

RECENT ARCHAEOLOGICAL AND PALAEOLOGICAL INVESTIGATIONS IN THE P2 CAVE SERIES

REVIEW OF COMPLIANCE WITH THE ACCESS POLICY AND RECOMMENDED BEST PRACTICES

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PREAMBLE

The following report presents findings concerning the practices and process steps followed by researchers to gain access to the P2 cave series (P2) for the purpose of conducting palaeontological and archaeological investigations.

Though never formally inventoried and evaluated, P2 is one of the more significant and sensitive caves on Vancouver Island (Province of British Columbia, Canada). A gate was installed to protect the cave after its discovery by cave divers in 1994. A restricted access policy was adopted by the BC Ministry of Forests and Range (MFR) in 1995.

Consistent with Provincial policy, the MFR is the agency in British Columbia (BC) that has been assigned jurisdiction over caves in Provincial forests. The MFR is effectively the cave manager for P2. The MFR's interim management objective for P2 was to allow minimal access to cavers, monitors and scientists engaged in non-consumptive research in order to maintain the cave in a relatively natural state until a comprehensive cave inventory could be undertaken and a cave management plan developed by the MFR.

On 30 June 2007 a party of three researchers entered P2 to conduct an 'archaeological reconnaissance'. An unspecified number of affiliated parties drawn from up to thirteen people subsequently re-entered the cave in the period 20-27 August 2007 to conduct 'archaeological /palaeontological investigations' for four or more hours each day.

This review identifies errors or omissions linked primarily to the P2 access policy and the recommended best practices for conducting palaeontological or archaeological investigations in BC caves. The researchers generally failed to recognize MFR's jurisdictional authority for protecting and managing caves in Provincial Forests, and abide by the related protocols. As a result, P2's resources or values were put at considerable risk.

Cave managers in BC are generally not opposed to carefully designed and executed consumptive research activities in caves provided that they do

not result in unacceptable impacts. The practices described in the P2 access policy and recommended BMPs are intended to reduce the risk.



Figure 1

Palaeontological and archaeological research activities in caves have been cause for concern in BC for years. Concerns about the essentially permanent adverse impacts on caves that can result from such research activities were the impetus for the development of Best Management Practices for Palaeontological and Archaeological Cave Resources (Griffiths and Ramsey 2004). The document was widely circulated in British Columbia throughout 2004 and 2005.

Four years after this document was introduced, the situation in BC continues to worsen. Virtually all funded cave research of this type today centers on manipulative or destructive investigative methods. Disturbingly, the researchers involved are often affiliated with the foremost provincial and federal agencies charged with conserving and protecting BC's natural and cultural heritage.

Research proponents appear to have little appetite, and no legal obligation, to hold off on their activities until other cave resources and values can be studied, inventoried and assessed. Degradation, damage, and outright destruction of BC caves through all sorts of uses continue to be facilitated by the absence of overarching cave protection legislation and a robust provincial cave management program.



Figure 2

EXECUTIVE SUMMARY

This report presents findings concerning the practices and process steps followed by researchers to gain access to the P2 cave series ('P2') for the purpose of conducting palaeontological and archaeological investigations.

Though never formally inventoried and evaluated, P2 is one of the more significant and sensitive caves on Vancouver Island. A gate was installed to protect the cave after its discovery by cave divers in 1994, and the British Columbia Ministry of Forests and Range (MFR) adopted a cave-specific access policy in 1995. The MFR's interim management objective for P2 was to allow minimal access to cavers, monitors and researchers engaged in non-consumptive research in order to maintain the cave in a relatively natural state until a comprehensive cave inventory had been undertaken and a cave management plan developed by the MFR.

On 30 June 2007 a party of three researchers entered P2 to conduct an 'archaeological reconnaissance'. An unspecified number of affiliated parties drawn from up to 13 people subsequently re-entered the cave in the period 20-27 August 2007 to conduct 'archaeological/palaeontological investigations' for four or more hours each day.

The scope of the review was restricted to identifying errors or omissions linked to the Best Management Practices for Palaeontological and Archaeological Cave Resources (Griffiths and Ramsey 2004) and the P2 access policy. Staff members from the MFR North Island-Central Coast Forest District were interviewed. The cave was examined on 15 November 2007 for any evidence of physical changes that may have occurred since an earlier inspection visit and numerous unregistered, representative photos were taken.

The review found that the research party failed to recognize or properly communicate with the MFR as the agency charged with the responsibility for managing and protecting the cave, and abide by other essential obligations for access and research use set forth in the two referenced protocols. The researchers did not submit to the MFR details of planned research activities. The cave was entered and research activities involving the excavation or removal of cave resource materials proceeded without a plan approved by the MFR in place, and without prior written authorization from the MFR. As a result, P2's cave resources or values were put at considerable risk.

The report concludes by outlining steps for immediate corrective action. A key suggestion is to refrain from authorizing further manipulative or destructive research activities in P2 until an inventory and evaluation of the cave is carried out, visitor impacts and remediation potential more completely assessed, and a specific management plan developed and approved by the MFR. A recommended approach to policy and administration of archaeological or palaeontological research to prevent recurrences of the type reviewed is also outlined.

This is the first review of its type in British Columbia. Palaeontological and archaeological research activities in BC caves have been cause for concern in BC and internationally for years. Concerns about the lasting adverse impacts on caves that can result from such research activities were the impetus for the development of Best Management Practices for Palaeontological and Archaeological Cave Resources (Griffiths and Ramsey 2004).

Cave managers in BC are generally not opposed to carefully designed and executed consumptive research activities in caves provided that they do not result in significant impacts. The practices described in the P2 access policy and the recommended BMP's are intended to reduce the risk.

INTRODUCTION

This report presents the findings in the matter of the practices and process steps followed to gain access to the P2 cave series ('P2') for the purpose of conducting palaeontological and archaeological investigations. It is the first review of its type in British Columbia (BC).

The main body of the report includes the following information:

- The scope of the review – including descriptions of the key recommended practice requirements to be met by proponents of archaeological or palaeontological research activities in BC caves

- The review procedures used
- The findings related to the practices reviewed
- Discussion and conclusion
- Recommendations

P2 is ranked as one of the more important cave sites on Vancouver Island and is classified as a significant cave by the MFR cave classification standard (BC Ministry of Forests 1994). Consistent with Provincial policy, the MFR is the agency that has been assigned jurisdiction over this cave and is effectively the cave manager (Runka 1992).

Caves such as P2 are finite in number in BC - they are considered to be non-renewable forest resources and inherently susceptible to disturbance. The number of pristine caves in BC has been dwindling noticeably in recent years. They are increasingly threatened, either by imprudent visitor uses or practices, or by degradation or destruction linked to surface activities. SPAET Cave near the provincial capital is one recent and extreme example of a cave site that was ruined to facilitate land development (Griffiths and Ramsey et al. 2007). The fate of SPAET Cave is atypical, however. While not threatened by outright annihilation, many BC caves, including those in remote locations, are exposed to other more insidious types of degradation, including those linked to the Province's passive approach to managing manipulative or destructive scientific uses.

