BCRA

BRITISH CAVE RESEARCH ASSOCIATION

BCRA Cave Science Policy

by Trevor Faulkner

1 Preamble

Following the launch by BCRA of its Cave Science and Technology Research Initiative (CSTRI) at the Hidden Earth conference in Somerset on 24 September 2005, this Policy states the new BCRA research objectives and determines how the initiative will be implemented.

2 Introduction

Now that BCRA has divested itself of national body responsibilities, following the establishment of the British Caving Association, we have the opportunity to enhance our international cave and karst science reputation. Previous benchmark achievements were the publication of two books: British Caving edited by Cullingford (1953, 2nd edition 1962) and The Science of Speleology edited by Ford & Cullingford (1976). These were, and still are, highly regarded internationally. To the list of important British works can also be added Karst Landforms by Marjory Sweeting (1972) and the books on Limestones and Caves of ... (1974–1989). The publication of The Encyclopaedia of Caves and Karst Science has also been a major recent achievement. Additionally, the 7th International Speleological (UIS) Congress in Sheffield in September 1977, hosted by BCRA, was an event that is still described in fond memory by overseas friends.

The world has changed considerably since most of the above achievements, and our international cave science presence is now provided by the BCRA journal Cave and Karst Science, by the annual BCRA Cave Science Symposium and by the attendance of a few people at international cave and karst science events. There is less basic cave research going on in the UK (perhaps in the mistaken belief that there is little left to do), and active 'recreational / sporting' cavers are insufficiently involved. It is also increasingly difficult to ‘work alone’ outside a university environment, because of the amount of pre-reading required and the academic discipline needed to forge ahead in a new direction. Moreover, during the referred time interval, scientific knowledge has advanced considerably on a broad front across many fields that potentially have contributions to make to cave science. Cave science thus needs to ‘catch up’, especially by converting new information about global planetary environments into new analyses about how these environments influenced the karst areas and, indeed, individual caves.

BCRA has funded cave research so far through its Research Fund scheme, but in a way that has been *supportive* of individual initiatives, rather than *directive*, that is by initiating ambitious programmes of work to achieve major gains in new knowledge. The aims of this Policy are to establish strategic research projects that will have major deliverable outcomes and to integrate with the existing scheme.

3 Major research themes and objectives

BCRA’s funding for the next decade will be directed towards four major research themes: speleogenesis, archaeology and palaeontology, biology, and technology. Introductions and key references for the first three of these themes are provided by Proudlove (2006). Other areas of cave research will be considered for funding on a case-by-case basis, as at present, without active promotion by BCRA.

3.1 Speleogenesis of British Caves (Trevor Faulkner)

Since the publication of the Limestone and Caves of … books the techniques of dating cave sediments by radiocarbon, U-series and cosmogenic nuclide methods (among others) have advanced considerably. Additionally, the c. 100,000 year period of the glacial – interglacial planetary climatic environmental cycle is now well-established for the last 800,000 years from Antarctic ice cores. From this knowledge, we now know that the present (interglacial) type of climate only accounts for some 10% of this timescale, which means that many long British caves spent most of their existence in glacial or periglacial conditions. Thus, we need to consider cave development to present configurations under both glacial and interglacial climates and under the transitions between them. Viewed against this background, it is clear that we currently have limited and possibly naïve understandings of the histories of cave development in the British Isles, but that the better dating methods may, with suitable interpretations, help extend our knowledge backwards in time. Additionally, the present knowledge of British glaciations prior to the last (Devensian) glaciation is very sketchy, but these glaciations shaped the landscape, especially in the upland areas, and therefore greatly influenced the local hydrology and the development of the caves in many karst regions. Thus, in order to understand local speleogenesis, we must also consider the evolution of the external landscape and the varying climatic regimes that the caves and their host regions have experienced. We can now be greatly assisted in this endeavour, because the laws of the physics and chemistry of limestone dissolution were at last derived by the early 1990s (by American and German researchers). Consequently, the timescales of cave inception and passage enlargement may now be calculable from basic assumptions and can be related to changes in external topography and hydrology. Previous assumptions about the sequence of passage development in individual caves (as written in the above books) should become testable, tied to specific, dated, glacial events, and viewed in a regional context.

