own vehicle insurer or a motoring organisation.

BCRA travel rates are published in "Caves and Caving" and further details are available from the BCRA Insurance Manager.

What about claims?

If you suffer injury, receipts for treatment and medical certificates should be obtained.

If theft or loss of items occurs these should be reported to the Police and a Statement of Notification to the Police obtained.

In countries where it is impossible to report to the police (because there are none) or where such reporting is likely to lead to the detention, injury or inconvenience of the person reporting, this should be made known to the insurer before you leave. Any dispensation you receive on this point should be in writing.

Do not expect foreigners to act like we do. In the United States of America and Canada you will be turned away from hospitals/left bleeding in waiting rooms until you can prove you are insured.

In countries where crime does not officially exist, for you to report a theft is a slur on their government/system and you are likely to be treated as the criminal.

If you are going to a country where English is not generally spoken, get the insurer to produce a certificate in the local language to wave at doctors/hospital administrators.

Find out if the insurers operate locally or have a representative. Get their name and address. This may help in a medical claim.

Avoidance Of Claims

BCRA's experience is that non-medical claims rarely occur at the caving site. You are most likely to be robbed in a town/city before or after the expedition. Probably your car will be broken into when you are involved in the celebrations after the expedition. Be careful in cities and especially careful in the continental Channel ports! If possible lock items in the boot of a car. Don't invite theft. Destruction by animals is another cause of damage. If you are camping and cows, goats and horses etc. are running wild, try to pick an area in which they are excluded.

Don't report articles stolen if in fact you have lost them. In some countries (Spain for example) the local police will then interrogate all the locals. If they are not to blame you might find your expedition very unpopular.

12

EXPEDITION REPORTS AND PUBLICATIONS

Tony Waltham

Introduction

The expedition report is vital. An expedition without a report is instantly relegated to the level of holidays and personal memories. The prime purpose of the report is to be a record of the expedition and hopefully of the useful work which it accomplished. There is always the additional potential of an expedition producing a publication which is saleable and can contribute to its budget, and the possibility of publishing scientific papers in academic journals should not be forgotten.

Even during the planning of an expedition, someone should be delegated the responsibility of report compiler, writer or editor; this is a task just as important as that of treasurer or equipment officer. That person will than have the responsibility for the report, and even during the expedition fieldwork s/he will be thinking ahead, at least in terms of maps and photographs that will be needed. When the expedition is completed, s/he will then plan the style, scale and details of the report; s/he will also consider how it will be published, before either writing the report or calling on other members to produce their contributions to the style which with editor will dictate. Clearly the final format of the report will depend on the nature of the expedition, the scale of its discoveries and also the means of publication, but the best results are always gained from careful coordination.

The Main Report

This is the key report which must appear in print in some form or other. It should be a comprehensive record of the expedition, written in a form which will survive the test of time. The contents will be dictated by the style and results of the expedition, but the following outline covers most possibilities, and it can at least be used as a check-list to ensure that vital sections are not omitted.

Introduction
Outlining the location and objective of the expedition, the scale on which it was carried out, and the time it occupied.

The area
Summary description of the topography, scale of relief, natural vegetation, land use, drainage, climate, and access by road or otherwise.

Geology
Basic description of the main rock types and structural relationships; depending on the geological expertise within the team, this may be based on a literature study and competent fieldwork, or may be only a few observations, and then may be only a paragraph in the previous section.

Exploration history
Previous work in the area and by whom, together with a key to the existing literature; can also include comment on the future potential of the area or cave.

Expedition diary
To some extent this is the log of the expedition and is a record of the exploration. The length of this section is critical; it can easily become far too parochial, of interest to the expedition team but of little value to an outsider. On the other hand it can make good reading as a description of an adventure; anecdotes of events are generally welcome, but if too exhaustive become too tedious. The length and balance will much depend on how and where the report is being published. It is best to avoid mixing scientific data with personal memories, and useful results of the expedition should not get lost in this section. Use this section to express the personal side, and so keep the rest of the report more for the hard facts.

Surface karst
This is to set the scene in preparation for the description of the underground which follows. It may be just a brief record of entrance locations, and relating the cave to surface features, or it may be a more comprehensive geomorphological account.

Cave morphology
Description of the cave, or caves, explored. This should not consist of inch-by-inch passage detail, as the survey provides that, but should be summary statements with some dimensions (of passage size, along with total lengths and depths). If the rigging of the cave is not obvious, a separate section and tackle list may be needed.

Cave geomorphology
The absolute minimum required is some notes on the main genetic features of the cave(s), notably in relation to past water levels, and some comment on the probable age of the cave relative to other landscape features. An experienced team could and should

be able to produce more. Also scope for comments on the cave's relationship to the surface and any missing links which might await exploration.

Cave geology
Relationship of the cave to bedding and fracture patterns, and comment on the controlling features of the cave - why is the cave where it is? Without a geologist in the team, this may be a paragraph in the previous section.

Cave hydrology
The pattern of drainage routes, and the results of any dye tests. A basic statement on the quantity of underground flows, and perhaps a comment on what happens in flood events. In some parts of the world only, it may be relevant to comment on the scale and location of underground water with respect to implications on resources in the area.

Cave biology
With a biologist in the team this can be a major section. Even without, tropical caves will warrant at least some basic observations, though in colder environments these may be unnecessary.

Summary or conclusions
A nutshell statement designed for the literature searcher, and may be complimented by an abstract at the start of the report.

Acknowledgements
The length of the list will depend on how the report is published; a private publication can and should thank all the sponsors, whereas a journal may not accept a long list on the end of a paper.

Bibliography
A proper list in author alphabetical order, citing for each reference, author, year, title, journal, volume number, page numbers (or book publisher).

And remember that presentation is critical. Plan the report carefully, and use clear sub-headings and titling. Use photographs and maps carefully, to break up massive blocks of text and to create a pleasing visual impact.

The Publication Problem

The crunch question is not usually what to publish but how to publish. There are various alternatives, ranging considerably in scale, cost and potential, and though all the choices may not be practical for a given expedition, the selection is worth some careful thought. Before making the decision, look around. Look through some back numbers of 'Caves and Caving', and 'Cave Science', to see what others have done, and to see what can be

done within the format of the journals. Go to a BCRA Conference and look through the reports on sale at the bookstalls. Larger expeditions should send someone to the RGS library to look through their expedition report collections. And be critical - decide which reports look turgid and boring, and which look inviting and interesting. Then plan your own report. Don't be over-optimistic and too expensive, but think positively and aim for something useful and presentable within the scope and budget of your own expedition results.

Essentially, the publication choices fall into four groups, and for some expeditions more than one may be appropriate. At least consider them all.

Private publication

This is the basic way to produce any report, at relatively low cost with total flexibility and your own control over what it looks like. Modern photocopiers are so good and so cheap that they have made the more elaborate stencil or litho printing obsolete for production runs of even a few hundred copies; (Commercial printing is still very expensive and only starts to be feasible on print runs of over 1000). All that is needed is a competent typist to produce clear copy, and access to a photocopier. Both are available commercially, but a helpful contact through a university, friend or sponsor, can be useful to get photocopying done at charges more like cost price than commercial rates. Collation can be done by hand, but do ensure the binding is adequate; staples that are too small are a disaster, and a little expense on plastic blinding may be worthwhile.

It takes very little extra effort to made a private publication into something attractive with some sales potential. Good layout, clear copy, a few photographs and a smart cover can make all the difference - this is where the expedition editor earns his keep. There are no large profits to be made, but a few sales can cover some costs and also increase the distribution.

The difficulties lie in the illustrations. Good half-tone printing is expensive, but some modern photocopiers do a very good job on the photographs, and it may be worthwhile going to a more expensive machine just for the photo pages. Large maps are a problem. Anything over A3 is expensive to duplicate, and also complicates binding; though in all honesty, sheets larger than this are rarely needed.

Another important point with a private publication is to have a permanent address on it; a temporary private address is as bad as none at all. Think of the person five years in the future who wants to trace the report. To ensure some permanence, give away a few copies, particularly to libraries (BCRA and RGS and any others); it is all an investment in publicity and the future.

Saleable publication

To make big money with sales of an expedition report is not easy. Significant profits only come from a big, glossy, well printed publication, based on good expedition

results. And the initial costs are high, with major outlays before any profits are even on the horizon; the Mulu reports, now classics of their kind, each involved outlays of well over œ1000. So this is only possible for the big, glamour expeditions, but if done well can become a good little earner.

Publish in a journal

The advantage of this is that the hard work of printing, editing and distribution is looked after by the journal. The difficulties are that there are very few appropriate journals available to take expedition reports, and then the report has to fit the journal style and may also have severe length restrictions. In general, club journals should be avoided, even though they are easy to satisfy and willing to accept most material; nearly all suffer from parochialism and very few have any permanence - so an expedition report in them soon becomes almost untraceable.

The obvious appropriate journal, in Britain, is 'Cave Science', which does have a permanent record and welcomes sound expedition reports of appropriate length and scale. Particularly in some developing countries, a national journal of the natural sciences, or a museum publication, may welcome a factual report by a foreign expedition in its own caves; they can sometimes offer quite an attractive printing deal, but beware, for some produce more promises than publications.

A small expedition, or one going to a single cave, or revisiting a known area, may only have the material for a much shorter report, and then 'Caves and Caving' can be a very suitable means of publication, with its wide readership and good library record.

Other publications

Once the official expedition report is safely taken care of, there are numerous possibilities for publishing material in other styles and places. Either general summaries or articles on particular aspects of the expedition should be considered, and wider publication of results really only makes an expedition more worthwhile. Each article will have to be tailored to suit the editorial demands and the readership of the publication it is aimed for. Each will have to be specially written, and cannot be regarded as a substitute for the main report. It is all extra work, and there is always the chance of rejection in the competitive world of publication; but this is all part of a successfully completed expedition.

First, the magazines. 'Caves and Caving' is the most obvious; any good caving expedition should put an article in this, Britain's national magazine; and such an article is always a good advert for any privately published report on sale. Then there is 'Climber and Rambler', and various other outdoor or adventure sports magazines, which are often on the lookout for a good, well illustrated article, preferably with some unusual angle on it. Look through your local newsagent to see who is currently in the market and get some idea of their style. The 'Geographical Magazine' is an excellent showplace for an expedition with some sound or unusual explorations which they can

back up with good photographs. 'Descent' will take almost any article on a caving expedition.

A magazine article is always worthwhile for the prestige alone, and they may also pay a small fee. But the big money - from the newspapers and high circulation magazines - is very, very difficult to reach. Only the big, glamorous expeditions have a chance; there has to be an exceptional angle to sell, or a first, or a record; and a sale will normally also depend on there being excellent colour photographs from the expedition. The same applies to book contracts. They may be lucrative, but they involve a lot of work, and rarely live up to the initial expectations of literary stardom.

Finally, there are the various scientific journals, including the prestigious 'Geographical Journal'. These offer academic kudos, but certainly no financial reward. Papers suitable for them will be in the hands of individual specialists on the expedition, and each should know their own potential. Though few caving expeditions have the necessary scientific objectives, a paper in a good journal can be regarded as the hallmark of a worthwhile project.

A word on publication schedules is appropriate. Too many expeditions take far too long to publish their results. Reports in journals are tied to editorial timetables, but private expedition reports are totally controllable. Some expeditions have produced good photo-duplicated reports inside a month of their return to Britain, and even glossy, printed reports have been produced inside three months. Remember that it is easiest to write a report straight after the expedition is over, while memories are fresh, and before members disperse to new projects. Six months is more than enough for the completion of almost any expedition report, unless there is a lot of scientific data to be worked on. Any report gains from being topical; there is no such thing as old news; and a first report produced more that a year after an expedition's completion is almost beyond consideration.

Report Illustrations

A separate note on these is well warranted, as they make or break a report and are so often poorly prepared. Photographs, maps and cave surveys are all vital to a caving expedition's publications.

Any photographs for a report, or many other publications, should be good quality black and white prints with reasonably high contrast. Black and white prints can be taken from colour slides, and these can be of adequate quality, but there is no excuse for not taking at least some surface shots in black and white as well as colour. And make sure that the underground photos are of the cave, and not just close-ups of cavers who could be anywhere.

Adequate, well-prepared maps are vital to a report. There must be a location map, showing access and where the cave or karst is in relation to major towns or features which can be located on anyone's atlas. Then an area map should show the main topographic features, drainage lines above and below ground, and have superimposed on it black-line surveys of the major caves; another larger scale map may be needed to relate a smaller cave to surface features. This aspect is sadly missing from many reports, and a map of surface and cave is invaluable in understanding the overall situation.

Before drawing the cave surveys, have a look at some existing good ones, because presentation and style is so very important. Look at some of the surveys produced within the last 10 years of some of the major Yorkshire caves, to get an idea of standards to aim for. The size of the drawing is critical. Do not have it too large, or it is almost unprintable; it is rarely necessary for a master drawing to be larger than A2 size. Use a reducing photocopier to reduce the originals before the master is prepared from them. And plan the drawing to fit on a suitable size and shape of paper. Adjust the position of plan and profile to an economical fit, and don't leave ludicrous and wasteful wide margins. Use the panels of cross section, titles and any detail enlargements, and perhaps a location map, to fill in blank spaces, and don't let them make an already inconvenient shape even worse.

For both maps and surveys, draw the masters on tracing paper (not plastic), and aim to reduce again for printing or duplicating; a reduced drawing always looks more professional, as it eliminates the effects of pen-shake and it is impossible to draw as small as it is easy to read. Use Letraset for the lettering; it is so much smarter than stencils, and there is no excuse for using freehand these days. And use a sheet of graph paper underneath the tracing paper to get the letters and lines straight. Use a letter size and a line pen size to allow for the planned reduction for printing; and of course only use bar scales, as representative fractions are useless when a map is reduced to fit a page. Finally a common error on cave surveys is to label half the passages of cave features on the plan, and the other half on the profile; this makes the survey very difficult to correlate and understand; label both plan and profile - it may be twice the work but it is worth it.

In conclusion, think before you act. Then, with only a little extra effort, you can produce reports and publications which are not only useful to others, but which also bring rewards both in pure satisfaction and in your credit rating on future expeditions.

13

EQUIPMENT, TECHNIQUES AND TRAINING

Tim Fogg

Introduction

These notes assume basic knowledge of caving equipment and techniques and are, with only one exception, intended to cover underground equipment [1].

Equipment

The frustrating fact about organising a caving expedition is that, in most cases, the obstacles to be encountered are undetermined. The unknown must be catered for, with only a basic knowledge of the area and within the constraints of weight and transport.

The aim is to take safe, versatile equipment in quantities which can be usefully split in order to sustain a number of working groups.

Before the expedition
Having researched and discussed all the available information on the proposed area or system to be visited, equipment needs should be assessed. Compare the resulting list of what you will need against what you can get together from members, your clubs and the BCRA Equipment Pool. You will need to get anything which is left over by purchase, loan or scrounging.

The equipment you require should be gathered together and tested. Testing is important if the equipment is new to members. Inevitably, personal gear tried and tested by the owner will give fewer problems in the field. Attention to detail at this stage will make the field work easier. For example, pre-shrinking and marking rope lengths.

Listing, weighing and packing must take into account customs regulations, freight restrictions and unpacking order. Transportation weight constraints may tempt equipment modification and/or cuts which in turn may jeopardise safety.

Clothing
Once you have ascertained, in general, the types of system to be visited (active, inactive, big, small, vertical, horizontal etc.) and the climate of the area, you are in a position to make some choices about clothing.

The functions that clothing must fulfil are keeping the caver comfortable through extremes of body temperature in a variety of conditions. For example in alpine caves, from inactive cold to hyperactive heat; in tropical caves the choice can be between overheating and severe abrasion. Inactivity is particularly a feature of expedition surveying, scientific sampling etc. Many issues of clothing are matters for personal choice but members new to expedition caving may need careful advice.

Prolonged periods underground give rubs and cuts a chance to develop to miserable proportions. Comfortable, well fitting clothing will reduce rubs and gloves will protect hands. Feet need careful consideration by individuals but wet-socks or woolly socks and well broken-in boots will help prevent the development of soreness [3].

Helmets are again a matter for personal choice, but for vertical caving they should conform to U.I.A.A. standard.

Bad choice of clothing can result in loss of working days, reduced morale and poor safety.

Lighting
The need for reliable and sufficient light is obvious. The options are between electrics and carbide. Electrics require a charging source in the form of mains (of correct voltage), a portable generator or vehicle battery. When charged they have a limited duration.

Petzl "Zoom" head torches equipped with halogen bulbs provide good short trip/reconnaissance lighting when powered by disposable batteries (an adaptor for round cells makes them more versatile).

In the majority of cases an actetylene/electric combination system provides the best light. Their disadvantages are often attributable to operator error or lack of familiarity and can be overcome with practice and simple modifications [4,5,6].

Carbide is not easily transportable due to weight and freight regulations, but it is available in most countries. However the quality is not standard nor is the size. When calculating the quantities you will require you must consider quality variations, its possible use as a light source for surface camps and the size of the passages you are likely to explore. Make sure you take something to break up oversize lumps and also something airtight in which to store it prior to use.

In some systems you will need to carry a length of plastic tube to utilise small pools, rivulets, drips etc., because water is scarce. Transport of carbide underground is best achieved by using sections of old car inner-tube sealed with rubber-bands made of the same material. These 'pigs' are also useful for carrying spent carbide out of the cave.

Load carrying

The standard range of tackle bags available will cover for most expedition needs; capacity being dictated by passage size and expected load. It is worth taking a variety of capacities to give versatility. Comfort and durability can be increased by a lining of closed cell foam which will also be welcomed in a "forced stop" or an emergency, for seating. In large caves a standard day sac (approx. 45L) can be a still more comfortable choice.

Waterproofing a load can be achieved with careful packing in two or more polythene bags sealed individually with inner tube bands, 'pigs', ortleib bags, or by using B.D.H. containers or ammo boxes where greater rigidity is required. (Used carbide may also be transported out of the cave in these containers taking care not to put damp, half used carbide inside an airtight container). Any combination of these packed in a tackle bag without drain holes and carried with a little care will keep bivi gear etc. dry. The heavy, noisy and cumbersome ammunition box would only seem appropriate to carry delicate scientific or photographic equipment.

Equipment for wet caves

Choice of equipment for wet caves is influenced by water temperature, velocity, depth and any possible increase in the latter two. In long swims, particularly when surveying, a buoyancy aid is invaluable [3,7]. If, in your planning stage, you identify the likelihood of encountering deep water, then you should consider taking an inflatable dinghy. However, improvised rafts can be made from sticks and water-proof containers and will provide an exciting alternative. Other improvised floatation could include closed cell foam mats wrapped around the trunk and tied or the empty 'bladder' from a wine box. A light line will ease passage on sections where repeated journeys through deep water have to be made. The tackling of flowing water or rigging rope above water will require the same equipment as vertical caving.

Vertical caving equipment

Vertical sections are a possibility in any cave system. On almost all expeditions, weight and space are at a premium and, as a result, SRT is almost always preferable to ladder and lifeline. Rigging requires good technique and practise [8,9,l0] and, assuming your team is capable of doing this well, then the lower weight 8mm and 9mm offer the opportunity to carry more rope for a given weight [11]. There is also a place for 9mm dynamic rope for climbing, traversing and rescue. Where numerous descent/ascents of pitches are foreseen then 10.5mm - 11mm rope should be installed. Taking low grade rope, such as polypropelene, for deep water or hand lines etc. leaves you open to the

temptation to use this in a vertical situation and should the SRT rope run short - this can be highly dangerous.

Rigging tackle should be varied and therefore able to cope with a wide range of situations. It could include - 8mm rock anchors, bolting kit (if you carry the weight of a bolt kit then you may as well take a reasonable number of anchors), a variety of hangers, maillons, screwgate karibiners and snaplinks, tape for slings and rope protectors (it is worth considering a lighter weight material than is usual for these, since the weight of the material does not seem to offer proportionately less protection). A set of pitons, climbing nuts and "Friends" will be useful for redirecting and climbing.
Unless you intend to undertake a particular climbing problem, you should aim to use free/aid climbing techniques and equipment which is lighter and more versatile than scaling poles or bolting platforms.

Personal ascending/descending kit is a matter of individual choice. However, if a standard rig/method is used by all members of the team then you can increase versatility and also decrease underground loads by swapping components of kit and by members sharing one kit on simply rigged pitches. Most people agree that the Frog system is the most versatile SRT rig. With the addition of a pulley, rescue and hauling systems can be improvised [l2] and with the addition of another jammer, some shock cords and a sling, a faster rope walking system can be created [l3]. With thought the weight of the kit can be safely reduced [l4].

Underground camps
The choice of sleeping gear for underground camps is largely determined by cave temperature. Cooking equipment depends on how arduous the carry is likely to be and how many man-nights will be spent in the camp.

In cold caves a hammock, sleeping bag (down is the most compact but problematic when wet), and "Gortex" bivvy bag provide the best possibility of sleep. Custom made underground hammock/tents are available but require practice in use and perfect siting underground. In the tropics a closed-cell foam mat and bivvy bag are often sufficient. Such minimal bedding can be supplemented by fibre pile and thermal under-wear to give more temperature control.

A one night camp can exist on a solid fuel stove (e.g. Meta), the Swiss developed conversion burner for a Petzl acetelene head-set or the newly developed "hot-cans", plus one metal mug or pot. For more prolonged camps there are a variety of lightweight stoves and cooking utensils available [l].

For camps which will be used over a long period, it is worth considering carrying in a large sheet of plastic to provide a clean floor area. In addition it may be worth taking in extra sets of furry-suits or similar to be used for sleeping/camp festering only. The

availability of such dry (and relatively clean) clothing will do much for comfort and morale.

Spares and emergency equipment
Personal survival equipment, lighting spares and prussik-loops for SRT self rescue, are best carried by individuals. The technique of carrying spares between the cradle and shell of your helmet reduces the protection it should give and may even cause more skull damage on impact. Rescue equipment, first-aid and trauma kits should be added to the group caving equipment to provide cover in the event of a major accident.

Surface navigation, location and recording systems
Maps, (topographical and geological), compass and information from previous expeditions, are basic. In addition, stereo aerial photographs can give topographical details not easily interpreted from conventional maps whilst infrared or satellite photos show surface temperature variations which may be associated with cave entrances. If you have a University contact, s/he may be able to obtain these for you, if not, cultivate such a contact. Altimeters are useful for obtaining height data.
If you are likely to be visiting numerous surface features then you will need some form of marking system, the most simple is to take a pot of paint and a brush for numbering. This will avoid wasted effort but should be done with consideration for the environment and the local inhabitants.

Equipment pool
An increasing amount of equipment is available on loan from the B.C.R.A (Mulu) Equipment Pool, information is available from B.C.R.A. [l5].

Equipment care
You rely on your equipment for both comfort and safety. Unless you are a suicidal masochist you should make sure that you look after it properly. Rope washing and light maintenance should be carried out during the expedition. Gear will often be used and trusted by different parties and should be kept in a condition which merits that trust.

Techniques

Techniques used during an expedition will vary according to many factors - climate, surface and underground terrain, numbers of cavers etc. The safety and success of any venture will be increased by a wide working knowledge of relevant techniques.

Location of entrances
Information from local people, the geology, maps, aerial photos and the interpretation of surface features will all be part of cave location. Local information varies in quality from amusing through frustrating to invaluable. An important factor is the energy of the expedition members and the confidence in each other's search efficiency. A marking

system (see above) and regular documentation of what has been covered will reduce the time wasted by repetition.