Problems related to palaeontological or archaeological research activities in caves have been cause for concern in BC and internationally for years (Ramsey 2004). However, there is also vigorous and mounting pressure on using the stalagmites of caves for climate change research, even in the four-year interval since the inception of best management practices (BMPs) for conducting palaeontological or archaeological activities in caves.

The purpose of this report is not to cast the individual members of a research party in a negative light, or to discourage all palaeontological or archaeological research activities from taking place in all caves. Instead, the purpose of the report is draw attention to the need for a more proactive approach to overall cave management in general, and to the need for more proactive inter-agency management of consumptive or manipulative cave research in particular. While no two caves are identical, the lessons to be learned from the P2 case can nonetheless be used to benefit other caves in Provincial forests as many of the findings and recommendations described in this report are likely to be applicable to other caves.

Caves and all of the many resources or values associated with them are a fragile and non-renewable part of BC's natural heritage. (Blackwell 1995; BC Ministry of Forests 1980, 1981, 1983, 1990, 1991, 1994, 1997; Griffiths 1991; Stokes 1996) Members of the archaeological or palaeontological research community in BC must also step forward and advocate for enhanced cave protection and management. Their actions will help to prevent the deficiencies exemplified in the P2 case from becoming institutionalized or self-perpetuating.

CHRONOLOGY OF EVENTS LEADING TO REVIEW

A party of three researchers entered P2 on 30 June 2007 to conduct what is described in the logbook as an 'archaeological reconnaissance'.

The logbook, maintained by the North Island-Central Coast Forest District also shows that in the 20-27 August 2007 period additional parties drawn from up to thirteen persons pursued 'archaeological/palaeontological investigations' in the cave for four or more hours each day.

On 6 November 2007 the Ministry of Tourism, Sports and the Arts (MTSA) Archaeology Branch confirmed that an investigation permit for the cave had been issued pursuant to the Heritage Conservation Act (HCA). The MFR reasserted its administrative control over access to P2 and replaced the gate lock on 15 November 2007.

LOCATION AND SITE DESCRIPTION

P2 is located within the Glory 'ole Cave/Karst Management Area (GCMA). The mapping and exploration of the other caves in the GCMA occurred mainly from the mid 1980's to mid-1990's (Griffiths 1994; Stokes et al. 1998). Various other cave systems were identified in the management area, including the 10.6-km long Arch Cave (currently the 4th longest cave in Canada).

The P1 and P2 cave series form part of the greater Pellucidar Cave system, which is 1.9 km in overall mapped length. The P2 cave series was discovered in July 1994 when a cave diver passed the 15-m long siphon at the upstream end of the 220-m long outflow cave series ('P1'). By digging in from the ground surface, recreational cavers provided a dry entrance route to P2 shortly after its discovery by the cave divers. The exploration of P2 by cavers immediately revealed the significance of the cave resource features and values. Thereafter, the cavers installed a culvert gate and access was initially controlled by 'delegated authority'. The newly discovered cave series initially remained accessible to cavers and scientists with few restrictions. The conditions of access were not

widely publicized beyond the original working groups, as it was recognized by the MFR and cavers that P2's resource contents, notably the speleothems and palaeontological materials, could be damaged through negligence, carelessness and vandalism.

The intrinsic, non-renewable values of the cave are widely acknowledged by cave specialists who have examined them. The essentially pristine cave environment varies from an active vadose stream passage to large dry fossil phreatic passages. In places there is minor flowing, dripping percolation, or condensation water. Resource contents include, but are not limited to, speleothems, undisturbed floor sediments of unusual depth, and varied palaeontological material. Extremely rare blackflies (Borkent and Currie 2001) have been identified in P2 and invertebrate fauna are expected to include cave-adapted organisms (Shaw and Davis 2000). Currently, the cave is not known by the MFR to be either an archaeological or a traditional use site.



Figure 3

REVIEW SCOPE AND PROCEDURES

The scope of the review was restricted mainly to the practices for this type of research activity described in the Best Management Practices for Palaeontological and Archaeological Cave Resources (Griffiths and Ramsey 2004). The reviewable factors were drawn from the 31 recommended best practices and itemized in a checklist format for use in the review. A secondary reference document used for the review was the P2 access policy (Griffiths 1995).

Legal and non-legal frameworks for protecting and managing caves in Provincial forests were assembled and examined. These framework descriptions may be of interest to cave managers outside of BC.

INSPECTION OF THE CAVE SITE

The area of the cave between the culvert gate and the start of the Highway-Byway passage was examined on 15 November 2007. Direct observation techniques were used to identify any evidence of physical changes that may have occurred since a 8 May 2004 inspection visit. Numerous unregistered, representative photos were taken.

STAFF INTERVIEWS

In conducting the review, responsible MFR North Island-Central Coast Forest District staff members were interviewed. The staff members were initially contacted by telephone and email correspondence. A formal meeting with the responsible staff was held at the district office on 18 January 2008. In keeping with a pledge of transparency regarding the methodology and findings, the tentative review findings and recommendations were conveyed to MFR staff throughout the course of the review.

INFORMATION GAPS

The North Island-Central Coast Forest District did not obtain a copy of the Heritage Conservation Act (HCA) investigation permit from the MTSA Archaeology Branch. As a result no information on the individual roles or affiliations of persons who entered the cave during the 20-27 August 2007 period was made available for the purpose of the review.

REVIEW FINDINGS

Interviews with MFR staff substantiate a finding that no formalized communications took place between the research party and the MFR, the government agency charged with the responsibility for protecting and managing caves in Provincial forests. (Province of BC 1981)

The researchers did not submit to the MFR details of planned research activities. The cave was entered and research activities involving the excavation or removal of cave resource materials proceeded without a plan approved by the MFR in place, and without prior written authorization from the MFR. The logbook confirms that a party of three researchers initially entered the cave on 30 June 2007 accompanied by recreational cavers for an 'archaeological reconnaissance' lasting four hours. A second logbook record shows that 13 different persons entered the cave for the purpose of an 'archaeological/palaeontological investigation' for the 20-27 August 2007 period. Each daily visit lasted for four hours or more. Qualified cave resource monitors approved in advance by the MFR did not accompany the parties for these latter visits.

