Cave and Karst Management in Australasia XVII

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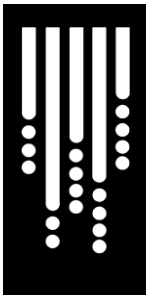

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Introducing Cultural Heritage

Elery Hamilton-Smith

Abstract

Caves have fascinated all peoples. So they are often seen as places of spiritual importance, as a site of religious rituals, as a place of curiosity or a place of great beauty. So, in addition to their value as natural heritage and often of scientific importance, they have also been seen as cultural icons. In some cases, use of a cave as a sacred or other special place is inextricably related to the surrounding landscape and so falls into that group of heritage sites now known as cultural landscapes. At another level, some are places of great intensity, and our keynote speaker will discuss the very specific example of rock art.

Introduction

Arguments for the protection and conservation of caves have often focussed upon their "scientific" values and there is no question that these are of great importance. Further, virtually all cave and karst sites recognised in the World Heritage Register have been inscribed on the basis of Natural Heritage Criteria. Most of the smaller number of sites inscribed as Cultural Heritage are archaeological sites. Similarly, much of the speleo-conservation rhetoric and the media coverage have focussed upon "science".

Yet, if we reflect upon the real interest demonstrated in many cave areas by both managers and the public, then we can readily see that social, cultural and historical events and issues play a major role.

Some of this may be because entertainment will boost visitor numbers and make more money, but Buchan provides a fascinating example of a site that is extremely rich in its cultural values. In fact, the caves provide the core sense of identity for Buchan as a township and a community.

In making cultural heritage values a major theme of this conference, I am sure many other areas will be able to think of a comparable historical and cultural context in their own cave area, although sadly, none have offered papers on this theme.

The Fascination of Caves

Virtually all people appear to be fascinated by caves, or to find them of value as comfortable housing, a source of food, a shelter during war and other utilitarian purposes. Many stories have been told about them over the centuries. Perhaps most importantly, caves have also served as places for magic and worship. In short, virtually all cultures appear to be fascinated by caves for one reason or another. It also goes further back, not just to prehistoric peoples, but also even to early humanoids, and to our predecessors, including the Neanderthal.

The First People

When the Aboriginal people arrived they would have found an attractive living area with plenty of good food and a number of rock shelters along both the Buchan and Murrindal rivers. The river flats would also have provided habitation sites in good weather. Cloggs Cave and New Guinea 2 Cave (on the Snowy River) are the only two sites to have been adequately investigated by archaeologists (Flood 1973, 1974; Ossa et al 2002).

Sadly, there are also major sites of the Aboriginal massacre by early settlers. Slaughterhouse Cliffs is probably the best-known example. White settlers claimed that the massacre which occurred here was necessary because the aboriginal people had been stealing sheep and cattle. The Aboriginal story is a very different one. A farm worker named Dan Moylan had kept a young Aboriginal woman tied up in his hut and raped her repeatedly. She was rescued and Moylan was killed by a group of aboriginals. This led to them being pursued and slaughtered. Probably the Gippsland area was the first area to see such major attacks on the aboriginal population. John Alexander Rose, who was one of the early pioneer settlers, left because of this and moved to the Grampians (Roses' Gap) where he became

known as a friend and protector of the Aboriginal people (Gardner 1990, 1993; Pepper and De Araugo 1985).

So, Aboriginal Cultural Heritage can be seen in Cloggs and New Guinea II caves, other rock shelters and campsites, and (sadly) the Slaughterhouse Cliffs.

White Settlement during the 19th Century

Although the caves were recognised by Stewart Ryrie (1840) in his survey expedition (and perhaps even earlier) they received little attention. Awareness of them gradually increased and by the 1880s some landowners and hotelier J. C. Wyatt, commonly took visitors through the caves. Broome (1886) described the lighting arrangements. Visitors were generally given candles but their leader would carry a bundle of stringy bark soaked in kerosene and light it when entering the cave. At that stage, the most popular cave tours appear to have been to Spring Creek and Wilson Cave.

Wyatt's Reserve was established in 1887 as a camping area and a stop for drovers. It is hardly a suitable site, but probably was the only bit of land not already taken up for pastoral purposes. As was often the case in southern Australia, the Buchan area became a focal point in the search for minerals and a small mine was initiated at the Pyramids.

This was not particularly successful but it did bring people with mining experience to the area and they probably were more willing to search for and enter caves. J. C. Wyatt was one of these and soon realised that he could make more out of mining by running a hotel than by looking for minerals. He laid an important foundation for the development of tourism.

The growing interest in caves led to the first scientific investigation by James Stirling of the Victorian Mines Department. J. H Harvey of the Public Works Department, who happened to be one of the leading amateur photographers of the day and who took the excellent first photographs of the caves, accompanied him.

Harvey became an enthusiastic campaigner for the caves to be reserved and opened for tourism along the lines of the Jenolan Caves. With the growing pressure for commercialisation, geologist Albert Kitson (later Sir Albert) was sent to report further on the caves and recommended an important series of reservations.

Aspects of cultural heritage that can be seen to this day include

- Wyatt's (long known as the Potholes) and Wilson reserves;
- Development of Wilson Cave both to provide for visitors and to provide a place where the locals held many parties and special events
- Spring Creek Cave as the site of Stirling's investigations
- Early buildings: Murrindal Homestead and Homeleigh come readily to mind.

The Fairy Cave Discovery

Frank Moon had grown up in Buchan but went wandering as a prospector and miner. He was a very fit man and distinguished himself as a champion cyclist in the Kalgoorlie area. Given the competitiveness and difficulties of goldfields cycling (Fitzpatrick 1980), this was a significant achievement. His prize money enabled him to return to Buchan for a holiday with the family, where the caves fascinated him.

A young Missioner, John Flynn, who later became famous as Flynn of the Inland, joined him for a couple of years in exploration. Flynn's photography helped to make both the name of the caves and Frank Moon much better known. Then in 1907 Moon discovered Fairy Cave. In announcing this discovery he said "he had found Jenolan's rival." This was certainly a more beautiful cave than those already known and it was seen immediately as being particularly suitable for tourism.

A large number of visitors started to arrive and make their way through the cave, however, it was clear that this was not approved as there were fears that the cave would be damaged. So within a few weeks, the cave was closed and Frederick Wilson formerly of Jenolan was engage to oversee the development and management of the caves. Wilson also played a part in continuing exploration and led the party responsible for discovering the Royal Cave.

Wilson could well be described as a self-taught engineer. His meticulous design and craftsmanship in construction of barriers from pipe and wire netting to protect the caves was of very high quality. In due course, he also demonstrated excellent capacity for designing and excavating tunnels where necessary. It was necessary to cut a trench through the flowstone floor in various places and he carefully preserved the speleothems that had to be removed. Many were placed in the *Font of the Gods*, so that the original three stalagmites were added and became the *Twelve Apostles*.

Fairy Cave proved the turning point for tourism development at Buchan. An excellent Guide Book was published (Whitcombe undated, but 1908) and regular tours were developed. The Caves were publicised at every opportunity and came to be seen as one of the great attractions of the State. The momentum generated by this discovery continued and there was probably little change until the 1930s. The cultural significance is self-evident and largely centres upon Wilson's craftsmanship.

Improvements to the Cave Reserve

Small changes gradually developed, with the development of shelters for visitors who were waiting for a tour to commence, some garden beds, and improved walking tracks. The beginning of significant improvement came in the 1930s when the Committee of Management appointed Landscape Architect, Hugh Linaker, to provide a planting plan for the beautification of the reserve. His plan was only implemented slowly but after Moon's retirement in 1940, Phillip Sandford (previously a foreman at the Melbourne Botanic Gardens) was appointed as Manager and energetically completed the planting very much as initially designed by Linaker.

The other major change came in 1938 when the Minister for Lands, Albert Lind, decided to establish Buchan Caves Reserve as a National Park. His concept of a National Park was that it would be a place that would provide a range of opportunities for recreational activities. At Buchan this was expressed with the caravan park, a camper's kitchen, tennis courts and a swimming pool. The archway, that still welcomes visitors to the Park, was also built at this time. The constructed features tended to be modelled upon those in the United States National Parks and adopted the form known as "Parkitecture". The gateway and the various visitor shelters are excellent examples of the genre.

So, socially inspired features of the Reserve, developed during the 1930s, remain to this day as a central element of the cultural heritage. Caves House, originally built to house Frank Moon, is still maintained. The main street also has Homeleigh (formerly the Cricket Club, then Buchan Hotel), the current Buchan Hotel (formerly Riverview House), Callemondah and the shops of the period. Regrettably, John Flynn's cottage has been demolished.

The Photographic Story

The photography of the caves and their place in the landscape is more than a record of local history - its timing is such that it encapsulates much of the history of photography.

J.H. Harvey used glass plate negatives. But interestingly, he was one of those who continued to use wet plates long after the dry plate technology became available. This meant that he could check the quality of each photograph on site, and if it proved to be unsatisfactory, it was easy to clean off the plate, re-coat it with emulsion, and re-photograph the scene.

Both James H. A. MacDougall (of Walden Studio at South Buchan) and George Rose produced stereographic pictures, which were extremely popular and which were very well suited to provide a sense of depth and perspective in cave photographs. MacDougall also distinguished himself as the first cave photographer to realise that placing his lighting to one side of the intended view showed the crystal structure of cave speleothems much better than the flat effect of frontal lighting.

John Flynn lived through the transition to modern technology and so used various techniques. But although his early photographs were on glass plates, probably on the advice of his mentor Norman Caire, it was Howard Bulmer who really marked the beginning of modern film photography.

Meanwhile, off to one side, J.A. Sears, responsible for much Victorian Railways photography, used a panoramic camera in his

wonderful landscapes and even had the courage to hold it on its side to capture vertical scenes, including his great picture of the coach to Buchan crossing the Boggy Creek Bridge.

The Cultural Landscape concept

A brief definition of the Cultural Landscape idea is provided in the Operational Guidelines for the World Heritage Convention (UNESCO 2005, para 47):

Cultural landscapes are cultural properties and represent the "combined works of nature and of man"…..They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal.

A well-developed discussion can be found in Phillips (2004) and this argues that the basic principle centres about the continuing integrity of the relationship between culture and nature.

Buchan provides an excellent example with its evidence of the relationship between people on one hand and the karst and river environments on the other. It certainly demonstrates the mutual inter-relationship between people and environment.

In fact, the broader region might even be considered with the early pastoral runs; the Lake Tyers Aboriginal settlement, the remaining evidence of the early cave tours in the lakes shipping, Lakes Entrance, Tyers House, Lake Tyers and Boggy Creek; and Cameron's Quarry, which provided the marble for the State Library Building and Australia House in London.

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Australian Rock Art

Robert G. Bednarik

Convener, International Federation of Rock Art Organisations

Abstract

Australia is distinguished not only by possessing the largest concentration of rock art, but also by being the only country that has continuing broad access to ethnographic interpretation of rock art by its traditional custodians. Moreover, Australia has the largest organisation of rock art researchers, the premier scientific journal in the field, and the largest academic congress in the discipline. This paper illustrates the work of rock art researchers, and it offers a brief overview of the huge corpus of Australian rock art. The major regional concentrations of it are introduced, with special attention given to the cave art of Australia, which is the world's second-largest body of this particular phenomenon. Also considered are the methodology of estimating the age of rock art, the issue of its interpretation, and the questions of its preservation and protection. The paper closes with a brief synopsis of the current campaigns to protect rock art in Australia.

Introduction

Australia, almost the size of Europe but with a population only a third of that of Italy or Britain, boasts not only the greatest concentration of rock art in the world, but also the highest number of rock art researchers relative to population size. The work of these researchers over the past twenty or so years falls primarily into four areas: inventories and new discoveries, analytical studies and dating work, ethnographic studies, and conservation and site management projects. This work will be briefly reviewed here.

The perhaps most interesting aspect of Australian rock art research is that the country's rock art scholars are significantly less inclined to attempt interpretation of rock art than those of any other world region. Bearing in mind that Australia is universally agreed to have the strongest ethnographic evidence for the original meanings of rock art (Fig. 1), this presents us with a paradox. It would seem that Australian rock art researchers are either excessively pessimistic about interpreting rock art, or other rock art researchers are excessively optimistic about their powers of interpretative discrimination. The evidence from Australia certainly favours the latter alternative.

However, this is not all we have learned from the rock art of the Great Southern Land. Australian researchers, opting for scientific investigation in lieu of the creation of a modern mythology about rock art, have been very active in such fields as physical rock art analysis, age estimation, preservation techniques and methods of site management. Indeed, Australia is a leader in these fields, a position reinforced by the research work conducted especially since the formation of the Australian Rock Art Research Association (AURA).

Australian cave art

In a speleological context, however, the most relevant type of Australian rock art is perhaps the continent's cave art, which happens to be the world's second largest national body of this phenomenon. Currently the occurrence of authentic cave art has been confirmed in forty-six sites, distributed over four regions across the southernmost parts of the mainland and Tasmania (Bednarik 1990). The four mainland areas of confirmed cave art are the limestone karst bodies of the far south-west (north and south of Perth), the Nullarbor, the Portland to Millicent region centring on Mt Gambier, and a single site just north of Buchan. In most cases, Australian cave art consists of petroglyphs (rock art made by a reductive process), pictograms (made by an additive process) occur in only eight caves. The latter are nearly absent in the main body of Australian cave art, at Mt Gambier, although in 2007 some otherwise invisible motifs were discovered through ultra-violet illumination in one cave.

Among the Australian cave petroglyphs, several genres or styles have been recognised, all of which are entirely non-figurative (non-iconic). Finger flutings, similar to those found

in many French and Spanish Palaeolithic cave art sites, occur wherever soft deposits of moonmilk speleothem (*Montmilch*) have formed (Bednarik 1984), and were found in thirty-four Australian caves so far (Figs 2 and 3). The 'Karake style' has been reported from ten caves, all in the Mt Gambier area, but it also occurs on many archaic rock art sites above ground (Figs 4 and 5). This genre comprises petroglyphs of deeply engraved circles, barred circles and circular mazes, convergent lines motifs (often called bird tracks) and a few other types. There is a tradition of deeply chiselled pits or cupules and heavily pounded rock panels, and a recent tradition of shallow incisions.