Use of human resources
The use of personnel to do the work at which they are most skilled will maximise the results. A keen fit caver who spends three hours a day preparing food or a caver using all his/her energy on a surface carry is not the best use of resources.

Expedition rigging
Since safety is a primary consideration, should the rigging for a single ascent/descent of a shaft be any different to that for multiple journeys? This question can arise in any vertical expedition caving. The reason given for imperfect rigging is that it takes too long to arrange a 'perfect hang'. Rope abrasion must be avoided for exploratory descents and this can, in fact, be quickly achieved by using climbing equipment and rope protectors rather than using bolts for rebelays and redirections. For multiple ascent/descents the safest rigging is provided by using 10.5mm - 11mm rope, good natural belays and bolts [6].

Climbing techniques
Standard rock climbing techniques with dynamic rope, modern protection and no climbing ethics, where possible, can be the fastest and safest approach. To speed up aid climbing with or without the addition of a bolt platform [9], the technique of only fully drilling every third bolt can be employed.

Water
Rigging above water needs the same techniques as vertical and/or climbing problems but usually requires them to be applied horizontally. Traverse rigging is inevitably time-consuming and makes heavy demands on tackle resources. For the safest possible rig for repeated journeys across a traverse you should use static and dynamic ropes in parallel but tied off alternately, with a sling or etrier at each belay on the bottom (static) rope. Passage along this requires three cow's tails. Crossing fast flowing/heavy water is fraught with problems and requires specific thought and techniques [7].

Communication
In deep, flood prone systems, communication to the surface by telephone has often been regarded as essential for safety. Radio communication and location by inductive-loop systems may provide a better alternative in the future [8]. The mechanics of surface communication from cave to camp to emergency services should be studied in case of a major accident. If you consider taking radios with you, you must check the restrictions on their use. Unauthorised radio communication can be extremely sensitive in some countries! The relevant Embassy or High Commission should be able to advise.

Route marking
Marking routes with lines, tapes or cairns through dangerous or complicated boulder chokes, on loose boulder slopes, around delicate formations or surface routes to entrances is worth consideration. On the surface, strips of bright plastic are eyecatching and can be written on in indelible pen; they should of course be removed when you pull out.

Bivouacing/camping
A decision on when and where to set up an underground camp will be influenced by the distance from the surface to the area being worked, the difficulty of the caving to reach this point and the availability of a suitable site. A good site can be regarded as one with plenty of easily available fresh water, a level floor, flood free, without a draft or conservation problems; abandoned oxbows are often perfect.

Training

The best possible physical condition and individual expertise is an important basis for the success of any caving expedition.

Climate
If you are likely to be visiting a tropical climate you might consider making regular and increasingly frequent visits to a sauna before you go. The benefits of this are arguable but some individuals are convinced that it helps the process of acclimatisation.

Skills training
Each individual member of the team should assess which skills s/he is weak in and make positive steps to 'brush-up' or acquire them before leaving. Particularly important would be any skill on which other members would rely to ensure their well being (e.g. SRT rescue techniques, first aid) and scientific disciplines (e.g. surveying) to ensure quick and accurate work in limited time.

Physical training
The probability of a member being incapacitated by injury or illness and therefore reducing the team strength can be reduced if members are physically fit. There are many forms of fitness training [l6], regular caving probably being the most relevant together with swimming and running. Stamina (the ability to keep going) is perhaps the most essential feature of expedition fitness. Flexibility is, however, often overlooked. This is best achieved by stretching exercises and yoga [l9,20]. With flexibility comes the ability to move through a cave with the minimum of effort. This increases the length of time you can stay underground and improves the safety margins.

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14

CAVE SURVEY ON EXPEDITIONS

Tony White

Why survey?

It has become a standard requirement of a caving expedition to produce surveys of the caves it explores. This is necessary as a record of work done, reference information for future use and to substantiate claims - it is no good saying that you have discovered the biggest, deepest or largest unless you've surveyed it.

In addition, and of considerable importance to the explorers themselves, cave surveying assists exploration. For this to be most effective the survey must be drawn up in the field, preferably between exploration trips. It is with this in mind that you must assess your survey methods, how to plot your results and what equipment you should take.

What type of survey?

The type of survey will depend upon your objectives:

Reconnaissance
Here the objective may not be to fully explore caves but to investigate an area superficially for a future, more thorough, expedition. Manpower will be low and time will be better spent covering more ground rather than producing highly accurate surveys. Often a pace and compass survey will be sufficient. In areas where maps are unreliable or unobtainable an altimeter is invaluable and is certainly the quickest and easiest method of calculating the depth potential of a system.

To a well explored area or system
Here your objective will be to find more passage. A Grade 5 survey will be expected if you are successful but there is little point in taking the drafting office with you unless you are confident of substantial new discoveries. If your objective is to bottom a known system then it is worth having survey equipment to hand, just in case, but plotting with a protractor and calculator will suffice.

Full scale expedition

Although your objectives may include both the above, here you will mainly be concerned with the discovery of lots of new cave passage. Grade 5 is the standard and the correct equipment for survey and drawing up can make the expedition far more productive, enable details to be checked in the field and enable a report to be produced with maximum speed on your return.

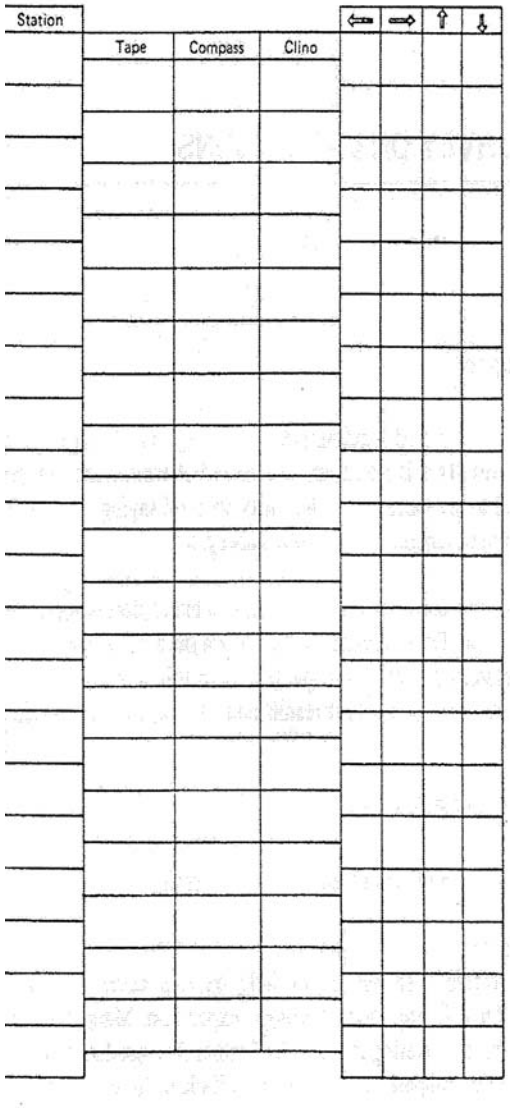

Fig 14.1

Methods Of Survey

Detailed descriptions of the various techniques of survey and their merits are given in the standard texts (Ellis, 1984, 1988). Speed and accuracy of survey can be enhanced by the design of the survey notebook and the method of sketching.

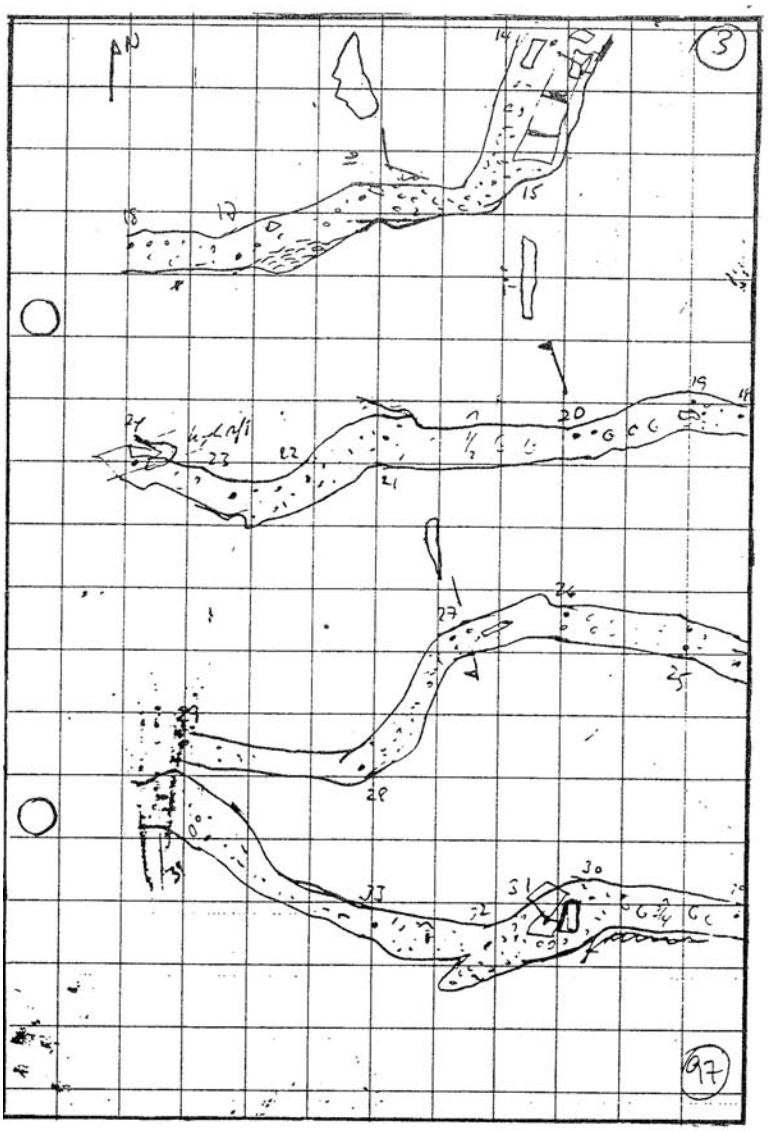

Fig 14.2

Figure 14.1 is set out in tabular form. This immediately shows up any missing items and also allows easy transfer of data to a computer. Columns are ready printed for distances to left and right walls, roof and floor.

Figure 14.2 is printed with a 1 cm grid for the sketch. This can allow the sketch to be drawn directly to scale and direction.:
Choose the scale at which you wish to draw e.g.:

1:500 for small caves
1:1000 for most caves
1:2000 for large caves

and mark a magnetic north direction. Once the measurements have been called and noted, plot the leg length and direction very roughly by eye. Mark on the wall distances and sketch in the details. If the drawing runs off the page, continue the drawing elsewhere but maintain the orientation.

This method may, at first, be slightly slower than the traditional rapid sketch but the resulting drawing is far more accurate. This is of particular importance in complex passage areas. The sketch may be good enough to transfer almost directly onto the finished survey by tracing.

In or out?
Individual preferences vary as to whether it is better to survey in or out of the cave when exploring. In a vertical system logistics may demand a separate party or for the exploration team to survey out when not overladen. Surveying out offers the advantage of a greater understanding of the cave morphology and, therefore, better placing or survey stations, more accurate sketching etc. In a flood liable cave this knowledge of the cave could prove invaluable to your safety. It has the disadvantage that, unless you are able to estimate the time you will require very accurately, you are likely to either cut short your explorations unnecessarily early or to overrun your time in the cave and leave the survey hanging. Surveying in may lead to less well positioned stations, and temporary confusion in complex areas. However, it is more exciting for first exploration. In a complex system with loops and multiple entrances efficiency is increased since many passages will not require a return visit.

Complex systems
Where several survey teams are working in a system confusion can easily arise. Sticking to the golden rule that "explorers survey their own finds" can prevent confusion since the corollary is "if it's got footprints in it, it has been surveyed".

Picking up the ends of another party's survey can be made easier if markers are left at relevant junctions and where they finished. Small pieces of waterproof paper cut out of the survey pad are ideal and can hopefully be removed later. Write on it the survey station number and, if the marker is not on the precise station, its location, e.g. "1.6m up" or "end of stal".

In the evening, when drawing up the survey, it is important to draw the cave walls, not just the survey line. Let the survey sort out the complexity and hopefully indicate connections and extensions.

Deep Water
Fixed points are necessary so utilise places where it is possible to hang onto walls. Some extra flotation, especially for the instrument reader, will make life easier (not to mention longer). Sight TO awkward stations and FROM the easier ones. Water level

can be used as a height control, so you can dispense with the clinometer, but do remember to drop verticals to the water surface at each end.

In rivers, noise is the problem so it is useful if the instrument reader has paper to note down her readings, which are transcribed into the survey book after each leg. The tape is less likely to snag if the tape operator is upstream.

Large passages and chambers

Top priority is a good light and preferably a high power spotlamp. One method of surveying rapidly through a high passage if time is short is shown in Figure 14.3 The survey line is run close to one wall and an extra person explores the opposite wall, preferably making a sketch himself. He parks himself at strategic positions so that the survey team can take instrument readings on him. The distances are calculated by triangulation.

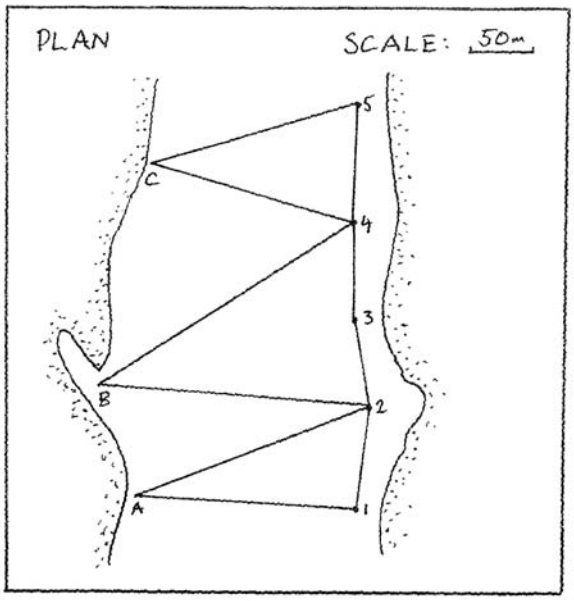

Fig 14.3 Surveying a large passage. 1 to 5 are main survey stations; sightings only are made to an extra person A, B and C. This person sketches his side of the passage.

This method has the advantage that the surveyor can see both sides of the passage at the same time and get a much better feel for the size and shape of it. If later they find they have some spare time the other wall could be surveyed properly. In general, try to keep the triangle length: base ratio less than 3:1.

Big pitches

If climbing against a wall, measure between rebelay points, or on long sections it may be possible to have extra fixed stations on the walls.

On free-hanging pitches there are several methods, each of varying accuracy:

i) Measure the rope. This is probably the most frequently used technique. You tie a knot in the bottom and measure it after you have pulled up the rope.
ii) Join two tapes together.
iii) Low stretch wire has been used by the Americans (Steele, 1982).
iv) Tandem method. (Figure 14.4). For safety, this method is not suitable for use with lightweight ropes. Jo prusiks up one tape-length, marks a station on the rope with a piece of string or even a safety pin with a streamer on it! Leg A is measured. Rob goes up the mark while Jo continues; they then measure leg B, etc. etc. Total pitch length is then A+B+C+D.

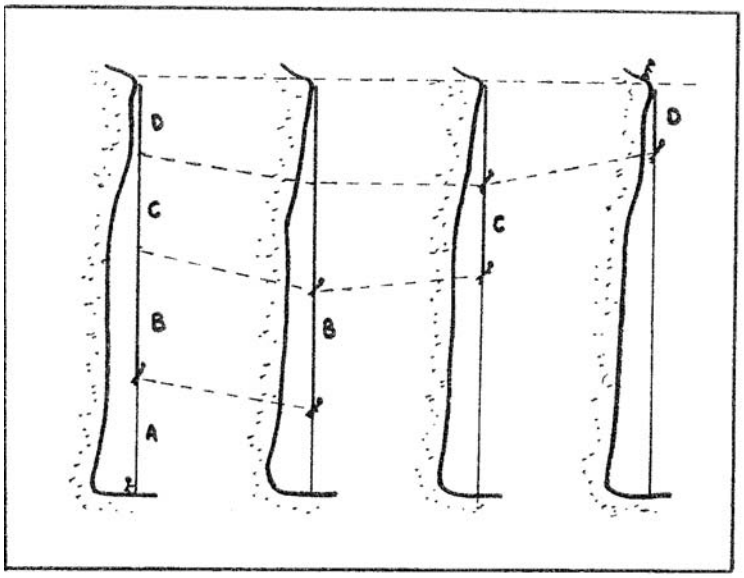

Fig 14.4 Tandem method of surveying a big pitch

Despite the marks being at different positions for each stage, the total is actually the length of the pitch. The reason is that the sections B, C and D are, when measured, under the same tension as when section A was measured (give or take a bit of rope on the ground).

If the cavers are wildly different weights, say Rob is heavier than Jo, then the total pitch length would be a little too high. So Rob could give Jo all the tackle to carry to the pitch.

A way of eliminating that error is if Rob gets on the rope first and hangs just off the ground. Then mark the rope at ground level. Rob gets off, and when Jo starts up, they measure the mark again. The difference in the measurement is a correction factor which can be included in the formula, as follows:

If L = uncorrected length calculated above, T = tandem length (B+C+D in this case) and S = difference in stretch measured at the bottom, then:

Pitch length = L-(SxT)/L

This method relies on the elastic properties of the rope and any inelastic effects such as slippage of fibres or sheath could affect the result. However, it does give people a good excuse for having a rest on the rope.

Methods Of Plotting (Ellis, 1988)

Graphically
Using a protractor and ruler. The traditional method which is convenient for a few legs. For large complex surveys it is slow and less accurate. It is usual to use a calculator to work out the horizontal and vertical components of each survey leg.

Hand plotting coordinates
A programmable calculator or computer is useful for calculating coordinates.

Machine plotting
Using a computer with linked plotter.

For all the above methods, if you have an area map with a grid, then as soon as you begin, estimate grid references for all your cave entrances and plot them to grid north. This will allow every point in the caves to be easily related to the map, the separation between caves is immediately apparent and any discrepancies in position are likely to be quickly seen, allowing checking and correction while you are still in the field.

What is required?

For Surveying
(a) Compass. Grade 5 surveys require a compass graduated to 1 degree. The standard for years has been the Suunto KB-14/36ORT, which is small, robust and easy to read when handheld. Regrettably they are liable to leak and must be sealed around eyepiece and top-plate before use in wet conditions.

A possible alternative is the Silva 54NL, a map compass with a direct sighting facility for more accurate measurements.

Pace and compass surveys can be done with the KB-14 but another model, the Silva type 7NL, is easier to use for mapwork and general surface navigation, is lighter and

more likely to be carried at all times on a recce trip. Even on a Grade 5 survey it is handy for the notetaker to have one of these instruments to take rough bearings to improve the sketch.

It may also be worth considering the Suunto MC-1 mirror compass for rough surveys. This has a built in clinometer which could be useful for estimating heights and depths.

Compasses are balanced for the magnetic dip of a particular latitude. If incorrect for your expedition area the needle or card will not pivot horizontally. Usually the whole instrument can be tilted to compensate but if severe, or if you are obtaining new instruments, get them balanced correctly.

(b) *Clinometer*. Essential for Grade 5 but not for rough surveys. Again the accepted standard has been the Suunto PM-5360PCT, graduated to 1 degree. It also has a per-cent scale which has the dual function of estimating heights and confusing the inexperienced. It leaks and must be sealed before use.
(c) *Survey Books*. Wiggins Teape produce a laminated plastic material called "Synteape", in various grades, of which FPG 130 grade is ideal. It is totally impervious to water, takes ballpoint ink and pencil very well and with a little care, can be easily washed clean of mud. Loose sheets (preprinted as in 14.3 above) can be bound together in a plastic cover using a two hole binder. The book and pencil can be attached to, and carried in a pvc wallet hung around the neck. I personally prefer a 0.5mm HB clutch pencil, even in water.

(d) *Measuring Tape*. A 30m glass reinforced plastic tape in an open reel is ideal, such as the Rabone Chesterman 701/55. With heavy use and especially in river caves, it can be shredded or broken, so consider taking spares. For very large caves, surface survey and vertical caving a 50m tape is useful. An alternative is to use a Topofil measuring device which uses a biodegradable cotton thread, or an electronic distance measuring instrument if a cheap, reliable handheld instrument can be obtained.

(e) *Altimeter*. Not essential but useful. The Thommen TX is small and light enough to be carried anywhere. It is graduated in 10m intervals. If used singly, local pressure variations are a problem but, even so, it can provide considerable information with little effort. If the party uses two altimeters then accurate altitudes can be obtained - one instrument being kept at camp and its readings recorded at half hourly intervals, the second instrument is used in the field to take measurements at the desired sites. The plotted variations in readings from the static instrument may then be used to calibrate the other readings in order to remove the effect of local pressure variations through the day.

(f) *Sundries*. Waterproof containers for carrying the instruments underground. A container of drying agent (e.g. silica gel or carbide) with room for the instruments if they do succumb to moisture.

Sufficient complete sets of survey gear should be taken for the maximum number of teams surveying at any one time (roughly one set for every three team members) but spares should also be allowed, especially if going on an extended trip.

For Drawing Up

(a) *Paper*. For hand plotting by protractor use a rectangular grid and a 1mm grid for plotting by coordinates. Take large sheets folded or rolled in a tube for protection, and A4 graph pads for small caves and extensions to the main sheet.

(b) *Pencils*. Hard pencils are only good for tearing your paper when you are working under pressure; use an HB and keep it sharp.

(c) *Erasers*. Use soft ones.

(d) *Rulers*. For most purposes you won't need one longer than 10cm but a 30cm ruler may be worth taking.

(e) *Protractor*. If hand plotting, take a 360ø protractor, otherwise a small one is adequate.

(f) *Drawing Board*. You will need something flat for resting on but weight and bulk will undoubtedly restrict you. If you are going to an area where wood is abundant, try taking some thin sheets of rigid white plastic. If nailed to a table frame these give an easily cleanable table to eat from, draw surveys from and, with a bright lamp underneath, a light table.

(g) *Binder*. To store survey sheets.

(h) *Logbook*. Multi-purpose, vital for keeping a record of who does what and when, but also useful for pasting or stapling in odd sheets of paper and computer print-outs.

(i) *Sundries*. You might also consider taking: scissors, paper glue, adhesive tape, small stapler (and staples), tracing paper, acetate film, coloured fine marking pens, drawing pins, and large sheets of paper or polythene onto which to draw the survey as it grows - display this near the eating table to stimulate ideas of what, why and where to work next.

Calculator or computer?

(a) *Calculator*. For graphical plotting it should have sine and cosine functions. For coordinate plotting, many programmable ones are suitable. The Casio fx-3600P has just sufficient programme steps to convert the raw data into eastings and northings for the

plan, and height and a projection coordinate for a projected elevation. A cave survey programme for this instrument is given in the appendix to this section.

(b) *Computer*. This may do a little or a lot more than a calculator. For example it could print out a permanent record of the data and coordinates, perform adjustments to close loops, plot the survey line and elevation, and record data on tape or disc. More powerful machines are getting smaller and more robust all the time. Two examples of machines which have been successfully used on several expeditions are:

i. Sharp PC1251. A calculator sized unit which can be inserted into a combined printer/minature tape recorder. It is programmable in BASIC, appropriate softwear has been written by Mike Meredith.

Options are: 1. Set magnetic declination.
2. Enter starting coordinates.
3. Reverse data.
4. Enter readings and print results.