PRACTICE ERRORS OR OMISSIONS

Some of the more significant exceptions to the recommended best management practices (BMPs) are described in the following list:

- The research party did not plan the access and research activities in conjunction with the MFR. (BMP no. 1)
- Research activities were not undertaken by the minimum number of qualified personnel required. (BMP no. 3)
- The research party commenced research activities before receiving a comprehensive orientation or training session from qualified persons. (BMP no. 5)
- The research party collected palaeontological materials without written authorization from the MFR (BMP no. 11)
- The research party did not submit to the MFR a detailed research and excavation proposal, including an analysis of potential impacts. (BMP no. 12).
- The research party commenced subsurface sampling or excavation before a formal cave inventory and evaluation, completed by qualified persons and reviewed by the MFR, was in place (BMP no. 15).
- Qualified persons were not used to monitor the research activities in the cave. (BMP no. 15).
- The research party did not prepare a final research and excavation plan in conjunction with the MFR. (BMP no. 17)
- The research party did not submit a reclamation plan for proposed excavations to the MFR for review. (BMP no. 19)
- The research party commenced research activities before baseline photomonitoring was in place. (BMP no. 22)
- The research party commenced research activities before an individual cave management plan or prescription was in place. (BMP no. 28)

ADVERSE CAVE IMPACTS

The inspection of the cave on 15 November 2007 revealed a number of disturbed areas or instances of damage. Upon entering the cave, there was an obvious aesthetic impact on the floor surfaces of the cave. Some of the examples of adverse cave impacts were attributable to the removal of palaeontological material and disturbance of associated cave sediments. [Figure 1] Other specific disturbances or material changes observed and photo-documented during the on-site inspection included the following (refer also to photos):

- Footprints on soft cave fill [Figure 2]

- Compaction and/or liquefaction of floor sediments. [Figure 3]
- Minor transfer of floor sediments (e.g., boot tracking of mud and transfer/spreading onto speleothems or other floor surfaces) [Figure 4]
- Crushing of calcite crusts or layers [Figure 5]
- Erosion and polishing of floor surfaces (rocks, cobbles) [Figure 6]
- Possible breakage of small-scale speleothems [Figure 7]
- Transfer of mud onto speleothems and other cave surfaces [Figure 8]
- Transfer of moonmilk deposits
- Minor amounts of litter, including possible clothing fibres
- Corrosion stains on calcite deposits (caused by metallic pins left in the cave) [Figure 9]

The majority of observed changes away from obvious collection or excavation sites could not be directly attributed to the recent palaeontological or archaeological research activities with certainty, because baseline photomonitoring of the cave series had not been undertaken.

Note: A length of yellow polypropylene rope was found fixed between two mature trees outside the cave (about 10-20 m downslope of the culvert gate).

The length of rope was removed during the on-site visit as it could draw attention and possibly attract casual visitors to the location of the culvert gate. The protection of P2 and its culvert gate from harm relies in large measure on not drawing attention to the site. Leaving unnatural objects and debris near the entrance is inappropriate as it places the cave site at risk.

SUMMARY OF FINDINGS

In summary, the practices followed by the research party substantially departed from the established or recommended MFR access control procedures, and represented a risk to the cave environment. The research activities undertaken in the cave constituted a manipulative and destructive disturbance, which resulted in degradation to some of its recognized natural values.

DISCUSSION

THE PAST AND CURRENT STATE OF BC CAVES

BC's natural heritage includes some exceptional cave and karst resources. One attribute of these resources that makes them outstanding is their 'pristineness'; a quality which is now becoming exceptionally rare in caves internationally.

The caliber of BC's cave management performance has generally not matched the quality of its cave resources. To date, Provincial authorities have avoided actively protecting and managing the majority of caves by relying heavily upon the relative remoteness or isolation of many caves, and the sparse populations in many of the areas where they occur. These factors have enabled, and perhaps rendered somewhat defensible, the evolution of a passive approach to managing caves. The fact that a good number of our most significant and fragile cave resources have been 'out of sight and out of mind' has tended to foster a general complacency about the state and security of BC's caves.



Figure 4

Such complacency about the lack of proactive cave protection and management is no longer warranted. Every year our cave resources come under increasing pressure from land use activities above ground and inappropriate or unregulated use below. The opportunities to preserve something more than fragmented and degraded remnants of BC's splendid cave resources are rapidly slipping away.

Cave resources or values under threat include:

- Physical cave resources such as air, water, cave surfaces and sediments, speleothems, petromorphs, palaeontological resources, etc.
- Physical processes such as speleogenesis
- The cave ecosystem as a whole
- Biological resources such as plants, animals and communities and their cave habitat
- Biological processes such as succession and evolution
- Aesthetic and spiritual values, traditional use values, etc.

The P2 case is illustrative of the inadequate state of cave protection and management in BC. At the same time, it is a somewhat atypical example for a number of reasons:

- The cave itself is exceptional in terms of resources and 'pristineness'
- The protective measures/strategies afforded the cave were among the highest in the province
- Many of the individuals participating in the research activities that were the subject of this review were affiliated in some capacity with institutions charged with stewardship of BC's natural and cultural resource heritage.

Most of the known caves in BC do not enjoy the same level of protection as P2. The majority of cave visitors are not scientists or individuals vested with the responsibility of caring for the province's cave heritage. The P2 case begs this question: if we cannot ensure that visitors follow best practices in a cave as significant and well protected as P2, what hope is there for BC's cave resources in general?

SPLENDOUR UNDIMINISHED?

Most caves in BC have no form of legal protection. Caves in parks or other protected areas do not necessarily enjoy a higher effective level of protection than those located on Crown land outside of parks - e.g., the unrestricted access caves at Horne Lake Caves Provincial Park. With very few exceptions, caves on private land have no protection at all. Thirteen of 20 known caves on privately owned land in the Greater Victoria area alone have been significantly damaged or destroyed in recent years; SPAET Cave and Langford Lake Cave are two well-known examples.

Some of the karst caves found on Crown land have some legal protection from certain activities. Three forest districts on the BC coast have issued Government Action Regulation (GAR) orders for karst resource features, including karst caves. These orders are intended to prevent damage to karst caves on Crown land outside of protected areas caused by primary forest activities. What are missing are legally supported protection mechanisms to prevent damage or degradation of Crown land karst caves caused by non-forestry land use activities, or through visitor abuse, misuse, or consumptive or manipulative research activities.

'WE HAVE MET THE ENEMY, AND HE IS US.'

Why are caves so fragile? What does damage or degradation mean in the context of the cave environment? These questions are briefly addressed below. A more detailed discussion of these issues is provided in *Palaontological and Archaeological Cave Resources in British Columbia: A Discussion of Management Issues* (Ramsey 2004), as well as the companion BMPs.

All human cave visitors, whether they are scientists, recreational cavers, casual visitors or cave resource professionals, cause some deterioration in caves. The great majority of visitor-related degradation to BC caves is unintentional.

Most visitors do not realize that very subtle impacts can ultimately constitute, or contribute to, damage to caves. When people think of 'damage' they usually envision a fairly obvious and sudden physical change – e.g., broken speleothems, or large soiled tracts of flowstone such as we see at some of the Horne Lake caves with unrestricted access. However, there are other more insidious and much less obvious categories of degradation that cumulatively constitute damage over time.