Although there is little current research into the speleogenesis of British caves, there has been significant research activity in the caves over the past decade, but a great deal of this cave science has been 'inside out'. That is, the focus has been on what cave chemical and clastic deposits can tell us about the external environment at their time of deposition rather than on the direct study of caves to learn more about them and their origins. These studies have been driven by the much greater availability of funding for projects of relevance to climate change and global warming. They are clearly important, not least because the value of caves as museums preserving evidence of past environments has been a powerful argument for their conservation when threatened by quarrying. Other positive feedbacks are that, from the results of these studies, speleologists can later make deductions about the minimum age of individual passages and sediment deposits and can use the revealed external conditions to constrain passage enlargement timescales. An additional benefit is that, although the majority of those undertaking 'inside out' research were not originally cavers and some only enter caves to collect samples, others have taken to the sport and continued after their research was completed, thereby providing the opportunity to expand the numbers and expertise of available cave researchers. With the present emphasis on climate change, there is very little chance of the major grant awarding bodies funding research into speleogenesis itself, which has no immediate economic return. BCRA's objective in promoting this theme is therefore to stimulate this research, which is fundamental to our understanding of caves.

Speleogenesis research will be promoted for each major karst region of Britain, including Scotland, Yorkshire, Derbyshire, North Wales, South Wales, Forest of Dean, Somerset and Devon. Extension to Ireland could also be considered. A theory that embraces all these areas will be developed, alongside an appreciation of the varying glacial and interglacial regimes that Britain and Ireland have experienced during the Quaternary.

3.2 Archaeology and Palaeontology of British Caves (Andrew Chamberlain)

In recent years there has been increased recognition that natural caves, rock shelters and fissures have a heightened potential for the preservation of archaeological and palaeontological remains, and scientific understanding of cave taphonomy has progressed substantially. As natural features in the landscape, caves provide ready-made opportunities for shelter and concealment, for animals and humans alike, while in many instances cave entrances provide vistas that allow the occupant to observe the surrounding landscape from a position of security. This means that caves are focal points that are likely to accumulate evidence of activities and occupation over considerable periods of time. An additional factor contributing to the potential of caves to preserve ancient remains is that cave environments provide protected depositional circumstances where archaeological and palaeontological remains can be insulated from external forces of erosion. The stable environmental parameters of the caves, including relatively constant temperature and humidity and reduced biological activity, enhance the preservation of organic remains, while the location of the majority of caves in rugged terrain tends to limit the extent to which archaeological deposits are impacted by agricultural practices or urban and industrial development.

While the archaeological and palaeontological importance of caves is well established, our knowledge of specific cave sites is still limited to a few localities which have been subject to intensive survey and / or controlled excavation. The scientific study of archaeological and palaeontological remains in Britain's caves commenced in the early part of the 19th century, but despite nearly two centuries of research most caves in Britain have still not been visited by a professional archaeologist. Only in the last two decades have there been comprehensive regional archaeological surveys of caves, and these surveys have been relatively limited in their geographical extent. There is considerable scope for extending these archaeological surveys with the eventual aim of auditing the cave archaeological resource in at least some of the caves in every recreational caving region. A principal aim of such surveys is to establish a baseline framework of knowledge which can inform future research into cave archaeology and palaeontology, as well as identify vulnerable sites where active conservation management is required in order to secure the survival of important deposits.

English Heritage has been proactive in initiating and funding professional audits of cave archaeology in the Peak District and Yorkshire Dales National Parks, as well as in the southern part of the Magnesian Limestone outcrop. In the course of these surveys a field recording protocol has been developed that could easily be adopted by local caving groups with minimal advisory input from archaeologists. Additional comprehensive surveys of cave archaeology need to be undertaken in South Devon, Mendip, the Forest of Dean, South and North Wales, the Morecambe Bay region, the northern Magnesian Limestone, the North Pennines, the North

Yorkshire Moors and Northern Scotland. As a follow up to these assessment surveys, selected cave sites could be targeted for further research, including the excavation of tests pits in cave sediments together with sampling of environmental evidence and a programme of radiocarbon dating of faunal remains. There is also a need to audit museum holdings of artefacts and faunal remains from cave sites, as current records of these archives are often out of date.