It is amply evident that most, but not all, Australian cave art is of the Pleistocene. This is indicated by the superimposition of megafaunal scratch marks (most Australian megafauna had become extinct by around 20,000 years ago) and a variety of speleothems (laminar travertine skins, moonmilk, stalactites and straws); by significant tectonic (structural) changes in the cave morphologies since the art was produced; by indirect dating in two sites (Koonalda and New Guinea 2 Caves); and by direct dating in Malangine Cave (Bednarik 1999). Six of the Australian caves containing rock art have also yielded evidence of underground chert mining, most of which also seems to date from the Pleistocene.

Open air rock art

With such a large national corpus of rock art, the creation of inventories is a long-term process involving many individuals and research teams. Because the greatest concentrations of rock art tend to be in the north of the country, this is where most of the survey work has been focused (Fig. 6). In the far north of Queensland, especially on Cape York Peninsula (Fig. 7), the pioneering work by Percy Trezise (1971) has found a continuation in projects by Andrée Rosenfeld (Rosenfeld et al. 1981), Josephine Flood (1987), Noelene Cole (Cole and David 1992), Mike Morwood (1992), Bruno David (David and Chant 1995) and John Campbell (2000; Campbell and Mardaga Campbell 1993). The major concentration of stencil art is centred on the Carnarvon Ranges in Queensland, featuring not only thousands of hand stencils, but also many stencils of other body parts (arms and feet, even whole human bodies), parts of animal bodies (e.g. emu feet) and a wide range of artefacts (Fig. 8). The famous Arnhem Land rock art (Fig. 9), consisting almost entirely of paintings, was initially explored by such researchers as George Chaloupka (1984) and Eric Brandl. It has been the subject of several more recent studies, involving those of Paul Taçon (1987, 1988), Christopher Chippindale (Chippindale and Taçon 1993) and Erle Nelson (2000; Nelson et al. 1995). Howard McNickle (1991) opened up another major rock art region in the Victoria River district (Figs 10 and 11), which is geographically intermediate between Arnhem Land and Kimberley, and comprises both paintings and petroglyphs. Grahame Walsh (1994) and David Welch (1990, 1993, 1995) have explored the massive rock art body of the remote Kimberley during the 1990s. It consists basically of two major painting traditions, the earlier Gwion-gwion paintings (which were once inappropriately called Bradshaws) and the more recent Wandjina art (Figs 12 and 13). Further to the west, in the Pilbara, Robert Bednarik (1973, 2002) still continues the survey he and Bruce Wright (1968) began in the 1960s (Figs 14 and 15). This study of the world's greatest petroglyph concentration has been augmented by the work of Patricia Vinnicombe (1987) and Michel Lorblanchet (1992). Ben Gunn (1995), June Ross, Dick Kimber, Josephine Flood, Andrée Rosenfeld, Julie Drew and others have conducted research in the central part of the country, around Alice Springs and in other areas. It needs to be emphasised that many of these studies have been carried out with the active involvement of local Aboriginal custodians, whose collaboration with researchers has always proved to be highly productive.

While the sites in the north have attracted the greater interest, it should not be overlooked that inventories have also been attempted in some southern regions. For instance, Ben Gunn has worked in the Gariwerd (Grampians mountains) and elsewhere in Victoria, while Robert Bednarik (1990), Elfriede Bednarik, Geoffrey Aslin, Alexander Gallus and Yann-Pierre Montelle explored the extraordinary cave art sites in four limestone regions along the continent's southern coast. Margaret Nobbs (1984) surveyed the sites of the Olary region, Jo McDonald (1992), Hugh Cairns, David Moore and Kelvin Officer (1992) those near Sydney, and John Clegg (1992) focused on

Sturts Meadows, a major petroglyph site in western New South Wales. While the rock art of southern Australia is visually not as spectacular as that of the north, the scientific issues it has presented are just as important. Finally, a small corpus of about thirty sites has been studied in Tasmania (Sims 1977; Bednarik et al. 2007), consisting mostly of archaic petroglyphs, some of which seem to relate to some of the cave art at Mt Gambier.

It is impossible at this stage to provide reliable quantitative estimates of Australian rock art and in view of the size of the task, this will remain so for many more years. However, in assembling the best estimates from leading specialists working in the main regions one would expect that there are well in excess of 100 000 rock art sites in Australia. The largest of them comprise several tens of thousands of motifs, but as a very rough estimate of average numbers, a figure in the order of perhaps 500 to 1000 motifs per site seems reasonable.

Analytical studies

Scientific analytical work began in Australia with the introduction of direct dating and nanostratigraphy by Robert Bednarik (1979) during the 1970s (Ward and Tuniz 2000). The tradition of rock art dating which Australian researchers have since developed remains impressive by world standards. Nearly all analytical rock art dating methods currently in use were initially developed or introduced in Australia: carbon nuclide and uranium series analysis of carbonates as well as microerosion analysis by Robert Bednarik (1992, 1999, 2002); radiocarbon analysis of oxalates and inclusions in accretive mineral crusts by Alan Watchman (1990, 1992a, 1992b, 1993a, 1996); carbon isotope dating of paint residues by Jo McDonald and colleagues (1990; first used in South Africa, however; cf. Van der Merwe et al. 1987; Hedges et al. 1987); luminescence analysis of sand grains in wasp nests by Bert Roberts (Roberts et al. 1997, 2000); and carbon-dating of beeswax figures (in Arnhem Land) by Erle Nelson and colleagues (Taçon and Garde 2000; Nelson 2000). Methods introduced in other continents, such as the determination of cation-ratios in rock varnishes or of cosmogenic radiation products, have been rejected as unsuitable. Nanostratigraphy, first introduced in 1977 (Bednarik 1979), has during the 1990s been developed into a stunningly sophisticated technique by Alan Watchman (2000; Watchman and Hatte 1996), who with John Campbell (2000) has presented outstanding analytical results from Walkunder Arch Cave in north Queensland. In one case, ten radiocarbon dates spanning 26,000 years were obtained from a sequence of mineral layers only 2.11 mm thick. This kind of work has been made possible by the introduction of innovative techniques such as focused laser extraction of carbon-bearing substances, replacing manual excavation of microscopic stratigraphies (Watchman 1993b; Watchman and Lessard 1993). The development of the Lucas Heights AMS facility by Claudio Tuniz and Ewan Lawson (Lawson and Hotchkis 2000) has been a great help in analytical projects.

Analytical work with rock art is not limited to dating attempts, however. For instance, Noelene Cole and Alan Watchman (1998) have examined paint residues to locate evidence of binder substances as well as incidental inclusions, such as brush fibres, vegetable remains, pollen and airborne matter, all of which can provide useful information about the circumstances of the painting event. Other applications of analytical methods applied in Australia include: investigations of paint recipes by John Clarke (Clarke and North 1991) and Malcolm Ridges (Ridges et al. 2000); 'internal analysis' of engravings in deep limestone caves; and Robert Bednarik's (1998) study of petroglyph technology, which includes the analysis of the tools that were used in creating petroglyphs.

The ethnography of Australian rock art

Ethnographic studies of Australian rock art have been conducted by many scholars, including George Chaloupka (1992), Robert Bednarik (1973), Ken Mulvaney (1996), Josephine Flood (1995; Flood et al. 1992), Claire Smith (1993), Patricia Vinnicombe (1992; Utemara and Vinnicombe 1992), Paul Taçon (1992), Bruno David, Ian McNiven, Robert Layton (1992) and Graeme Ward (1992).

The most important message from Australian rock art studies is that, unless one is a participant in a culture, one has no scientific access to what the rock art means. Much of rock art 'research' outside of Australia comprises such practices and it has to be

resoundingly rejected by the serious scholar. Australian ethnographic rock art research, while still inadequate in many ways, is the most comprehensive in the world. This is the result of observations of the production and use of rock art having been made throughout the twentieth century in some parts of the country and the continuation of the importance of this cultural element within an existing, functioning society. Such research has always shown that the valid interpretations of rock art are vastly more complex than a Eurocentric observer would be able to deduce; interpretations concocted by uninitiated outsiders are almost universally false. We know from various contemporary peoples that their perception of the world can differ significantly from that of, say, modern Europeans, so it would be hasty to assume that people of the distant past, such as the Final Pleistocene people of Europe, perceived the world as modern Europeans do. Hence it is to be expected that the intricate iconographic meanings of palaeoart are not effectively accessible to us.

It is precisely *because* of Australia's superb access to indigenous ontologies and cosmologies that the continent's rock art researchers have learned to exercise restraint in the invention of interpretative mythologies. Researchers of an entirely alien culture have simply assumed that these motifs depict praying humans, by projecting their own iconographic perception and contemporary beliefs and mores onto the mute and undated rock art. It is inappropriate to call the application of such a simplistic belief system 'research'.

Management and protection

At the start of this paper I have shown that there is considerable overlap between the spheres of interest of speleologists or managers of caves and those of rock art researchers, particularly in the area of cave art. There is, however, a second significant common interest. The management and protection of natural monuments such as caves has great similarities with that of cultural monuments in natural settings, such as rock art and megalithic stone arrangements. Both spheres of interest are closely tied to geology, geomorphology and geochemistry, and both develop strategies of securing public and political support for the preservation of the respective resources. Indeed, the similarities are so obvious that both groups of researchers and managers stand to gain from learning from the others' successes and failures. In the case of cave art sites, the common interests are indeed so closely interwoven that they are obvious. But I would argue that these common interests are also well served by considering the similarities in our strategies of garnering the support of the public and the media, and thereby influencing the decisions of policy makers and legislators.

Australian rock art preservation and site management practices owe much to the efforts of Alan Watchman (1992a), David Lambert (1995), Fay Gale (1985; Gale and Jacobs 1987), Andrée Rosenfeld (1985) and Andrew Thorn (1991, 1993), who have been instrumental in establishing an Australian tradition of site care. The underlying strategy is that by selecting well-known and easily accessible sites for public viewing, attention is drawn to these localities, while the locations of others can and do remain confidential. Vast numbers of sites are on private land and as many landowners are quite co-operative, this offers considerable protection, particularly in remote regions. Sites selected for public visitation are usually intensively developed, often with marked access paths, raised walkways and viewing platforms, 'psychological barriers' as well as physical barriers of various types, interpretation material and visitor books. Visitors' vandalism at Australian sites has decreased sharply as a result of subtle public education measures. Active conservation measures include graffiti removal, stabilisation of deteriorating rock, the installation of artificial drip-lines and other changes to hydrology, modification of micro-climate, removal of fire hazards, dust suppression and installation of protective barriers. Obviously there are many parallels in cave management practices.

Of particular importance is the involvement of local Aboriginal communities who in many cases now own the sites and manage them. They sometimes employ specialists in conservation and management techniques, and with the assistance of relevant state agencies they develop long-term management strategies. Funding of protection and site management programs is available from several sources. As a result of the policies developed over the last fifteen to twenty years, even the few sites

'sacrificed' to tourism are usually in excellent condition, while the remainder is protected by restricting visitors' access and by protective legislation. The Australian public now tends to perceive the country's rock art as a major cultural asset, and as an integral part of the international image of Australia.

This public attitude is itself an important safeguard in rock art protection: it can be more effective than laws, fences or signs. The change in the public perception of rock art, from one of almost complete indifference and ignorance just twenty years ago, coincides with the establishment and progress of the Australian Rock Art Research Association, which since the mid-1980s has lobbied the media and public agencies. In this sense the Association has been spectacularly successful. Not only have these changes had profound effects on the prospects of Australian rock art to survive, they have had equally dramatic effects on the public's perception of Aboriginality, that is, of the value and significance of traditional Australian culture.

This shows how far-reaching the results of campaigns to raise the cultural status of rock art can be in some circumstances. In the Australian experience it needs to be emphasised that the public funds made available to conservation programs are in fact quite unsubstantial. In many cases they are derived from small seeding grants or drawn from various public works programs. The Australian experience indicates that the actual level of funding is not necessarily a decisive factor in the success of a project to protect rock art. The most important factor is that such an endeavour needs to be supported by a genuinely altruistic, non-governmental body such as a scholarly society. Bureaucracies and the mass media can both be usefully enlisted in such efforts, but the impetus must come from dedicated and genuinely motivated individuals with a long-term commitment.

However, this description needs to be qualified in some respects. It should not be swept under the carpet that there are two lingering site management issues in Australia, where state governments have essentially abrogated their responsibilities. The smaller of these two problems concerns Tasmania, where we have experienced ongoing rock art vandalism for the past half-century, because legislation defines indigenous cultural heritage as almost worthless. In Tasmania, the fines for damaging European heritage are 500 times greater than those for damaging Aboriginal heritage, which has encouraged corresponding public attitudes. This is a simple problem and is being addressed by applying considerable international and local pressure to what is essentially an anachronistic attitude of a state government. I am confident that this will be resolved in the short term.

The second site protection and management problem, however, is of an entirely different magnitude. Incredibly, in a country that has one of the world's best practice rock art management records (exceeded only by France), history's greatest confrontation between a state and rock art protection advocates has been allowed to develop. It concerns the largest rock art concentration of the world, which occurs in the Dampier Archipelago of Western Australia (Bednarik 2006). The Archipelago houses in excess of one million petroglyphs (Figs 16 and 17), but in the 1960s the state government began to establish a harbour and processing plants on the main island, Murujuga ('Burrup'). No impact study was conducted and the existence of the massive cultural monument was hushed up so as not to impair development plans. Planning blunders have cost the state government hundreds of millions of dollars, and the loss of about $30 billion in industrial investment in the state (involving the withdrawal of nineteen multinational companies). The present confrontation between the state and the campaign to save the Dampier monument, which I lead, began in 2002 and is continuing. It will continue until the perpetual survival of the largest art gallery in the world (measuring 270 km^2) and Australia's greatest cultural monument is secured. At the time of writing, we are about half way to that goal, but I regard the final outcome as a foregone conclusion, delayed only by an inept government whose ranks are presently being decimated by the Crimes and Corruption Commission informed by our campaign. The state government is presently under investigation by the United Nations High Commission of Human Rights for its destruction of indigenous culture, and it will be sued under the UNESCO Declaration Concerning the Intentional Destruction of Cultural Heritage. In July 2007, most of the Archipelago was listed as National Heritage,

but the massive emissions of nitrogen oxides continue to destroy the Dampier rock art (Figs 18 and 19).