Figure 5

Damage or harm to caves can be caused by things like the introduction of light and noise, foreign matter such as lint, or fungal spores which can upset the cave's ecology. The perceived defilement of a sacred space can be a form of 'damage' for some. There may also be issues related to potential increases or decreases of nutrients in different parts of the cave. Finally, there is plain old generalized wear and tear of the cave.

Environmental events that tend to erase 'spoor' on the surface are generally absent in caves. Human traces can persist for long period of time in cave environments. As a classic example, consider that a cave in France has been found to contain Cro Magnon footprints (Tattersall and Schwartz 2001).

This means that many impacts that would be considered negligible or insignificant on the surface are essentially permanent when they occur underground in the cave environment. One small scuff or mud splatter on a calcite-covered rock left by a single visitor may not appear to be much of an impact, but ten permanent scuffs and splatters begin to be noticeable. Now picture four

visitors following along the same travel route in the cave – and then returning along it several times a day.

Before long the sum of the permanent minor impacts makes a once pristine space begin to look a bit grubby and shopworn. At some ill-defined point, the sum of tiny impacts reaches a point where our description of the changes shifts from 'degradation' to 'damage'. Cave damage of this sort is not uncommon in BC. The situation is analogous to a 'death by 1000 cuts' because many of the human visitor impacts are cumulative. Human nature being what it is, the answer to the question 'Which cut was the fatal one?' will usually be 'Not the one that I made!'

IMPACTS TO CAVE FLOORS – A SPECIAL AREA OF CONCERN

Cave floors may be relatively unattractive or uninspiring to some, but they often contain the records of past biogeoclimatic changes, human and animal succession, and are in and of themselves important cave habitats (Hamilton-Smith 2006, 2007). Ordinary-looking substrates are frequently the most neglected component of the cave environment and can be quite routinely trampled by cave visitors. The unconsolidated substrates disturbed by this trampling can then be spread about other parts of the cave by boot tracking, occasionally marring otherwise clean calcite surfaces.

The inspection of P2 revealed that the most obvious and extensive visitor impacts are to the floor of the cave. Visitors moving through the passages at present cannot avoid touching, polishing or smearing rock and calcite floor surfaces. Calcite floor elements can be easily damaged when they assume the form of a thin crust or coating. In some places along the travel route, calcite crust has been cracked or broken and the mud exposed beneath it. The travel route in general is a continual source of mud and other particles. Modification of the hydrological regime caused by continuous erosion and reworking of unconsolidated floor deposits can locally impact cave ecosystems and processes.

DAMAGE IN THE NAME OF SCIENCE?

There is a commonly held belief that the use of a cave for a research purpose (and any damage resulting from its use) can be justified if it is done to advance scientific knowledge. The argument goes something like this: we should accept some level of cave damage in return for knowledge gained through consumptive research activities, because the information can serve to help the public to appreciate the values of caves.

It is debatable whether damaging caves in the name of science promotes the public's appreciation of the multiplicity of cave resources or values, the inherent susceptibility of cave environments to human disturbances, or even the need to conserve caves. What is certain is that consumptive types of research can draw public attention to caves with an underlying message that caves and the other values associated with them are expendable. The fact that non-palaeontological/non-archaeological cave values are diminished or degraded by human activities and that these and other values cannot be recovered to any meaningful level is often either not addressed or glossed over.

That certain caves must be impacted if research is to occur at all is another argument occasionally advanced. However, the research value of a cave is not restricted to the value that is extracted from it by manipulative or destructive research activities. Remote viewing and interpretation techniques for caves are already available and proving themselves, and new less intrusive or destructive investigation methods are rapidly evolving.

If the overall objective of protecting a particular cave cannot be met by permitting even limited research-driven use, then exclusion of this use from the cave may well be the more desirable action to take to meet the management objective. There is no pressing need to authorize manipulative or destructive research activities that are not being proposed in response to the need to document cave resources in imminent danger of being vandalized or otherwise damaged, stolen or destroyed. Palaeontological material, for example, can often survive undisturbed in caves for many thousands of years, and will continue to do so if the caves themselves are not at risk.

Without question, palaeontological material ranks high among the suite of known values associated with P2. Unfortunately, even the relatively modest level of human activity in the cave to date has had a detrimental impact on the cave environment. Protracted visits for the purpose of unregulated archaeological or palaeontological research activities only add to these impacts, when there is already a need to mitigate and possibly curtail use of the cave. Identifying limits of acceptable change in an attempt to make added use possible is not especially meaningful as many of the cave impacts observed are irreversible in our lifetimes. In a manner of speaking, the limits of acceptable change for P2 have already been exceeded.

The lower energy parts of a cave system tend to be associated with enhanced preservation of bone material and its contextual cave environment. This holds especially true for limestone solution caves. All inactive karst caves should be considered to be significant or potentially

significant for this reason. The potential for conflict between a cave protection mandate and research use can arise because bone material tends to be found in lower energy parts of the cave, which in turn are inherently more sensitive to disturbance. Bones older than 10,000 years are routinely found in relatively inactive caves. Thus, bone specimens may actually last longer (and more inexpensively than if curated) if left undisturbed in the cave.

CAVE MANAGEMENT PLAN

Currently P2 lacks a specific cave management plan. The interim P2 access policy formulated and adopted by the MFR in 1995 called for determining the 'acceptable level of use' for the cave. This level was to have been set, before regulation of use levels, through the correlation of use statistics and photomonitoring results from fixed photopoints. The 'trigger' would then be incorporated into the visitor use strategy component of the cave management plan. Should significant damage occur (or be anticipated) before the correlation was established, the MFR was to have immediately set limits to achieve the overriding protection and conservation objective. These aspects of planning were not carried out, in part because of the loss or lack of dedicated positions with administrative authority for cave management.

A specific management plan to manage the use of P2, maintain environmental quality, and prevent its further degradation must now be made a priority. This management plan should include:

- Goals and objectives
- An inventory and evaluation of the cave resources
- Development and implementation of the management strategy to be followed
- Visitor monitoring
- Visitor access policy based on limits of acceptable change
- A provision for the periodic re-evaluation of the implemented strategy

Additionally, the review findings and recommendations outlined in this report should be incorporated into the context of the cave-specific plan and the global Glory 'ole Cave/Karst Area Management Plan. The P2 cave management plan should be reviewed annually at the level of the Glory 'ole Area Management Plan Committee.

An effective cave management plan will necessarily embody the precautionary approach, which recognizes and upholds preventive conservation as the most effective means of promoting the long-term preservation of the cave. The precautionary principle is applicable to making decisions on research uses of the cave

because these types of resource features are known to be fragile and basically non-renewable. Sensitive caves such as P2 have few if any natural restorative processes. The principle of not authorizing research uses of the cave that do not conform to the BMPs must be an essential element of the management plan.

Inventory and evaluation of caves are crucial steps in the development of the cave management plan; they are distinctly different processes. The inventory process is used to catalog cave resource contents and provides ecological data for the cave. The evaluation process analyzes and interprets the inventory data. Together the inventory and evaluation processes provide information critical for determining features or elements that need to be protected and addressed in a cave management plan. Proposed research activities should be compatible with the inventory objectives and priorities (BMP #2).