3.3 Biology of British Caves (Paul Wood and Graham Proudlove)

The historic work of members of BCRA, up until the mid-1970's, significantly raised the profile of British cave biology internationally. However, in the absence of a new generation of cave biologists to continue the work, active cave biology / ecology research ceased in the late 1970's and much of the data collected remains to be analysed. There has been a recent (post-1995) resurgence of interest in the biology of British caves. The nature of research into cave biology has changed fundamentally during the intervening period and there has been a move towards clearly defined hypotheses-driven experimental studies and away from floral and faunal checklist of individual caves.

The biological communities of caves are widely considered to be simple compared to those occurring in epigean (surface) environments. They are usually typified by low abundances of individuals, and low diversities of taxa. However, in the absence of light and with scarcity of food many taxa have evolved unique strategies to obtain food or to survive long periods without it. As a result, caves are widely considered 'natural laboratories' where, due to the absence of light, limited food resources and relatively constant environmental conditions, it is possible to test fundamental biological questions associated with colonisation dynamics, the effects of population isolation, feeding relationships and the effects of anthropogenic disturbances.

The importance of the biology of caves is widely recognised internationally, although there has been an unfair tendency to assume that there is little biological interest in British caves. It is true that there a relatively few obligatory subterranean fauna in the British Isles compared to mainland Europe. However, being located at the northern and western limits of distribution of several obligatory subterranean taxa means it is vitally important that the taxonomic and genetic relationships between the British and European fauna are examined in detail. There is considerable scope for new research involving the examination of cave habitat used by terrestrial, aquatic and migratory fauna (e.g., bats, birds and many insects) of British caves. In addition, almost nothing is known regarding the biological interactions between obligatory cave organisms or the effect of the invasion of caves by surface (epigean) fauna as a result of organic pollution.

The conservation of the biological resources of caves is currently limited. With the exception of bats, none of the cave SSSIs cite any specific cave biology interest. In addition, English Nature, CCW and the Environment Agency have not been actively involved in cave biology research or conservation (with the exception of the Biological Recording scheme). This almost certainly reflects the limited number of individuals actively involved in cave biology in the recent past. It is important that the large volume of data collected prior to the mid-1970's is analysed in detail to provide a benchmark/baseline for new research. However, it is highly likely that the biology of many caves will have significantly modified during the intervening period due to anthropogenic changes and impacts in both the surface and subterranean catchments. As a result, there is a pressing need to initiate new research to protect the biological resources of British caves and to raise the profile of the science nationally and internationally.

3.4 Caving technology (Nick Williams)

[This section could include the subjects covered by Special Interest Groups (cave radio / electronics, cave surveying, and photography), plus geophysical instruments, very accurate measurement of cave temperature (to 0.01^{o}C) and cave draughts (for the study of cave meteorology), diving, explosives, SRT, lighting etc.]

4 Process

This section identifies what BCRA needs to do itself to implement this Policy.

4.1 BCRA organisation for cave research projects

The existing Research Fund scheme will be expanded into the CSTRI to incorporate the attainment of directed, strategic, research programmes. BCRA will establish a CSTRI grant aid panel that will normally comprise five people, one to lead each of the four major research themes plus the CSTRI Manager (presently David Checkley, the BCRA President), who will coordinate the panel and publicise its activities. Awards should be requested, and will be considered, at one of three levels: major, intermediate and minor. It will normally take 3 weeks for cheques to arrive after a funding decision is made.