Coordinates are plotted manually on graph paper.

ii. Sharp PC1500 plus CE150 plotter. Size 330 x 115 x 50mm, weight 1.4kg, standard available memory is 1850 bytes. Has a miniature QWERTY keyboard and a 26 character scrolling LCD display. It has a 5cm drum plotter with four colour ball-point pens. The recorder is, if required, a separate unit. Softwear written in BASIC by Paul Dyson was used on this machine with a 4K RAM module on the Muller '82 Expedition (Martin, 1984). Since an 8K module is available the softwear has been modified and extended. A 16K module is now also available.

Station labels have five alphanumeric characters, the first three containing coded information such as the cave, surveyor or instrument set used and the date; the final ones are normally numeric.

Options are: 1. Start, print date and time
2. Input data:
   (a) read from tape
   (b) enter from keyboard. After the first label is entered, all others will be generated with the numeric part increasing or decreasing. Measurements can be reversed if backsights.
3. Print out raw data and give total length surveyed.
4. Enter magnetic declination, coordinates of each starting point and calculate coordinates for all points.
5. Print out coordinates.

6. Set scale and plot plan.
7. Plot a projected section.
8. Record data onto tape.

In addition, plotting a projected section could be made available.

iii. Sharp PC1600 plus 32k memory, 210mm wide plotter disk drive. This is a compact unit with much greater capabilities than previous models. It has been successfully used in the field with software similar to that for the PC1500 but plotting modified for the larger size.

Since most surveys will not fit onto a 5cm strip, the first leg is plotted down the centre of the strip, its orientation and the coordinates of the first point are printed. Subsequent legs are plotted correctly in relation to the first. If the pen runs off the strip a new plot is begun with the uncompleted leg re-oriented. This results in a series of plots on different orientations. These are transferred to a sheet of graph paper by hand plotting the first and last points of each strip then overlaying the strip and pricking the other points through onto the graph paper with a pin. This is faster than it sounds ....

Power supply: this machine is powered by a built in rechargeable battery pack, charged from a 9v source. Dry cells (e.g. two MN-1203 or six D-cells) are an alternative to the mains adaptor which is supplied, so take a plug and connectors.

Satellite Navigation

Satellite navigation systems can now be hired for a reasonable price and are invaluable for locating prominent features in an area. Devices such as the Magellan GPS NAVIOOO satellite navigation system are compact, hand held and light weight. They give latitude and longitude locations anywhere on the earth to within 100 meters. A figure for altitude is also given, but is less accurate. To obtain these measurements four satellites must be in contact with the device and clearly, in a narrow valley with a limited horizon, this will not be possible. However, on top of a nearby hill a good fix will be obtained and conventional triangulation methods can be used to fill in the detail. The availability of satellites in the area you are going to should be checked in advance, particularly if it is close to a war zone.

Future Developments

It is clear that the use of portable computers can be of considerable benefit to expedition groups. The systems described above will undoubtedly require rapid modification in the light of advances in equipment design. Several 10cm plotters are now available and, although bulky, have obvious advantages. Sharp now make a drum plotter, the CE515P,

which can take an 11cm roll or paper up to 21cm wide, this will enable printing and plotting on A4 sheets or fanfold paper. Other manufacturers make combined processing unit/10cm plotter/minature tape drive units which look suitable for expedition use.

Several sophisticated survey programmes suitable for IBM-compatable machines are now available. With the increasing availability of notebook and palmtop computers, together with miniaturised printers, these offer tremendous opportunities for rapid, accurate and high quality plotting. Details of these programmes are advertised in the caving press.

One problem to consider with such automated processing facilities is that manual plotting can seem so tedious in comparison that groups working away from the base camp leave all their data unprocessed until they return to use the computer. Because of this, if the computer is too bulky to be taken to the camp where the action is taking place - you might be better off without it.

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Appendix

Cave Survey Programme For Casio Fx-3600p Scientific Calculator

A. Calculated Easting, Northing and Height coordinates allowing for magnetic declination.

Key Entry

1 MODE	11 K_{IN}	21 K_{OUT}	31 4	41 K_{OUT}	51 =
2 0	12 5	22 3	32 =	42 1	52 K_{IN}
3 P_1	13 ENT	23 =	33 INV_{P-R}	43 =	53 2
4 ENT	14 K_{IN}	24 K_{IN}	34 K_{OUT}	44 K_{IN}	54 K_{OUT}
5 K_{IN}	15 6	25 3	35 5	45 1	55 1
6 4	16 sin	26 K_{OUT}	36 =	46 K_{OUT}	56 INV_{RTN}
7 ENT	17 x	27 6	37 K_{IN}	47 6	57 MODE
8 +	18 K_{OUT}	28 cos	38 6	48 +	58 .
9 MR	19 4	29 x	39 INV_{X-Y}	49 K_{OUT}	
10 =	20 +	30 K_{OUT}	40 +	50 2	

Operation:

Enter starting coordinates E, N and H into memories 1, 2 and 3 respectively and magnetic declination into M (East is positive).
Press P to start.
Enter data in conventional order: tape, compass clino (if the leg is sighted in reverse, as in a leapfrog survey, enter the tape measurements as negative.)
Memories 1, 2 and 3 are then updated with the new coordinates and the programme returns for the next set of data.

B. Calculates Easting and Northing coordinates for a plan and Height and a Projection coordinate for a projected elevation. Magnetic declination not incorporated.

Key entry

1 MODE	11 +	21 MR	31 1	41 K_{IN}	51 K_{OUT}
2 0	12 K_{OUT}	22 =	32 =	42 2	52 5
3 P_1	13 3	23 INV_{P-R}	33 K_{IN}	43 INV_{RTN}	53 x
4 ENT	14 =	24 ENT	34 1	44 INV_{P_2}	54 K_{OUT}
5 K_{IN}	15 K_{IN}	25 =	35 K^{IN}	45 K_{OUT}	55 2
6 6	16 3	26 K_{IN}	36 6	46 4	56 =
7 sin	17 K_{OUT}	27 6	37 +	47 x	57 MODE
8 x	18 6	28 INV_{X-Y}	38 K_{OUT}	48 K_{OUT}	58 .
9 ENT	19 cos	29 +	39 2	49 1	
10 $INV_{M_{IN}}$	20 x	30 K_{OUT}	40 =	50 +	

Operation:

Enter starting coordinates E, N and H into memories 1, 2 and 3 respectively.
Enter sine and cosine of projection angle into memories 4 and 5 respectively. e.g. if you wish to draw a projection on 124
   memory 4 should contain 0.829
   memory 5 should contain -0.559
Press P to start.
Enter data in the order clino, tape, compass.
Memories 1, 2 and 3 are then updated with the new coordinates and the programme returns for the next set of data. Pressing P at this point gives the projection coordinate and P resumes operation.

Cave Survey Program For Sharp Pc1500

The program listed below requires an 8k RAM module. The options available are each selected by pressing two keys: 'DEF' and then the option letter.

DEF: Manual data entry
Old data is cleared, counters reset; the date and time are printed and a title is requested and printed.

"First Station Label:" 5 characters are required.
E.g. C1040. If the last two are numeric then sequential labels are generated.

"From C1040?" Hit 'ENTER' if OK, else the required 'to' label.

"tpe ? cmp clin" Give the three measurements, pressing 'ENTER' after each.

The data are displayed for checking. 'ENTER' if OK and move to next leg. Otherwise "N" and you will be returned to the start of that leg. If the 'to' label is the known one as in a leapfrog survey then the data will be reversed automatically. If neither label can be found or the data is invalid, then you will be warned and sent back to the start of the leg.

"From C1041?" Continue as above, or type "END" if you have finished, "NEW" if you want to begin a new traverse, or "REV" which will allow you to work backwards through a traverse. Labels can be decremented and all subsequent data reversed until reset using the same command.

DEF D Prints input data and total length

DEF S Calculate Coordinates
"Mag. Declin east + -1.25?" Hit 'ENTER' if OK, else the required value.
"Projection is -1?" Hit 'ENTER' or else required value (-1 means no projection coordinates are printed)
You will then be asked for starting coordinates for each traverse.

DEF L Prints out coordinates
DEF V Plot the plan
"Scale 1:1000?" Hit 'ENTER' if OK, else the required value (e.g. 500)

DEF X Plot the elevation
"Scale 1:1000?" As for the plan
The minimum and maximum height values are printed and the strip width.
"Base level?" e.g. if the strip width is 40m and you choose a base level of 800 then the range of the first strip is 800 to 840m and any values outside will initiate a new plot with a revised base level.
"Which side (L/R)?" If the projected traverse progresses from left to right then enter "L".

DEF F Record data on tape
Connect tape recorder (preferably with remote facility), slide remote switch 'on' and set to record. An identifying name for the file will be requested. 60 legs require approximately 4 minutes of tape.

DEF G Data entry from tape
The memory is cleared ready for the new data. The filename is requested. It will search for that file, print the title read and ask for verification before reading in the main data.

DEF C Continue data entry from keyboard
Default values and parameters: These are set in lines 5050 to 5100 of the program. They should be set in the program to the most common values but can be changed whilst running.

SC : Scale
PR : Projection
MD : Magnetic declination (West is negative)
ST : Stretch (To allow for machine error in plotting in the
Y :direction. If significant in the X direction then
the overall scaling value of 5000 in line 5820 should
be modified first).
LT : Line Type (0 = Solid line, 1 to 8 = broken)
LB : Labelling (0 = off, 1 = on, labelling off will remove
the cross and label printed at each station. This is
useful if plotting a cave at a very small scale,
e.g. for overlaying on a 1:25,000 map).

Program Listing

Wait for instruction

```
 50:"Z":CLS :TEXT
    :WAIT :USING :
    PRINT "Select
    function... DE
    F ??"
```

Manual data input

```
100:"A":GOSUB "J"
110:INPUT "Title..
    .";H$(0)
120:CSIZE 1:LPRINT
    H$(0):LF 1
130:"NC":CLS
140:INPUT "First s
    tation label :
    ";S$(A):F$(0)=
    S$(A)
150:"C":CLS :IF A=
    SWAIT 0:PRINT
    "<<< MEMORY LI
    MIT >>>":BEEP
    5,50,500:GOTO
    "Z"
160:CLS :F$=F$(0):
    S$=F$:WAIT 0:
    USING :PRINT "
    From ";S$;" ";
    :INPUT S$
170:IF S$="END"
    GOTO "Z"
180:IF S$="NEW"LET
    A=A+1:GOTO "NC
    "
190:IF S$="REV"
    GOSUB "LF":
    GOTO "C"
200:"RT":CLS :
    GOSUB "NL":F$=
    S$
210:PRINT "From ";
    F$;" to ";T$;"
     ";:INPUT T$
220:"DT":CLS :
    PRINT "tpe
      cmp     clin
    ":CURSOR 4:
    INPUT T:CURSOR
    13:INPUT C:
    CURSOR 22:
    INPUT D
230:CLS :WAIT 50:
    IF T<0OR C>360
    OR ABS (D)>90
    PRINT "Data er
    ror":WAIT 0:
    GOTO "DT"
240:PRINT "From ";
    F$;" to ";T$:A
    $=" "
250:WAIT 0:PRINT T
    ;"  ";C;"  ";D
    ;:INPUT "   ok
    ?";A$
260:IF A$="N"CLS :
    GOTO "C"
270:A$=F$:FOR I=1
    TO 2:FOR J=ATO
    0STEP -1
280:IF A$=S$(J)
    THEN "ST"
290:NEXT J:A$=T$:
    NEXT I
300:WAIT 50:CLS :
    PRINT "STATION
    S UNKNOWN":
    GOTO "C"
310:"ST":G=G+T:IF
    I=2THEN LET T$
    =F$:F$=A$:
    GOSUB "CH"
320:IF B$="N"THEN
    GOSUB "CH"
330:IF C>=360LET C
    =C-360
340:CLS :PRINT "WA
    IT...":A=A+1:S
    $(A)=T$
350:Z=Z+1:T(Z)=T:C
    (Z)=C:D(Z)=D:T
    $(Z)=T$:F$(Z)=
    F$:F$(0)=T$:
    GOTO "C"
```

List input data

```
400:"L":IF NOGOTO
    "S"
410:TEXT :CLS :
    CSIZE 1:COLOR
    CC
420:USING :LPRINT
    "Mag. declin.
    = ";MD;" deg e
    ast"
430:LPRINT " SIN
        EAST   NORT
    H  HEIGHT   ";
    PR$
440:COLOR CL:U$="#
    #####.#":FOR I
    =0TO A
450:IF PR>=0GOTO 4
    80
460:LPRINT USING "
    &&&&&";S$(I);
    USING U$;X(I)+
    SGN (X(I))*.05
    ;Y(I)+SGN (Y(I
    ))*.05;
470:LPRINT Z(I)+
    SGN (Z(I))*.05
    :GOTO 510
480:PC=X(I)*SIN PR
    +Y(I)*COS PR
490:LPRINT USING "
    &&&&&";S$(I);
    USING U$;X(I)+
    SGN (X(I))*.05
    ;Y(I)+SGN (Y(I
    ))*.05;
500:LPRINT Z(I)+
    SGN (Z(I))*.05
    ;USING "######
    #";PC+SGN (PC)
    *.5
510:NEXT I:COLOR C
    C:LF 6:GOTO "Z
    "
```

Calculate coordinates

```
600:"S":TEXT :CLS
    :WAIT 0:USING
    :PRINT "Mag De
    clin east = ";
    MD;" ";:INPUT
    MD
610:CLS :PRINT "Pr
    ojection is ";
    PR;" ";:INPUT
    PR
620:"RQ":IF PR>=0
    LET PR$="P"+
    STR$ PR
630:GOTO "c"
640:"c":A=0
650:GOSUB "RS"
660:FOR L=1TO Z
670:FOR J=ATO 2
    STEP -1:IF F$(
    L)=S$(J)THEN
    GOTO "K"
680:NEXT J:A=A+1:
    GOSUB "RS":
    GOTO 670
690:"K":U=T(L)*SIN
    (D(L)):H=T(L)*
    COS (D(L)):E=H
    *SIN (C(L)+MD)
    :N=H*COS (C(L)
    +MD)
700:A=A+1:X(A)=X(J
    )+E:Y(A)=Y(J)+
    N:Z(A)=Z(J)+U
710:GCURSOR L:
    GPRINT 62:NEXT
    L:NC=0:GOTO "Z
    "
```

List coordinates

```
800:"D":CLS :WAIT
    0:PRINT "... w
    ait ..."
810:CSIZE 1:COLOR
    CC:USING :
    LPRINT "FROM
     TO     TAPE
     COMP   CLINO"
820:COLOR CL:FOR I
    =1TO Z:LPRINT
    USING U$;F$(I)
    ;USING ;" ";
    USING U$;T$(I)
    ;
830:IF T(I)>0
    LPRINT USING "
    #####.#";T(I);
    C(I);D(I)
840:NEXT I:LPRINT
    :COLOR CC:
    LPRINT "TOTAL
    LENGTH";G
850:LF 6:GOTO "Z"
```

Plot plan

```
1000:"V":GOSUB "k
     "
1010:LPRINT "Mag.
      declin. =";
     MD;" deg eas
     t"
1020:GRAPH :
     ROTATE 0:F=1
     00:M=0:O=999
     :AT=0:P=48:
     COLOR CL
1030:CLS :GCURSOR
     Z+1:GPRINT 1
     27
1040:FOR L=1TO Z:
     GCURSOR L:
     GPRINT 62
1050:FOR J=ATO 0
     STEP -1
1060:IF F$(L)=S$(
     J)THEN GOTO
     1080
1070:NEXT J:AT=AT
     +1:O=999:
     GOTO 1050
1080:AT=AT+1:C=C(
     L):H=T(L)*
     COS D(L)
1090:IF O=999
     GOSUB "SP":
     GOTO "n"
1100:IF ASC P$(J)
     ()PGOSUB "SP
     ":GOTO "n"
1110:X1=K*H*SIN (
     C-O):Y1=ST*K
     *H*COS (C-O)
1120:X=X(J)-XS:Y=
     Y(J)-YS:W=((
     X*X+Y*Y)):Q=
     AIN (X/(Y+0.
     0000001))-MD
1130:IF SGN Y=-1
     LET Q=Q+180:
     GOTO "TH"
1140:IF SGN X=-1
     LET Q=Q+360
1150:"TH":X=K*W*
     SIN (Q-O):Y=
     ST*K*W*COS (
     Q-O)
1160:IF (Y+Y1)>M
     LET M=Y+Y1
1170:LINE (-X,-Y)
     -(-(X+X1),-(
     Y+Y1)),LT,CL
1180:IF ABS (X+X1
     )<100THEN
     GOSUB "x":
     GOTO "n"
1190:CSIZE 1:
     GOSUB "SP"
1200:"n":NEXT L:
     GLCURSOR (-1
     00,-M-80):
     GOTO "Z"
```

Plot elevation

```
2000:"X":GOSUB "k
     "
2010:LPRINT "Proj
     ection on ";
     PR
2020:MX=Z(0):MN=M
     X:NK=SC/25:M
     =0:F=1
2030:FOR J=0TO A
2040:IF Z(J)>MX
     LET MX=Z(J)
2050:IF Z(J)<MN
     LET MN=Z(J)
2060:NEXT J
2070:LPRINT USING
     "#####.#";"H
     eight: min =
     ";MN;" max="
     ;MX:LPRINT "
     Strip width
     ";NK:LF 1
2080:CLS :INPUT "
     Base level ?
      ";M1
2090:INPUT "Which
      side ? (L/R
     ) ";W$
2100:U=1:IF W$="R
     "LET U=-1
2110:GRAPH :
     ROTATE 2-U:
     IF U=-1THEN
     GLCURSOR (20
     0,0):SCRSN
2120:FOR J=0TO A
2130:PC=X(J)*SIN
     PR+Y(J)*COS
     PR
2140:IF J=0GOSUB
     "s"
2150:"j":IF Z(J)<
     M1LET M1=M1+
     NK*INT ((Z(J
     )-M1)/NK):
     GOSUB "s"
2160:IF Z(J)>M2
     LET M1=M1+NK
     *INT ((Z(J)-
     M1)/NK):
     GOSUB "s"
2170:Y1=(M0-PC)*K
     *ST*U:X1=(Z(
     J)-M1)*K*U
2180:IF Y1>500
     GOSUB "s":
     GOTO "j"
2190:IF Y1<M-500
     GOSUB "s":
     GOTO "j"
2200:GLCURSOR (X1
     ,Y1)
2210:IF Y1<MLET M
     =Y1
2220:GOSUB "x":
     LPRINT VAL
     RIGHT$ (S$(J
     ),2)
2230:NEXT J:
     GLCURSOR (0,
     M-150):GOTO
     "Z"
```

Record on tape

```
3000:"F":WAIT :
     PRINT "Set u
      p tape & hit
       ENTER"
3010:WAIT 99:U$="
     U85.6.1":
     PRINT U$:
     WAIT 0:INPUT
     "label ? ";L
     1$
3020:T$=F$(1)
3030:PRINT #L1$;U
     $,H$(*),T$,A
     ,Z,G
3040:PRINT #T$;F$
     (*),T$(*),T(
     *),C(*),D(*)
     ,S$(*):GOTO
     "Z"
```

Data input from tape

```
4000:"G":GOSUB "J
     "
4010:WAIT :PRINT
     "Set up tape
      & hit ENTER
     "
4020:WAIT 0:INPUT
     "label ? ";L
     1$
4030:INPUT #L1$;U
     $,H$(*),T$,A
     ,Z,G
4040:CSIZE 1:
     LPRINT H$(0)
     :INPUT "OK Y
     /N?";A$:IF A
     $="N"GOTO 40
     20
4050:INPUT #T$;F$
     (*),T$(*),T(
     *),C(*),D(*)
     ,S$(*)
4060:GC=0:FOR J=1
     TO Z:GC=GC+T
     (J):NEXT J:
     WAIT 200:
     PRINT GC;G
4070:IF GC<>GTHEN
     WAIT :PRINT
     "Checksum in
     correct"
4080:GOTO "Z"
```

Initialise

```
5000:"J":CLS :
     TEXT :INPUT
     "Erase old d
     ata?(Y/N)";E
     $
5010:IF E$<>"Y"
     GOTO "Z"
5020:CLEAR :S=60:
     DIM S$(S)*5:
     DIM X(S):DIM
     Y(S):DIM Z(S
     ):DIM T(S)
5030:DIM C(S):DIM
     D(S):DIM F$(
     S)*5:DIM T$(
     S)*5:DIM P$(
     S)*1:DIM H$(
     0)*50
5040:A=0:Z=0:NC=1
5050:SC=1000:REM
      scale
5060:PR=-1:REM pr
     ojection
5070:MD=-1.25:REM
     mag. declin.
      east
5080:ST=1/1.018:
     REM stretch
5090:LT=4:REM lin
     e type
5100:LB=1:REM lab
     elling on ?
5110:TEXT :CC=RND
     2-1:CL=CC+2:
     COLOR CC:
     CSIZE 2:LF 2
5120:A$=STR$ TIME
     :IF TIME <99
     999LET A$="0
     "+A$
5130:LPRINT TAB 4
     ;"-";TAB 2;
     MID$ (A$,3,2
     )+"-"+LEFT$
     (A$,2)+"-85
      "+MID$ (A$,
     5,5):RETURN
```

Get start coordinates

```
5200:"RS":CLS :
     WAIT 0:PRINT
     "Coord ";S$(
     A);:INPUT "
     East ";X(A)
5210:CLS :INPUT "
     North.. ";Y(
     A),"Height..
      ";Z(A)
5220:CLS :GCURSOR
     Z+1:GPRINT 1
     27
5230:RETURN
```

Generate next label

```
5300:"NL":B=VAL
     RIGHT$ (F$,2
     )
5310:IF (B=99AND
     D$<>"N")OR (
     B=0AND D$="N
     ")LET T$="??
     ???":RETURN
5320:IF D$="N"LET
     B=B-1:GOTO "
     CT"
5330:B=B+1
5340:"CT":IF B<10
     LET T$=LEFT$
     (F$,3)+"0"+
     STR$ (B):
     RETURN
5350:T$=LEFT$ (F$
     ,3)+STR$ (B)
     :RETURN
```

Change leg direction

```
5400:"CH":C=C+180
     :D=-D:RETURN
```

Change traverse direction

```
5500:"LF":CLS :
     INPUT "Incre
     ment labels?
     (Y/N)";D$
5510:INPUT "Forwa
     rd data?(Y/N
     )";B$
5520:RETURN
```

Start new plot-plan

```
5600:"SP":
     GLCURSOR (F,
     -M-50):SORGN
5610:GLCURSOR (-1
     00,10):CSIZE
     1:LPRINT INT
     (X(J)+0.5);
     INT (Y(J)+0.
     5):GLCURSOR
     (0,0)
5620:F=1:P=P+1:P$
     (J)=CHR$ P:
     GOSUB "x":
     LPRINT " ";F
     $(L):F=0
5630:U=C+MD:IF U>
     360LET U=U-3
     60
5640:IF U<0LET U=
     U+360
5650:CSIZE 2:
     LPRINT U:O=C
     (L)
5660:M=ST*K*ABS (
     H):LINE (0,0
     )-(0,-M),LT,
     CL:XS=X(J):Y
     S=Y(J)
```

Annotate station

```
5700:"x":IF F=0
     LET P$(AT)=
     CHR$ P
5710:IF LB=0THEN
     RETURN
5720:RLINE -(2,2)
     -(-4,-4),0:
     RLINE -(4,0)
     ,9:RLINE -(-
     4,4),0:RLINE
     -(2,-2),9
5730:IF F=0THEN
     CSIZE 1:
     LPRINT VAL
     RIGHT$ (T$(L
     ),2)
5740:RETURN
```

Set scale

```
5800:"k":IF NC
     GOTO "S"
5810:TEXT :WAIT 0
     :USING :
     PRINT "Scale
      1:";SC;" ";
     :INPUT SC
5820:K=5000/SC
5830:COLOR CC:
     CSIZE 1:
     LPRINT "Scal
     e = 1:";:
     LPRINT TAB 9
     ;SC:RETURN
```

Start new plot-elevation

```
5900:"s":CC=CC+1:
     IF CC>3LET C
     C=0
5910:COLOR CC
5920:M2=M1+NK:M0=
     PC:GLCURSOR
     (0,M-150):
     SORGN :LINE
     (200*U,0)-(0
     ,0),0:M=0
5930:CSIZE 1:
     LPRINT USING
     "#####";PC+
     SGN (PC)*.5;
     M1
5940:USING :
     RETURN
6000:END
```

15

SCIENTIFIC WORK ON CAVING EXPEDITIONS

Dr P.L. Smart

Why do science?