Figure 6

Monitoring is an essential ingredient in the effective protection and management of caves and should be an integral part of the P2 management plan. Currently, no specific ecological baseline monitoring data or extensive photodocumentation records exist for the cave, and visitor impacts on cave biota and water quality, for example, have not been fully established. Ideally, the management plan for P2 would have a provision for gathering data on the current state of the cave; however, establishing the monitoring program and a record of change must not be used to justify activities in the cave that are not suited to uses by the plan, or that could perpetuate a process of degradation. The appropriate management strategy for the cave at the present time is to reduce the number of avoidable use impacts, not to increase them.

The precautionary approach applied to the P2 would entail disallowing any use of the cave until a proper inventory and evaluation is undertaken,

the changes to the cave more completely assessed, and a management plan developed and approved. This would be seen as a proactive step towards effectively protecting and managing cave resources in Provincial forests.

THE JURISDICTIONAL QUAGMIRE

One of the greatest threats to Crown land caves in BC is the jurisdictional uncertainty that currently surrounds them. This problem poses a very real danger because it means damage to caves is allowed to continue unabated while various branches of government and stakeholders visit or in some cases revisit issues of jurisdiction and responsibility for cave protection and management.

Caves mean different things to different people – e.g., recreation to cavers, sacred or traditional use sites to First Nations, sources of bones for palaeontologists, or sources of revenue for cave tour operators. Many people, it seems, have different claims on caves – claims that centre on a range of differing cave values and resources. Unfortunately, this can lead to a Tragedy of the Commons scenario, with no single authority looking out for the cave as a whole. A management approach that does not have as its first priority the preservation of the cave as a whole will not achieve any meaningful protection and conservation objectives. An extreme example of focusing on a single set of values to the detriment of the cave as a whole was the case of SPAET Cave in 2006. The ‘unroofing’ of the principal cave chamber was authorized by the Archaeology Branch after concerns had been expressed about the safety of archaeologists working in the cave. The rationale for sanctioning the ruination of the cave chamber went something like this: archaeological material needed to be found in order to legally save the cave, but in order for archaeologists to safely ascertain whether such material was present, the cave first needed to be unroofed.

During the course of this review, it became evident that some MFR and other agency personnel are not entirely clear about present day government policy mandates or responsibilities with respect to protecting and managing caves in Provincial forests that do not meet the criteria of section 13(2) of the Heritage Conservation Act. The types of articulation and coordination between different agencies needed to achieve coherent results for cave-related policies are lacking. In addition to jurisdictional uncertainty, new staff may not have adequate training to competently deal with the range of cave management issues, while others with some requisite knowledge now find themselves coping with inadequate resources, insufficient time, and a lack of institutional support.

The majority of known caves are situated on Crown forest lands and the primary responsibility for managing and protecting them was assigned to the MFR by the 1981 Crown Land Cave Policy and Administration Statement. (Province of BC 1981) Certainly MFR staff members still have the best and most widespread knowledge and capacity for dealing with caves and karst resources; however, their focus now appears limited mostly to caves in the context of forest practices. Management agencies should always seek to develop their expertise and capacity for cave and karst management given BC's rich caves and karst estate. It would probably be desirable to assign responsibility for the overall environmental management of caves to a single ministry. However, given the range of different values associated with caves, which branch of government should have administrative jurisdiction for the overall management of a cave? Will it be Energy, Mines and Petroleum Resources? Aboriginal Relations and Reconciliation? Tourism, Sports and the Arts? Environment? Each has a legitimate claim to some part of the whole, but no obligation to consider the welfare of the whole first and foremost.

THE ROLE OF THE ARCHAEOLOGY BRANCH

This review identified a number of issues related to the lack of recognition or acceptance of MFR's administrative jurisdiction over caves in Provincial forests. Failure to correct this problem may result in further loss of control and the diffusion of inappropriate practices to other sensitive caves sites in the region. If the issues identified are not resolved and corrected within a reasonable time frame, the situation will repeat itself.

The Archaeology Branch knew or could be reasonably be expected to know that because of cave conditions at P2 and/or sensitivity factors described in the BMPs and other available guidance documents, the carrying out of the research activities in the cave was likely to result, directly or indirectly, in essentially permanent damage to the cave.

According to the British Columbia Archaeological Resource Management Handbook for Foresters (MTSA 2007) the forestry related role of the Archaeology Branch is:

'...to ensure that archaeological resource management is integrated into forestry planning and operations.'

This forestry related role for caves could be made viable only if the Archaeology Branch recognizes the following:

- The MFR's lead role and responsibility for protecting and managing cave resource features and values in Provincial forests

- The importance of non-archaeological cave values, protection strategies and objectives, and the principle of protecting and managing natural cave features and values on an ecological basis

EVALUATION OF RESEARCH PROPOSALS

Alternatives to planned research activities cannot be properly considered if a proposal is not first submitted to MFR as required by the P2 access policy and the BMPs. This process step is vital because it can help to identify potential risks to the cave that might result from proposed research activities and suggest acceptable and feasible alternatives. Adequate disclosures about the planned manipulative or destructive research activities in P2 should have been made to the MFR as the Ministry charged with the responsibility for protecting and managing caves for the full range of resource contents or values.

Manipulative or destructive research activities of the type reviewed in this report can only exacerbate the problem for the responsible cave managers, as the cave would be impacted even with the strictest supervision of research parties of a regulated size and frequency.

SUMMARY

Environmental pressures caused by mounting use of BC caves in general, and by manipulative or destructive research uses in particular, are requiring more than passive management. Failure to uphold basic management objectives for caves promotes disrespect for caves and cave management systems, the MFR's role and responsibility for protecting and managing caves in Provincial forests, and principles and procedures embodied within the P2 access policy and recommended BMPs. If improper practices were left unchallenged or condoned, the BC Government would be showing that it either does not recognize or does not understand the full spectrum of human and natural values of sensitive caves. It's been said that caves are barometers or indicators of general environmental health and if this is true, then the increasing incidence of damage or degradation to caves suggests the BC Government may be falling short of its widely published goal of becoming a world leader in environmental stewardship. One of the most effective cave protection and management strategies is education (Huppert 1992). There continues to be a general lack of awareness about the ecosystem-based management approach to cave use, and general cave protection and management techniques and issues. Researchers and members of the public who are well informed about the sensitivity of caves will usually choose to avoid activities that could potentially damage cave resources or values. The BC Government has

an excellent untapped opportunity to show leadership by providing good infrastructure and interpretation programs in parks and recreation sites with cave resources. Researchers also have an opportunity to greatly assist in public education as good role models by familiarizing themselves with cave conservation and management issues, and by striving to achieve and actively promoting excellence in low or minimal impact cave research.