4.1.1 Major awards

This process will be followed for all requests for >£500. Each 'theme leader' on the panel will seek help on an advisory basis from experts in his particular theme who will be consulted about each relevant major research proposal. If the proposal (amended and with conditions attached as necessary) is considered satisfactory, the theme leader will recommend it to the whole panel to make a binding financial decision. Large awards will be made by staged payments, dependent on progress. Capital expenditure may be funded by the award for longer projects, provided that the equipment concerned will be fully utilised. In order to provide speedy responses to applicants, as much deliberation as possible will be by email. However, larger awards may only be granted after suitable meeting(s) with all involved parties. The panel will also consider nominations for prizes to recognise outstanding research results already achieved. The progress of major award projects will be reported to each BCRA Council meeting using the BCRA CSTRI Grant Aid Applications chart (Appendix A1).

4.1.2 Intermediate awards

Funding requests above £200 and up to £500 will be considered by the CSTRI Manager, using the procedure of the previous Research Fund scheme, by consulting experts of his choosing relevant to each application. He does not need to consult the whole panel in advance, but will provide progress information before every BCRA Council meeting by updating the CSTRI Applications chart. Capital equipments above £200 value will not normally be funded for short projects that are unlikely to utilise them fully.

4.1.3 Minor awards

Awards up to £200, including for equipment purchase, may be made by the CSTRI Manager on his own evaluation, to facilitate speedy grants of small opportunistic studies that may be requested

with little formality (e.g. by email). However, dye tracing materials will only be funded after suitable consultation, as in 4.1.2 above.

4.2 Exploration of areas of cooperation with related bodies

Most of the research themes will require a multidisciplinary approach to move the subject forward from previous understandings. The theme leaders will therefore explore collaboration with other, related, organisations to assist in devising and creating the necessary research projects. These may be university research departments and specialist societies with complementary knowledge, some of which may have little prior speleological knowledge. Closer relationships with these other organisations will also benefit them by the transfer of our knowledge of underground environments that are applicable to their specialism, and thus create greater synergy for solving common problems.

4.2.1 Speleogenesis collaborations

Resolution of the complex histories of inception and enlargement of individual caves, and of groups of caves, in the various karst regions of Britain will need a holistic approach that probably requires collaboration with other, related, geological and geomorphological organisations, with local geological societies with interests in the karst areas, and with suitable University research departments. By working together and studying internal cave morphologies and sediments we should help to explain the evolution of the landscape under the glacial and interglacial climates. Hence, by making suitable observations and interpretations, we should be able to resolve better the previous glacial history of Britain *and* explain the cave development histories.

4.2.2 Archaeological and palaeontological collaborations

Refer to section 3.2

4.2.3 Biological collaborations (Paul Wood and Graham Proudlove)

Biological research within British caves can not be undertaken in isolation and needs to be carefully integrated into a holistic research strategy with other related hydrological, climatological and geomorphological research strands. It is important that local interest groups, University research departments, specialist societies (e.g., British Ecological Society and Freshwater Biological Association) and government agencies (English Nature, CCW and the Environment Agency) are consulted regarding proposed research where appropriate. In addition, data collected should be disseminated widely to both the scientific community and other organisations to ensure greater transfer of knowledge and appreciation of cave biological resources.

4.2.4 Technology collaborations

[Paragraph to be written with section 3.4].

4.3 Invitations for Research Proposals

From time to time, theme leaders will issue public invitations to BCRA members for research proposals that are written in rather general terms but provide direction for the next phase of work in each theme. As a seed-sowing exercise, to generate interest and enthusiasm among young cavers, these will include ideas for undergraduate dissertations on cave and karst science topics, to be funded by bursaries as part of, or in parallel with, their academic studies. As the CSTRI matures, and as the number of graduates with cave research experience expands, larger projects will be invited where BCRA provides funds towards PhDs that will be arranged through universities as normal, but with BCRA nominating at least one research supervisor. BCRA will also provide as much support as possible to each project from among its own members and their combined expertise. Research proposals will be initiated by using the Application form for BCRA CSTRI Grant Aid (Appendix A2).