Many countries now rightly expect something more than 'rape and plunder' exploration by visiting expeditions, and political permission many well depend on the utility of the work to be undertaken. On a wider basis the expansion of knowledge is generally recognised by society as a laudatory aim, and scientific studies may therefore provide justification for an expedition where the exploration element does not in itself provide sufficient rationale; we cannot all be off to find the underground Everest! Science may also bring prestige, raising the perceived level of the expedition from the grubbings of a peculiar fringe group (best known in the media for being rescued), to the meaningful studies of dedicated workers. Natural Science can be thankful for the popularisation that has arisen from programmes such as 'The World About Us'. On a more pragmatic note, a wider range of bodies may be approached for support if both exploration and scientific aims are included, the Ghar Parau (Scientific) and Sports Council (Sporting) awards being a case in point.

However, for many individuals, science on expeditions provides a worthwhile, satisfying and even exciting adjunct to exploration work. It will therefore be included in the expedition programme simply because of the interests of the expedition members. Most cavers have a certain curiosity about their caves; they want to know about the network and distribution of passage, or why certain bugs are found only in some caves. This interest will manifest itself in basic descriptive scientific work, while those with more specialist interests will pursue more advanced studies. Insights gained from such studies may also aid exploration, by indicating the proximity of surface entrances (biology), or the main routes in caves either fossil (geomorphology) or active (hydrology). Many expeditions will therefore opt to undertake some form of scientific study.

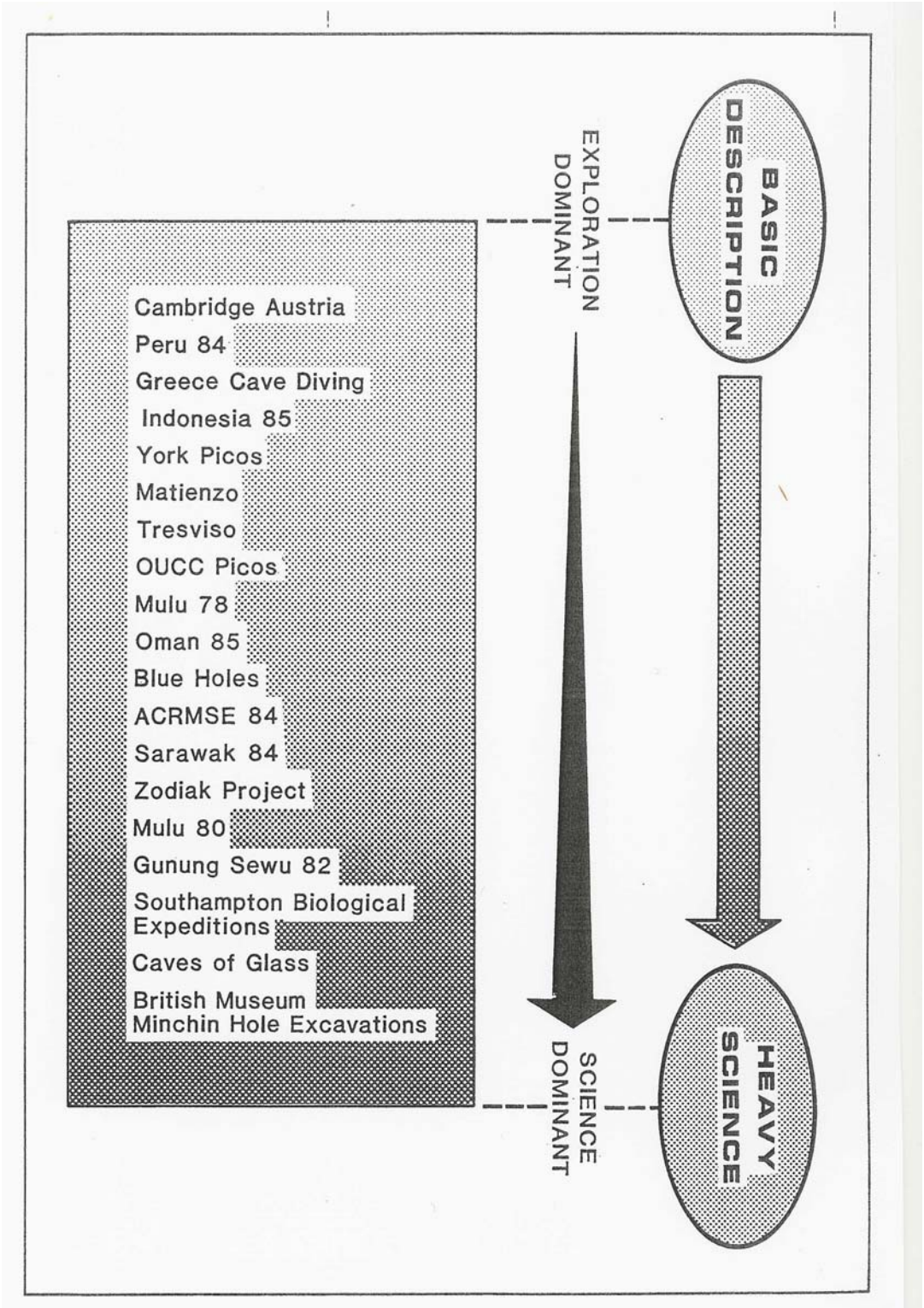
BASIC DESCRIPTION
EXPLORATION DOMINANT
Cambridge Austria
Peru 84
Greece Cave Diving
Indonesia 85
York Picos
Matienzo
Tresviso
OUCC Picos
Mulu 78
Oman 85
Blue Holes
ACRMSE 84
Sarawak 84
Zodiak Project
Mulu 80
Gunung Sewu 82
Southampton Biological Expeditions
Caves of Glass
British Museum Minchin Hole Excavations
SCIENCE DOMINANT
HEAVY SCIENCE

Fig 15.1

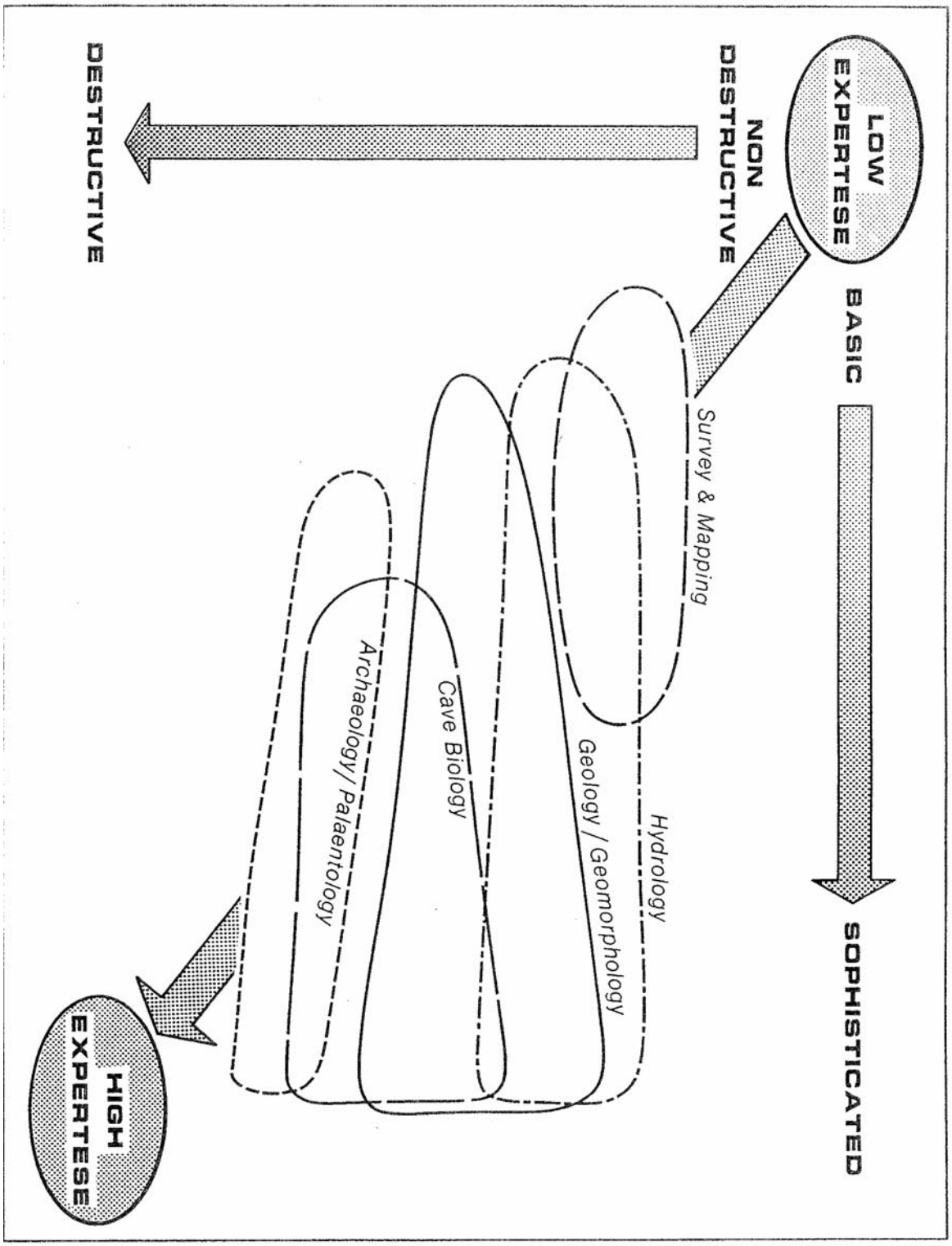
LOW EXPERTESE
BASIC
SOPHISTICATED
NON DESTRUCTIVE
DESTRUCTIVE
Survey & Mapping
Hydrology
Geology / Geomorphology
Cave Biology
Archaeology / Palaeontology
HIGH EXPERTESE

Fig 15.2

What can be done?

As indicated above, expedition science can cover the complete spectrum between basic descriptive work and very sophisticated experimental studies ('heavy science'). Figure l5.l shows the position of some recent British expeditions upon this continuum. Basic description provides the cornerstone for any scientific enquiry. Good quality survey and mapping, photographic recording and the publication of findings are essential, particularly in previously unvisited areas. Such work provides a useful inventory, of what is where, and requires only limited special effort. Even if exploration remains the main aim, all expeditions should include such basic descriptive work, indeed those that fail to do so would probably not get support.

In the central part of the spectrum, there is a variable mix of exploration and scientific work. The latter is often undertaken by individuals for their own interest and can range from specialised description (for instance the regional geology) and collection (cave fauna), to relatively advanced studies such as cave microclimate. The overall balance is therefore simply determined by the expedition personnel, a point considered further below. At the 'heavy science' end of the spectrum many of the expedition members will be professional scientists, who are completely committed to a full-time scientific project. The opportunities for exploration will therefore be limited, particularly as such expeditions will tend to visit areas where they can build on pre-existing basic descriptive work.

Whatever the type of study undertaken, it is imperative to record the results and findings in a suitable publication, be this expedition report, or erudite scientific journal.

Who should do it?

Poor quality scientific work is a waste of time and effort; an inaccurate survey is, for example, thoroughly misleading, and will eventually need to be repeated by others. There is therefore little point in attempting scientific work unless appropriate expertise is obtained. In the case of survey this is relatively easy, but for more sophisticated projects this may require considerable effort. Such projects should be avoided unless an acceptable degree of expertise is obtained, particularly as they can be destructive. In general, non-destructive sampling should be employed unless the information gained can justify removal; water sampling can, for instance, be undertaken freely, but collection of cave minerals can only be justified if detailed laboratory analysis leading to identification and explanation of their formation is undertaken. There is thus a complex interrelationship between the ability of the investigator, the topic of the research, the type of observation required, and the sensitivity of the subject of the analysis. Some research fields (Figure l5.2) are therefore almost exclusively the preserve of the professional scientists who has both the expertise and time to justify the degree of destruction necessary, archaeological excavation would clearly fall into this

category, while others are readily undertaken by those with only limited training egg. survey.

The above analysis does not by any means exclude the 'enthusiastic amateur'. Those that are sufficiently motivated will obtain the necessary expertise and attain the status of the expert. Indeed a high degree of motivation is essential for any expedition scientist if he is to have the necessary dedication to complete a project when faced with logistic, personal and other difficulties. This point is readily illustrated by considering dye tracing studies often undertaken on caving expeditions. These frequently fail because of waning enthusiasm for the drudge of replacing detectors at regular intervals, of ensuring that they are not lost and of adequately recording the relevant information, when faced with other more attractive alternatives. In such cases, the individual involved has often been volunteered for the task, and hence lacks the required motivation. The resulting study is rarely satisfactory, and represents a substantial waste of effort by all of those involved.

How To Make Science Work

The key to success is prior planning. It is necessary to formulate an interesting project appropriate to the area of study, personnel available and logistic difficulties anticipated.

In order to do this as much information as possible on the area and potential research topics should be obtained. You should familiarise yourself with the geography and character of the area, using maps, papers and information from previous visitors or local contacts. The latter generally prove difficult, but if correspondence is commenced well in advance, can be fruitful. If little information is available, it will generally be better to adopt a fairly basic research programme, but specific topics may still suggest themselves. These may then be predicated by what is logistically possible. Transport and access are particularly important here, plus the local availability of any specific analytical facilities needed. Where access is difficult, the emphasis must be on field description and observation with limited equipment. Where access is better, collection of samples for later analysis may prove possible, while in other areas well equipped field stations may permit quite complex studies to be planned.

During this planning stage, discussions should be held by all those carrying out scientific studies, to avoid duplication and overlap, identify areas of mutual interest and assistance, and ensure that no major omissions occur. It is also important for those individuals intending to undertake scientific studies to make clear the degree of logistic and manpower support they will require - are the other members really going to be prepared for routine caving trips to change dye tracing detectors when exploration continues elsewhere? This is particularly important in expeditions with dual exploration and scientific goals, and a realistic approach at this time can save much wasted effort and irritation at a later stage. A research design or plan should now be formulated, with

an indication of the personnel to be involved, their time, equipment and specific logistic requirements.

Before departure, it is imperative to adequately test the equipment and methods to be used. Frequently plans prove far too ambitious, and estimates of the difficulties and time involved prove hopelessly optimistic. Procedures should be tried out thoroughly under true field conditions, mud, wet and all. Substantial savings in field time can be achieved by prior preparation of sampling kits, and organisation of equipment. This should include provision for a self-repair capacity. Similarly it is often wise to be self-sufficient and take all necessary materials from the UK. Even if local materials may be available, these often prove time consuming to obtain, may be of dubious quality and are often not of the precise type or design required - this even applies to chisels for taking geological samples!

Finally, once in the field it is necessary to be flexible, change the research design to accommodate logistic problems and take advantage of the most important scientific opportunities. If everything could be anticipated in advance, science wouldn't be nearly such fun. Formal meetings are rarely required, but useful discussions generally ensue when workers meet in the field, and can often lead to new insight and new avenues of research. Mutual assistance also proves useful and prevents isolationism.

In Summary: If scientific work is worth doing,
it is worth doing properly, otherwise don't bother.

16

HYDROLOGY, GEOLOGY AND GEOMORPHOLOGY

Dr P.L. Smart

Hydrology

Basic hydrological work requires a minimum of specialist knowledge, and can often be carried out without too much special effort. Discharges may be simply measured using floats, timed along a length of stream of known cross-section, to give an overview of the inputs to the caves of the area, and temporal records may be obtained at frequently visited sites (such as rivers near base camp) by measuring water levels (stage). Simple observations on rainfall amount, duration and timing can also be obtained from routine diary style entries (see examples in Atea). If equipment is available, continuous records may be obtained, natural tracers, such as conductivity, used to assess the behaviour of the underground system (Smart 1984), and work on water quality undertaken (Waltham et al 1982). Generally such projects which require a specialist knowledge and considerable logistic effort, are only suitable for previously reconnoitered areas.

Many cavers have some prior experience of tracing underground water flows. The techniques involved (Friederich and Smart 1982, Quinlan 1977, Smart 1976) are generally robust and relatively simple, and many expeditions undertake this type of study (Oxford University Caving Club 1982, Friederich and Smart 1982, Waltham et al 1982). However, a high degree of organisation by a suitably motivated and responsible person, and close co-operation with other expedition members is needed to ensure satisfactory results. Many of the materials for tracing can be prepared prior to the expedition (pre-packing known weights of dye, manufacturing detectors, labelling bottles etc.), but it is not generally possible to obtain much prior information on the nature of the regional hydrology.

Many of the comments made above also refer to work on cave climate (Wigley and Brown 1976). During relatively short expeditions, quite sophisticated work can be undertaken with very basic equipment, and without detrimental effects on the cave environment (Atkinson et al 1983). Such studies may also be significant for work on the cave biology and cave mineral deposits.

Geology

Geology is essentially an observational science, and much basic work can often be undertaken during expeditions without the need for specialist equipment. Such work is very useful in explaining the regional relief and cavern development (Waltham 1981), and efforts should therefore be made to obtain information prior to departure. Possible sources include books reviewing the regional geology, information and maps from geological surveys (sometimes confidential) (see Bergquist et al 1981), and specialist papers in academic journals. The nomenclature in such sources is fierce, and generally some prior experience of the subject will be needed.

During the expedition, work on topics such as the geological factors controlling cavern development can often be carried out by observation during survey and exploration trips (Oxford University Caving Club 1982). Other cavers should be encouraged to mark geological information such as dip and strike, fault and joint orientation, and type of limestones to extend the data base. Geological mapping (Barnes 1981) generally requires more effort, involving excursions primarily for this purpose, but useful work can be accomplished (Lowe 1985, Webb 1982). In general, sampling will only be required if further more sophisticated study is anticipated. Those required for mineralogical identification of cave deposits (White 1976) are quite small, but much larger ones may be needed for thin section and other analysis with associated logistic difficulties. Care should be taken to check if a licence is needed for export of geological samples.

Geomorphology

Many cavers have an interest in the processes and sequence of both karst and cave development, and geomorphological studies are therefore popular on expeditions (Wood l971, Brook 1976, Waltham and Brook 1980, Waltham 1981, Smart 1984, Smart et al 1985). Much of the work can be undertaken during survey, but often it will be necessary to make special visits to ensure adequate coverage of the entire system. Little specialist equipment is needed, but it is essential to become familiar with the regional topography, drainage and geology prior to the expedition. Sources include Map Libraries such as that of the Royal Geographical Society, national topographic surveys, and map agencies such as Stanfords (l2-l4 Long Acre, London WC2E 9LP) and Geocenter (Internationales Landkartenhaus GMBH, Postfach 800830, D-7000 Stuttgart 80, West Germany). Information on the type of environment and the processes occurring should also be sought from text books and academic papers.

Modern process studies often require more equipment and specialist effort than historical studies, but can prove useful and interesting. The major problem is frequently one of limited field time, but measurements of static features (for instance scallops (Lauritzen et al 1983) and or short term process (for instance water chemistry, Laverty

1980) can be successful. Often such projects will be tackled by those already possessing the necessary expertise, otherwise information may be sought in handbooks and manuals by a person with an appropriate background (Picknett et al 1976, Goudie et al 1981). For instance an industrial chemist would be able to cope with work on karst water chemistry.

Cave deposits are important sources of information on Quaternary history and palaeoclimate. Cave sediments are particularly important, and whilst requiring some expertise in field interpretation, are generally present in large enough quantities that sampling does not present a problem. Entrance sediments, which frequently contain important archaeological and palaeontological remains should be treated cautiously. Excavation should not be undertaken, but samples of any material present should be carefully recorded and packaged, and lodged with a suitable authority. Some specialist equipment and techniques will be needed if laboratory analysis of sediments is to be undertaken (Noel and Bull 1982), but frequently field observations will prove sufficient. Dating of cave deposits by uranium series methods is a particularly exciting development, but speleothem samples should not be taken unless a prior arrangement for analysis has been made, and information on the preferred sample type obtained (Gascoyne 1984).

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17

CAVE BIOLOGY ON EXPEDITIONS

Philip Chapman

Introduction

Recent years have seen an annual lemming-like migration by British cavers bound for foreign parts, lured no doubt by the prospect of better weather and greater returns in metres of cave found for quantities of energy expended, almost anywhere beyond our rain-drenched shores. This has produced a kind of caving imperialism, with British groups laying claim to fruitful areas and returning time and again to extend "their" systems and impose their (English) names on newly-penetrated foreign passage. Biologists like myself, equally curious and impatient to unravel the mysteries of those caves, have explored with collection tube poised to snatch up any cave animal foolish enough to stray into view. Often the trip which failed to produce new cave produced instead an "New" creature, to be classified and later named (though less fancifully than the caves, and in Latin!).

Cave biology is still in its infancy. Many tropical cave faunas are wholly unknown and very few of even the best-known cave animals have been adequately studied. Though afflicted with the greatest density of cavers in the world, we are still pitifully ignorant of the life in British caves (e.g. see the "Cave Life" articles in "Caves and Caving" magazine, issues 14-22). There is therefore great scope for new discovery by biologists visiting caves anywhere in the world.

Animals which live only in caves are called "troglobites", while those which can live permanently in caves but which also occur in non-cave habitats are called "troglophiles". In practice, the detailed knowledge of distributions needed to make this detailed knowledge of distributions needed to make this distinction is available for only some of the species found in a few well-studied geographical areas. So these terms are of little use to the expedition cave biologist who will prefer to divide cave-dwelling animals into those which look cave-adapted ("troglomorphic" species) and those which look pretty much like their non-cave-dwelling relatives. These "non - troglomorphic" cavernicoles ("cavernicole" simply means "cave-dweller") may, or may not be troglobites. There is at present no suitable widely-used term for them, so I shall call

them simply "stygicoles" (animals which live in dark underground places) and will call the obviously cave-specialised animals "troglomorphs". Troglomorphs are simply a specialised sub-group of stygicoles.

It is the troglomorphs which are often of greatest interest to biologists and zoogeographers. They may be depigmented, eyeless, or have unusually long appendages, or specialised claws on their feet, or may retain juvenile features in the adult body. Many of their characteristics are specializations to a food-limited environment less apparent physiological characteristics fit them for life in perpetual darkness, or in a water-vapour-saturated atmosphere.

As a rule, tropical caves (particularly those which are used by large numbers of bats or birds) contain far more species of stygicoles in far greater concentrations than are ever found in temperate caves. On the other hand, the proportion of troglomorphs is much lower in tropical caves. Troglomorphs can be found in the remote parts of most temperate caves where there is food in the form of organically-rich silt or flood debris. The margins of the upstream ends of boulder-blocked sumps are a particularly rich hunting ground for terrestrial troglomorphs, while gently-flowing, lime-saturated streams and silt-floored gour pools are often rich in aquatic troglomorphs. The latter are well-represented in equivalent tropical cave habitats, but true "deep-cave" terrestrial habitats (saturated air humidity combined with intermittent poor food supply) are rarely met with in the tropics, so tropical terrestrial troglomorphs are infrequently seen. However, contrary to popular opinion they do exist and can be found, if searched for in the right places.