Figure 7

RECOMMENDATIONS

STEPS TO TAKE IMMEDIATELY OR AS SOON AS POSSIBLE

It is recommended that the following steps be taken immediately:

- Reaffirm the MFR's lead role as the government agency with overall administrative jurisdiction and responsibility for protecting and managing caves in Provincial forests. Call for the Archaeology Branch to suspend or cancel the HCA investigation permit if it is found to be still valid and do not allow archaeological or palaeontological research activities to resume pending a complete policy review. Re-institute the established or recommended administrative access controls prior to reopening the cave.
- Consider establishing the cave as a 'no consumptive use' or 'reference cave'.
- Keep the key to the culvert gate in a secure office location.
- Establish fixed photomonitoring stations in the cave between the culvert gate and the start of the Highway-Byway passage.
- Remove flagging tape and any other foreign material left by research party.
- Remove corroding metallic pins that are

the source of speleothem staining and review opportunities to remove corrosion stains.

- Reduce the width of the travel route to a minimum width required for safe passage by repositioning the reflective pin flags and review the opportunities to restore or remediate disturbed cave floors away from the route.
- Make routine but unscheduled inspections of the culvert gate, and consider deploying passive visitor detection and identification devices to detect unauthorized entry attempts or entries.

RECOMMENDATIONS FOR POLICY AND ADMINISTRATION OF PALAEOLOGICAL AND ARCHAEOLOGICAL RESEARCH IN CAVES

A NOTE ABOUT 'MUST' VERSUS 'SHOULD'

Readers will note that many of the following recommendations use the term 'must' rather than 'should'. The authors debated long and hard over this choice of words – a debate that was fueled by reviewers' feedback. Some reviewers argued that the term 'must' is too harsh and rigid to elicit voluntary buy-in. Others, including resource officers with cave management experience, pointed out that the term 'should' implies an inappropriate degree of latitude for interpretation that has a potential for misunderstanding or misuse. The authors finally settled on 'must' for the following reasons:

While it would be desirable to allow cave managers flexibility to manage caves, widespread capacity for informed cave management does not exist in BC at the present time. The responsibility for making difficult management decisions should not be forced on cave managers before they are adequately equipped with knowledge, support, resources, and the capacity to make fully informed decisions.

Most cave environments are unforgiving of management mistakes; as was noted earlier, there often is no second chance. 'Should' implies that a particular course of action is optional, to be taken if one feels like it so long as it fits with one's plans. Though it may seem harsh, the term 'must' is more appropriate to cave management because it removes ambiguity and reinforces the Precautionary Principle.

Cave resources must be managed to preserve fundamental physical and biological processes, as well as individual features, species, animal and plant communities and the habitats that support them. In addition to a responsibility to preserve natural cave resources and systems, the cave manager must also consider and protect any

cultural resources in, or associated with, the cave, and maintain the less tangible environmental qualities of the cave such as 'pristine-ness' or sacredness.

The cave manager must actively promote and pursue measures to protect caves and their values against human agents of damage or destruction. He or she should avoid associating the overall management of caves with management of recreation, and archaeological or palaeontological research values, and should instead emphasize maintenance of the ecological integrity of the cave site. Preventative management must be employed as much as possible to maintain the natural condition of the cave and avoid costly rehabilitation or restoration efforts. The natural condition of a cave can be defined as the condition that would occur in the absence of human presence in the cave or anthropocentric activities on the land surface above the cave that could change the cave.

The cave manager must apply the holistic approach to protection and management of natural and cultural cave resources, including managing the possible use of the cave for research purposes. While each resource type in a cave is most closely associated with a particular discipline, an interdisciplinary approach is needed to properly define the protection and management needed for a cave.

It is recognized that many different types of scientific knowledge may be derived through research in caves. Caves often contain superb examples of natural resources and processes with purely intrinsic values, but they can also include significant resources that have value for long term or future observational studies, or as control cave environments. The granting of access to a cave for consumptive research uses must only be contemplated for approval if it can be demonstrated that cave resources and natural conditions will not be impaired.

Note: Many of the recommendations that follow in this report section could be applied to research activities other than palaeontological or archaeological research activities.

PERMITTING SYSTEM

A formalized system of permitting for manipulative or destructive palaeontological or archaeological research activities that could adversely impact cave resources or values must be developed and used by the cave manager. This permitting system must adhere to the principle of treating objectives for consumptive palaeontological or archaeological research activities as subordinate to the overall cave management objectives for the cave's full spectrum of natural and cultural resources or

values. The cave manager must issue permits only when it has been determined that palaeontological or archaeological collections or studies will not create long-term impacts to cave resources. If there is reason to believe that the activities would lead to unacceptable impacts, the proposed activity must not be approved.

Palaeontological and archaeological research involving the physical removal or repositioning of objects, sediments or specimens from the cave is a potentially destructive process with the potential to unacceptably impact other cave resources or values associated with those components of the cave. Palaeontological resources in particular, including both organic and mineralized materials, should be protected, preserved and managed in situ for public education, interpretation and scientific research.

The cave manager must not allow any research activity that could reduce the research potential of the palaeontological or archaeological resources themselves without first performing an appropriate level of research, consultation and documentation.

Palaeontological and archaeological resources in caves must be preserved and protected as integral parts of the cave system if possible. Their removal, or activities associated with their removal, has the potential to alter the natural condition and inherent integrity of the cave. Generally, palaeontological or archaeological resource materials in restricted access caves must be left in place. Specimen collection should be well justified to the cave manager, and no natural or cultural components of the cave should be excavated, exhumed or removed without prior written permission from the cave manager. There must be compelling evidence that any physical disturbance of cave resources is warranted by extenuating research, preservation, or protection imperatives, or by significant interpretive requirements that cannot be achieved by non-destructive means.

Prudent management of palaeontological or archaeological resources includes proactive measures to mitigate threats of rapid erosion, vandalism, or unintentional harm. Measures such as on-site protection or stabilization must be considered and used before physical disturbance and possible collection are approved. The collection of palaeontological or archaeological material in caves that are threatened internally must normally be limited to the recovery of materials directly subjected to the threat, taking into account the implementation of any mitigation measures that the cave manager considers appropriate.

In most cases, the protection of the cave must be the predominant consideration when use conflicts

arise. The cave manager must be vested with the authority to disallow palaeontological or archaeological research activities that could result in unacceptable cave impacts, even when the research proponent is acting in accordance with a permit issued by the Archaeology Branch under the Heritage Conservation Act.



Figure 8

PRE-OPERATIONAL REQUIREMENTS

CAVE INVENTORY AND EVALUATION

The cave must be inventoried and evaluated before the cave manager can render a decision on a submitted research proposal. Government policy statements and guidelines for managing Crown land cave resources set out that important or priority caves should be inventoried and evaluated for the full spectrum of cave resources or values. (BC Ministry of Forests 1983, 1986, 1990, 1991, 1992, 1994)

The identification of palaeontological and archaeological resources can help to establish the protection strategy required for a cave, but this information is only one part of the overall cave inventory. The full range of other cave resources or values must also be appropriately inventoried and evaluated. The cave manager must use the inventory and evaluation information to support the cave management plan for the cave.