The monumental effort to save the magnificent Dampier Rock Art Precinct (Bednarik 2006) involves numerous initiatives and support groups, but in the final analysis it can only succeed through the voice of the public. Please visit its website at *http://mc2.vicnet.net.au/home/dampier/web/index.html* and sign the Dampier Petition. Thank you for your support.

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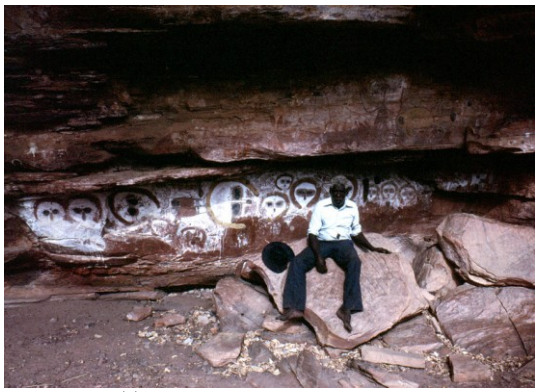

Figure 1. Traditional Custodian at Wandjina site he 'owned', in the Kimberley, NW Australia.

Figure 2. Montmilch (moonmilk) finger flutings in Koonalda Cave, Nullarbor, South Australia.

Figure 3. Single set of finger fluting in a Deckenkolk in Koongine Cave, Mt Gambier.

Figure 4. Karake-style petroglyphs on the ceiling of Malangine Cave, Mt Gambier, minimum dated through uranium-thorium analysis of a concealing re-precipitated calcite skin (speleothem) deposited 28,000 ± 2000 years bp.

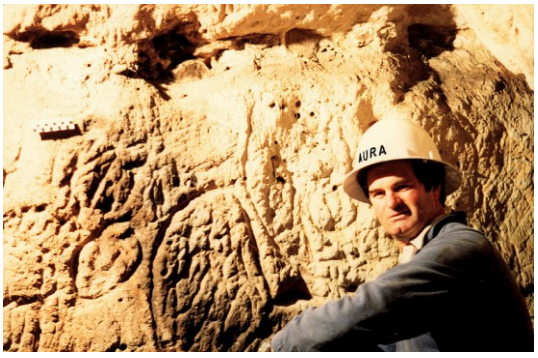

Figure 5. Geoffrey Aslin in Karlie-ngoinpool Cave, which contains not only the largest known concentration of non-iconic cave art in the world, but also some of the most extensive evidence of subterranean chert mining (see mined chert seam, one of three in the cave, in the upper part of the image).

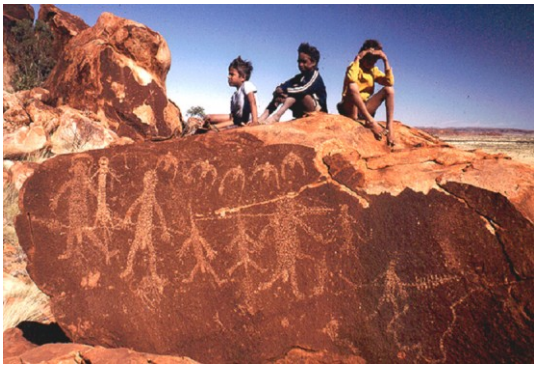

Figure 6. Young initiates being acquainted with cultural heritage from the Dreamtime. Pilbara, Western Australia.

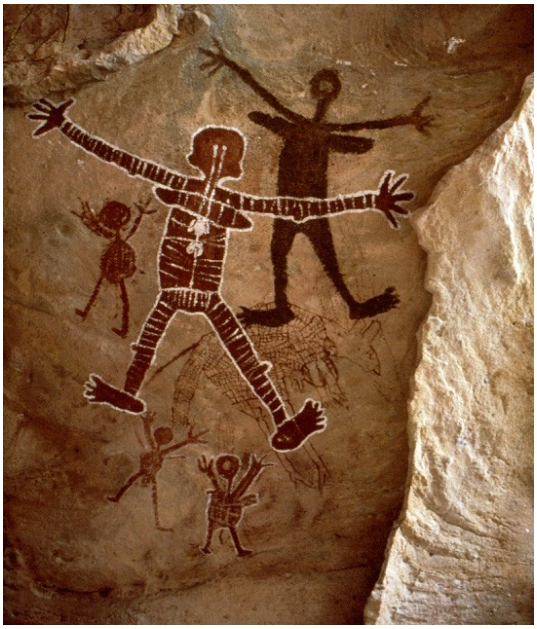

Figure 7. Quinkan rock art, Cape York Peninsula.

Figure 8. Stencil art, Carnarvon Gorge, Queensland.

Figure 9. Arnhem Land rock art, Nourlangie, painted 1964

Figure 10. The babies of the Rainbow Serpent. The Serpent itself, which should not be seen by the uninitiated, is curled up to the lower right. Victoria River, Northern Territory.

Figure 11. Bilbunbilbum, the 'Devil Dog', Victoria River district

Figure 12. Gwion-gwion art (inappropriately called 'Bradshaw figures'), Kimberley.

Figure 13. Dramatic Wandjina art under mushroom-shaped rock formation.

Figure 14. Petroglyphs at Spear Hill Complex, eastern Pilbara.

Figure 15. Macropod petroglyph,western Pilbara, WA

Figure 16. Petroglyph of a spirit being, the name and role of which is only accessible to the initiated, Murujuga, Dampier Archipelago.

Figure 17. Macropod petroglyph, western Murujuga, Dampier, Western Australia.

Figure 18. Sacred images at Murujuga, the meaning of which is known to the author.

Figure 19. The setting of the panel in Figure 18: the flame tower emits 14,000 tonnes of nitrogen oxide per year, which forms nitric acid in the atmosphere. Dampier has had acid rain since 1999.

In quest of Nargun and Nyols: a history of indigenous tourism at the Buchan Caves Reserve

Associate Professor Ian D. Clark

School of Business, University of Ballarat, PO Box 663, Ballarat Vic 3353

Abstract

This paper is concerned to document tourism and indigenous heritage values associated with the Buchan Caves Reserve in Gippsland, Victoria, Australia. It shows that indigenous values have not been at the forefront of the development of the tourism product at the Buchan Reserve. The inattention to Aboriginal values within the development of tourism may best be understood as a structural matter, a view from a window which has been carefully placed to exclude a whole quadrant of the landscape. Indigenous values of places were rarely discussed because they were not in the eye of the vision, 'out of sight' and 'out of mind'. Indigenous tourism at Buchan does not challenge this understanding.

Introduction

This paper is concerned to document tourism and indigenous heritage values associated with the Buchan Caves Reserve in Gippsland, Victoria, Australia. The cultural milieu of the 1840s Europe had seen a shift in the values of romanticism, in which emphasis was placed on feeling emotional about the natural world and 'scenery was something one could gaze at with delight'. Added to this re-valuing was the effect of the rise of natural history and the studies in geology that were emphasising the great age of the world. Urry (1997: 20) explains that 'Individual pleasures were to be derived from an appreciation of impressive physical sites'. He considers that romanticism led to the development of 'scenic tourism'. An essential interest in this new sensibility was caves and other geological curiosities. Caves were fine examples of 'nature's handiwork', and the perception of caves partly as grottos was consistent with romanticism and attempts at domesticating the landscape (Davidson & Spearritt 2000: 8).

The Buchan Caves: a history

European settlement began in the Buchan district in 1837, and the presence of large caverns at Buchan was mentioned in Stuart Ryrie's 1840 report (Ryrie 1840). The first mention in tourism literature of tourism at the caves dates from *Bailliere's Victorian Gazetteer and Road Guide* of 1879 where mention is made of caves near the Buchan township (Aitken 1994). Similar brief references to the 'famous Buchan caves' appeared in Broome (1882, 1884) and Pickersgill (1885). However, the earliest known reference to tourist use of the caves is believed to be RS Browne's (1886) *Our Guide to the Gippsland Lake*.

In 1889 the first geological surveying commenced. James Stirling, Assistant Government Geologist with the Mines Department, published in 1889 a description of Duke, O'Rourke, and Dickson (Dixon) caves, and the Spring Creek, Wilson Creek, and Murrindal caves. He recommended that the Buchan Caves be developed as a tourist attraction, along the lines of the Jenolan Caves in New South Wales. Stirling made ground plans of the Buchan and neighbouring caves and heliotype plates from the expedition photographs by J.H. Harvey, illustrating views in Wilson and Dickson caves. The status of these photographs (and others by Harvey not published in the report) has long been seen as being the first – but a much earlier photograph has now come to light and its provenance is currently being sought for confirmation (E. Hamilton-Smith pers. comm. 17/5/2007).

AE Kitson, a geologist with the Mines Department, in 1900 reported on the caves along Spring Creek. He recommended that cave reservations be set apart along Spring and Cave (now Fairy) creeks, at Dickson, Slocombe, and Wilson caves, in the vicinity of The Pyramids and at the Camping Reserve south of the Dickson Cave area.

By 1900 many of the more accessible portions of the caves had been damaged by vandalism, but Kitson recommended that outstanding features should be preserved and suggested new passages and chambers would likely be found along unexplored portions of the cave

complex. As a result of Kitson's report 65 ha, being the unsold portion of the Buchan township, were set aside as a caves reserve by the Department of Crown Lands and Survey (Government Gazette 19/7/1901; Swift 1951: 3), and 48 ha adjoining this in the vicinity of the Spring Creek caves were also reserved (Government Gazette 29/1/1902).

The 'Fairy Cave' was 'discovered' by Francis (Frank) Herbert Arthur Moon, a local Buchan resident and prospector, on 16 March 1907. He saw a small hole or crevice in the side of a hill, and enlarged it with some gelignite, and descended fifty feet to what is now known as 'Fairy Cave' (Salierno 1987:55). Dr John Flynn, a Presbyterian Home Missioner in Buchan during 1905-6 (McPheat 1963), accompanied Moon on many of his earlier cave excursions, and then paid a brief visit to the newly discovered Fairy Cave. His photographs were influential in persuading the Victorian Government to open the caves for tourism. Paths were constructed through the cave and wire netting installed to protect the decorations. Fairy Cave was opened to the public in December 1907. Initially, lighting was provided by candles given to the visitors and magnesium lamps used by the guides. Electricity was connected in 1920 when a generating plant was installed, and this was used until 1969 when State Electricity Commission power was connected. Subsequently there has been much upgrading of the Caves and associated infrastructure.

The 'Royal Cave' was located in November 1910, by a party led by Frederick J Wilson, Caves Supervisor of the Buchan Reserve since 1907, and formerly the manager of the Jenolan Caves in New South Wales (Swift 1951: 6). The others were Frank Moon and Constable Brown, a local policeman (Allen correspondence 28/5/1968 in File 'Caves and Tourism'; Brown 1920). At Royal Cave, in 1913, William H. Bonwick and William Foster, reserve employees, cut through a solid block of black marble, and used a large quantity of explosives to get through 150 feet. The cave opened to the public in November 1913.

'Federal Cave' was discovered in March 1915 by Wilson and Bonwick, and possibly Frank Moon (Moon 1985). In 1917, a tunnel was cut from the northern end of the Federal Cave, and in November of that year, the public was able to enter the cave (Dept. Crown Lands and Survey, 1975: 11). Thus, the entrances to the three show caves are artificial.

In July 1918, a committee of Management was constituted which continued until its reconstitution as an advisory committee in 1946.

In 1926, the Swanston Motor Tourist Bureau was offering tours, inclusive of accommodation, to the Australian Alps, Mount Buffalo, Omeo, Gippsland Lakes, and Buchan (8 days, cost £12.10s), and to the Gippsland Lakes and the Buchan Caves (8 days, £9.10s) (Wells 1986:258).

The caves area which was reserved in 1901 had long been used for camping and was subjected to a number of changes in reservation status and regulations. But a major change came in August 1930 when Hugh Linaker was commissioned to landscape the reserve. Then in December 1938, after extensive construction of new camping and recreational facilities the Buchan Caves National Park was officially opened.

The caves were closed to the public for four years from February 1942 owing to the fact that every staff member enlisted for military service during the Second World War (Swift 1951: 7).

In 1946, an Advisory Committee, under the chairmanship of EJ Pemberton, was formed to advise the Department of Crown Lands and Survey, on the development, maintenance and supervision of the caves. In 1951, the advisory committee comprised representatives from the Departments of Lands and Survey; Public Works; Victorian Railways, and a Lands Officer from Bairnsdale (Swift 1951: 6).

In 1991, a draft management plan for the karst and cave resources in the Buchan and Murrindal area was produced (Boadle 1991). In that plan, it was stated that the Buchan Caves Reserves consist of nine separate blocks, the largest being immediately west of the Township of Buchan, generally known as the 'Buchan Caves Reserve'. Archaeological values were listed as one of the values of the area, defined as 'Cloggs cave was occupied by aboriginals approximately 18,000 years ago. Such sites as this were highly significant (Boadle 1991: 6). Research at Cloggs Cave had revealed important palaeo-environmental and palaeo-climatic information, in addition to its

heritage values (Boadle 1991: 12). Recommended actions listed in the draft management plan, included that 'The aboriginal history of the region will be included in interpretive activities (Boadle 1991: 29)'.

In 1994, Richard Aitken, prepared a Classification Report for the National Trust of Australia (Victoria) of the Buchan Caves Reserve. Aitken considered the Buchan Reserve ranked second to the Jenolan Caves Reserve in New South Wales, in terms of its contemporary popularity, impact on local and regional development, surviving attributes and historical importance. The Buchan Reserve contains many fine examples of protective features, and the period and nature of the tourist development is comparable with places such as Mt Buffalo Chalet. A notable feature of the Buchan Caves Reserve is the degree to which it has been modelled on the United States of America National Parks Service, particularly the adoption of 'parkitecture' styles for some of its buildings.