Why take an expedition biologist?

Most expeditions require funding. The more diverse an expedition's research programme, the more sources of funding it can tap. Scientist-members of the expedition can be charged a realistic rate per day for their time in the field (as opposed to the subsidized rate paid by members who cannot secure large grants) and can be urged to raise this money from specialized grant-awarding bodies. Their programme of work can be used to strengthen the expedition's case when seeking approval and/or funds from such bodies as the Royal Geographical Society, Ghar Parau Foundation, etc. Expedition reports are usually enlivened by the inclusion of a well-illustrated biological section and some exciting biological discoveries may improve the chances of securing a grant for a return visit to the same area.

How Not To Do It

A half-hearted study is worse than useless. If the biologist does no more than collect a few of the more spectacular cave-evolved animals for return to the U.K, he/she will not

be doing any service to cave biology. What is needed in uninvestigated cave regions is detailed, systematic studies of whole cave faunas and their relationship to the cave environment. No cave biologist will be keen to do this when someone else has already "picked the plums" of the cave fauna, leaving only lots of hard work with few exciting discoveries in prospect. Expeditions should by all means record interesting general observations of the cave life (e.g. see Stoddard, 1985:p60), but any expedition intent on collecting material should be systematic and thorough, or should leave such work to future investigators.

Pre-Expedition Preparation

As with all other aspects of expedition work, successful biological studies are invariably based on sound preparation. The following guidelines are offered:

Keep your project to realistic proportions, bearing in mind numbers of personnel and time in the field. Identify the important questions you should investigate and collect relevant published information.

At an early stage, seek out and discuss your plans with someone who has done similar work to that which you are planning. It may save you many hours of fruitless effort.

Only when you have a clear plan of study, worked out in detail, should you approach funding bodies.

Beg or borrow equipment where possible from a university department, the Royal Geographical Society, the BCRA equipment pool, or the manufacturer, but do not rely too much on sophisticated electronic or delicate precision apparatus. Such equipment has a very short working life in a cave!

Check whether you need to approach the relevant authorities in the country you intend to visit for a licence to export preserved specimens. In general you will need such permission to export vertebrates, but not cave invertebrates.

Think about the volume and weight of equipment/specimens. Take the minimum you will need and always plan to carry any valuable material as accompanied luggage. Freight can be delayed, lost or damaged in transit and should only include insured, replaceable items; never your irreplaceable biological collections.

Collecting And Publishing Data And The Need For Conservation

A dead animal is useful only to a specialist who can measure, describe and classify it. If an organism cannot be identified in the field, it may be collected, killed and preserved

for later study by a specialist. If the identity of an organism is known and if it can be measured, photographed and described in the field, it should be released unharmed after examination. There is no excuse whatsoever to over-collect rare or unknown animals in caves, nor to mistreat them or damage their living-space. Cave animals often have a very low population density and reproduce slowly and so are particularly vulnerable to over-collecting.

The techniques involved in capturing cave animals and estimating their populations are much the same as those employed in similar non-cave situations. The reader is advised to consult any competent general text on ecological methods, such as Southwood (1978). A concise, inexpensive guide to biological collecting on expeditions is available from the Royal Geographical Society's Expedition Advisory Centre, 1 Kensington Gore, London SW7 2AR (Hollis et al., 1977).

A dead specimen is useless unless it is accompanied by details of at least where, and preferably how it lived: its behaviour, food, numbers and habitat characteristics. Always keep a field notebook up to date. It is impossible to record too much information. On-the-spot written observations can often suddenly take on an importance years later which could not be foreseen at the time of writing.

Always try to publish the results of your study so that others can benefit from your experience. Your report should be concise, informative and should be prepared as quickly as possible.

Copies of expedition reports should always be sent to individuals and institutions who have supported the expedition, and especially to any biological institutions in the host country with whom contact has been made, and who will probably have very little information about their own caves. Apart from being polite, such action is essential to ensure the continued tolerance to, and support of, future visiting expeditions by the host country.

Killing And Preserving Specimens

Specialists will advise on how best to kill and preserve their particular group of animals. Killing should be done quickly, humanely and without damage to the specimen's tissues. The British Museum (Natural History) publish a series of detailed guidelines under the title "Instructions for Collectors". As a general rule, insects with wings should be dried thoroughly and preserved in air, pinned in boxes, or loose in an airtight container. Steps should be taken to guard dried specimens against attack by fungus and other insects. Everything apart from winged insects may be preserved in a suitable fluid, my preference being 80% ethanol with 5% glycerol added. Always include a detailed, pencil-written label inside each container with each specimen. Soft pencil shows up well after years and does not blur when immersed in preservatives. Labels on the

outside of a container are easily lost or erased, and the unlabelled specimen is then virtually useless.

Getting Names For Your Animals

This is a particular problem for expeditions visiting tropical caves. There are fewer and fewer specialists in the world working on an ever-increasing mountain of material from the tropics. Some groups of animals, such as arachnids and myriapods which are particularly common in tropical caves, are almost impossible to get identified. The collector should be prepared for delays of several years with such material. Other groups, such as mammals, fish, beetles or Crustacea can be done very quickly. There is a need for a registry of specialists who are prepared to accept cave material. Exotic material takes time for a specialist to identify and this costs money. If the material belongs to an undescribed species, it will take up more of a specialist's time and so will cost even more to classify and describe accurately for publication. Many institutions will waive the fee which they could justifiably charge for the work involved, in which case it is considered polite to offer them some specimens for their institution's collections even if they do not insist on this.

All developed countries and many developing countries will have a well-established national collection and do not take kindly to visiting foreigners who make off with valuable biological material and then publish results only on their own country's periodicals, in their own language. If there is a well-curated museum collection in the host country, WRITE AND OFFER THEM MATERIAL. Contact any relevant journals published in the host country and offer them an article.

If You Do Not Take A Biologist

There is life in the caves, even if the expedition has no biologist to point it out. Treat it with respect! The same conservation rules apply in foreign caves as in British caves. All rubbish should be removed from the cave, including spent carbide. Roosting bats or nesting birds must not be disturbed - they may be just as vulnerable as our own dwindling bat populations. In shallow caves, including lava caves, living tree roots may be the sole food source for cave animals - they should be treated as carefully as the most delicate speleothems. Finally, any caver can become aware of the life in the surrounding darkness of the cave. It does not require a head full of Latin names to appreciate the beauty of a perfectly-designed cave animal. Record what you see on film or in writing - you may have been the first person the set eyes on a wholly unknown creature!

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18

EXPEDITION ARCHAEOLOGY

Charlotte Roberts

Definitions

Archaeology is the study of man in the past by means of the material remains which he has left behind.

Anthropology is the study of human beings and their behaviour in the past.

Palaeontology is the study of prehistoric animals and plants of which remains are left in sedimentary rocks as fossils.

These notes deal with archaeology and anthropology not palaeontology. However, the same principles may be applied.

Outline

1. The importance of archaeological deposits in caves
2. The types of sites which expeditions abroad may expect to discover
3. Preparation and the procedures to follow if such deposits are found during reconnaissance and/or exploration of caves.

Archaeological Deposits In Caves

Caves: their use in the past - Caves have always attracted both man and animal, usually for the purposes of a temporary refuge. However, some French Upper Palaelolithic sites (approx. 20,000 BC) indicate occupation over considerably longer periods (Pierpoint 1984:8). They have had important functions for many societies in the past. Apart from occupation, man has used caves for shelter during hunting campaigns (often returning every season), for ritual purposes or to bury the dead. During man's stay he has contributed to the accumulation of sediment deposits within the cave. These sediments

now represent events that occurred during that period of time. He has directly imported material into the cave (pottery, flint, bone and metal objects or artefacts) which, once discarded, have been incorporated into the sediment sequence. He may also have indirectly transported plants or earth clinging to his clothes or feet into the cave (Schmid 1969:156).

Animals have also exploited this environment. Their remains can be interpreted in several ways - the end-result of a human meal, prey remains or simply natural death.

Sediments - Caves are efficient sediment traps. These preserved sediments make up the stratigraphy of the site and remain stable within a changing environment. Layers of rock or soil are the result of human or natural processes (Coles 1972:152):

Natural Processes - For example:

- ù decomposition of rock from cave roof, walls and floor
- ù still or running water
- ù wind blown material from outside the cave

Human Processes - For example:

- ù clearance of areas in the cave with subsequent use
- ù rubbish accumulation

Deposits are either derived in situ (autochthonous) from the cave structure itself or brought in from the exterior by human, animal or natural agencies (allochthonous).

The end result is the intermingling of deposits with subsequent disturbance by the same agencies. It is possible to distinguish these 'layers' of deposition by features such as colour and texture of the sediments. If archaeological material within the layers is considered and related to the sedimentary sequence, the pattern of events within the cave's history can be reconstructed in reverse order. Of course, not all events will be represented but it is this interpretive aspect which is vital to the understanding of archaeological sites in caves. As Shackley (1975:5) states, an archaeological sediment is, "a deposit which is directly or indirectly related to past human activity". By special laboratory methods the origins, method and environment of deposition with determination of intensity and type of post-depositional processes can be carried out (Shackley 1981:18).

Types Of Archaeological Cave Sites

The types of sites which attracted man for occupation (either temporary/permanent) are:

Rock Shelters - These sites were easily found by man as many were in obvious positions along the bases of limestone cliffs and scars. Occupation deposits are often found around the entrance areas but can extend as for back as the rear walls of the cave.

Limestone Shafts or Fissures - Evidence of man has also been found in shafts which open out on to the surface. Shafts such as these have often been the focus of ritual or religious deposits. In addition, animals have met their death by falling down these features (see Jenkinson 1982).

Deeper Deposits - An archaeological deposit may be present in the further recesses of a cave. In some instances ritual? religious activities have lead to the use of passages well beyond the entrance. Water may also have washed deposits further underground.

Cavers on expeditions should be cautious about exploration of any of these types of sites with regard to the potential of archaeological deposits. Another point to bear in mind is that even if the cave is wet inside now (static/running water) and not a suitable habitat, it may not have been so in the past.

The Expedition: Preparation, Discovery And Procedures

The consideration of archaeological deposits within caves will vary among expedition objectives. There are three types of expeditions with differing aims in which members may become involved (Judson and Champion 1981:68):

(i) To extend or explore a single known cave system or group of caves in close proximity

(ii) Reconnaissance of a little known area

(iii) For mainly scientific objectives

Cavers participating in expedition types (i) and (ii) are more likely to come across archaeological deposits by chance. If a team is entering a little known area it is essential to be prepared for any eventuality including archaeology. For expedition type (ii) if it is known that deposits could be encountered, it may be advisable to recruit a professional cave archaeologist to the scientific team.

The following notes mainly deal with expeditions of type (i) and (ii) with the assumption that expedition members have little or no knowledge of archaeology.

Preparation

Other Expeditions - Have any other expeditions (not necessarily caving) been to the area? Read their reports.

Museums and Archaeologists - Make enquiries about the possibility of finding archaeological deposits in caves of the area. Contact the main museum of the country concerned or I.C.O.M. headquarters (see Appendix 1). Aim to obtain relevant information about archaeological cave sites in the area. Emphasis should always be on co-operation with the archaeologists.

Local Taboos - Find out if there are any taboos on entering caves which contain archaeological deposits. For example, in Mulu, Sarawak, if sacred burial sites were disturbed in caves there was a penalty of death (Lyon 1983:154). Alternatively, some communities would be happy to encourage an expedition to disturb their ancestors as happened with the 1985 Indonesian expedition to Sumba (Hurd 1985:36).

Law - Ensure that expedition members are aware of the laws regarding archaeology for the country which you are visiting. In Britain many caves with archaeological deposits are scheduled as ancient monuments. Disturbance in these caves is against the law. As an example, Green (1984:19) notes that members of a speleological group dug into the back of Pont Newydd Cave, North Wales in the 1960's to extend their knowledge of the cave system. This was illegal as the site has been scheduled since July 1933. Certainly in the United States, as N.S.S News 1983 reported, "in most states it is illegal to....remove or disturb historic or prehistoric artifacts or bones..." (Middleton 1983:27). The same rules apply in Europe especially Greece.

Museum Visit - Members of expeditions likely to come into contact with archaeology would be advised to visit one of the major British museums. Observation of the types of objects likely to be encountered such as pottery, animal/human bone and flint implements will be invaluable.

Literature - Read some general literature on archaeology specifically Barker 1977, Coles 1972, Greene 1983, Megaw and Simpson 1979 and Watson 1968. Artefacts are often illustrated and it is worth becoming familiar with them.

Discovery and Procedures

It cannot be overemphasised that archaeological deposits in caves should be left untouched.

A responsible caver should have the same attitude to archaeological deposits as he/she does to speleothems. The risk of damaging the cave's history warrants a sensible and rational approach. Contact the nearest museum and in the meantime leave well alone.

Do not attempt to excavate any part of the deposits and even if objects are loose on the surface of the cave floor they should be left where they are. If they are removed from their stable environment they will soon start to deteriorate.

If the site is very remote and it is not possible to have an archaeologist present then it is acceptable to sketch a plan and/or section to scale of the exposed parts of the deposits and objects; photographs of the same would also be invaluable for future reference but on no account should anything be touched. A higher grade survey (BCRA Grade 5d) should be undertaken in passages and areas in the immediate vicinity of the deposits. The site may well be in an insignificant cave in a remote area so care should be taken to record the location of the cave as accurately as for a large cave system.

All data should be transferred to the nearest museum as soon as possible even if it is at the end of the expedition.

Concluding Remarks

The procedures outlined above are to be used only as 'first aid' measures when an archaelogist cannot be on site when needed. If the deposits are disturbed by an amateur the information will be lost forever. Cave archaeology is a multidisciplinary subject. Excavation should be left to cave archaeologists who are experienced in this specialist field of archaeology. Excavation is "...always destructive...an unrepeatable experiment..." (Barker 1977:11-12). For the very long prehistoric periods of man's history, excavation is our only source of information. Irresponsible destruction would be an unforgivable act. The potential information (climate, vegetation, diet, economy, technology...) retrievable from archaeological deposits is vast. For example, at Franchthi Cave, Greece excavations of an area 150m X 40m have shed light on the would prehistory of Greece after the discovery of successive layers of habitation from the Palaeolithic to Neolithic periods (Wilson 1975:210).

Cavers can be of immense help to archaeologists. Expeditions to remote areas of the world may reveal archaeological sites previously unknown and informing the right people may lead to the filling of a gap in the area's history. A final word of advice - be sensible, follow the preparation procedures and, above all, if you discover anything let a local archaeologist know and do not disturb the deposits. Use your common sense.

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Appendix 1 : Museums

Below are listed the major museums for countries of the world which have had or may have caving expeditions visiting them from this country. The data was taken from The World of Learning 1984-1985 35th Edition. Published by Europa Publications Ltd. It is worth consulting this publication in the reference part of any library. There are many local museums listed which may be nearer to your area.

AUSTRALIA

Australian Museum, 6-8 College Street, Sydney, NSW 2000 Tel:339811

Western Australian Museum, Francis Street, Perth, WA Tel:328-4411

AUSTRIA
Naturhistorisches Museum, A 1014, Vienna I, Burging 7

BELGIUM
Musees Royaux d'Art et d'Histoire, 10 Parc du Cinquantenaire, 1040 Brussels

BRAZIL
National Museum, Quinta da Boa Vista, Rio de Janeiro

BULGARIA
National Archaelogical Museum, Sofia, A. Stambolisky 2, Tel: 88-24-05

CANADA
Vancouver Museum and Planetarium, 1100 Chestnut Street, Vancouver,
BC VDJ 3J9

National Museum of Man, Metcalfe and Macleod Streets, Ottawa, KIA 0M8

Saskatchewan Museum of Natural History, Wascana Park, Regina, Saskatchewan

CHILE
Natural History Museum, Palacio de la Real Audiencia, Plaza de Armas, Casila 9764, Santiago

CHINA
National Museum of History, 49 Nan Hai Road, Taipei, China

CRETE
Archaeological Museum, Heraklion, Crete, Tel: 081-28-23-05

CUBA
National Museum, Animas enter Zulueta, Y Monserrate, Havana, Tel: 613915

CZECHOLOVAKIA
Prague National Museum, 11579 Prague 1, Central Building, Tr Vitezne ho unore 74, Prague

EGYPT
Egyptian National Museum, Midan-el-Tahrir, Kasr-el-Nil, Cairo

ECUADOR
Museo Antropologic, 'Antonio Santiana', Universided Central del Ecuador, Quito,

FRANCE
Museum of Man, Palais de Chaillot, Paris 75116, Tel: 553-70-60

GERMANY
Natural History Museum, DDR 1040, Berlin, Invalidenstr 43

GREECE
National Archaeological Museum, Odos, Patission 44, Athens, Tel: 8217724

HUNGARY
Hungarian National Museum, 1088 Budapest, Muzeum-Krt 14-16, Tel:360796

INDONESIA
National Museum, JI.Merdeka Barat 12, Jakarta Pusat

IRAN
Iran Bastan Museum, Khiaban-e-Iman, Khomeinin, 11364, Teheran

IRAQ
The Iraqui Museum, Salhiya Quarter, Baghdad West, Iraq

ISRAEL
Archaeological Museum, Rockefeller Building, East Jerusalem

ITALY
Museo Nazionale Romano, Piazza dei Cinquecento 79, 00185, Rome, Tel: 06-483617

JAPAN
Tokyo National Museum, 13-9 Veno Park, Daito-Ku, Tokyo 110

LIBYA
Department of Antiquities, Assarai el-Hamra, Tripoli, Libya

MEXICO
Museo de las Culturas, Calle de Moneda 13, 06060 Mexico DF

MOROCCO
Division des Musees, Ministere des Affaires Culturelles, Rue Gandhi, Rabat

NEPAL
National Museum of Nepal, Museum Road, Chhauni, Kathmamdu

NEW ZEALAND
Auckland Institute and Museum, Provate Bag, Auckland 1

NORWAY
University Museum of National Antiquities, Frederiksgate 2, Oslo 1

PAPUA NEW GUINEA
Papua New Guinea National Museum and Art Gallery, POB 5560, Boroko

PERU
Archaeological Museum, Avda Bolivar 155, Pueblolibre, Lima

PHILLIPINES
National Museum of the Phillipines POB 2659, Padre Burgos St., Manila 2801, Tel: 48-14-27

POLAND
State Archaeological Museum, 00-950, Warsaw 40, ul Dluga 52, Tel: 31-32-21

ROMANIA
Muzeul de Arta al RSR, Bucharest, Str. Stirbei Voda 1, Tel: 13-30-30

SPAIN
National Archaeolgical Museum, Serano 13, Madrid

SWITZERLAND
National Museum of Switzerland, Museum Str. 2, CH-8023, Zurich

TANSANIA
National Museum of Tanzania, POB 511, Dar es Sd-am

TURKEY
Museum of Anatolian Civilisation, Ankara

URUGUAY
Natural History Museum, Casa Rivea, Calle Rincon 437, Montevideo

RUSSIA
Anuchin D.A., Anthropoloigical Museum and Institute, Moscow State University, Pr Marxa 18

USA
National Museum of Natural History, Smithsonian Institution, Washington DC 20560, USA

Arizona State Museum, University of Arizona, Tucson, Arizona 85721, Tel: 621-6281

VENEZUELA
National Science Museum, Plaza Morelos, Los Caobos, Caracas 101

VIETNAM
History Museum, 1 Pham Ngu Lao, Hanoi

YEMEN
Department of Antiquities and Museum, POB 473, Ministry of Culture and Guidance, Aden

YUGOSLAVIA
Belgrade City Museum, 11000 Belgrade, Zmaj Jovina St 1., POB 87 Tel:637-945

I.C.O.M: International Council of Museums, Luis Monreal, Maison de l'Unesco, Rue Miollis 1, F-75732, Paris, Cedex 15, France, Tel: 734-05-00

It may be worth contacting ICOM. They will be able to pass archaeological queries on to the representative from the country your expedition is visiting.

It is also worth bearing in mind that some foreign caving organisations produce journals which are exchanged with BCRA publications. These journals will be in the BCRA library at Matlock. Addresses cited below are groups who have an interest in cave archaeology.

Comite Cubano Espeleologia, c/o Academia Ciencias Cuba, Istituto de Geografia, Calle ll NO 514 E/Dye, Vedada, La Habana, Cuba

Le Directeur, Laboratoire Souterrain, Moulis 09410, France

Greek Speleological Scociety, 11 Rue Mantzarou, Athens 135, Greece

Israel Cave Research Centre, Exchange Service Ofra, D.N. Harei, Jerusalem, 90.906, Israel

Museo Prehistoria/Arqueologia, Biblioteca, Excma, Diputacion Provincial, Santander, Spain

National Speleological Society, 1 Cave Avenue, Huntsville, Alabama 35810, U.S.A

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STILLS PHOTOGRAPHY ON EXPEDITIONS

Jerry Wooldridge

Photographic Needs Of An Expedition

(i) To record the expedition and its discoveries.

(ii) To produce photographs which may be of use to sponsors.

(iii) Uses of photographs: lectures, displays, publications.

It is vital to give thought to these needs in advance of leaving the country. Forward planning will allow the best choice of film stock amongst the team members; will allow sponsors requirements to be collated and specific individuals given responsibility for necessary shots; will maximise the breadth of coverage of the expedition's photographic record; will allow rationalisation of equipment and should reduce arguments after the expedition, about possible sale of photographs.

Film Stock

It is best to use the correct type of film for the job:
- if b/w photographs are needed for publication or display - use b/w film:
- if colour prints are needed for displays - use colour negative film:
- if colour pictures are needed for lectures and publications - use colour transparency film.

It is, of course, not always possible to shoot all three types of film, and in practice most people are likely to use only slide film. Improvements in printing from transparencies have occurred over recent years, so that very good colour display material can be produced without the use of colour negative film stock. Black and white prints can also be produced from slides but this necessitates re-photographing onto b/w negative film. This is never as good as shooting a b/w negative at the time.

In many ways colour negative is the ideal compromise as from the one negative it is possible to make transparencies (of excellent quality). (Colour slides can be made on Kodak 4111 film or Kodak 5072 35mm film - using C41 process). For reproduction purposes, with modern scanning techniques a colour print is just as good as a slide. (Some publications, however, are still not prepared to accept colour prints).

To shoot on colour negative only would not be economic as the cost of having lecture slides produced would be far too expensive. However it would make a great deal of sense for a particularly difficult caving trip where equipment would need to be kept to a minimum.

Film Speed

In general a fast film (200 or 400 ASA) is needed for underground use. There have been great advances in film technology in recent years and fast colour films produce very good results. All of the major film manufacturers now make very good fast films, however personal experience has shown the Fuji 400 ASA films to be very good indeed.

Surface photography does not normally need such a fast film, but in jungle terrain the light level will be found to be very low, and a fast film is essential.

Sponsor Photographs

Consideration should be given to the uses to which firms might wish to put photographs. This is of course very difficult to assess, but shots showing products in use may be useful for advertising purposes, shots for in house magazines (often general shots of the expedition and the caves, not specifically featuring products) are frequently popular. Black and white shots for press release purposes may well be needed. Consider prints for hanging in the managing director's office or reception area, or perhaps for displays at trade fairs.