CAVE MANAGEMENT PLAN

A specific management plan for the cave must be in place before the cave manager can render an informed decision on a submitted palaeontological or archaeological research proposal. An acceptable cave management plan is one that supports perpetuation of the natural systems associated with the cave, such as drainage patterns, airflows, mineral deposition, and plant and animal communities. The cave entrance zone and photosynthetic plants that inhabit it is considered an integral part of a cave system for management purposes.

IMPACT ASSESSMENT

All research proposals for palaeontological and archaeological studies with the potential to disturb resources or values in a cave must be accompanied by an impact assessment report detailing the potential impacts of proposed research activities on the overall cave ecosystem. Before considering the approval of palaeontological or archaeological research activities, the responsible cave manager must use the report to help make an informed determination in writing that the proposed activity will not lead to unacceptable impacts and impairment of cave resources or values. In making the determination, the cave manager uses professional judgment and seeks, as needed the advice of qualified persons who are subject experts or have relevant knowledge or experience about the sensitivity of cave resources, processes, systems and values. (see Commitment to Professionalism section) As always, the protection objective must be predominant in weighing competing uses of the cave, and the cave manager should restrict or eliminate research activities that are already taking place and shown to be detrimental.

BASELINE MONITORING

The cave manager must obtain relevant baseline data on the nature and types of cave resources and the cave environment before research can be approved and activities in the cave commence. The data must be reviewed in consultation with cave resource specialists with relevant expertise in the specific subject area where necessary. In collaboration with the cave resource specialists, the cave manager must use the baseline data to set indicators of change to monitor and identify ways to address and monitor unacceptable impacts. Unacceptable impacts can be defined for this purpose as those that, individually or cumulatively, are inconsistent with objectives for the current or future desired conditions for the cave. The threshold at which a change in the cave occurs that should trigger a management response must be initially set with a margin of safety to ensure that a permanent unacceptable impact will not occur.

RESEARCH PROPOSAL

Approval of palaeontological or archaeological research activities in a cave must be preceded by the submission of a research proposal by the research proponent to the cave manager. The proposal should include a detailed description of the nature and scope of the intended work. Cave managers should appropriately review proposals to ensure consistency with the cave management plan. An advisory panel of specialists should be assembled to evaluate any future proposals

submitted to MFR for conducting archaeological or palaeontological research activities in caves.

In the event the Archaeology Branch has issued a permit under the HCA to conduct an investigation, the Branch must be required to draw to the cave manager's attention the existence of the HCA permit. The Branch should set out the details of the proposed investigation activity for the cave and recognize the lead role of the cave manager for overall cave protection and management. This essential notification step is consistent with the Archaeology Branch policy direction for integrating archaeological resource management into forestry planning and operations as detailed in British Columbia Archaeological Resource Management Handbook for Foresters (MTSA 2007).

When evaluating a research proposal, the cave manager must first consider if it is feasible to conduct the project in a less sensitive cave where manipulation of the palaeontological or archaeological resource materials is less likely to result in unacceptable impacts. Constraining manipulative or destructive research activities that have the potential to cause material damage to less sensitive caves (e.g., caves designated by government as directed access caves) can lessen demand for access to the limited number of sensitive and highly vulnerable caves. The cave manager must also consider the potential for the proposed research activities to result in unreasonable interference with existing appropriate activities or uses. The cave manager must ensure that research is coordinated such that decisions are not made in isolation for the same cave. The identification of mutually acceptable alternatives to a research plan can be explored in the event an initial proposal is found to be unsupportable.

Manipulative or destructive palaeontological or archaeological research activities, including specimen collection, must require a scientific research and collecting permit or other written authorization issued by the cave manager. A written statement of environmental and cultural resource compliance appropriate to the proposed methodology and the cave must accompany the decision to approve a research proposal. Research activities that diminish opportunities for future researchers to learn something from natural or cultural cave resources in their natural context must be disallowed.

CONSULTATION WITH AFFECTED PARTIES

Proposed palaeontological or archaeological research activities with a potential to alter cultural heritage resource values of the cave should be approved or disapproved only after adequate planning and consultation with

interested or affected parties, including First Nations.

It is essential to protect caves with archaeological and cultural heritage resources or values significant for First Nations. When proposed palaeontological or archaeological research activities risk harming the cultural heritage cave resources or values, the cave manager must consult on a government-to-government basis with the First Nations whose cultural life is shown to be associated with the cave site. Proposals received for research activities in caves with known First Nations cultural heritage resources or values must be referred to affected First Nations for review and comment. Of necessity, meaningful consultations or information sharing with First Nations should address the protection of all relevant natural and cultural heritage cave resources and values. The consultations should take place apart from Archaeology Branch referrals in use for HCA permitting purposes, as these referrals cannot be relied upon to adequately address the protection of the natural cave resources or values that might be associated with the cave, or possibly the cultural cave resources or values not legally protected under the HCA. Indeed, information sharing with First Nations would be appropriate in cases when major alterations to an existing cave environment are planned for, to facilitate a heritage investigation. There could be an existing use of that cave by a First Nation that is of continuing importance to them, and they should be given sufficient opportunity(s) to communicate their interests in the area.

While the cave manager must consider the views held by First Nations when reviewing palaeontological or archaeological research proposals and making decisions for caves with cultural heritage resources or values held significant for First Nations, he or she must not approve research activities that could lead to unacceptable impacts to the cave. The rationale for the rejection of a research proposal must be made known to affected First Nations.

OPERATIONAL REQUIREMENTS

Archaeological or palaeontological research activities approved by a cave manager must employ non-destructive research methodologies to the greatest extent practicable. Where manipulation is unavoidable, researchers must use practices and procedures that protect cave processes, and natural, scenic and cultural resources. Adverse and potentially irreversible impacts on cave sediments must be minimized. Normally, only small quantities palaeontological or archaeological resource materials may be collected. Repeated collecting visits should be discouraged. Materials removed from the cave

must be properly curated and not used for commercial display purposes. Casts or replicas should be substituted for display purposes.

Defining or redefining a travel route in the cave to facilitate research may be required to control the sediment tracking. The removal of boots or boot washing to remove mobile material is frequently not a practical countermeasure; neither is it possible to effectively clean up tracked floor sediments.

If protracted research uses are to be permitted in the cave it may be more practical to protect the floor of the cave with a suspended walkway or other removable infrastructure.

PARTY SIZE

A research party will vary in size depending on the nature of the palaeontological or archaeological project. Even so, the size of the party to be permitted inside the cave at any one time should be limited to as few persons as possible, and consideration must be given to the ratio between the number of experienced guides or resource monitors and novice visitors. A maximum party size of three or four persons only should be allowed for most visits to a cave.