Aboriginal spatial organisation in the Buchan district

The Buchan Caves National Park falls within the Krauatungalung language area (Clark 1998:189-190). This language or dialect, is one of five normally referred to as the 'Ganai nation' or 'Kurnai nation', a cluster of dialects sharing linguistic, social, cultural, political, and family associations. According to Howitt (1904:76) Krautungalung is derived from 'krauat' meaning 'east, and 'galung' meaning 'of' or 'belonging to'. Hence the name means 'belonging to the east', or 'of the east', and the name serves to differentiate, geographically, these dialect speakers from other Ganai or Kurnai dialects. The placename Croajingalong is a corruption of Krauatungalung.

There may have been a clan centred on Buchan, known as the Buchan mittung (Howitt Papers 1876 in Wesson 1994: 48). Robinson (Mackaness 1941: 17) referred to a 'Buchan tribe', but this may be a general reference, like the term 'Loddon tribe', or 'Yarra tribe'. Howitt's (1904: 80) reference to a man belonging to 'Bukkan munji', is a reference to the place, which Howitt stated should be referred to as Bukkan munji, and not as Buchan. Thus, Bukkan munji is a place name, and not a clan name.

Within the ethno-historical records and general literature on Buchan, several meanings and derivations are given for the name 'Buchan'. GA Robinson, for example, spelt Buchan several ways: Buckun (Jnl 3/6/1844); Buckin (Jnl 17/6/1844); Bucking (Jnl 21/6/1844); Buckan (Jnl 4/7/1844); and Bucken (Jnl 5/7/1844).

One view is that it is of Scottish, or pseudo-Scottish, origin (Howitt 1904: 80; Seddon 1994:63; Morgan 1997: 21). The BSC (1989: 8) suggested that the many people of Scottish origin who settled in the district were responsible for the current spelling 'Buchan', after the town in Scotland.

Another is that it derives from the word 'bukin' or 'bugin', a medicine-man of supernatural ability, dreaded because he stole human kidney fat its magical properties' (Roberts 1977:14). Roberts speculated that perhaps the caves were haunts of the dreaded Bukin. The BSC (1989: 8) claimed the Bukin inhabited caves. According to Howitt, the Baukan was an evil spirit of which little could be learned. He was only able to state they were negative, but not very powerful, and consequently not much feared (Fison & Howitt 1880: 254).

A third is that it was called Bukkan-munji (Howitt 1904: 80); Bukan Munjie (Fison & Howitt 1880: 192; Salierno 1987:51), Bukkanmungie (Gardner 1992: 17), Buk Kan Munjie, Bukinmunjie (Seddon 1994:62). Howitt (1904: 80) noted that Bukkan-munji was 'the native name for the bag in which the Kurnai carries various articles', and literally means 'bag there' or 'the place of the bag'. According to Seddon (1994: 62) the name signifies a carrying bag, the common suffix 'munjie' indicating 'women's article'. Gardner (1992: 17) translates Bukkanmungie as 'place of the woman's bag'. The BSC (1989: 8), however, translate mungie as 'water'. Another translation is 'Grass bag' (BSC 1989: 8).

William Thomas informed the Central Board for the Protection of Aborigines, in 1861, that 'Buccan' meant 'stack of rocks with a hole in it' (Pepper and De Araugo 1985: 120). The tourist brochure 'Buchan Visitors Guide Snowy River Country', produced by the Buchan Tourist Association in conjunction with Lakes and Wilderness Tourism, in a variant of Thomas' entry, claimed Bukan-

Mungie means 'place of rocks with holes in them'. According to Roberts the specific area from which Buchan Mungee is supposed to take its name is near the junction of the Tarra Creek with the Buchan River; an area where cliff section reveals sharply folded and contorted limestone strata, and close to recently discovered Aboriginal caves.

The Ganai word for 'cave' was most likely to be the equivalent of their word for hole, 'Ngrung' (Fison & Howitt 1880: 191), which is used in reference to the 'hole of Nargun'

Aboriginal heritage values at Buchan Caves

In 1952, Robert H. Lavelle submitted a draft manuscript about the Buchan Caves to the Department of Crown Lands and Survey. A copy of this manuscript is on file at the Parks Victoria Buchan Office. The manuscript is entitled 'Buchan Caves Victoria Australia: Australia's most wonderful Caves'. It was Lavelle's intention to submit the manuscript to the London magazine, *Wide World Magazine*. It has not been possible to confirm if the article was ever published. The manuscript is of interest because it contains interpretation of the significance of the caves, as well a description of the site by an Aboriginal man named Harry Belmont.

The Aboriginal tribes who inhabited these domains know of the caves from time immemorial, and for the reason that parts were used by the Headmen as a secret ritual ground, their existence was closely kept secret, and only by the chance of an inquisitive boy were they discovered in 1891 (Lavelle 1952: 1).

Regarding the scenic setting of the caves, Lavelle (1952: 4) noted:

> The whole is a dream of Paradise, without saints; that is unless you are willing to admit that the natural fauna are the spirits of the Saints, as the aboriginals do.
>
> The best description I ever heard was uttered to me by an aboriginal friend, 'Harry Belmont', who pointed to the caves and said in his own tongue; 'Bogong, Murryang, Biamee'. I asked him for the translation of those three phonetic words. It is: Bogong: the birthplace of a great spirit. Murryang: we meet in that dream land at the end of the ocean where Biamee lives. Biamee: God, or Great Spirit. This, truly is the finest description one can give of the Buchan Caves: 'Paradise on earth'.

He concluded with a discussion of Aboriginal place names:

> Curious unfamiliar names, such as Gelantipy and Wulgulmerang Ranges convey only a hint of the original inhabitants the aboriginals (Lavelle 1952?: 5).

It has not been possible to learn anything about Harry Belmont. His name is not entered into the Aboriginal Biographical Index at the Australian Institute of Aboriginal and Torres Strait Islander Studies. The index to marriages in New South Wales does list a marriage in 1926 in Sydney of one Harold Belmont to Vida Brown (Registration No. 11395). Preliminary analysis of the three Aboriginal words listed by Lavelle, as derived from Belmont, does suggest a connection with New South Wales. Biamee is likely to be a reference to 'baayama' meaning 'god', listed in Austin's (1992: 53) dictionary of the Gamilaraay language of northern New South Wales spoken at places such as Moree, Narrabri, Gunnedah, Tamworth, and Boggabilla. Ridley (in Smyth 1878, Vol. 2: 285) confirms that Baiame (pronounced by-a-me) was used by Aboriginal groups scattered across northwest and west New South Wales, and was used by the Wiradjuri people at Mudgee and other localities. 'Bogong' is a Ngarigu word for the brown moth *Agrotis infusa* which breeds on plains in southern Australia (Dixon et al 1992). Adult moths migrate to mountains where they collect in rock crevices in early summer and were harvested by Aboriginal people and were a staple food source at this time. This understanding of bogong diverges from that given by Belmont. It has not been possible to find any reference to the other word.

When the Bataluk Cultural Trail was being developed in the mid-1990s, see below, the brochure, which was printed in 1995, stated the following about the Aboriginal heritage of the Caves themselves.

Traditionally Koorie people did not venture deep into the limestone caves at Buchan. There were, however, many stories about the wicked and mischievous Nyols which live in the caves below the earth.

Phillip Pepper recalled that in the early 1900s, his father, Percy Pepper was a friend of Frank Moon. They shared a passion for foot running, and would often run together. They would also go rabbiting together. Phillip recalled that his father was setting rabbit traps with Frank Moon on one occasion when Moon 'found one of the caves at Buchan' (Pepper & De Araugo 1989: 53).

In Gippsland, caves are associated with two mythical beings; the Nargun and the Nyol. In 1875, Alfred William Howitt explored the Mitchell River by canoe accompanied by two Ganai men - Turnmile and Bunjil Bottle (Seddon 1989). Up one creek, known as Deadcock Creek, they came to a cavern. Howitt noted that his companions expressed delight upon finding this cavern, and planned to return and camp there and collect the tails of the woorayl (lyrebird) among the scrubs of the river, and feast on koalas and wallabies. A little further on, they came to a second cave, fringed by stalactites. The two Ganai men removed some stalactites to show their friends. Bunjil Bottle was convinced that this was the haunt of the mysterious creature, the nargun, the 'ngrung a narguna' (Seddon 1989: 18). The nargun, is a mysterious creature, a cave dweller that haunts various parts of the bush. Howitt learned that they especially haunt the Mitchell Valley. Howitt's companions could not describe a nargun, beyond that it is like a rock (wallung), and is said to be all stone except the breast and arms and hands. It inhabits caverns, into which it drags unsuspecting passers-by. Howitt knew of another cave in the Miocene limestones of Lake Tyers that was said to be inhabited by a nargun (Seddon 1989: 18).

Smyth (1878, Vol. 1: 456-7) presented the following account of the 'Nrung-a-Narguna'.

> A mysterious creature, Nargun – a cave-dweller – inhabits various places in the bush. He haunts especially the valley of the Mitchell in Gippsland. He has many caves; and if any blackfellow incautiously approaches one of these, that blackfellow is dragged into the cave by Nargun, and he is seen no more. If a blackfellow throws a spear at Nargun, the spear returns to the thrower and wounds him. Nargun cannot be killed by any blackfellow. There is a cave at Lake Tyers where Nargun dwells, and it is not safe for any black to go near it. Nargun would surely destroy him. A native woman once fought with Nargun at this cave, but nobody knows how the battle ended. Nargun is like a rock (Wallung), and is all of stone except the breast and the arms and the hands. No one knows exactly what he is like. Nargun is always on the lookout for blackfellows, and many have been dragged into his caves. He is a terror to the natives of Gippsland.

Massola (1968: 74-5) has recounted the story of the Nyol at Murrindal.

> Once, when the tribe was camped at Murrindal, one of the men went possum hunting. Possums were plentiful on the trees growing amongst the rocks there. While he was hunting, he noticed an opening between two rocks. He put his foot in it and was drawn in.
>
> He found himself in one of the many caves in the vicinity. The cave was lit by a strange light, and was inhabited by many very small people who came to him showing signs of friendship. They called him Jambi, which is a general term for friendship, although it means brother-in-law. He tried to get back above the surface, but found that he had to wrestle with the little people. They were very strong, although small, and although he fought many of them, they all overcame him.
>
> Feeling exhausted he lay down to rest. The little people, the Nyols, gave him rugs to sleep on and grubs to cat. The latter were a great delicacy, and he enjoyed them very much. At last, many of the Nyols went away and he was left in the charge of one of them. Everything had been quiet, but now he heard a rustling sound. One of the Nyols came to him saying he would show him the way to the surface of the ground. Before very long he was amongst his own people, but for several days could not tell them what had happened to him. His mind had temporarily gone blank.

Inclusion of indigenous values in Buchan tourism

This discussion is concerned to show how indigenous values at Buchan have been incorporated into the tourism values at the Buchan reserve. The first major attempt at such incorporation came in the mid-1990s with

the development of an indigenous tourism trail in Gippsland. The Bataluk Cultural Trail launched in 1995 is a collaborative project between five Aboriginal community organisations in East Gippsland and local government, concerned with cultural and eco-tourism. The five community organisations are the Far East Gippsland Aboriginal Corporation; Gippsland and East Gippsland Aboriginal Co-operative; Lake Tyers Aboriginal Trust; Moogji Aboriginal Council; and Ramahyuck Aboriginal Corporation. The trail integrated 12 separate cultural sites, stretching from Sale to Cann River.

Regional officers of the Department of Conservation and Natural Resources were informed in December 1994, by the facilitator of the trail project that the Den of Nargun in the Mitchell River National Park and Buchan Caves had been identified as important stops along the trail, and that they were to be included in the Aboriginal Cultural Trail.

Trail brochures were published and distributed from May 1995 (East Gippsland Institute of TAFE 1996: 13). The trail was officially launched on 27 October 1995 by the Commonwealth Minister for Aboriginal Affairs, at the Knob Reserve at Stratford, one of the sites of the trail. The Buchan Caves are Site 8 of these 12 sites, where the focus is carvings, archaeological sites 12,000 years old, Dreamtime stories and creatures.

Visitation through the show caves during the decade 1981-91 averaged 85,082 people per year, with approximately 160,000 visiting the Main Reserve each year (Boadle 1991: 41). Boadle (1991: 44), in a draft management plan, recognised the important role played by visitor facilities and services at the Main Reserve, and highlighted the need for information provided to be of a high standard, and recommended the production of a high quality brochure for tourists. The plan acknowledged that the Main Reserve was a focus of tourist activity, and an educational centre visited by many secondary and tertiary groups. In relation to the content of the information given by guides during guided tours of the show caves, the draft management plan detailed the range of subjects guides needed to understand to maintain the quality and accuracy of information given. Aboriginal history and heritage was not included in this list.

In 1995, the Buchan Caves Committee of Management received a grant of $6,000 from the National Estates Grant Program. The project involved the production of an interpretation display located at the Buchan Caves Reserve, focussing on the significance of Aboriginal culture in the Buchan area, particularly Cloggs Cave (Calnin 1997). It was emphasised in the application that the Aboriginal heritage of the Buchan district was something the visitors to the Buchan Caves complex were 'not normally exposed to'. It was also suggested that the content of the display would be able to be incorporated into the information usually presented during guided tours of the show caves. The project brief noted that the interpretive display should feature a concept/theme related to refuge or shelter; follow a similar format, style, and colour scheme of the interpretive signs that had recently been designed by the Buchan Caves Friends Group; and the significance of Cloggs Cave related to Aboriginal occupation 18,000 years ago. The 'Cloggs Cave interpretation sign' was installed at the Buchan Caves Reserve in August 1996.