It is obviously not possible to shoot lots of different shots on different film stocks for all sponsors, however a considerable amount does need to be done for major sponsors.

Camera Equipment

As it is highly desirable to be able to use different film stocks, a medium format camera (Bronica/Mamiya/Hassleblad) with interchangeable film backs, will offer very great advantages as well as extra quality.

Whatever equipment is to be used, it is most important there should be some back-up. Malfunctions may well occur a long way from service facilities and accidents do happen. It is worth taking a small tool kit - screw drivers which fit camera screws. It may even be possible to have a session with the service department of the importers of the particular camera in use, so that simple repairs might be attempted. (This is likely to be difficult to achieve but is worth a try). It would be very wise to have a thorough service done before the trip.
In damp conditions totally electronic cameras may well be more subject to problems than totally mechanical ones. If an electronic camera is to be used make sure that if the electronics do fail, the shutter may still be opened on the 'B' setting, so that pictures can at least be taken underground. Take spare camera batteries!

Care Of Equipment

The amount of protection needed underground will very much depend upon the caves themselves. An ammo box might be almost essential, or in some caves a padded camera bag may suffice. Regardless of protection against knocks, some protection against damp is necessary. Some sort of airtight container, preferably with a silica gel container is normally necessary.

Desiccator - normally silica gel - is particularly important in regions of high humidity, particularly the tropics. Film readily absorbs moisture from the atmosphere, swells up, jams the camera (35mm) and may also stick to itself. This will easily happen in what may seem to be a dry fossil system in the tropics if the camera is not stored in an airtight container with silica gel when not in use. Of course the silica gel must be in good condition and if not, it needs to be 'cooked'. Silica gel is blue when dry and pink when saturated. It can be dried out quite easily over a stove, preferably in something like a frying pan so that it can be moved about during drying. If it gets too hot it will go black and be useless.

Convenient containers can be made from 35mm film cassette (plastic) containers. Transparent ones are best, as it is easier to see the state of the desiccator. If some lids have holes punched in and some lids are kept intact, then it is easy to replace a saturated container with a fresh one by swapping lids.

To un-jam a 35mm camera, the camera back needs to be opened and the camera then placed in a container with silica gel for a while. When that section of film is dry it should be re-wound. Obviously this needs to be done in the dark; at night; underground or in a changing bag. Roll film (120 size) suffers less from this problem, firstly because with fewer exposures the film is likely to be in the camera for less time, secondly there is a paper backing which ensures that the film cannot stick to itself.

HEAT. Film - particularly exposed film - deteriorates in heat. Keep it out of direct sunlight as much as possible, store in as cool a place as possible, perhaps a cave! Use silica gel, particularly for storage of exposed film, in poly bags. Ensure that 35mm cassettes are stored with silica gel for a while before being returned to their plastic containers. Camera electronics can also suffer from excess heat.

FUNGUS. This will grow easily on film and on coatings of camera lenses in the tropics. Careful storage should prevent this happening, but lenses should be cleaned regularly, even if not being used, to prevent any fungal growth.

AIRPORTS

Carrying photographic equipment through airports in ammo boxes is likely to generate interest from security staff, and perhaps make them more awkward/thorough!

Security scans can be ultrasonic or low dosage X-ray. Both are 'film safe'. Ultrasonic is safe, but the X-ray effect is cumulative so could cause problems with repeated scans if a number of airports are passed through. X-ray proof film bags are available, but this is not practicable for enough film for a whole expedition.

Make it as easy as possible for security staff to see that you are carrying film and do not want it to pass through a scanning machine. Place all your film inside a large poly bag, perhaps take the film out of the boxes (Fuji 35mm is in transparent containers which helps - I have seen security staff insist on opening every Kodak container which are not transparent). Some staff may still insist that it is scanned, in which case there is not much you can do about it, but the more you can avoid the safer it is.

Lighting

As well as normal lighting for photographing caves, it may be necessary to take powerful lighting units for chambers and passages larger than normally found in British caves. Large bulbs are still available. These are made in Korea and imported by Keith Johnson with Pelling. The bulbs are Bowens M22B. The guide number is about 85 (metres) for 100 ASA film, making them equivalent to the old PF60's. (PF60 and PF100 bulbs are no longer made). These bulbs are excellent, very durable and have a very low failure rate, but they are expensive (around œ1.00 each). Flash units to fire them can be purchased but are expensive. A normal flash circuit fires them, and a car headlamp reflector provides a very even spread of light. The bulbs have an edison screw fitting, so screw type lamp holders will need to be acquired. With a little ingenuity a cheap flash unit can be made.

Slave units provide a convenient method of firing flashes which are remote from the camera. They are triggered by an electronic flash and set off the flash to which they are connected. Slave units can be purchased but these are likely to have a limited range underground. Specialist units are advertised in the caving press or may be constructed by the photographer using the data provided by Stuart France (1988).

An alternative to these bulbs are flash bars, available for Polaroid cameras. It is possible to obtain circuit board 'edge connectors' with the contacts correctly spaced for these flash bars. Thus it is reasonably easy to make a very compact unit which will fire all 5 bulbs on one side of the bar at once; the light output is similar to an M22B bulb. As the 5 bulbs on one side are connected in parallel, it is possible that they will not all fire. This is because the resistance of the bulbs may vary, and one bulb with a higher resistance than the others will not get sufficient current to fire it, so the correct output ought to be assumed to be somewhat less than might be expected. No reflector is required as there is an integral reflector with each bulb. These are very convenient as they are very compact. In the space taken up by one M22B bulb it would be possible to pack about 5 bars, each of which has two sides. However the spread of light is not as even as that of the large bulb.

The normal flash bulb now readily available is the AG3B, and guns to fire them are not at all easy to find. Nevertheless, they are likely to be the major light source available for expedition underground lighting.

Electronic flashes do have their place in expedition work, but be certain either that charging facilities will be available, or that a sufficient supply of batteries is available. These will, of course, need the usual protection against damp conditions.

Field Processing

A certain amount of processing in the field may be worth considering. Processing a few sample rolls of slide film can give a good idea how things are going. This is now quite an easy thing to do as kits of chemicals, which are very easy to use, are available (Phototechnology 3 bath Chrome Six). At the end of the Sarawak '84 expedition, it was possible to mount a slide lecture with slides processed on location. In the audience of about 200 were most of the expedition's local helpers as well as many other interested persons. This was a very valuable public relations exercise as well as a good 'thank you' to all our helpers.

Some black and white processing may also be valuable, provided that some way of producing prints can be sorted out (either local processing facilities or some sort of base camp enlarger). Prints may be of use for press purposes either locally or back home, and it is a real bit of one-upmanship to send your own postcards home.

Sponsorship

(i) The photographic side of an expedition is one for which it is difficult to get sponsorship, but it can be done. If unfamiliar equipment is acquired, it is most important to use it enough to get to know it thoroughly before going off to foreign parts.

(ii) Film: probably the most useful thing to try to get, is extremely difficult to obtain.

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CAVE CINEMATOGRAPHY ON EXPEDITIONS

Sid Perou

Introduction

When I look at what I said on this subject some years ago, I am reminded of the vast changes that are taking place in the world of film and television and in the technology of film making. Many of the things I wrote then remain relevant, but some things have made significant changes to the possibilities of expedition film making.

The invasion of ever more sophisticated video technology is promising to revolutionise cave film making, and every year brings improvements in the equipment available. Still in many respects film has much to offer. In particular, it can achieve much superior quality and handle a much wider contrast ratio than video tape. The choice, for a television orientated film, is often made by the television company, but the relative merits of each I will leave to discuss later.

Why make a film?

The decision to make a serious expedition film cannot be taken lightly. Whilst few members would deny that having a filmed record of their adventures would be nice, many will not have considered the full implications of such a decision.

Advantages Of A Film

There can be little doubt that television films recording the achievements of caving both at home and abroad, help to improve the public image and understanding of caving in general. Hopefully this pays off in a number of ways, not in the least when outside assistance and sponsorship are needed for further expeditions.

More directly, the possibility of a film, particularly a TV film, considerably enhances the attractiveness and prestige of an expedition to would be sponsors. Later, should a

follow up expedition be planned, the filmed record of earlier achievements will again prove to be an asset.

It is possible that a TV film may provide some direct income to an expedition but this is seldom as much as some may anticipate and cannot usually be considered a valid reason for having a film crew along. In very exceptional circumstances where a subject or story is particularly desired by one of the wealthier TV companies, this could change, but probably only at the cost of the expedition being almost completely film orientated.

Of course a fully fledged TV film is not the only possibility. A cheaply produced short film or video could be attractive to TV magazine programmes or local television news (even national news if something dramatic enough happened).

Using film in later lectures is another possibility, but it must be said, that in spite of the attractiveness of modern video camcorders, one big limitation of video is that the equipment required to show it to a large audience is expensive to hire.

Disadvantages Of A Film

A film doesn't "just happen" by having one or two film makers along waving cameras about while the expedition gets on with the task in hand. Getting good underground footage with sometimes complex lighting set-ups is often unavoidably slow, boring and labour intensive.

Film can provide a task requiring effort almost equal in many cases to the main aims of the expedition.

The degree to which this will detract from the overall achievements of the expedition, depends on the nature of the expedition, the film and on the relative size and strength of the expedition and film crew teams.

Remember - too little expedition involvement in the film can mean a bad film, while if the film uses too much expedition time; there may be few achievements to make a film about.

Many expedition members who are notably pro-film before the expedition, are often completely unprepared to put time and effort into the film during the expedition, when more attractive tasks are on offer. I have even known members who would have nothing to do with the filming on the trip, and then complain afterwards that they were not represented on the finished film.

Television Sponsorship

A professionally produced film or video TV documentary of 50 minutes duration can have a total cost of anything between œ30,000 and œl00,000 or even more; consequently, in the majority of cases a prior agreement with a TV company is almost certainly required.

Unfortunately caving is still not attractive to the majority of TV companies. The number of TV slots for "Adventure" type material is very limited and highly competitive. Television is becoming very cost conscious and the limited number of slots available for documentary material are chased by an ever growing number of independent film makers. The success rate is low. The independent company, of course, will lead you to believe that there is a good chance that they can get a TV commission, but many times the decision at the last moment, will be no.

The most promising situation by far comes when a programme slot is already available for a proposed or already existing series. The question then is how well does your project fit within the existing parameters of the series; in subject matter, in cost, and in time scale.

Basically a TV programme controller will be asking:

(a) Why will this programme be strikingly different from any other caving film I've seen before?

(b) Can I guarantee to have a good TV programme for my money and without unforeseen spiralling costs?

(c) Do the subject matter and expedition logistics lend themselves to practical film coverage?

(d) How does the cost, risk and potential programme material compare with other projects on offer?

(e) Have I got a programme slot for it?

The high technical standard of TV today mean that the days are gone when an amateur with a few hundred pounds worth of film gear could make a film and sell it to TV.

A TV company will usually only put a substantial amount of money into a film when it has the security of using its own TV crews or freelances with an established track record.

The pro's and cons of coping with the consequent film requirements during the expedition can only be weighed according to the individual contract. Where the TV company provides the finance, the international TV rights are normally retained by the TV company concerned, and a once and for all payment to the expedition is the most likely arrangement. A print for lecture purposes may be negotiable.

Making A Film Or Video Without Prior Sponsorship

Occasionally television expedition films have been made without TV money up front, with individual and/or the expedition financing the film with the hope of selling it later.

Attaining high standards on a limited budget is difficult enough, but it also must be said that even for a good film, a number of international TV sales will often be required to even cover costs.

However, the wide availability of domestic camcorders make the possibility of a non TV expedition video a real possibility. Many of the problems of 16mm are eliminated or at least reduced to a much more acceptable level and the costs come down to an acceptable level. Nevertheless, to produce something that is more than what amounts to a holiday video still requires a professional approach and commitment both from the film maker and from the expedition. The real costs of video come after the expedition when the original tapes are edited down to produce a presentable finished film. The more sophisticated the final product, then the more the time and cost required to produce it.

Film Or Video

A television company, particularly if the film is to be one of a series will have it's own ideas as to whether it wants the film shot on film, video or a mixture of both.

Where 16mm is chosen, the prime considerations are the quality of the image, the latitude and ability to handle the high contrast light conditions often met within a cave. Also film can be edited in a much more versatile and, many would argue, more creative way than video. It is also less affected by differing international television standards. As video standards improve, so does film stock. Film is faster, less grainy, more tolerant than it ever was, and a lot of television producers still choose to shoot on film.

The standard video format in television is Beta SP. The cameras are bigger, much more expensive, and more fragile than the equivalent film camera. As they are basically electronic, they are vulnerable to damp and dirt. However, a 30 minute roll of video stock costs around œ15 where 30 minutes of processed film would cost more like œ300.

Unfortunately, some of the savings on stock are lost due to the higher editing costs, so the overall cost is not vastly different be it film or video.

Nevertheless, video has several advantages over film. The sound is recorded on the same tape as the picture. There are no clapper boards so it is easy to run more quickly and less obtrusively than with film, and for 30 minutes at a time if need be. All this without needing to keep too much of an eye on the stock costs.

In addition, modern video cameras can give acceptable results even at very low light levels. This can be used to great advantage, but too low a light level can also lead to a deterioration of picture quality.

The quality of domestic camcorders is improving annually. With the higher quality formats Super VHS and Hi-8 it is possible to shoot underground footage with a domestic recorder with a quality that is acceptable to television. (Although for major programming material the normal TV standards would be expected for surface material). There are great advantages in terms of less light requirements, and greatly more compactness of equipment. The biggest advantage of all is the possibility of a much more spontaneous actuality filming style with logistics which interfere much less with normal caving progress.
Needless to say, there are pitfalls and difficulties which will be discussed later, but in the exploration and expedition fields I am becoming more sure the future lies with video rather than film. Unfortunately many television producers are still instinctively suspicious of what they regard as the 'amateur' formats.

Equipment Considerations

If a professional film or TV company is involved, it will provide its own equipment. However it must be remembered that most TV equipment is not designed for caving use and can be very heavy.

Consequently it can be tempting for an expedition to underestimate or considerably underplay the difficulties that the filming might present when an attractive film offer is at stake. This additional weight and volume of equipment can also mean complete rethinking of transport and carrying requirements.

If an outside company is not involved much of this still applies but the main equipment requirements are as follows:

16mm Cameras

The chief considerations in selecting a camera are as follows:
(a) Reliability and robustness under the required conditions. (Simple cameras are often more robust but offer less facilities).

(b) Lenses available. Lens requirements are wide aperture (F 1.8 or wider) to maximise on available lighting capacities and a good wide angle. (10mm or 12mm on l6mm camera or 5mm or 6mm on Super 8).

(c) Compactness and lightness. (As far as this does not conflict with other requirements).

(d) Quietness of operation and sound system requirements. (Mute stripe, sync pulse, crystal sync).

Sound With Film

Sound for a TV documentary is usually recorded on a high quality spool to spool tape recorder which uses a built in crystal controlled pulse generator to record a 50 hertz signal on the tape to maintain synchronisation between sound and picture. However this system will only hold sync in conjunction with a camera designed for sync sound work (with its speed accurately controlled by another crystal) and with all the trappings of clapper boards etc.

Small, high quality cassette recorders offer high quality and light weight at a reasonable cost. SONY produce an excellent professional cassette recorder which is available with a crystal syncroniser and which will fit easily into a small ammo box.
The new range of DAT sound recorders that record digitally are remarkable for their compactness and sound quality, but they are not easy to use under cave conditions as the controls are often fiddly and they are more complex than a standard tape recorder. However they have the advantage that they will hold sync with a crystal controlled camera without modification.

Intelligible speech underground is not easy to record. Background water noise and cave acoustics work together to make necessary very close microphone work to get good results. One trick is to use small lapel microphones fitted to the helmet brim. However trailing leads can then only be avoided by using radio microphones.

Directional microphones which work fine on the surface are less effective underground because of reflected sound from the cave walls.

Whatever the system, sound is as important as picture for a good film, and is often given too little consideration in the planning stage.

Video Cameras

Video equipment is changing and improving year by year so any direct advice is liable to be quickly updated.

There are several different tape formats and a wide range of cameras available. Some criteria are similar to those of a film camera, but there are some very specific requirements.

Lightness and compactness are a real asset underground, but holding steady and operating a small camera is infinitely harder than with a big one and all the automatic functions in the world won't turn a bad cameraman into a good one.

The zoom lens must be of good quality, but in particular, it must have a good wide angle range. Wide angle adaptors can be useful, but are not as good as a true wide angle on the camera.

The automatic focus control will be found to be almost unusable at times underground as low light levels and areas of darkness confuse it. An easily operated manual override is essential.

Video tape can, more easily than film, burn out the highlights if the peak brightness is too high. The result is often washed out faces. Automatic exposure cannot be expected to cope with harsh artificial lighting and large areas of black. Again the requirement is for a manual aperture override that is easily operated.

None of the cameras can have anything like the robustness of the film camera, but there is a saving factor. Splash housings can be purchased for some models at a modest price which give excellent protection against wet and dirt. However only limited controls are available outside the housing which means manual overrides are only available outside the housing. The problem then is that if the housing is opened up to make adjustments then damp enters and the result is almost always misting up of the lens port.
The light levels at which these cameras operate gets lower all the time. It is possible even to get results from the lights on the cavers helmets. However, generally the higher the light level, the better the picture quality. All cameras are still inclined to give vertical streaking from hot highlights such as the cavers lights at low light levels although this may be considered less important in circumstances where capturing the action is more important than technical quality.

At present there are the following tape formats:

Betacam (SP) - This is the normal professional standard at the present. The normal camera is big and heavy (15-20lbs). The tapes are the size of a normal Beta tape, but they only last 30 minutes. The camera is robust by normal standards but not by caving standards. Its basic cost is œ20,000 to œ30,000 and the normal hire fee is from œ250 to œ300 per day. It can be seen that the cost of the camera hire alone on an expedition is considerable. If then it goes wrong there it is very difficult to repair on location. It is therefore difficult to justify it's use in anything but the most easily accessible location underground.

VHS - This is the popular domestic standard for home video recorders, but the size of the tape makes the VHS cameras relatively large. The quality is adequate until it needs to be copied when it quickly deteriorates. It is therefore only suitable where the original tape is going to be shown directly via a domestic playback unit.

VHS-C - This is a smaller version of the VHS tape which puts a shorter tape (45 mins) in a smaller cassette. This makes for much more compact camera sizes, but the remarks on quality still apply. A mechanical adaptor enables the cassette to be played directly on a standard VHS machine.

SVHS - This is a better quality VHS system using higher grade tape and more sophisticated recording techniques. There are standard SVHS size tapes and SVHS-C size tapes as in the ordinary VHS system, the latter similarly allowing more compact camera design. This format has been in use for some time as a cheap form of television news gathering camera. The quality is therefore good (but nowhere near as good at Beta SP).

8mm - This is a format using a cassette size similar to those used for audio cassettes and with a quality about equal to VHS. However it is possible to get 90 minutes of recording on these small tapes. The cameras are compact but the tape needs copying before it can be shown on a standard player and this of course leads to quality loss.

Hi-8 - This is probably the best of the present formats for underground use. It is the 8mm equivalent of SVHS and most people believe the quality to be superior. With 90 minute tapes and an impressive quality from very small cameras it has a lot to offer. The sound also have the advantage of being digitally recorded thus being capable of excellent quality and low tape noise levels.

Sound On Video

Although most video cameras are fitted with built in microphones they can not perform miracles. The cameras are quiet and the microphones generally of good quality, but all the parameters that apply to film sound recording still apply. In general, sound on

camera is useful for sound effects and even for speech if the camera is close in and the acoustics are good, but with material shot on camcorders it is as often the sound that is a problem rather than the pictures. The problem is that the sound is often taken for granted and left uncommitted. Ideally a separate microphone should be used wherever necessary and all the sound monitored. It really requires a sound recordist, but at least then there is somebody who is primarily watching out for the sound quality. Incidentally, radio links are now available that will eliminate the microphone leads where mobility is important, but it does lead to monitoring problems.

Lighting

The most common questions are about lighting. Two types are available: battery lighting and generator powered mains lighting.

Battery lamps
The most usual basic lamp units are 250 watt quartz halogen bulbs in a professionally made reflector unit. I use the commonly used 24v 250w A1 223 projector bulb. This has the advantage of being directly replaceable by the 24v 150w A1 216 when light output can be sacrificed to give longer battery life.

Projector bulbs with a built in diachroic reflector have also been used to give simple, very compact, efficient lamp units, but the reflector gives uneven lighting and replacement bulbs are expensive.

I also use 4 x 24v, 250 watt bulbs of this type (A1) on a bar to give a very compact 1000 watt light for the occasional big shot. These are wired in two pairs and run from two standard batteries. The uneven lighting is countered by the multiple lamp units.

Bulbs with built-in multi-facet reflectors are becoming more widely available, giving a more even beam, but a little narrow for most purposes. However, the 12 volt 50 watt (M50) type of bulb is extremely useful for closeup work.

Lighting batteries
Three types of cell are suitable for lighting and are usually made up into 12v, 24v or 30v units.

A. *Lead acid 'wet' cells*
Although they are readily available, cheap and (in the short term) work well, these cells present constant problems of electrolyte spillage and subsequent corrosion of both equipment and in bad cases - personnel. Attempts to limit this must take account of gassing while on charge. An explosive mixture of oxygen and hydrogen is produced and if this is ignited by a spark while under pressure in a sealed ammo box the results are spectacular!

However, two 6v motorcycle batteries fit neatly into an ammo box and so offer a cheap, readily available power source.

B. *'Dry' lead acid cells*
Several types of sealed cell are available and all are suitable. Drying out of the electrolyte under the high discharge currents was a problem with older types. However, now a new type manufactured by 'Cyclon' batteries can handle very heavy discharge currents and, unlike other lead acid batteries they do not suffer from being left discharged for long periods. Nevertheless they are damaged by excessive discharge, and need more careful charging than other lead acids or nicads, but they are less than half the price of equivalent nicads and they work well in practice.

C. *Nicads*
The 7 ampere-hour nicad cell is the standard cell. It is used in professional battery lighting packs. Smaller capacities don't cope well with the high discharge rate. While reliable and simple to charge, nicads have the disadvantage of high cost.

Generators and mains lighting
Occasionally it is possible to work with one or more mains generators with mains filming lights. This has the advantage of providing high light levels for a long period, but lights on stands can lead to static, uninteresting and artificial looking lighting - only suitable for some film situations. Also, generator noise can make sound recording impossible and if long cables are used some system of countering the voltage drop in the cable must be used.

Charging
A problem arises that after a filming session, camera batteries, sound batteries and lighting batteries will need recharging.

In civilised areas mains electricity may be available, in others a generator may be the only possibility.

Generator charging presents its own problems. Most generators are noisy and only run 6 hours or so on one tank of fuel. Efficiency demands that everything is charged at once, so one charger is required for every cell. (or specially designed multi-chargers).

Problems also arise when, after a days surface filming, only a camera battery (requiring a few milliamps of power for 10 or 12 hours) requires charging.

Video lighting
Video lighting techniques are little different to film techniques other than the fact that video tape having less latitude than film is more prone to burning out highlights. The result is that less harsh lighting is required and I have found that the use of more diffuse reflectors and some diffusing material in front of the lamp makes lighting less critical.

Some of the lights made commercially for video cameras are very good and not too expensive, but many are too low light output and too small a battery capacity to be of much use.

Care Of Equipment

Camera and equipment care in most climates is a question of common sense, and no different in basis to the requirements of stills equipment.