Note: Consideration must be given to rescue preparedness and prior notification of BC Cave Rescue if the technical difficulties of the cave, or the nature of the party and planned work in the cave, warrant. The resource monitor must be familiar with contingency planning and small party self-rescue techniques for caves.

USE OF RESOURCE MONITORS

Each research party must have one or more designated resource monitors approved in advance by the cave manager. The resource monitor is a person well familiar with the cave and with demonstrated qualifications in the cave management field.

He or she is present in the cave with the research party to make key methodological decisions on safety and conservation matters and has the right to deny access to any person within the party who may threaten the integrity of the cave or the safety of the party.

Change Detection

When an approved research use is operational, the cave should be monitored anew and independently of the research party to detect changes relative to the baseline data obtained prior to approval of the research. Monitoring results must be used by the cave manager to identify adverse and unacceptable levels of change

and to develop appropriate management actions. The actions taken by the cave manager and the decisions to limit use must be based on well-supported cave management principles and objectives outlined in the cave management plan, the best scientific information available, and a strict adherence to the precautionary principle.

REHABILITATION OR RESTORATION

Rehabilitation or restoration attempts may be warranted to reestablish natural cave functions and processes should unacceptable impacts occur during the course of an approved research project. While much cave damage cannot be 'restored' the harm to cave processes can be moderated. Any occurrence of damage must be recorded by the resource monitor and promptly reported to the cave manager so that work can be stopped if necessary and a plan for repair and restoration can be developed.

The impacts to the cave should be further assessed using standard cave photomonitoring techniques and compared to the baselines established through the initial monitoring completed before the research was approved. This helps to establish the spatial characteristics of the damage and documents the type of damage that can occur.

No further work in the cave should be permitted until a satisfactory plan and budget for possible remediation is in place. Full restoration work is expensive to undertake and rarely successful in execution. The cave manager may consider securing a portion of the funds needed to support rehabilitation or restoration projects through the establishment of a reclamation bond.

LEADERSHIP IN ENVIRONMENTAL STEWARDSHIP

Cave managers must have an obligation to demonstrate and promote leadership in environmental stewardship. Achieving and maintaining a superior level of cave management performance means implementing strategies supported by best available management practices and sustainability principles that go beyond legal requirements.

Managing the impacts of archaeological or paleontological research in caves to protect other cave resource values is not a legislated requirement in British Columbia – but it should be! Ideally, a cave and its resources or values should be passed on to future generations in as good or better condition than we find them in today. This pursuit is entirely consistent with attainment of BC's Great Goal #4 – to lead the world in sustainable environmental management.



Figure 9

COMMITMENT TO PROFESSIONALISM

A satisfactory level of cave management performance demands a sustained commitment to professionalism and continuous improvement. Approved palaeontological or archaeological projects in caves should be administered and conducted only by fully qualified personnel and conform to current best management practices.

Cave managers must call upon qualified cave resource professionals to assist in reviewing all aspects of proposed research having the potential to alter the cave in an unacceptable manner in order to reach informed management decisions.

Palaeontologists and archaeologists must also consult with cave resource professionals before undertaking any work in caves, including but not limited to activities such as reconnaissance and planning visits, impact assessment studies, the operational phase of the research, and assessing the need for any repair or restoration work. Researchers must recognize and acknowledge the limits of their professional competence or area of specialization with respect to caves and they must be careful to work within those limits.

The principles and procedures embodied within the BMPs should be incorporated into government training curricula for cave managers and other government cave and karst resource management personnel. Management agencies should seek to develop their expertise and capacity for karst [and cave] management (Guideline #14, Guidelines for Cave and Karst Protection, IUCN World Commission on Protected Areas. 1997:14).

TRAINING AND EDUCATION

Given that effective cave management requires informed decision-making about all aspects natural and cultural cave resources and values, cave managers must be knowledgeable about the laws, regulations and policies that may pertain to the cave resources and values that they are responsible for protecting and managing. This

knowledge base must include familiarity with informal policies and understandings that have been recognized by the responsible management authority as specific guidance or direction.

Training and education programs should also be developed to help make archaeologists, palaeontologists, and the general public more aware of the full range of values associated with caves, the sensitivity of caves to human disturbances, and other cave conservation issues and concerns.

The Ministry of Forests and Range must designate one staff person and one alternate to coordinate the cave management program for the District. This measure alone will help the District to develop a more proactive and visible role in managing caves. This individual is termed the 'cave manager' for the purpose of these recommendations for policy and administration for palaeontological or archaeological cave research in caves in Provincial forests.

A NOTE ABOUT NON-DISCLOSURE TO THE PUBLIC

Providing information about the location of cave resources may place these resources at risk of damage, theft or destruction. It is therefore inappropriate to release this information to the public in most cases. The cave manager must withhold information about the nature and specific location of sensitive caves, unless it is determined that disclosure of the information will further the protection of the cave and would not create an unreasonable risk of harm, theft or destruction of cave resources.

OTHER CAVES IN PROVINCIAL FORESTS

There is a growing legacy of problems involving similar research activities at other BC caves in recent years. Other caves in Provincial forests where archaeological or palaeontological research has already taken place should be inspected and their condition documented by qualified persons. Additional reference or no-use caves should be established where appropriate.

PROVINCIAL CAVE PROTECTION LEGISLATION INITIATIVE

The statutes of BC with the goal of conserving and managing cave ecosystems were examined by the West Coast Environmental Law Association (WCELA) in 1992. The WCELA report on the need for a BC Cave Protection Act concluded:

'No one act would provide for [cave] ecosystem protection as contemplated. While a coordinated effort on the parts of a number of government actors might achieve the result without specific

legislation, we recommend specific legislation providing for cave ecosystem protection and establishing the Ministry of Environment responsible for administration of existing policies, procedures and field guidelines have not been effective and because they are, to a considerable extent, not enforced. The Act would also serve as a mechanism to inform people of the significance of cave ecosystems in BC.' (West Coast Environmental Law Association 1992)

The P2 case is another instance where the need for separate, specific, and overarching cave protection legislation in BC is highlighted. Cave managers and administrators should actively support the Provincial Cave Protection Legislation Initiative.

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EDITOR'S NOTE: The full report, containing substantial additional material and appendices, is available on request from Paul Griffiths: <pgriff@island.net>

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the problems found through this review.

Many specialists and/or recognized experts in the areas of karst cave protection and management were also consulted for the purpose of this review. Cave management is an inherently multidisciplinary undertaking. It therefore stands to reason that a review of cave management issues should also be multifaceted. Invaluable contributions, critiques, comments and encouragement came from sources as diverse as environmental law specialists, cave and karst resource managers, experts in the areas of karst cave protection and management, a First Nations lands manager, cave and karst researchers, compliance and enforcement officers, geoscientists, biospeleologists, citizens groups, cavers, professional foresters, archaeologists, ecologists, biologists, elected government representatives and assorted academics, senior government administrators and planners, and legislation and policy specialists.

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