In October 1996, Urban Spatial and Economic Consultants Pty Ltd (USEC) completed an audit of the tourism infrastructure of Gippsland. They identified the Bataluk Cultural Trail had state-wide significance (USEC 1996: iii). The Bataluk project was prioritised as it offered the visitor to Gippsland a unique Aboriginal perspective. They considered the trail required minimal capital input and provided opportunity and flow on effects for the Aboriginal population of the region (USEC 1996: 22). In an analysis of the trail, USEC (1996: 85) claimed that Buchan was 'where aborigines would retreat for the winter months and live in caves'.

In 1997, ID Clark and L Larrieu produced an indigenous tourism strategy for Victoria for the Mirimbiak Nations Aboriginal Corporation. This strategy was the result of six months of research and consultation with Victorian indigenous peoples and key stakeholders in the industry. In relation to the Lakes and Wilderness tourism region of Tourism Victoria, which includes Buchan, consultations were held with Aboriginal community representatives in Sale, Orbost, and Lake Tyers.

Clark and Larrieu (1997: 28) recommended a series of pilot projects to ensure that their strategy was of practical value and achieved desired community outcomes. One pilot project centred on the Bataluk Cultural Trail, where it was recommended that a detailed tourism plan be produced. Despite the production of a glossy trail brochure, development of the trail was seen as minimal and much more development is required for the trail to become a significant tourist experience.

In 1997, Urban Spatial and Economic Consultants Pty Ltd (USEC) produced a regional tourism development plan for the Lakes and Wilderness tourism region. In terms of indigenous issues, the plan acknowledged that 'Lake Tyers and Buchan were significant current Aboriginal tourism areas' (USEC 1997: 10). Aboriginal tourism, via the Bataluk Cultural Trail, was identified as a product strength of the region. The development plan recommended the development of the Snowy River as a 'heritage icon'; development of the Buchan township and Buchan Caves as a heritage precinct for the region; and further expansion of the Bataluk Cultural Trail (USEC 1997:40). However, their analysis of Buchan identified the further development of Aboriginal tourism product as an 'opportunity' (USEC 1997:9-10).

In December 1997, Box et al produced an ecotourism strategy for Far East Gippsland, for Parks Victoria and the Department of Natural Resources and Environment. Its purpose was to provide direction and co-ordination of ecotourism development and activity in the region over the following five years.

It was found that approximately 472,000 people annually visited public land in East Gippsland, 332,000 to parks and reserves, and 140,000 to state forests (Box et al 1997:8). Major tourist interests were found to be bird watching, geology, bushwalking, and general outdoor activities. In relation to Buchan, the caves reserve was recognised as a regional example of a natural area intensively managed for high levels of recreation. The caves in the Buchan–Mid Snowy River area were recognised for their geological values, and 'many have a history of aboriginal use as well (Box et al 1997: 19)'. It was acknowledged that liaison should occur with the 'Aboriginal community regarding interpretation of aboriginal history'.

The ecotourism strategy noted that interest in experiencing Aboriginal art, history and culture had increased in recent years. It was acknowledged that:

> Far East Gippsland is richly endowed with Aboriginal culture and excellent opportunities exist for ecotourism enterprises based on interpretation of traditional Aboriginal cultural practices, places and events. The degree to which such opportunities are developed ultimately depends on the wishes of local Aboriginal communities who are the custodians of their culture. A recent initiative has been the development of the Bataluk Cultural Trail which extends through much of East Gippsland, from Sale in the west, to Cann River in the east. The Trail includes numerous points of cultural interest where further on-site information will be provided (Box et al 1997: 21).

In terms of visitor amenities and services, opportunities were found to exist for on site information boards, interpretive walks, and guided tours and activities. Along existing tourist drives and key walking tracks more on-site interpretation facilities were recommended. Aboriginal culture was identified as one of the more popular themes to be considered (Box et al 1997: 36).

In early 1999, Parks Victoria undertook a visitor survey at the Buchan Caves Reserve. In February 1999, circa 250 responses were received and processed. Yet, of these responses, only four, representing less than two per cent, requested more information about indigenous values. In 2002-03 visitor interpretation at the Buchan Caves Visitor Centre was redeveloped by Spellbound Interpretation in close association with the Moogji Aboriginal Cooperative and staff at AAV and Parks Victoria. New installations addressed the Indigenous cultural heritage of the Buchan Caves, the Buchan District, and the Snowy River Valley.

Conclusion

This paper has presented a history of tourism of the Buchan caves with a particular emphasis on the focus on indigenous values associated

with the caves. Despite the fact that there are indigenous values they have not been at the forefront of the development of the tourism product at the Buchan Reserve until 2002. Interpretive signage installed in 1996 presented tourists with some understanding of this heritage, although its focus was general and did not mention the rich accounts of malevolent spirits such as *nargun* and *nyols* that were associated with caves.

Foremost in the development of the caves for scenic tourism was the view that they were 'natural wonders', and the question of whether or not they were of significance to local indigenous interests did not appear to have been asked – indeed, except in areas where indigenous values are obvious, such as at rock art sites, exclusion was the rule, and not the exception. The inattention to Aboriginal values within the development of tourism may best be understood as a structural matter, a view from a window which has been carefully placed to exclude a whole quadrant of the landscape. Indigenous values of places were rarely discussed because they were not in the eye of the vision, 'out of sight' and 'out of mind'. Until the last ten years, indigenous tourism at Buchan did not challenge this understanding.

Biographical note:

Dr Ian D. Clark is an Associate Professor in Tourism in the School of Business at the University of Ballarat. He has a Doctorate in Aboriginal Historical Geography from Monash University. He has been a Lecturer in Tourism Management at Monash University, Research Fellow in History at AIATSIS, Manager of the Brambuk Living Cultural Centre in Halls Gap, and Senior Researcher with the former Victorian Tourism Commission. His areas of interest include regional tourism, cultural heritage management, attractions management, indigenous tourism and Victorian toponyms. He is the Chairperson of the Victorian State Committee of the Australian National Placenames Survey. He is president of the Buninyong and District Historical Society. He is also an avid collector of the music and memorabilia of Ella Jane Fitzgerald.

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Internet Sites

http://www.comu.net.au/tour/ndx/boorun.html
Titled 'Boorun the pelican – explore Aboriginal East Gippsland'. The internet site of the Bataluk Cultural Trail, the brochure in electronic format.
http://www.tourism.net.au/victoria/lakes/default.htm

The web site for the Lakes and Wilderness tourism region has an oblique reference to Koori culture as a thing to see. It promotes the Den of Nargun, a shallow cave, as significant in local Aboriginal culture, however, there is no reference to indigenous values at the Buchan Caves Reserve.

The abode of malevolent spirits and creatures - caves in Victorian Aboriginal social organisation

Associate Professor Ian D. Clark

Abstract

A study of Aboriginal associations with Victorian caves finds that there is a rich cultural heritage associated with caves. This association has been found to be rich and varied in which caves and sink holes featured prominently in the lives of Aboriginal people – they were often the abodes of malevolent creatures and spirits and some were associated with important ancestral heroes, traditional harming practices, and some were important in the after death movement of souls to their resting places. Aboriginal names for caves, where known, are discussed.

Introduction

This paper documents Aboriginal associations with caves in Victoria through considering their place in stories and mythology and also through examining place names of caves. Rock shelters, commonly called caves, are a rich repository of Aboriginal cultural heritage, however this study will attempt to follow the narrower understanding of 'cave' employed by most cavers, that is, they must have a dark zone, however it needs to be acknowledged that not all the caves identified here have dark zones. Some dozen or so caves have been identified as having documented Aboriginal association.

Discussion

The earliest records of Aboriginal associations with caves are found in the 1843 journal of George Augustus Robinson, Chief Protector, Port Phillip Aboriginal Protectorate, and the 1846 publication of William Hull. On 10 November 1843, Robinson visited the Widderin Caves [3H-1][1] near Mt Widderin[2] (Weerteering, in Robinson's orthography) in the Western District. The day before, he met about a dozen Aboriginal people, including Piccaninny Bob, a brother of King William at AM Allan's station near Mt Emu (see Billis and Kenyon 1974: 13). From these people he learned the names of the caves, and noted that 'the natives have a tradition that Kanung made the caves at Anderson's'. The identity of 'Kanung' is not known. Henry Anderson was at 'Borriyallock', 50,750 acres on Mt Emu Creek, near Skipton, 1839-50. Robinson (Journal 10/11/1843 in Clark 2000a) entered the following account of his visit to the Widderin Caves south of Skipton:

> visited the caves. Mr Anderson's brother went with me. The entrance is a half mile from Weerteering west. The entrance is in a large hole, 60 by 50. Very large tree mallee, 10 to 12 feet high, the largest indigenous tree mallee I have ever seen. The bats during in last month were seen in thousands; there were only three at this time. There are large mounds of dark kind of excrescence [sic] rising in five [columns] 10 or 12 high which is said to be bats' dung. It contained shiny particles. These heaps swarmed with moths, probably what the bats feed upon or the particular […] composed of pieces of moths. I got […]. We had two candles which dimly lit the cave. The cave contained two large chambers (see plan), vaults.

Robinson's 1843 sketch of the interior dimensions of the Widderin cave is believed to be the earliest sketch of its kind in Victoria. Duncan, Baker, and Montgomery (1999) have noted that the Mt Widderin Caves were once an immense maternity site for the Southern

[1] Where possible, the cave identification codes [e.g. 3H-1] of the Australian Speleological Association (Mathews, 1985) have been given to avoid the problems that result from multiple names being used for the one cave, or the same name for several caves. The numbers refer to tags which have been placed on the actual cave entrances.

[2] Mt Widderin has also been known as Anderson's Hill, after Henry Anderson who held the pastoral run in the 1840s

Bent-Wing Bat (*Miniopterus schreibersii*), but they disappeared from the site in the late 1860s. Charles Barrett (1944: 32) explains how access to the lava caves is through one of the 'sinks' formed by the collapse of the basalt. 'Caves near to the entrance in past times were inhabited by hosts of bats, and layers of guano were deposited on the rock floors'. A detailed description of the cave and its mineralogy may be found in Vince and Hall (1993).

Andrew Porteous has recorded the Aboriginal name of the Mt Widderin Cave as 'Larnook' (Smyth 1878 Vol. 2: 179). This word is 'larng.uk', uk being the possessive suffix, translated 'his/her', and larng meaning 'home', 'camp', 'nest', 'habitation', 'resort or resting place', 'camping place'. Larng is found in numerous western Victorian place names, such as Langi Gheran, Langi Kal Kal, Langi Logan, Langi Willi, Larnebarramul, Laanecoorie, and Larngibunja (see Clark 2003: 9).

William Hull (1846: 28) noted that although some remarkable caverns had been discovered in the Port Phillip District, Angel Cave [3GP-8], near Cape Schanck on the Mornington Peninsula, was the only one that he knew of which had any 'native' tradition attached to it. 'This cavern, facing the sea, they say was once the residence of Pungil, the God of the natives, who they believe came out of the sea – formed it, and much delighted in it. There are no paintings or marks, but apparently a wide altar and decayed steps in the recess'. Massola (1969: 158-9) notes that Angel's Cave (his spelling) is a cool stalactite cave on the seashore east of Cape Schanck near the mouth of the Murwurrarong Creek. He explains that it takes its 'name from the fact that from a certain position in the semi-darkness of the cave, a group of stalactites has a vague resemblance to an angel shape' (Massola 1969: 158-9). He adds that Aboriginal people claimed that 'Bunjil was one day taking a walk upon the sea, when a great storm arose. The "Great Man" walked up to the then flat shore, commanded it to rise into a cliff, and ordered a cave to form there. He then sheltered in it until the storm had passed'.

Other sites directly connected with Bundjil include a 'cave' at Bushy Creek, Lal Lal Falls, and the rock-art site known as Bunjil's Shelter in the Black Range near Stawell (Massola 1957). Parker alluded to the existence of an Aboriginal legend in an article published in the *Port Phillip Gazette* after the March visit (Parker 1840). Parker wrote, 'The deep and basaltic glen or hollow, forming the fall of Lallal on the Morrabool, near Mr Airey's Station, was the residence of Bonjil or Pundyil while on earth'. Robinson confirmed the connection with Bundjil when he visited the falls on 7 August 1846, and learned from an Aboriginal informant that they were called 'Punjil' (Clark 2000b:108).

James Bonwick (1863:54), also, discussed Bundjil's residence at Lal Lal Falls:

> At Cape Schanck, of Western Port, a cave is pointed out from which Pundyil or Bin-Beal used to take his walks beside the sea. He was accustomed when upon earth to frequent other caves, chasms, or dark places. Deep basaltic glens were favourite homes. We are well acquainted with one of these assumed divine residences situated in a romantic volcanic rent some fifteen miles from Ballaarat, through which the river passes after rolling down the Lal Lal falls. The planet Jupiter shines by the light of his camp fire in the heavens, whither he has now retired.

The name Bungal, a variant of Bundjil, is found locally in the name of the Bungal pastoral Run adjoining the Lal Lal station on the east, and also in Bungal Dam. This is also the second waterfall in Victoria, thought to have been named after Bundjil. The other is the Wannon Falls, known as Bung Bundjil, and the local clan was named 'Bung Bundjil gundidj' (Clark 1990; Clark and Heydon 2002).

Anthropologist, Aldo Massola (1968b:59), described the Kulin 'myth' of the 'Lal-Lal Falls on the Moorabool River' thus: 'Bunjil made the falls to relieve the monotony of the landscape. He liked them so much that he decided to make them his earthly home'. This story is unsourced, however Massola (1968b:x) explained in his foreword that the accounts he published 'were collected over a period of ten years, from Aborigines in all parts of Victoria', and he supplemented these with 'the scant published material'. Massola speculated that Bundjil chose to live at the falls because of its idiosyncratic features:

Apart from the fascination of watching the wide creek ending its placid run through the level plain by suddenly tumbling, with a mighty roar, down the 200 feet chasm, there were

other reasons, no doubt, why Bunjil was made to live there. One was the fact that the swamp supported a large population of birds and other animals which assured the Aboriginals of plentiful supplies of food. Another was the comfort of the sand dunes on the south-east of the swamp, which make ideal camping places. A third, and no doubt very important reason, was the deposits of white pipe-clay on the east side of the swamp, which are now commercially quarried for paper clay (Massola 1969:70-71).