In cold conditions care should be taken that all equipment will still function at low temperatures. If in doubt a few tests in a cold store will save problems later. Batteries are a problem in the cold, particularly nicads.

Mud and wet underground are common to all climates and always create problems for technical equipment. The usual answers apply - watertight containers, drying cloths, tissues and care.

A neoprene home-made 'wet suit' gives useful protection to camera, recorder and many other items, particularly as putting gear back into containers for every change of location is often not practical.

Silica gel drying is often less straightforward in practice than in theory, as the equipment is often too wet for the chemical to absorb a useful amount of water in a reasonable time. The size of the equipment is also a problem to keep the amount of silica gel within reason. Individually sealed polythene bags are useful to restrict the volume of air contained.

Where lenses or other vulnerable items are a problem, silica gel dust can also become a problem if the chemical is not carefully packaged.

In the tropics all damp and wet problems are multiplied by the high humidity. Any electrical contacts (other than gold or platinum) will corrode. Silicone sprays will help but won't stop corrosion completely.

Removing batteries where possible will stop electrolytic action while equipment is not in use.

In prolonged damp, lenses are liable to fungus growth and crystallisation between lens surfaces.

There are no solutions - only compromise; in difficult conditions some problems with equipment have to be anticipated and catered for with spares and back-up systems.

Film Stock

Care of film stock gives its own problems.

If film gets hot the grain size after processing will increase considerably. As cave films use the fastest film stocks and the shots have large areas of black, this will be particularly noticeable.

A cave may be the coolest storage place, but watch out for floods! If possible get the film out to somewhere with a fridge. Modern x-ray machines, at airports, shouldn't effect film to a noticeable degree but beware - in some countries the machines are not modern.

The Film

Having got the equipment, solved the logistics, got the budget, did you have time to think much about the film?

The technical problems of filming in caves are a major subject in themselves.

Video seems to solve some of these problems, but the danger is that as the stock costs are low, the discipline having to be selective goes out of the window. Too much undisciplined footage can be a big headache when it comes to editing.

Even with a good cutting ratio (the total film shot compared to the finished film length) the choice of what few hours of the expedition you choose to record on film is a difficult one.

Whichever you use, be it Cine Photography or Video Photography the end result has the same criteria. It is not just about taking moving still pictures, it is about using the language of film to tell a story.

Most cave films fall down in two areas - bad film construction and lack of a story. The skill is to choose those elements of the expedition as it evolves which will, back in the editing room, give you the classic elements of a story from introduction to climax and ending. It's not an easy task.

21

CAVE DIVING

Robert Palmer

Introduction

Cave diving is increasingly being used as an expeditionary tool, both to penetrate further in vadose cave systems that end prematurely in a sump (e.g. Gouffre Berger, Cueva del Agua, Huautla), and in the exploration of phreatic systems that are expected to lie underwater for their entire extent (e.g. Blue Holes). For the purposes of this chapter the two will be treated separately. As in the USA, diving at the end of vadose systems will be termed "sump-diving", and the exploration of entirely submerged systems will be termed "cave-diving". There are significant differences in technique and approach to each type.

Approach

The first question to ask when planning a caving expedition to a system which may end in a sump is: do we want to pass the sump? The second question is why, the third, how.

Diving the terminal sump in a deep and difficult cave system demands a lot, not only of the diver, but also of the rest of the team. Psychologically, the focus of the expedition is suddenly on one or two individuals, and this itself can cause problems in a group in which the effort and rewards of exploration had previously been more equally shared. Whilst the exploration of the cave should come first, people's motives for being there differ, and it should be clearly decided before the expedition takes the field that the full team weight will be flung behind the diver in such a situation. This gives people time to adjust to the idea. If any team members feel strongly otherwise at an early stage, readjust plans accordingly, or exclude them.

Having decided a plan for a diving contingency, commitment to that should be honest and complete. Given that it needs an expedition approach to get to the bottom of your cave anyway, any attempt at passing a "terminal" sump should be seriously undertaken,

and not just a gesture made with a mask and the smallest of tanks. This requires a commitment on the part of the diver and a sensible choice of support team to start with.

A minimum plan for a lightweight attack on a sump at the end of a deep cave system might be to take one diver with gear, 2 x 30cu.ft. tanks and l00m of line to the site to allow a decent exploratory dive to be made. Then the expedition will at least be aware of: a) how long and deep the sump is; b) what sort of approach will be needed to pass it, if feasible; or c) that it doesn't go, anyway. Equipment for such an attempt could be carried by 2-3 people in addition to those needed to tackle the cave. Difficult caves or long distances may demand more people if gear is heavy (ie. larger tanks used).

Once a cave sump has been passed, logistical problems become even more difficult. Putting 2-3 divers beyond a medium length sump (l00-250m long) and providing them with enough equipment to explore safely beyond, survey, and possibly camp, or pass further sumps, is a very serious commitment. Decide whether the infrastructure of your expedition is going to be able to cope with that. Such exploration is really the aim of an expedition in itself.

Sump divers undertaking exploration dives in an expedition situation must have considerable experience in such exploration in difficult conditions in their home country, otherwise they are wasting their own and the expedition's time. It takes a lot of effort to get a diver to the end of a deep cave system, and it is not really the place for developing egos. Make it efficient and effective!

Finally, make sure that the support team is good, too. All gear taken in must be taken out of the cave (vis. Pearce's tanks at the bottom of the Berger, that littered the place for years), ideally on the same trip; it is too easy to avoid going back for gear later on. Diving gear is relatively delicate, and the team must be capable of getting it down and out without damaging it. Much of this may seem obvious, but only if you already know it!

Diving

Cave diving involves the exploration of a completely flooded cave system for its own intrinsic sake, without the expectation of reaching and exploring dry passages beyond, although the exploration of any such passages may be a secondary aim. Cave types included in this category are marine caves (e.g. Blue Holes), major springs (e.g. Florida) or cave resurgences. The emphasis in such exploration will be on long distance diving, often in excess of those depths normally encountered in sump-diving. Experience, equipment and attitude should reflect these conditions, and again it is a considerable advantage to have prior experience in long-distance cave diving in the home country, and of deep-diving, starting in open water. Experience in decompression diving and buddy-diving is an additional asset; the large underwater caves encountered on such

expeditions are often suitable for pair-diving, and there is no reason for this not to take place. Often it makes work more effective, and the dive safer.

In marine caves, other skills are essential. Generally such sites are accessible only by boat, so experience in boat handling, coastal navigation and outboard motors and their maintenance is advisable. Be aware of the effects tides have, both inside and outside the caves.

Other than the degree of commitment, the major differences in long-distance or deep cave diving are in equipment and experience. Equipment is discussed later, and experience cannot be gained from just reading textbooks.

Equipment

Personal diving gear for a sump diving project will probably be similar to standard sump diving equipment in the home country. Size and weight of gear is often a problem when a hard caving trip lies before the sump. Resist the temptation to skimp on safety, and take a small spares and tool kit. Ensure that a spare regulator, mask, fins etc. are taken out with the expedition, and are available at the surface. Minor repairs can be undertaken on site, but it would be sad to have to abandon the project simply because a single item of equipment is lost or irreparably damaged.

For a cave-diving expedition, where stage-diving may be anticipated (the use of spare tanks deposited down the passage to increase penetration potential), equipment needs to expand accordingly. Regulators for stage tanks should be of the same quality as those on the main tanks worn by the diver.

Clothing

The choice of wet or dry-suit will depend on several factors; accessibility of site, water temperature and expected in water duration. Long and/or deep dives will probably necessitate use of a drysuit, for its thermal qualities on decompression if nothing else. Even in tropical waters, long decompressions can become hypothermic, and in colder European waters, a drysuit would be essential in such situations. The choice between membrane-type (Viking, Typhoon, etc.) and foam-neoprene (Unisuit, etc.) is often personal, and may also be dictated by site accessibility. Even in sump diving, if the water is very cold, or if the dive is expected to be long and deep, a membrane suit may well be an advantage. It should be remembered that in long decompression stops, a membrane suit is only as good as its underwear; use good quality thermal suits underneath. Alternatively, a wet/dry suit may be used in cold waters with short decompression schedules.

In warmer waters, or for short dives, a wetsuit is probably best. Even for short dives in the warmest waters, a full, one-piece 3mm wetsuit provides better abrasion resistance than skin to rock and corals.

Compressors

Any expedition with a serious cave-diving or sump-diving content would be well advised to take their own compressor. The larger the expedition, the larger the compressor needed, or number of compressors needed. For a sump diving project with 2-3 divers, a 3cfm (cubic/foot/minute) portable compressor would be adequate. For one involving 4 or more divers, perhaps with 80 to l00cu ft tanks, at least l x 7cfm compressor should be taken per 6 divers. Otherwise the machine would be working overtime, and may well fail after the first couple of weeks unless excellently maintained. Take a full spares kit, and get a course in maintenance of your particular unit before you go.

Don't rely on "known" sources of air in a foreign country unless they are l00% reliable. Air is often the most difficult thing to get hold of abroad, especially away from major diving areas. You may well need a BSAC or CMAS card to get tanks filled abroad, as well.

Laying

Line type is partially dictated by cave conditions. In big, clear caves with little or no current flow, the US/European-style 2mm line is quite adequate, especially as more can be got onto a manageable reel, and exploration tends to be faster in such caves. This line needs practice, though. It must be laid tautly and with greater care than thick line. An entanglement in thin line can be more serious than thick, and the diver is more likely to need to cut him or herself free. Practise in a swimming pool.

In caves with low visibility, strong currents, cold water or constricted passages, thick line (6mm) is safer. It is easier to feel, easier generally to untangle, and is considerably more abrasion-resistant. Light blue or yellow are probably the most visible colours to work with. Floating line has distinct advantages in caves with mobile sediment banks.

Lines can be tagged in several ways. Thin line is generally knotted at 5m intervals before being wound on the reel, and duct tape arrows (Fig 21.1) or clothes-pegs are used to indicate direction at line junctions. Arrows and pegs must always point to, or be on, the side of the junction nearest the entrance. Arrows can be used every l00m or so as a direction indicator in case the diver becomes disorientated. Thicker line is generally tagged with insulation tape, spliced through the strands if the line is hawser-laid. On Blue Holes expeditions, we colour-tag with yellow and black tapes. Yellow tags are nearest the entrance, black towards the inner cave (Fig 2l.1).

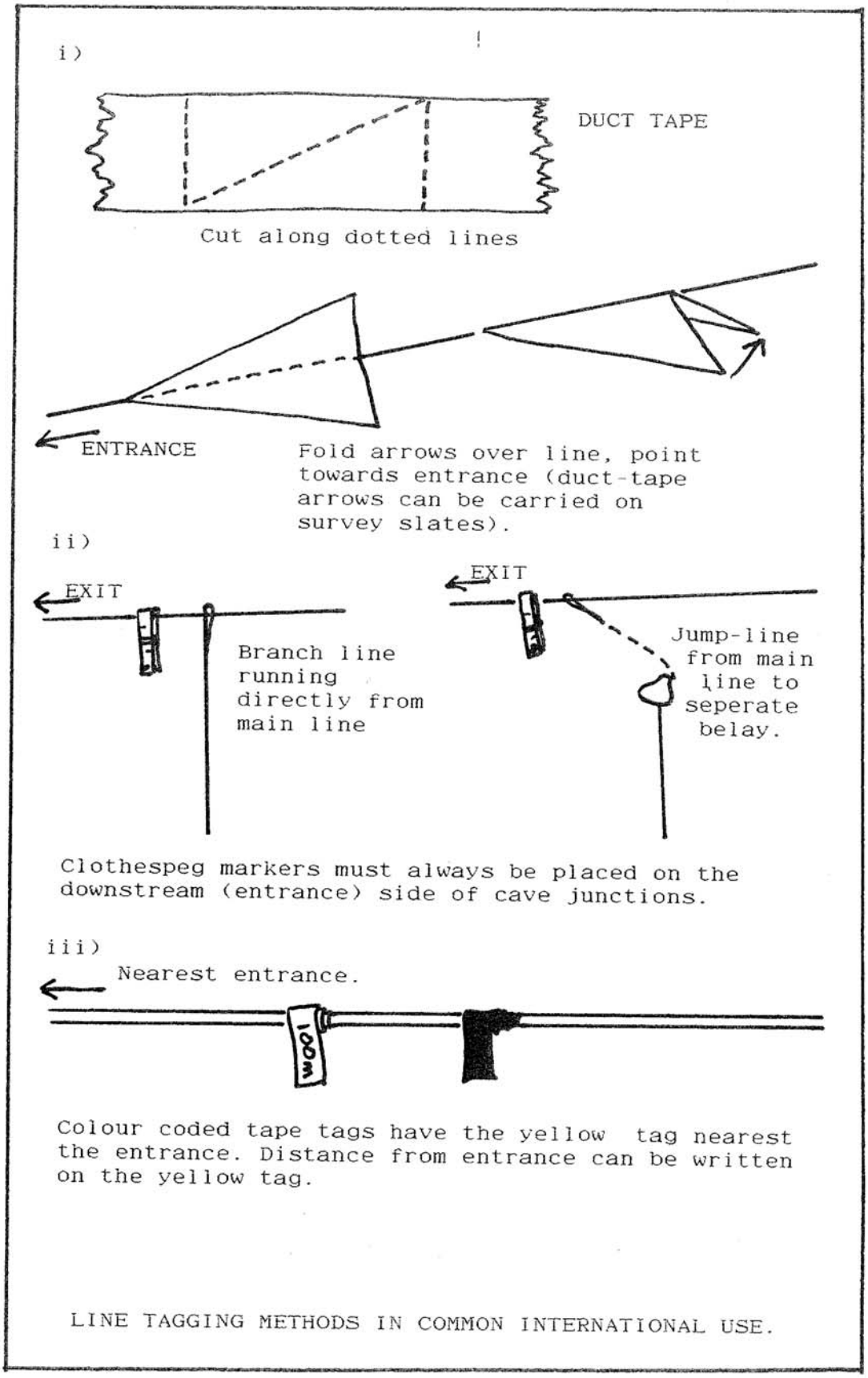
i)
DUCT TAPE
Cut along dotted lines
ENTRANCE
Fold arrows over line, point towards entrance (duct-tape arrows can be carried on survey slates).
ii)
EXIT
Branch line running directly from main line
EXIT
Jump-line from main line to seperate belay.
Clothespeg markers must always be placed on the downstream (entrance) side of cave junctions.
iii)
Nearest entrance.
100m
Colour coded tape tags have the yellow tag nearest the entrance. Distance from entrance can be written on the yellow tag.
LINE TAGGING METHODS IN COMMON INTERNATIONAL USE.

Fig 21.1

Use of a small "jump-reel" or safety reel is important, where exploration, survey or photography may be carried out off the main line. A small reel with 20-30m of thin line not only makes it easier to find the main line if parted from it in low visibility, but can be used to branch off the main line for short distances to check out leads or cross chambers.

Lighting

For sump-diving in freshwater, the standard helmet-mounted torches and cell of British sump-diving is adequate (e.g. 2 x Aquaflashes + caving cell). With fresh batteries on each dive, they are suitable for exploration use beyond the sump, in the event of a successful dive.

For large caves, or long and clear sumps, lighting should be more efficient; helmet torches should use a quartz-iodine or halogen bulb for brighter beam, though this is generally at the expense of duration. The use of a larger 25-50 watt unit, with a waist or tank mounted battery, is highly recommended, and the torch-unit should be hand-held to avoid loss of vision through backscatter. The boundaries of the cave passage can be more easily seen, and exploration is therefore more efficient, the brighter light also being a considerable psychological boost.

Prime (ie. non-rechargeable) alkaline batteries undoubtedly last longer, but the use of rechargeable batteries on a lengthy expedition can be an asset if mains power or reliable generators for recharging are available. This can cut down considerably on bulk and cost of equipment. A few boxes of prime batteries should be taken for emergency use. Short-duration expeditions to remote sites may find prime batteries more useful, but the temptation to use batteries until they are exhausted should be avoided.

Rechargeable batteries are only as good as their charger, so take a good, variable output charger that allows you to charge Ni-Cad batteries at their rated specifications (ie. l.24V, 500/ah "AA" cells need 50ma; 4ah "D" cells need 400ma, each for l4 hours). Don't just rely on a cheap "fits any battery" unit. You won't get the best, or a full charge, from your batteries.

Repairs

Experience has shown that several basic items are invaluable for keeping diving expeditions going. In addition to a basic tool kit, regulator, compressor and generator spares (diving gear spares and tool kit are well outlined in "Scuba Equipment Maintenance" by Farley and Royer), pack two or three large rolls of 2" duct tape (good quality), stainless steel jubilee clips (available by the roll), inner tubes, electrician's plastic tie-pulls and a roll of 1" nylon webbing. PVC pipe is extremely useful for a variety of do-it-yourself items, but can often be obtained locally, even in third-world countries.

Diving Medicine

If diving is to be an integral part of your expedition try and take a doctor trained in diving medicine. If that isn't possible, get your medical officer to discuss the programme with one. There are several health problems connected with diving that can arise (not including the more dramatic ones, like decompression sickness or embolism), so be aware of their existence. Things that bite and sting in the water hurt .... know what these will be in your expedition area. Be well-versed in life-saving techniques if marine diving is anticipated.

Decompression

Ideally, avoid the necessity for decompression diving, especially in remote locations. Even small "bends" can cripple or kill if treatment is much delayed. If you must plan for decompression diving, know exactly where the nearest local facilities are (with two or three backup chambers, in case the nearest is unoperational), and know exactly how to get to them fast, in case of an incident. Make sure that the chamber you have chosen can cope with recompressing the victim to allow for the depth he or she has been diving to; many chambers, especially those in remote locations, may not be rated for the deeper recompression needed for extremely long or deep dives. Victims can, in extreme cases, find themselves several hundred miles from the nearest facility that can cope with their particular problem, and will suffer accordingly for their lack of planning.

There are ways of keeping decompression victims in the best possible shape during transit, involving the use of oxygen and intravenous drips, but this should only be done under medical supervision. Take a trained diving medic on any expedition involving decompression diving. To do otherwise is foolhardy.

Note that when undertaking decompression diving, the normal third of the air supply left in the cave-diver's tanks for emergency use should NOT be regarded as being available for decompression. A spare tank, containing at least 2 times the anticipated air needed for decompression stops should be placed at the -9m stop. Oxygen can be used at -6m and -3m, but times should be as for air decompression. Before oxygen is used, the diver must be familiar with the physiological problems posed by its use.

Diving Science

On a cave or sump diving expedition, a tremendous amount of basic and valuable scientific data can be gained with a little extra work, in what is generally an environment inaccessible to scientists. It is worth discussing the possibility of making basic collections of cave fauna, or doing some basic geological notation as part of a survey programme. In most cases, the additional knowledge this adds to the overall

picture of the cave environment is so great as to be worth the minute amount of extra effort involved. The diver doesn't have to be any sort of scientist to do this, and it certainly increases his or her awareness of the underwater cave environment in general. Discuss appropriate techniques with someone in advance. The author would be happy to advise on this point.

Conservation

The phreatic zone of caves is often one of the most important areas of the cave in wildlife terms. Cave divers and sump divers can do an immense amount of damage to an underwater cave ecosystem by careless movement or thoughtless exploration. Caves are delicate places, surprisingly enough, and underwater caves even more so. The use of an ABLJ, and experience in fine buoyancy control is essential .... stay clear from solid surfaces when possible, and swim carefully over sediments. Such good technique will not only be good for the cave, but also makes the dive safer.... sediment is less likely to be put into suspension in the water. Move slowly; there is no need for excess swimming speed. The chapter on "Silt" in Exley's "Basic Cave Diving" is recommended reading.

In marine caves, or other caves in which speleothems have formed during lower water conditions, such formations may have re-crystallised, and can be extremely fragile. They can be broken by water movements created by a diver passing too closely, and certainly by being swum into. Try and avoid using delicate ones for belays!

Underwater caves are home for many rare and unstudied aquatic animals. Take care. If you are not concerned about the cave environment you are swimming through, you frankly have no business being in it.

Politics

Every country has its own rules, whether you agree with them or not. If you are cave diving or sump diving abroad, be aware of those that concern caving and diving. Diving politics are often more delicate then caving politics; in Greece or Spain, for example, two countries that regularly feature in the caving expedition scene, diving expeditions may have to fulfil additional requirements. If you break the rules, you will just be making it more difficult for those coming after you, and you will justifiably lose support for future ventures of your own. Contact local cave diving organisations where possible. Play the ambassador and make social and sporting contacts. In many countries, (e.g. France, U.S.A.) cave diving is treated in a much more professional manner than it often is in the UK, so be professional in your own approach.

Getting air from local dive shops abroad may need the production of a BS-AC or CMAS card .... check with the BS-AC in London on national diving regulations for the country you intend to visit.

On Return

It may be unnecessary to say so, but thank your sponsors, especially any from the diving world. Cave diving expeditions have a very good reputation to date, fostered by cave divers over the last decade. Don't abuse the privilege of this foundation work; set a good example to the next generation of cave diving expeditionaries.

Finally, never be afraid to ask for advice from those who have cave dived on expeditions before. We'll be only too happy to give it!

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22

SMALL TEAM AND SELF-RESCUE

Paul Ramsden

These notes are intended to cover the main rescue considerations facing an expedition caving in a remote area, especially if there is no efficient rescue team nearby. The consequences of an accident are more serious than normal. There is a need for self-sufficiency both at the level of the expedition and of each caving group. This has certain implications or requirements:

Expedition Requirements

A Stretcher
The expedition should seriously consider taking a stretcher in case someone has an accident and cannot be moved safely in any other way. Robinson (1969) covers stretcher evacuation in theory, though membership and practice with a cave rescue team would be helpful. Lighter versions of the traditional stretcher have been made (e.g. Marbach in France). Brian Boardman, Hon Sec of the Cave Rescue Council is a good contact as prototype stretchers are often made by individual rescue teams and not commercially available. The SKED drag stretcher is light and suitable for expedition use, also a canvas hammock with pole sleeves on all four edges makes a good improvised stretcher.

Medical supplies, with or without a doctor
See Section 23 and Lyons (1984)

THE CAVING GROUP CONSIDERATIONS (in no particular order)

Party size
Generally, solo exploration (as opposed to following regular routes) should be avoided. It could be difficult to find someone who has had an accident, especially in a relatively unexplored area, without another person to fetch assistance. The more traditional view

suggests three as a minimum number: one to stay with the injured person, especially if unconscious and one to go for assistance.

Emergency equipment
This will depend very much on the length of trip and distance from base.

First Aid - such as a wound dressing, strapping plaster and a bandage (many other items can be improvised)

Writing Equipment - to send a message or leave markers.

Spare Food

Spare Lighting - in case of delays

Survival Bag - for each individual as protection against hypothermia in unexpected waiting (Frankland 1984, Ramsden 1984) or accident.

One or two Lightweight Pulleys - of the type that can be put into the middle of a rope, can reduce friction and enable rescue to be carried out using just the personal S.R.T. equipment normally available.

Knife - to cut rebelays, victim's rope etc. as this may be the quickest way to resolve the situation.

Training
Cavers have a responsibility to each other to prepare themselves for an emergency situation.

Basic First Aid - may mean the difference between life and death. Lyons (1984) 'A Mountain First Aid Course' is likely to be the most relevant type commonly available.

Rescue Techniques - practised by the one or two cavers at the scene of an accident can be life saving. Good intentions are not enough, prior training is essential if effective help is to be given. You must be reasonably sure of the outcome of any action taken, otherwise you may find yourself in trouble and only make a bad situation worse.

The Rescue

Primary aim
The primary aim is to make the victim safe and give First Aid.