4.4 Review and evaluation of Research Proposals

New major research proposals will be reviewed as covered in section 4.1.1. Reviews will consider the extent to which the research will 'close the gap' between present speleological knowledge and the general advance of science. Projects that are collaborative with other organisations will be especially favoured. By providing the possibility of BCRA pump-priming and added-value grants, researchers and research teams who bid suitable projects should also demonstrate the acquisition of matching and additional funds from elsewhere. (BCRA can also help identify other funding sources). In this way, the achievement of BCRA research aims should gain considerable leverage so that good cave science results are obtained in a cost-effective manner. All BCRA awards will be conditional on BCRA being acknowledged as a sponsor of the research and on results (even if negative) being offered non-exclusively for publication via C&KS or Speleology. The existing rules and guidelines governing Research Fund awards have been suitably amended (Appendix A2). A policy for Intellectual Property Rights (IPRs) may need to be developed. Prior to this, IPRs will be considered case-by-case.

BCRA recognises the practical problems of undertaking cave research. For example, if one wanted to study the dimensions and orientations of scallops in relict phreatic passages in the Easegill system (so as to deduce the final flow regimes before the passages became abandoned), many visits to the cave would be required. But such a study would be an individual one, and the underground safety of that individual would be a serious issue. The solution might be to group such studies together, so that a study team of (say) 2–5 people could travel and cave together, but work individually on separate topics such as biology, scallops, chemical sediments, clastic sediments, water chemistry, passage morphology, the use of new technology, and (possibly) archaeology. This approach could yield individual qualifications, but would require coordination and supervision by one or more senior researchers who would also benefit by drawing together the various outcomes into a more comprehensive picture of cave development and the cave environment.

Research proposals therefore must also address the safety issues involved. These can be mitigated by the inclusion in the project of active cavers with a less (or non) academic background, so that the role of the 'interested amateur' is strengthened within an expanding membership of BCRA cave researchers, and / or by the combining of several projects that support each other intellectually into one overall proposal, depending on the particular cave(s) being studied.

4.5 Monitoring of research progress

In addition to other normal supervisory procedures, the CSTRI grant aid panel will review the progress of each major project at its midpoint and its conclusion, and at least annually for long projects (for which the publication and discussion of interim results via BCRA will be encouraged). The review will consider expenditure as

well as technical achievement. The continuation of staged payments will depend on the success of such reviews.

5 Outcomes

The overall objective for each of the four research themes will be the **eventual publication of a text book** with a title similar to that of the theme, each of which will provide a considerable advance in cave science knowledge of international significance. The editorship of, and contributors to, each book will be determined by BCRA Council as each research theme progresses.

6 Success criteria

Because the task to write a text book for each theme is itself ambitious, an appropriate timeframe cannot be determined at the outset. It is anticipated that it probably requires a decade to create a new generation of cave research specialists in each field and to assimilate the results of their successive research projects into new syntheses. Key to success will be the successful and enthusiastic reception of the ideas in this Policy, especially by young cavers who are about to embark on relevant academic studies.

The first major review point for the whole CSTRI should therefore be led by BCRA Council at the end of 2007, to decide if the initiative has been satisfactorily launched and if sufficient new research projects have been sponsored. A second major review point will be in 2010, when the current BCRA commitment of 5-year funding comes to an end. If successful, later reviews will depend on the extent of further funding commitments and will also concentrate on the projects to write the text books.

In the mid- to long-term, additional funding may be required to secure major new research projects. This could require BCRA to engage in additional fund-raising activities, such as the encouragement of members to support the BCRA CSTRI in legacies. In this case, the overall success of the CSTRI would then need to be reviewed against not only the research outcomes, but also its capacity to generate sufficient income for the future.

7 References

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8 Appendices

A1. BCRA CSTRI Grant Aid Applications chart. Please refer to BCRA Council's internal report)

A2. BCRA CSTRI rules, guidelines and application form. Please refer to **bcra.org.uk / detail / cstri_info.html**

Issue 1.3 by Trevor Faulkner, with specific contributions identified, following BCRA Council 133.

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