Bundjil, the creator-spirit, is also associated with another cave. R.B. Smyth (1878, Vol. 1: 456) recounts the story of Buk-ker-til-lible, the cave or chasm at Cave Hill near Lilydale. The Aborigines believed that Buk-ker-til-lible had no bottom, and when they threw stones into it they could never hear the stones land. They believed that Pund-jel made this deep hole when he was angry with the Yarra Aboriginal people. They had committed deeds that displeased him and he caused a star to fall to the earth, striking and killing a great many people and the star fell deep into the earth, and made this chasm.[3]

Several caverns exist in southwest Victoria, near Port Campbell, where they have been washed out under the cliffs by the force of the Southern Ocean. Phillip Chauncy has provided us with a discussion of one of these caves:

> One of these extends under ground nearly a quarter of a mile, and in one place the rain-water has washed a small hole from the surface of the ground down into the cavern. There is a continual draught of air blowing up through this hole, so that if a leaf or any light substance be thrown over it, it is immediately carried up into the air. For ages past the natives were in the habit, whenever they approached this air-hole, to throw a piece of wood into it to propitiate the demon supposed to reside within its profound and mysterious depths. When the late Mr. Superintendent La Trobe examined this part of the coast, in 1842 [sic], some of his men made a rope ladder, and went down over the cliff and explored this cavern. When they came to the part nearly under the hole communicating with the surface, they found an enormous pile of wood, which must have been the accumulation of ages, as the natives had to carry the pieces of wood from the distant forest. The men set fire to the pile, which lit up and displayed a magnificent vaulted chamber, bedecked with long glistening stalactites, and tenanted by vast numbers of bats, whose whirring, whizzing noise was probably that which the natives attributed to some supernatural being (Chauncy in Smyth 1878, Vol. 2: 268-9).

This cave was visited by C.J. La Trobe in 1845 and 1846, and he recorded a detailed description in 1846 (see Blake 1975). La Trobe noted that the 'natives' referred to it as 'Lubras' Cave'. This is probably what is now called 'Starlight Cave' [3W-5], south-east of Warrnambool. Edmund Gill (1948) names this 'Guano Cave', and other names include 'Bat Cave' and 'Lake Gillear Cave' (See Gill 1948 and Hall 1993 for more information). La Trobe explained that local indigenous people knew the caverns well and 'had a superstitious dread of them, stating that the caverns below were inhabited by headless lubras' (Blake 1975: 19).

In northwest Victoria, two of the most important Ancestral Heroes, are the buledji Brambimbula, the two Bram brothers. Accounts of their actions survive from three languages: Wergaia, Djadjawurrung, and Wembawemba (Hercus 1986). Accounts have them active in a vast expanse of country stretching from Lake Boga in the northeast to Naracoorte Caves in the southwest. A.W. Howitt (1904: 485) noted that the Bram brothers lived in a cavern far to the west. In August 1907, at the Lake Condah Mission, the Reverend John Mathew spoke with Jackson Stewart, a Wembawemba speaker born near Lake Boga. Stewart told Mathew that the

[3] Bundjil was also associated with the Bridgewater caves (shelters). Bonwick (1970: 112) explained that the 'natives have some dim shadowings of traditions connected' with the caves. 'Some spirit, Punyil, once resided in one, and was accustomed to descend therefrom and walk the shore. Rude attempts at drawings were said to be found there. I did not observe any, though want of time prevented a close examination of the various caverns'. Presumably this is a reference to the line of shelters in the cliff overlooking the Bridgewater Lakes at Tarragal [3P-9].

'Brambanngul were two brothers, chief men, who lived in a cave near Naracoorte (Mathew Papers).

Many of the place names in and around the Gariwerd Gampians National Park have mythological references, and many to the actions of the Bram brothers in forming the landscape of the Gariwerd/Grampian ranges (see Clark & Harradine 1990; Clark & Heydon 2002). For example, in the story presented by RH Mathews (1904), in which the Bram brothers are pursuing Ngindyal, the emu, features in the mountains, such as Rose's Gap, are explained. Many of the Gariwerd placenames recorded actions and events associated with Ancestors and many contained references to Ancestral body parts; for example, Mudjambula which means 'the two of them pick something up'; 'Mud-dadjug' 'blunt or useless arm'; Wudjub guyun 'stabbing spear in the stomach'; Gunigalg 'excrement stick'; Werdug 'his shoulder'; Wudjugidj 'belonging to the man'; and Wulbuwa 'to burn very fiercely'. The importance of the Bram brothers is also seen in the name of the interpretive and cultural centre 'the Brambuk Living Cultural Centre' in Halls Gap, a clear reference to the Ancestral heroes, the buledji Brambimbula, the two Bram brothers. Brambuk translates to 'belonging to Bram'.

Smyth (1878) published an account of the Bram brothers which he had received from the Reverend Hartmann. Presumably, Hartmann obtained them from Wergaia residents at the Ebenezer station.

> The Rev. Mr. Hartmann says in a letter to me, in reference to this story, that, according to information given by the blacks, it is known all over the country. It is only part of a long story. The two Brambambulls were rather remarkable men. The blacks' further account of them may be briefly stated thus: --The Brambambulls were invulnerable, and the elder could make himself invisible whenever he pleased. The last thing known about the elder is that he went away in a whirlwind. The younger Brambumbull is said to have vanished too for a while, but to have made his appearance again in another part of the country. He was followed and found by his mother. It is said that he died from the effects of a snakebite; that he was buried; and that he became alive again. After that he could not be found any more. The portion of the story that is sent, Mr. Hartmann says, is written in the way a black would tell it--of course considerably abridged (Smyth 1878: 53-4).

Associations with malevolent creatures and spirits

Caves were often thought to be the abode of malevolent creatures and spirits. For example, JM Allan, at Tooram station near the mouth of the Hopkins River, reported to the 1858 Select Committee that the Aboriginal people in his district believed spirits called 'Tambora' inhabited caves (Victoria 1859: 71). Tambora is the Giraiwurrung word tampoorr, their general word for devil, 'male devil', 'bad male spirit' (Krishna-Pillay 1996: 59). Luise Hercus (1986: 211) learned of the existence of a mythical malevolent creature known as 'Ngaud-ngaud'. Stories of the Ngaud-ngaud are widespread, and range from the upper Murray people of eastern South Australia (Swan Reach) to the Woiwurrung of central Victoria. According to the upper Murray people, the Ngaud-ngaud was a malformed giant, who was ultimately imprisoned by the people in a cave where he starved to death.[4]

In Gippsland, caves are associated with two mythical beings; the Nargun and the Nyol. In 1875, Alfred William Howitt explored the Mitchell River by canoe accompanied by two Ganai men - Turnmile and Bunjil Bottle (Seddon 1989). Up one creek, known as Deadcock Creek, they came to a cavern now known as "Den of Nargun" [3GP-5]. Howitt noted that his companions expressed delight upon finding this cavern, and planned to return and camp there and collect the tails of the woorayl (lyrebird) among the scrubs of the river, and feast on koalas and wallabies. A little further on, they came to a second cave, fringed by stalactites. The two Ganai men removed some stalactites to show their friends. Bunjil Bottle was convinced that this was the haunt of the mysterious creature, the Nargun, the

[4] These legends have been the basis for stories written by Patricia Wrightson (1973). In one story she describes a boy's encounter with Nyols who drag him into their cave and want to wrestle with him (among other things).

'Ngrung a Narguna' (Seddon 1989: 18). The Nargun, is a mysterious creature, a cave dweller that haunts various parts of the bush. Howitt learned that they especially haunt the Mitchell Valley. Howitt's companions could not describe a Nargun, beyond that it is like a rock (wallung), and is said to be all stone except the breast and arms and hands. It inhabits caverns, into which it drags unsuspecting passers-by. Howitt knew of another cave in the Miocene limestones of Lake Tyers that was said to be inhabited by a Nargun (Seddon 1989: 18). Massola (1962) searched for this cave and found that its description matched not the presently named "Nargun's Cave" [3NN-1] but another cave, "Cameroon's No.2" [3NN-3].

Smyth (1878, Vol. 1: 456-7) presented the following account of the 'Nrung-a-Narguna'.

> A mysterious creature, Nargun – a cave-dweller – inhabits various places in the bush. He haunts especially the valley of the Mitchell in Gippsland. He has many caves; and if any blackfellow incautiously approaches one of these, that blackfellow is dragged into the cave by Nargun, and he is seen no more. If a blackfellow throws a spear at Nargun, the spear returns to the thrower and wounds him. Nargun cannot be killed by any blackfellow. There is a cave at Lake Tyers where Nargun dwells, and it is not safe for any black to go near it. Nargun would surely destroy him. A native woman once fought with Nargun at this cave, but nobody knows how the battle ended. Nargun is like a rock (Wallung), and is all of stone except the breast and the arms and the hands. No one knows exactly what he is like. Nargun is always on the lookout for blackfellows, and many have been dragged into his caves. He is a terror to the natives of Gippsland.

Massola (1968: 74-5) has recounted the story of the Nyol at Murrindal.

> Once, when the tribe was camped at Murrindal, one of the men went possum hunting. Possums were plentiful on the trees growing amongst the rocks there. While he was hunting, he noticed an opening between two rocks. He put his foot in it and was drawn in. He found himself in one of the many caves in the vicinity. The cave was lit by a strange light, and was inhabited by many very small people who came to him showing signs of friendship. They called him Jambi, which is a general term for friendship, although it means brother-in-law. He tried to get back above the surface, but found that he had to wrestle with the little people. They were very strong, although small, and although he fought many of them, they all overcame him.
>
> Feeling exhausted he lay down to rest. The little people, the Nyols, gave him rugs to sleep on and grubs to eat. The latter were a great delicacy, and he enjoyed them very much. At last, many of the Nyols went away and he was left in the charge of one of them. Everything had been quiet, but now he heard a rustling sound. One of the Nyols came to him saying he would show him the way to the surface of the ground. Before very long he was amongst his own people, but for several days could not tell them what had happened to him. His mind had temporarily gone blank.

Other cultural associations

This study has discovered the Aboriginal names of numerous Victorian caves, in terms of generic words for 'caves' in southwest Victoria, James Dawson (1881: vii) learned that the Djabwurrung word for cave was 'Yeitchmir' meaning 'close the eyes'; the Gurngubanud dialect of Dhauwurdwurrung knew caves as 'Yatmiruk', which also meant 'close the eye', and the Bigwurrung dialect used the word 'Yuluurn'.

A cave featured in the story of the movement of the spirits of deceased people to Deen Maar (Lady Julia Percy Island), an island off the southwest coast of Victoria. On the Victorian coast, opposite this island, a cave named 'Tarn wirring' or 'road of the spirits' formed a passage between the mainland and the island. Grass found at the mouth of the cave was considered proof that a good spirit called 'Puit puit chepetch' had removed the body, of a recently buried person, through the cave to the island and conveyed the spirit to the clouds (Dawson 1881: 51). Aldo Massola (1968a, 1969) claimed to have identified this coastal cave at The Craigs, east of Yambuk, but no ASF number has been assigned.

John Mathew learned in 1890, of an ingenious use of sinkholes in south-west Victoria. A local surveyor informed him of a custom practiced near Macarthur involving two large sinkholes which Aboriginal people would use in their harming practices: they would drop a morsel of the excrement of an enemy down the sinkhole 'who was supposed thereafter to pine and die' (Mathew Papers). These would probably be two of the large collapsed entrances of the lava tubes at the Byaduk Caves, north of Macarthur [3H-11, 12, 13 etc]. In western Victoria, Aboriginal people were very careful in disposing of their excreta, usually burying it with a spatula they called a gunigalk (excrement stick) to ensure that it could not be found by their enemies (Rose in Bride 1898: 150).

Conclusion

This brief review of the ethnohistorical literature has examined Aboriginal associations with caves in Victoria. These associations have been found to be rich and varied. Caves and sinkholes featured prominently in the lives of Aboriginal people – they were often believed to be the abode of malevolent creatures and spirits and some were associated with important ancestral heroes, and traditional harming practices. Some were important in the after death movement of souls to their resting places.

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A caving pioneer: Frank Moon and the caves of Buchan

Bob Haldane

The Buchan Caves have long been a regional icon in East Gippsland, drawing up to 88,000 visitors a year from all parts of Australia and overseas. The premier tourist caves, Fairy Cave and Royal Cave are the most famous caves in the Buchan and Snowy River areas, however they are but two of the 425 known caves in the district and doubtless there are others; each one a unique subterranean wonderland awaiting exploration by speleologists and inquisitive adventurers.[1]

Over a period of many years there has been considerable debate about by whom, how and when the caves of Buchan were first discovered. Clearly, there is no doubt that Indigenous Australians can truly lay claim to being first and caves within the Snowy River area bear signs of Aboriginal presence and engravings that date back 22,000 years.

The provenance of contemporary cave exploration is not as clear but the one name most commonly associated with the discovery and development of the caves in Buchan is that of Frank Moon. So what was his true role in this discovery? Has he been lionized or should we in this, the centenary year of the discovery of the Fairy Cave, duly recognise his personal achievements?[2]. Along with those other pioneers of the Buchan caves, who have shared the experience of Mallacoota adventurer and writer Edwin James Brady, who ventured into the 'Cimmerian night' of Buchan's 'underworld' and in 1918 wrote, 'It gives one a curious sensation of unreality, this descent through a hole in the hillside, into a region of glamor and mystery, beautiful but weird'.[3]

The first recorded exploration of caves in Buchan was made by Stewart Ryrie on 7 April 1840. Accompanied by an Aboriginal guide and three soldiers he was surveying the area for the New South Wales administration when passing through the Buckan [sic] forest he noted, 'Blue limestone abounds all over this forest and it is full of caves. I descended into one of them to a considerable depth but saw nothing remarkable'. One study published in 1992, using Ryrie's original reckonings, suggested that the cave explored by Ryrie was 'most likely *Moon Cave*' but more recent work undertaken by speleologist Peter Ackroyd concluded, 'based on the thin evidence available' that Ryrie descended a cave now known as 'M-22 The Garage'. [4]

Following in the tracks of Ryrie, the noted explorer Alfred William Howitt (GHJ 1-38) extensively explored the Buchan and Snowy River areas and in 1876, in a report for the Geological Survey of Victoria, he described in detail Buchan's topography and geology.