Assess the situation
Your action will depend on the circumstances. It may be that you need to move the victim before First Aid can be satisfactorily given e.g. loose rocks, deep or falling water or the victim is immobilized mid-rope.

Rescue with victim stuck mid-rope
It is necessary to get the victim off the rope quickly and safely. There may be problems breathing, bleeding or with falling water, even a good harness will cause constriction, so unless they are removed in 15-20 minutes further problems will be caused.

The choices are either haul them up or lower them down. (Ramsden 1983, Marbach 1980, Elliot 1983, Meredith 1980, Montgomery 1977). This may be done from the pitch head or from mid-rope. Pitch-head hauling has the advantage of being safer, but is slow and strenuous so is unlikely to be the preferred choice unless they are near the top.

Lowering is normally only possible with an extra rope. A mid-rope lower is possible, using rope pulled up from below, providing it is longer than the pitch length. Intermediate belays cause problems for both hauling and lowering without an extra rope.

Generally the quickest solution will be to get them to the bottom, even if this means lowering the victim further into the cave. Hauling an unconscious person is a dubious course of action. First Aid suggests putting them in the recovery position.

If you have a spare rope, the least strenuous and therefore easiest option available is likely to involve attaching the spare rope and cutting the victim's rope, then lowering them. This may be done from the pitch head, or mid-rope which allows intermediate belays to be passed. This is a fairly drastic measure but is worth consideration.

Without a spare rope, another quick option is to climb or reverse prussik to the victim, assess the situation, unfasten his ascenders and abseil off with him. A non-strenuous way of passing intermediate belays on the way down is to use two descenders. One descender is locked off immediately below the anchor. The rescuer with attached victim abseils down and clips onto the lower descender, before releasing the upper one. It may be judged acceptable to simply remove an intermediate belay, where there is only a glancing rub-point.

Towing him upwards is slow and strenuous. Once the victim is out of immediate danger you are in a better position to give first aid and plan the next stage of the rescue. Circumstances will dictate your course of action: what are the injuries? How many people are available? Is a stretcher required? You may decide to move the victim or that you need extra assistance.

Assuming the victim is off the rope at the base of the pitch, it is now much easier to set up an effective hauling system, borrowing gear as necessary.

Recommended hauling systems

One of the least strenuous hauling systems with only one rescuer is a form of counterbalance with a pulley jammer at the pitch head, with a separate safety/hauling line to the victim as a useful addition. This system allows hauling from the pitch head, or next to the victim, giving First Aid en route (Martinez 1979).

An easier system is a two to one counterbalance. If there are two people, hauling with a mechanical advantage may be easier.

General points

When an accident happens it is easy to get flustered and make an unfortunate hasty decision. The only way to become proficient with rescue techniques is practise. Take a short time to think through the sequence of what to do before you begin the rescue. It may be that you need to remove intermediate belays or borrow gear from the victim. If you need to remove your body jammer from the central maillon in an exposed place, it is better to detach the jammer, refastening it with a karabiner, so that it can be removed without unfastening the harness.

One of the commonest problems with mid-rope rescue is getting a confused tangle of gear in the central maillon. Be meticulous about the way gear is attached to the maillon. It is probably worthwhile removing all attachments to the right hand side of a 'croll' body jammer, which could prevent the cam being opened during a strenuous move.

A 'stop' self-locking descender can be used as a type of jamming pulley (Elliot 1982). Handled-jammers are particularly useful for hauling. Getting the victim off the top of a pitch is usually awkward, high belay points will facilitate this. Hauling up several pitches almost vertically above one another or a pitch with intermediate belays, may be dealt with by running the hauling rope through a series of pulleys at each ledge. Each pulley is tied off on a sling with an Italian Hitch, so that it can be released as the victim/stretcher approaches.

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23

EXPLORATION MEDICINE

Dr Jon Buchan

Introduction

However good the equipment, however extensive the caves, if half the expedition is sick or injured not much exploration will be done. Anyone who is laid up for any reason will be frustrated, bored and not a little angry with themselves for having been so stupid as to become ill when what they really wanted to be was at the peak of fitness. Their mood may be contagious and affect adversely the other members of the team. Any measure to prevent this happening is worth taking.

Keeping an expedition at work can be hard work. Someone has to do it and the sooner that someone can be singled out the better. They will have plenty to do. If the team includes a doctor they will be responsible. Make sure they know what you expect, then make sure they do it. Doctors are no more immune to "last minute-itis" than anyone else. Remember that any doctor who is prepared to forgo, perhaps for an extended period, the chosen profession of healing the sick and being God's right hand person in order to go caving somewhere is probably flawed in some respect. There is enough in medicine to occupy an ambitious person full-time all the time. There are plenty of Knighthoods in medicine but, so far, not in caving. Perhaps your doctor, if you have one, is not absolutely certain of being a medical maestro. If you have no doctor, delegate the task to someone else. They are likely to have to try to learn a lot, so pick someone who is studious and conscientious. Much of the work will need to be done before the departure so give the person plenty of warning if you can.

They will need to set about acquiring skill in the following subjects: geography; physiology; nutrition; medicine; psychology.

Geography
Assuming someone in the expedition knows where it is going, what sort of place will it be? Locations vary from nude sun-bathing beaches to high glacier valleys. The climate can vary from hot and wet to desperately cold and wet and that is just above ground. It may be remote, it will almost certainly be steep and there may be special features which

make it difficult for a team to stay healthy, for example mud. The easiest way to find out is to ask someone who has been there to tell you what it is like. Previous expeditions may have written reports which could be helpful, (this is not guaranteed). There are not just caving expeditions and the other types may give useful information. Stick to the sober factual accounts. Some expeditions want to sell the book and they publish horror stories which emphasize the 'lucky to be alive' aspects of the trip.

Physiology

Once you know the terrain it is as well to learn something about the human body's reaction to the likely conditions if only to dispel some of the myths. It was once thought, for example, that in a hot climate the suns rays would penetrate the skull, irradiate the brain and cause sun-stroke. The same was held to be true of the spine. The pith helmet was designed to prevent this catastrophe and men were cashiered for not wearing a shirt. Why a cotton shirt should be more effective than 2 or 3 milometers of skin at keeping out the sun no-one seems to have explained. The truth is that sun-stroke was really heat exhaustion. This occurs when heat output exceeds the body's cooling capacity, usually due to lack of water. Wearing a hat, pith or otherwise makes matters worse [1].

Cold is a particular problem for cavers and should be studied in great detail by reference to the excellent literature in the subject [2].

Nutrition [3]

This is really the province of the food officer but the person in charge of health must be interested too. An expedition runs on muscle power and muscles are fuelled by food [4]. If nutrition is inadequate fatigue, cramps, weakness and other undesirable things can happen. The antidote is calories or, to be up-to-date, MegaJoules. The units really do not matter as long as there are lots of them. They can be in any form but fat has the most calories per gram [5]. Never mind the balanced diet. Unless the expedition is inordinately long no-one is going to get deficiency diseases. The food officer would have been lynched long ago if the expedition had had to live exclusively on polished rice which is the diet which produces pellegra, beri-beri and the other horrors of malnutrition.

Medicine

Qualified medical practitioners take years to graduate and years to acquire some practical knowledge and skills. Many of them find that 90% of the time they can do a perfectly good job knowing what could be written on this page. The rest of the knowledge and experience is strictly for the other 10%. Starting with young, fit, healthy adults the risk of meeting anything that falls within that 10% is very small and the rest can be mastered. There is a saying in medicine that commonest things are commonest. These are just the things that you are likely to have experienced beforehand and to know about and these are what you are likely to meet. Be of good cheer.

Psychology
This is really a matter for the expedition leader as much as anyone but the medical person may be involved. The first essential is to pick the right team. Unfortunately that is like trying to pick the right parents. By the time you find out what they are really like it is far too late. Once you are in some remote corner of the globe you have to live with the personality clashes. If these are serious someone has to act as 'honest broker' and it may fall to the medical officer, amateur or professional, to do the job. Of course the medic may well be the one who is impossible in which case someone else will have to sort him or her out. On the whole the remedy for stroppiness is sheer fatigue. That means lots of work, climbing, caving, surveying, detackling etc. and that, in turn, means a fit team. Not just physically fit in the sense of being in training but without illness or injury and keen and willing to go.

Preparation

Let us suppose that you have been selected as expedition medic, (perhaps you volunteered?) What do you have to do?

Information
Gather as much information as possible about terrain, climate, flora and local inhabitants - human and otherwise. If there have been no previous expeditions it could mean time spent in the local library. If there have been previous expeditions go and talk to someone who was there, preferably the medical officer, but anyone will do.

Known hazards
If there are health hazards try to find out what they are and how to protect against them. Health hazards means everything from sea-sickness crossing the channel or travellers diarrhoea from the first stopover to frost bite, hypothermia, histoplasmosis and rabies.

Prevention
If there are injections to have, make sure you know what they are and ensure that everyone is given the list. The usual ones are:

Cholera;
Typhoid (monovalent or TAB);
Tetanus;
Polio;
Hepatitis.

Hepatitis

This is a complex disease with several variants and manifestations. For expedition purposes there are two types, A and B.

Hepatitis A This is a water or food borne infection. It spreads when human excrement gets onto or into human food or drink.

Prevention in the field: Drink only uncontaminated water, eat only uncontaminated food and you will not catch it.

Hepatitis B This is transmitted when infected blood or other bodily fluids are introduced into your bloodstream. Normally your blood is sealed inside your blood vessels. An infection will only get in, therefore, if those normally intact vessels are breached and infected material introduced. Where does the infection come from? Either directly from an infected person or from their stored blood tissue or fluids.
Prevention in the field: Stay away from people who are infected with hepatitis B. Do not allow their blood or other body materials to be introduced into your bloodstream. Normally this should be easy unless one of the team is infected. Most unlikely.

The biggest risk is from a blood transfusion with contaminated blood. A young fit person who needs transfusing has done some serious bleeding. That probably means a life threatening accident. You may be where a bottle of blood could be infected but it would seem unreasonable to insist on dying now on the off chance that the treatment might eventually kill you.

Prophylaxis. There are two approaches to protecting against virus infections.

1. Trick the body into believing it is infected when it is not thereby stimulating a defence response which will be in place for the real thing.

2. Find someone who has had the infection and survived. Their blood is rich in anti-virus protein. Those proteins injected into someone else will, as long as they last, retain their anti virus properties. That may be about 3 months.

Both approaches are available for both types of hepatitis. The tried and trusted way is method 2. The effect starts to wane immediately and farewell parties have been interrupted by travellers being hauled off to have needles stuck into uncomfortable places in the interests of protection for the longest possible time.

Method 1 is comparatively recent, is better established for hepatitis B than A and requires careful planning and forethought. For frequent travellers it is the method of choice so look out for an opportunity to discuss the possibilities with an expert. If he or she recommends it, do it.

Acquired Immune Deficiency Syndrome (AIDS)

With one notable exception AIDS is the same as hepatitis B. The difference is that there is no prophylaxis for AIDS. All you can do is to take the precautions listed in

'Prevention in the field' for hepatitis B. Hepatitis is much more infectious than AIDS and, logically, is more to be feared.

You may be travelling to an area where there is Yellow Fever, Plague, Rabies, Encephalitis, Aids or any other condition which your research tells you is likely to be present. Some of the vaccines may be available free of charge as part of the public health policy of protecting travellers to certain areas. The public health laboratory service will only issue free rabies vaccine to those who run a definite risk of contracting the disease because they are handling wild animals in an area where rabies is endemic. A mention of caving and bats is usually enough to qualify.

Tablets

If there are tablets to take get the best advice you can. Malaria is, of course, the major problem [7]. The malaria parasite is extremely cunning. It acquires resistance very easily and the prophylactic drugs are fairly toxic. Doubling the dose of the tablets can stop the malaria parasite but it can also kill the traveller. People who live there may tell you they never bother. They may not tell you that they have air-conditioned homes, offices and cars. Where you are going there will not be much aircon, but perhaps many mosquitoes. For political reasons foreign embassies in this country like to tell you there is no malaria back home. The remarks about air-conditioning also apply to embassy staff. It can be very confusing. Get as many opinions as you can and take the one from the most trustworthy source. The only useful tablet is the one that is swallowed, and the only way to persuade healthy people to swallow nasty tablets is for them to believe absolutely in the value of what they are doing. That can only come from your confidence in your recommendation [8].

Risk Analysis - Low Risk High Stakes.

There are some conditions for which prophylaxis is available, which are potentially lethal but which are so rare as to make the risk almost negligible. If the chances are so low is it worth the expense and inconvenience of having the prophylaxis? Malaria, for example is highly lethal to Europeans but it is transmitted by mosquitos. If there are no mosquitos there is no risk of malaria and the tablets are unnecessary. Can you guarantee that there will be no mosquitos? Of course not there are no guarantees but you need to try to assess the risk.

If the chances of being bitten are less than the chances of being killed by the tablets it is probably better to risk the disease. The problem is how do you know which is better? The medical advice should be unequivocal. Conditions which are lethal but preventable should be prevented and the expedition advised accordingly. It is for individuals to decide for themselves in the light of their own experience and knowledge. The task for the medical person is to acquire and disseminate the best information possible so that the team has as good a foundation as it can get for the decision. A problem could arise

when, having ignored the advice, the worst does happen and there is bailing out to be done.

These issues need to be discussed as part of the preparation for the trip. Not to do so is unfair to person who has to do the bailing.

Dental treatment
Bully everyone into going to the dentist. Tell them that you intend to borrow a set of dental forceps and that you will simply pull out any tooth that hurts. That should encourage them to have proper treatment.

Equipment
Assemble the medical equipment. Start at the beginning with the known health hazards. Then work through your own experience of accidents. You may have been lucky enough not to have been involved in any caving accidents but everyone has had cuts and bruises. Remember commonest things are commonest. A cut and bruise are the same whatever exotic location you happen to be in, above or below ground. What did you do? How did you cope? What did you use? Would you have liked something to be available that wasn't? Can you get some? Can it form part of the equipment? Should everyone have his own or should there be just some for the expedition? Start with the things you are familiar with and think you would be confident using. Start with Paracetomol and Band Aid if necessary. Go on through crepe bandages and slings. Now check your list against one of those prepared by the expert expedition medical men [9,10,11]. Yours may be different, shorter perhaps, but there is nothing worse than being in the field trying to deal with a crisis only to find that you are faced with an array of bits and pieces that you do not know how to use.

Are there any particular problems you can imagine arising but which you do not know how to tackle? Back to the library [12,13] or you could go and talk to your friendly neighbourhood GP. You are going to have to go the surgery to arrange your injections, so why not make an appointment to discuss things. You have a 50/50 chance that they will be interested in what you are doing. If they are, cultivate the contact, they can help you. If not you can always change your doctor.

By comparing your own ideas on equipment with the published lists you can get some impression of what you want. Have you any money? Normally you will have to do what the rest of us do and beg. Start with the expedition equipment pool, or with someone who has just come back from somewhere. Beware. Drugs go out of date quite quickly and a few weeks in some caver's sack does no good at all to dressings and bandages. Look carefully at it all.

Try your GP. They will almost certainly have cupboards full of free samples that they were always intending to send to the third world but never got round to it. Make sure they do not load a boxful of miscellaneous junk on to you. Have your list ready, check

that the stuff is what you want and check the dates very carefully. If you do not want it leave it. Never throw unwanted drugs in the bin. It is the doctor's problem to dispose of it.

Next, the local pharmacist. It is surprising what you can get without prescription if you have money. Begging is less easy but you may have the necessary charm and powers of persuasion. At least you should be able to get them to give you a nearly up-to-date copy of MIMS [14]. That contains the addresses of all the drug manufacturers in a list at the back.

Drug companies receive hundreds of requests each year from various people. They seem to have specific budgets for promotional activities including sponsorship of expeditions. Once they reach the cash limit they stop. Fortunately most items you want are made by more than one company so provided you leave enough time you can go from one to the other.

Quantities depend on what you intend to do. For example a standard treatment course is 4 tablets a day for 5 days. If each person is to have one course that is 200 tablets for a 10 person team. On the other hand it is unlikely that all 10 persons in a team will go down with the same illness. If half of them catch it that is only 5 courses of treatment and this may be enough if you can guarantee that a central cache of pills will be accessible. In that case half the number of tablets would do. It depends, of course, on what the treatment is for, how likely people are to catch it and whether or not your team will be together or dispersed. Once you start giving a supply of tablets to each person it is amazing how many you need. The same applies to dressings and bandages.

Evacuation

Plan your escape routes [9]. The transport officer will know what vehicles are going where and what arrangements can be made to ship someone out. It is the medical officer's responsibility to know where the casualty is going and what arrangements need to be made beforehand for the treatment once there. Is everyone insured? Do you need form E111? Has everyone got one? Is there a hospital which would be prepared to take your wounded? Where is it? Does it charge? Will the insurance cover the charges?

These things are not at all easy to find out from the United Kingdom. Someone who has been to the expedition area will know. It does not have to be an expeditionary. Someone who has lived there will have the information, particularly if they had children. There is nothing like having young children for pressing the local medical services into action. The team medic should make it a high priority job to visit the local medical services as he goes through. They should do it even if it means missing part of the initial welcoming dinner.

Contact with GP's

If you believe that the team members should make special preparations it is courteous to write to their General Practitioners. Explain who you are, what you think should be done and why. Get your colleagues to see doctors and get them to check that they have no unusual allergies, rare diseases or hypersensitivities. The GPs record may be plastered with red writing saying, "allergic to Thingymycin". They found this out when the explorer was a baby. They may know nothing about it but you may have been given free samples of "Thingymycin" which were left over from an advertising campaign last year. You need to know if it is likely to kill one of your team.

People do go on expeditions bearing secret ailments. There is nothing you can do about it. Unless you are a doctor the GP will not tell you and not necessarily even them. It is much more of a problem on commercial treks but it has happened on serious expeditions. If things go wrong do what you can. If you are the expedition medic you will have to cope even if it means staying behind or travelling back to base. Caring for the sick can be a chore.

If something of the sort does happen, do write to the relevant General Practitioner for information. They may not care but you cannot be blamed for that.

Local people

If you are lucky enough to be going to a remote area there is the problem of the indigenes. It may be remote to you but it is home to them. If you visit them at home carrying supplies of things that they perceive might be useful to them you must have thought carefully about what your response is going to be to the considerable demands that may be made upon you. Ivan Illich [16] and Thomas McKeown [17] were probably right when they said that nutrition, sanitation and restriction of family size are what keeps people well. On the other hand, those who have not read Illich and McKeown seem to feel that medicines will do them good.

The main things is to do no harm. The odd tablet of this and that will not deplete your stocks and is unlikely to trigger massive resistance or severe reactions in those who take them. Be courteous and humble. Whatever you do the problems will still be there when you have gone.

In The Field

What are you going to do out there? In a perfect world the team will have been chosen carefully and will comprise only perfectly fit and well motivated, well adjusted men and/or women. They will be physically strong, wonderfully courageous but inherently careful. All will be so confident of their own ability that there will be no need to compete or show off. There will be perfect co-operation so that the boring jobs are done

as well as the exciting ones simply because everyone realizes that everything must be done. What need will there be for medical attention with a team like that?

Not everyone leaves home fit. There is such a lot to do planning and packing that it is very easy to be vulnerable to infections and accidents just around departure. The team leaves tired. Three or four days spent travelling take their toll. What with sitting about waiting for transport, wrangling with beaurocracy and spending nights lying on the floor here and there, the first few days can be very testing particularly if it is a short expedition and there is pressure to get started. Make sure you travel with some equipment to hand. It can be very frustrating to have someone with a blister and the nearest plaster is 2 miles away on the back of a truck. The team medics should not let their personal kit out of their sight whatever the others may do.

Watch out for the walk in. Ride if you can. It is very frustrating to land up at the exploration area and be no use at all in the early stages because you have been exhausted by getting there. It is better to take a day longer and be in good shape than to burn along and arrive a heap with a mass of sores.

The hope is that you will only have to deal with those conditions you were expecting. Commonest things are commonest. Cuts, bruises, grazes, blisters, coughs, colds and sore throats are the commonest ailments wherever you are. The worry is how to cope with a major disaster [18]. If it happens you do what you can. Boldly going where no-one has been before is likely to be dangerous. Everyone accepts that or would not be there. If there is an accident you have only 2 choices. You either do something or you do nothing. If what you do turns out to be effective you have won a great victory. But if it does not you have not lost. As long as you can give a reason for what you do and it is not plainly silly then even if it does not work, no blame can be attached to you either from yourself or others. The risk of exploration has been accepted beforehand and the risk will be very small for a well selected, well motivated skilful team. The commonest cave accidents involve falls due to fatigue and inexperience. [19] No one on your expedition should be likely to fall for these reasons. If there are genuine accidents you do what you can in the conditions and it is up to God or mother nature or both to do the rest.

Specific Conditions

There are 3 specific medical conditions I would like to mention:

Diarrhoea
There are 2 types (a) food and water borne infections, (b) dietary indiscretions.

Type (a) are what people usually fear and which can be very unpleasant [20]. The secret is a good water source, usually no problem when the water comes straight from

underground. Good latrines well sited, no cooks with boils and/or diarrhoea other commonsense measures will prevent most outbreaks.

Type (b) is usually the responsibility of the food officer. A good varied diet with plenty of calories and a reasonable bulk will keep diarrhoea at bay. It is not an inevitable consequence of being in a squalid camp. Squalor is not infectious provided it is clean squalor. Things inevitably become coated with mud. As long as it is not the food it does not matter too much. Hand washing, particularly by the cooks and isolation of sufferers is important. Watch for the one explorer who has diarrhoea. All the rest will stomp off underground and leave the affected person back at camp. They then have a free run of all the stores and out of kindness of heart may rise from the bed of pain to prepare a succulent meal for the returning heroes. Not a good idea. If possible leave someone else behind to prepare the meal and also to watch that the infected one stays put. They may not really be infectious, but take no chances.

Sore feet

Nothing stops an expedition so quickly as sore feet. They soon harden but after the weeks of packing, telephoning and letter writing they may not be very robust at first. Do not trust them. Travel on your backside as much as possible. It is demoralising to arrive at the cave with huge holes in the soles that take a week to heal.

Poisoning

Alcohol is by far the commonest poison you are likely to meet [21]. It may be the local noxious brew prepared by fermenting some completely unrecognizable plant or it may have come from home in a well-known dimpled bottle. Either way it does what it does because it poisons the neurones. You may like that freshly poisoned feeling; it is very popular but it can be incapacitating. The only remedy is time and re-hydration with lots of clean water taken internally. The incapacity passes but it can interfere with exploration and, as the medic, you may be asked to do something. Fill a large jug at the water point and hand it over; you can do no more.

Conclusion

Explorers worry that the symptoms that they have, though minor at the time, might progress to be something far more serious and debilitating. In the early stages of any illness this is impossible to predict, be you professional or amateur medic. Contrary to all the accepted canons of medical teaching the thing to do is to give antibiotics. You cannot afford to say to the sufferer "come and see me in 2 days by then it will be either better or worse! If it is worse I shall know what to do". Those 2 days could represent the critical push to the bottom of a deep system or a dynamic gallop into 10 promising dolines. Treat first, diagnose later if the treatment does not work. Scientists and clever doctors will be appalled but in remote areas the danger of resistance is small, the subject is young and healthy and as far as you know not allergic. The treatment may have no effect but no treatment certainly has no effect. If it does work you have much to gain. This heresy is not to be spread beyond caving expeditions.

If everyone stays well, keeps working and laughs a lot, the expedition medic will be able to spend time on exploration which I am sure will be a perfect arrangement.

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