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[1] Caving figures provided to author by Dale Calnin, Parks Victoria (Buchan Caves), 7 August 2006.

[2] Sources that lionize Frank Moon or otherwise erroneously depict him as 'the discoverer of the Buchan Caves' include: Howard D. Bulmer, *Beautiful East Gippsland*, (4th Ed.), The Author, Bairnsdale, n.d.; Nathan F. Spielvogel, *The Gumsucker at Home*, George Robertson & Company, Sydney, 1914, p. 51; Albert E. Clark, *The Church of Our Fathers*, The Diocese of Gippsland, Melbourne, 1947, p. 170; *The Weekly Times,* 18 May 1949, p. 18; David Swift, 'Buchan - Valley of Caves', *Mining and Geological Journal*, Vol. 4, No. 4, September 1951, p. 24; *The Sun Week-End Magazine*, 30 October 1948, p. 2; David Swift, 'This Man Spent 50 years Underground', *The Argus – Magazine Special Supplement,* 16 November 1951, p. 3; *The Sun*, 12 October 1955; *A brief history of Buchan District and Schools*, Buchan School, Buchan, 1977.

[3] Linda Wilkinson, 'Aboriginal Historical Places Along the Snowy River', *Gippsland Heritage Journal*, No. 23, 1999, p. 7; Edwin James Brady, *Australia Unlimited*, Angus & Robertson, Melbourne, 1918, pp. 348; *ADB*, Vol. 7, 'Edwin James Brady (1869-1952)', pp. 386-7.

[4] 'Stewart Ryrie's 1840 report on Gippsland', *Gippsland Heritage Journal*, No. 11, December 1991, p. 13; *Nargun*, Vol. 24, No. 10, May 1992, p. 90; Peter Ackroyd, 'Stewart Ryrie's 1840 Report on East Gippsland – Buchan Area', Unpublished paper, 10 November 2006.

Highlighting the scientific and geological potential of the caves he noted,

> '… caverns and "sink holes" abound' but 'No systematic exploration of these caves has, however, yet been made; it seems not impossible that some, at any rate, may be found to afford fossil remains of the extinct Australian fauna'.[5]

The first significant government move to protect the caves occurred in 1887, when the area that is today known as Wyatt's Reserve or the Potholes, was reserved by government proclamation to specifically protect the caves and any associated natural features. The following year, James Stirling, a botanist and geologist, then employed as a Victorian government assistant geological surveyor, visited East Gippsland in company with Public Works Department architect and secretary of the Amateur Photographic Association of Victoria, John Henry Harvey. Stirling was an associate of Howitt's and also of the noted botanist Ferdinand Mueller (GHJ 10-3) and was familiar with the Buchan area, having previously worked as a mail rider between Bruthen and Bendoc. The primary purpose of their visit was in connection with the work of prospecting parties in the Buchan District. Stirling was conversant with Howitt's 1876 treatise on the Devonian rocks of North Gippsland and bearing Howitt's suggestion 'in mind' Stirling and Harvey 'made a temporary examination of the caves' in Buchan, accompanied two assistants, Mr Tetu and Mr Ralston, 'a plucky young Australian', who was often the first of Stirling's team to delve underground. They were guided on some of their work by William Kellie, a local publican and Buchan telegraph operator. Stirling mapped a number of the caves and Harvey, who had already photographed the Jenolan caves, took the first known successful photographs of the Buchan caves. In 1889 the government published Stirling's 'Preliminary Report on the Buchan Caves', which included detailed descriptions of a number of caves, including Duke's, Moon's, O'Rourke's, Wilson's, Dickson's[6], and the Spring Creek Cave. Displaying considerable prescience, Stirling foresaw the tourist potential of the caves and recommended that a caretaker be appointed and that ladders, hand-rails and lighting be installed in some of the caves. He proposed using water from the Buchan River to drive a dynamo to generate electricity. During a public lecture given in Sale soon after, on the topic of his cave tours, Stirling asked, 'Why should not that characteristic energy which exhibited itself in the Australian cricket or football fields be directed to scientific research to discovering some of the many beauties of Australia's subterranean wonderland?' Stirling and Harvey 'left no stone unturned in [their] efforts to point out the value of the caves to Victoria from a tourist's point of view' and Harvey referred to them in his lectures on the Jenolan Caves. So enamoured was Harvey with the Buchan caves that he twice unsuccessfully attempted to have Jeremiah Wilson, caretaker of the Jenolan Caves, brought to East Gippsland to explore them. [7]

[5] Alfred William Howitt, 'Notes on the Devonian Rocks of North Gippsland', *Reports on the Geology, Mineralogy, and Physical Structure of Various Parts of the Colony,* Geological Survey of Victoria, Melbourne, 1876, pp. 203-204; James Stirling, 'Preliminary Report on the Buchan Caves', *Reports of the Mining Registrars for Quarter ending 31st December 1889,* (Hereafter cited as Stirling Report), P.66, for quotation; *ADB*, Vol. 4, 'Alfred William Howitt (1830-1908)', pp. 432-5.

[6] In his report Stirling interchanged the spellings Dickson's and Dixon's. The correct spelling is Dickson. Reference: Buchan Sesquicentenary Committee, *Bukan-Mungie: 150 Years of Settlement in the Buchan District – 1839-1989*, Buchan, 1989, p. 102, for Dickson family.

[7] *Victoria Government Gazette,* 23 September 1887, p. 2760 & 31 December 1901, p. 5096; H.J. Gibbney and Ann G. Smith, *A Biographical Register 1788-1939*, Australian National University, Canberra, 1987, Vol.2, p. 282; and Amie Livingstone Stirling, *Memories of an Australian Childhood 1880-1900,* Schwartz, East Melbourne, 1980, passim, for notes on Stirling; Debra Squires, et al, *Gippsland in Focus*, Kapana Press, Bairnsdale, 1990, p. 39, for note on Harvey & p. 72 for Stirling; Alan Davies, et al, *The mechanical eye in Australia: photography 1841-1900,* Oxford University Press, Melbourne, 1985, pp. 94-5, for Harvey; Stirling Report, p. 66, for Kellie reference; pp. 66-7, for cave

Much of the early interest in the caves of Buchan centred on their potential as a tourist attraction and by the 1880s tourists to the district were able to undertake guided cave tours, often accompanied by local hotel proprietors. In 1886 'Tanjil' wrote of a guided tour through Wilson's cave, the pathway illuminated by candles and kerosene torches. On this tour the guide providing a stunning denouement when he ignited a quantity of stringy bark saturated in kerosene to show a 'fairy-land-like' display of 'thousands of stalactites and stalagmites'. The caves were promoted in tourist literature for the Gippsland Lakes and trekkers used a combination of train, steamer, motor launch and four-horse coach to make their way to Buchan. In August 1899 Sale photographer Alexander Ward addressed the Sale branch of the Australian Natives' Association about his visit to the Buchan caves. He described 'the caves country' in detail and informed his audience that,

> 'All the necessary articles to assist you going through the caves – such as lanterns, candles, torches, ropes, rope-ladders, poles, retracing lines, magnesium tape and other coloured lights for the purpose of showing the chambers in different colours – may be obtained at the township, and guides and horses are also available'.

It was during this era when considerable irreversible damage was caused to the caves by visitors taking cave formations as souvenirs or 'specimens'. And Ward, urging protection for the caves, lamented that it 'was a common thing for people to smash the stalactites out of pure thoughtlessness. There are tons of the broken specimens to be found about the caves'. Ward found his trek to Buchan quite arduous and told his audience, 'People are usually very glad to reach Buchan, not because they love the town, but because they have got to the end of a long journey'. In contrast, guests of the entrepreneurial John C. Dahlsen, proprietor of Lakes Tyers House, journeyed to Buchan in style. As early as 1902 Dahlsen was quick to see the Buchan Caves as 'an untapped commercial treasure' and the caves figured prominently in Lake Tyers House advertising. It was a time when Lake Tyers House was the playground of the well-to-do, including prominent politicians and vice regal visitors and Dahlsen promoted holiday packages to the caves that included all meals, accommodation, launch fares and coach transport to-and-from Buchan.[8]

Although tourist operators lobbied the government and expressed the same sentiments as Stirling, his recommendations went unheeded for more than a decade and it was not until 1900 that his work was expanded upon by Albert Ernest Kitson, who was then undertaking geological field work for the Victorian Geological Survey. A Fellow of the Geological Society of London and a widely published author on matters of geology and natural history, Kitson studied and photographed the caves in 1900. He was dismayed that some of them had already, 'been greatly despoiled of their treasures by acts of pure vandalism' and observed that a number of caves, 'suffered from the vandalism, carelessness, and thoughtlessness of sightseers, who have smashed most of the smaller stalactites, stalagmites, and stalactital drapery within reach'. It was an era when, 'people were known to carry away wagon loads of cave formations'. Like Stirling before him Kitson grasped the scientific and tourist potential of the caves, describing the Buchan district as a place, 'of great interest to the lover of the beautiful in nature, and to the scientist'. He predicted that if, 'the claims of the district as a pleasure resort [are] brought prominently before the public, I have no hesitation in venturing the opinion that large numbers of tourists will be attracted during the summer and autumn months'. He proposed, 'that action be taken to preserve such of the

descriptions; and p.68, for recommendations; J.H. Harvey, et al, 'Buchan And Its Caves', *The Victorian Naturalist*, Vol. xxiv, October 1907, p.99; *Gippsland Times*, 25 February 1889, for Stirling lecture notes.

[8] John D. Adams, *The Tambo Shire Centenary History,* Shire of Tambo, Bruthen, 1981, p. 201,for first Buchan cave tours; 'Tanjil', *Our Guide to the Gippsland Lakes and Rivers,* (Third edition), 1886, pp. 74-5; *The Gippsland Mercury*, 22 August 1899, for Ward notes; Peter Synan, *The Dahlsen Story – A pioneering Family in Gippsland Since 1862,* Lookups Research, Sale, 2005, pp. 25-32, passim, for Lake Tyers House & Buchan Caves.

beauties of the caves as have not yet been despoiled, and prevent vandalism in any that may be discovered in future' and recommended seven new cave reservations be established in the Buchan District: one of which, gazetted in 1901, formed the genesis of the Buchan Caves Reserve as it exists today. [9]

Despite the urgings of Stirling, Kitson and others, the tourist and scientific potential of the Buchan caves was never optimised and it fell to local caver Francis Herbert Arthur 'Frank' Moon to propel Buchan and its caves into the public spotlight. Born at Gelantipy Station on 20 November 1880, Frank Moon was one of three boys and five girls born to Robert Moon, and Margaret (nee Ross, formerly of Rosedale). Raised and educated in the Gelantipy and Buchan districts, Frank Moon was a noted horseman, athlete and bushman, good enough according to oral tradition, to walk the distance of forty-five kilometres from Buchan to Gelantipy in three hours. He once walked sixty-five kilometres from Gelantipy to Tubbut to compete in a footrace - which he won - then walked` home again. Athletic feats of this nature earned Moon the sobriquet 'Cyclone'. He left Buchan aged sixteen to go prospecting on the Omeo goldfields, then went mining in Mount Lyell, Tasmania; Broken Hill, New South Wales; and Coolgardie near Kalgoorlie in Western Australia. Whilst in Coolgardie he competed in a cycling race against professional riders and won a purse of twenty-five pounds. After a period of years working away, he used his winnings to travel back to Buchan, intending to spend a brief period with his family before travelling to Argentina to work as a miner.[10]

During his sojourn in Buchan Frank Moon 'pottered around' looking for caves and in September 1906, accompanied by his brother Robert and a friend, Jim Connors, Moon explored a cave on the northern bank of Spring Creek near its junction with the Buchan River. Previously known as O'Rourke's Cave, they extended its known limit and it was subsequently renamed Moon Cave.[11] A report in the *Snowy River Mail* credited 'Mr Frank Moon … the pioneer' with this discovery but did add that 'several others' were with him. Following the discovery of more impressive caves nearby the Moon Cave was rarely used for public tours and in 1907 it was recommended 'That no steps be taken at present to improve the Moon Cave which should be kept locked up and visitors only admitted by special permit'. Many years later it was assessed as having no appreciable scientific, aesthetic, social or spiritual value. Its principal significance was found in the natural heritage value of the cave at river level as a platypus habitat. Notwithstanding the modest nature of Moon Cave, Frank Moon garnered considerable publicity and displayed early signs of his promotional adroitness when his tale of discovery was reported in the local press,

> 'Moon secured a rope, and went down into the water. The stream was 4 feet deep. He scrambled through narrow low passages, up to his neck in water, with his head almost touching the roof. Stalactites and stalagmites, absolutely perfect, were found in immense chambers and low passages.

[9] Parks Victoria (Buchan Caves Collection), Letter from tourism agent J.H. Coffey, 13 August 1897; *ADB*, Vol. 9, p. 618, for Kitson; Albert Kitson, 'Proposed Reservation of Limestone Caves in the Buchan District, Eastern Gippsland', *Records of the Geological Survey of Victoria*, Vol 2, Part 1, 1907, pp. 37-44. Kitson's reports were written in 1900 and published in 1907; *Victoria Government Gazette*, 19 July 1901, p. 2772, for reservation; Adams, *The Tambo Shire,* p. 244, for wagon loads.

[10] Register of Births in the District of Buchan, 1881 No. 12, for birth details; Lois Mackieson, *A Brief History of the Family of Frederick Robert and Jane Moon 1831 – 1981*, The Author, Buchan, 1981, for Moon family history; Trudy Sady, 'Buckan Mungie: Place of Holes – Discovery and Exploration of the Buchan Caves', Bachelor of Education (Gippsland History) essay, Monash University, 1988; and Elery Hamilton-Smith, 'Historical Notes on Buchan and Buchan Caves', Notes edited by Peter Ackroyd from talk given to the Victorian Speleological Association Inc., 7 October 1987, p.2, for early Frank Moon oral history; Adams, *The Tambo Shire,* p. 245.

[11] This cave was not connected in any way with Moon's Cave, which was located in Moon's Paddock at Murrindal River. Refer: Stirling Report, p. 67, for Moon's Cave.

Moon caught mountain trout of a whitish colour with large sightless eyes'.[12]

Following the eponymous naming of this cave, a fortuitous series of events combined to focus government attention on the caves and in 1906 the Department of Lands and Survey employed Frank Moon on a temporary salary of $11 13s 4d a month as the first Government appointed 'Caretaker of the Buchan caves'. On the day that Moon announced his discovery he arranged for John Flynn (GHJ 26-19), who was then resident in Buchan as a Home Missionary, to photograph the Moon Cave and they did so that night. Flynn subsequently travelled to Orbost and showed lantern slides of the cave to the Orbost Railway League. An active supporter of the league was Orbost resident and MLA for East Gippsland, James Cameron and he was keen to see East Gippsland, opened-up to commerce and trade. He was also already familiar with the geological opportunities of the Buchan district through his involvement in marble extraction at Buchan South and mining investment at Nowa Nowa. Cameron's immediate predecessor as MLA for East Gippsland was former Omeo miner and Minister for Mines, Henry Foster, who more than once was intransigent in the face of requests to promote exploration of the Buchan caves. In contrast Cameron was a keen supporter. Following his lantern slide show at Orbost, Flynn was elected as the Buchan Railway League delegate and included in an East Gippsland Railway League deputation to Melbourne on 3 October 1906, where he took the opportunity of discussing the value of the Buchan caves as a tourist attraction with the Premier of Victoria, Sir Thomas Bent. Flynn's advocacy was opportune, as the Bent government was keen to promote Victoria as a tourist attraction and just that year had established the first Victorian Government Tourist Bureau. During October 1906 Bent toured East Gippsland, including the Buchan caves, and on his return to Melbourne he gave a public lantern slide lecture to 2,000 people at the Melbourne Town Hall, during which he waxed lyrical about the Buchan caves, describing them as 'dazzling'. A Railway League publication of the period, illustrated with John Flynn's photographs, opined, 'This district will at some future date be known as the wonderland of Victoria'. [13]

In the midst of all this cave-related activity Albert Kitson returned to Buchan and spent two weeks with Frank Moon and others, undertaking survey work in furtherance of the reports that he had completed in 1900. The main report of his 1906 visit he penned aboard the R.M.S. *Oruba*, somewhere in the Indian Ocean, off the Western Australian coast, destined for Southern Nigeria: and the report 'had to be written from memory', as in the hurry of his departure from Melbourne he left his Buchan field notebook behind in Australia. Despite this haste Kitson lost nothing of his passion for caves and East Gippsland and proved a good friend to Frank Moon. He wrote of the grandeur of the Buchan and

[12] Sady, 'Buckan Mungie', p.13, for pottering around; Hamilton-Smith, 'Historical Notes', pp. 1-2, for O'Rourke's Cave & Moon Cave; Parks Victoria (Buchan Caves Collection), Report by Lands Department District Surveyor, dated 15 May 1907, for Moon Cave closure; Richard Aitken Pty Ltd, 'Buchan Caves Reserve Heritage Action Plan', The Author, South Yarra, 2004, p. 9, for Moon Cave assessment; *Bairnsdale Advertiser*, 6 October 1906; and *Snowy River Mail*, 29 September 1906, for press reports.

[13] *Victoria Government Gazette*, 31 January 1907, p. 723, for employment of Moon as caretaker; Sady, 'Buckan Mungie', p. 16, for Moon Cave photographing; Robert Haldane, 'Photo Folio – John Flynn at Buchan', *Gippsland Heritage Journal*, No. 26, 2002, p. 20, for John Flynn; W. Scott McPheat, *John Flynn Apostle to the Inland*, Hodder & Stoughton, London, 1963, p. 37, for Railway League delegation; *ADB*, Vol. 7, 'James Cameron (1846-1922)' pp. 536-7; *ADB*, Vol. 3, 'Sir Thomas Bent (1838-1909)'pp.144-6; www.parl.vic.gov.au/re-member/biogresearch.cfm (searched 07 August 2006), for Henry Foster; Harvey, et al, 'Buchan And Its Caves', p. 99, for Foster's intransigence; *Snowy River Mail*, 29 September 1906, 6 October 1906, 3 November 1906 and 10 November 1906, for Flynn's election, delegation and Bent tour; Susan Priestley, *The Victorians: Making Their Mark*, Fairfax, Syme & Weldon Associates, McMahons Point, 1984, p. 224, for Tourist Bureau; Orbost and East Gippsland Railway League, *Railway Extension Through East Gippsland*, Atlas Press, Melbourne, 1908, p. 18.

Snowy River country and of the 'delightful uncertainty about caves that leads to the charm of cave exploration, for there is absolutely no end to such work' He appended a draft set of regulations for the management of caves in Buchan and endorsed 'Mr. Moon' as the person who 'will have his time taken up quite fully in opening up and looking after the caves in the neighbourhood of Buchan'[14]

In December 1906 Frank Moon discovered a cave near the Spring Creek Cave and named it the Kitson Cave after Albert Kitson, who was knighted in 1927 and also had a fossil mollusc, a fossil eucalypt and a living eucalypt named after him. Moon began conducting tours through this cave almost immediately and its formations were photographed extensively by John Flynn, who sold his photographs for publication in newspapers, reproduced them as postcards and used them in lantern slide lectures[15]

The exploratory work of Moon and others was given impetus of a different sort when noted palaeontologist Thomas Sergeant Hall visited Buchan in December 1906, 'to inquire into the truth of statements in the newspapers as to the presence of mammalian bones in the floors of the caves'. Despite the previous damage and souveniring of fossils in the Buchan caves, Hall was able to build on the earlier work of Stirling and his visit resulted in an important collection of bones for the National Museum.[16]

Although Frank Moon was clearly not the first person to discover the Buchan caves, he was instrumental in promoting both the Moon and Kitson Caves and continued thereafter working assiduously to locate and develop new caves in Buchan. On 18 March 1907 his interest was rewarded when he opened-up a small hole on a hillside near the Spring Creek Cave and discovered a significant new cave that far excelled 'in extent and beauty, all others yet discovered in the district'. Years later Moon ebulliently described how he made this discovery:

> 'It was a small depression on the ground … it was blocked with huge rocks and I blew them open with explosives, put a crowbar across and fifty feet of rope and skid down and ultimately got into where the fall of rock is in the Fairy cave, where the tunnel goes through today. I returned from the fall of rock and came out as quickly as I could and came over the hill to the township to inform someone what I had found. The most wonderful cave that's ever been discovered … I was very excited you know'.[17]

He named it the Fairy Cave and two days later wrote to the Secretary of the Lands Department, enthusiastically informing him of his discovery:

> 'I have the greatest pleasure in announcing to you in writing my discovery of the 18th
>
> The only surface indication of this Cave was a hole that you could put your fist in.
>
> By breaking it away large enough to admit my body I lowered myself down a distance of 40 ft into an immense cavern. I have explored its passages for fully ¾ of a mile and must say that it is beyond all my expectations. All I can say is that it is amazingly beautiful. In fact one could not explain its grandeur to anyone. I am allowing Mr. Bulmer to take some views of it and will forward some as soon as possible. I feel convinced now that I have Jenolans rival'.[18]

[14]Sady, 'Buckan Mungie', p. 17, for excerpt of Frank Moon interview and relationship with Kitson; Parks Victoria (Buchan Caves Collection), Report to the Secretary for Mines by A. E. Kitson, 25 November 1906; *ADB*, Vol. 9, 'Sir Albert Kitson (1868-1937)', pp. 617-8.

[15] *ADB*, Vol. 9, p. 618, for Kitson; Hamilton-Smith, 'Historical Notes', p. 2, for Kitson Cave; Robert Haldane, 'Photo Folio', p. 20, for John Flynn.

[16] J.H. Harvey, et al, 'Buchan And Its caves', p. 98; *ADB*, Vol. 9, 'Thomas Sergeant Hall (1858-1915), pp. 166-7; Stirling Report, p. 68.

[17] Parks Victoria (Buchan Caves Collection). Copy of A.E. Kitson correspondence, 13 May 1907, for cave description; Sady, 'Buckan Mungie', p. 18, for Moon's account of Fairy Cave discovery.

[18] Parks Victoria (Buchan Caves Collection). Copy of letter from F.H.A. Moon to The Secretary Lands Department, 20 March 1907.

Frank Moon did not have personal knowledge of the famed caves at Jenolan in New South Wales but he was keen to see the caves at Buchan rival their renowned status as a tourist attraction and within days he began guiding parties on tours through 'his' Fairy Cave: by April more than one hundred visitors had been shown through the cave.[19]

The 'Mr. Bulmer' referred to in Moon's letter was Gippsland photographer Howard Decimus Bulmer, who was in the early stages of a career in photography that was to last for almost fifty years. His photographs of the Fairy and other Buchan caves were an important element in their publicity and further development. John Flynn had moved from Buchan back to Melbourne on 4 January 1907 and was not about to assist Moon with his photographic promotion of the Fairy Cave. Although Flynn did return to Buchan in 1908 on leave, to deliver a lantern slide lecture on the Snowy River and photographed some Fairy Cave formations during that visit. Other photographers who figured in the early promotion of the Buchan caves were Buchan South Postmaster, James Henry Macdougall, who operated Walden Studios from Buchan and F. Verrell Heath In 1907 Heath published his illustrated work *Views of the Buchan Caves and Pyramids*, which included photographs of Frank Moon and the Spring Creek, Kitson and Moon caves. Because its release on 26 March almost coincided with the discovery of the Fairy Cave, Heath missed the opportunity to include the Fairy Cave in the first impression of his booklet[20]

Lands Department District Surveyor, William Thorn, visited the Buchan caves in April 1907, which is when the first known map of the Fairy Cave was drawn, including the naming of some cave formations after characters in William Shakespeare's play *A Midsummer Night's Dream*. 'Oberon's Throne' (Oberon was King of the Fairies) and 'Titania's Bower' (Titania was Queen of the Fairies), were two of these. Mindful of the damage that visitors had already done to other caves in Buchan, Thorn moved quickly to preserve the finely decorated Fairy Cave and recommended on 15 May 1907 that the cave 'be absolutely closed until the formations have been protected' adding that Frank Moon was 'an enthusiastic and intrepid explorer' and 'an experienced and intelligent miner' but that he required assistance 'to erect railings and netting'. It was further recommended that 'an experienced man be obtained from New South Wales' for this task. The Fairy Cave was closed almost immediately and Frederick John Wilson, a former caretaker of the Jenolan Caves in New South Wales, was appointed to develop the Fairy Cave for tourism in accordance with what was then accepted as best caves management practice. Wilson has been described as 'a very shy man … a very reticent and retiring man' but also as 'a visionary with a great sensitivity to the natural world'. Assisted by Frank Moon and others, he established pathways and handrails in the Fairy Cave and it was re-opened to tourists on 2 December 1907. Using the one entrance-exit point Moon and Wilson were then able to guide tourists to the rock fall known as 'Titania's Bower'. On 17 March 1908 Sir Reginald Talbot, the Governor of Victoria, visited and officially opened the Fairy Cave and he and his party were served refreshments in a chamber of Wilson's Cave, that was set with a picnic table and dubbed Picnic Hall.[21]

[19] Peter Ackroyd & Elery Hamilton-Smith, 'An Idyllic Setting: the Buchan Caves Reserve', *Gippsland Heritage Journal*, No. 25, 2001, p. 18, for no knowledge of Jenolan.

[20] Squires, *Gippsland in Focus*, p. 6, for Bulmer, p. 39, for Heath, pp. 52-3, for Macdougall; Haldane, 'Photo-Folio – John Flynn', p. 20, for Flynn's return to Melbourne; McPheat, *Apostle to the Inland*, p. 240, for Flynn's 1908 visit; http:/nla.gov.au/nla.pic-an24586889 and pic-an24353401 (searched 29 July 2006), for Flynn's Fairy Cave images of 'Shawls' and 'The Crystal Grotto'; F. Verrell Heath, *Views of the Buchan Caves and Pyramids*, T. C .Lothian, Melbourne,1907.

[21] Ackroyd & Hamilton-Smith, 'An Idyllic Setting', pp. 18-19; Sady, p. 19, incorrectly cites Titania's Bower as Titania's Bath: refer to Harvey, et al, 'Buchan And Its Caves', for Fairy Cave Map; Hamilton-Smith, 'Community Consultation notes', pp. 2-3, and Elery Hamilton-Smith, 'Buchan Caves Memorabilia: An exhibition at the Museum of Victoria 3rd – 8th June 2004' p. 9, for description of Wilson; Harvey, et al, 'Buchan And Its Caves', pp. 101-3, for report on Thorn's visit; Parks Victoria

Always an intrepid explorer, the full extent of Frank Moon's caves explorations will probably never be known but another discovery in which he played a significant role occurred in November 1910, when, together with Frederick Wilson and local police Constable Hercules Brown, he explored beyond the surveyed limits of Fairy Cave and discovered what today is known as Royal Cave. Recently arrived in Buchan, Brown had served during the Boer War as one of 'Kitchener's Fighting Scouts' but despite that robust background he found life underground with Wilson and Moon tough going. On the day of their initial discovery they spent nine hours underground in mud and perilous conditions and returned on the following two days to undertake further work. Although Wilson instigated this exploration, when at one point their progress was impeded, it was, according to Brown, the younger and more athletic Frank Moon who led the way,

> 'it looked as if our advance had become completely blocked when Mr. Moon, who had been ferreting around, discovered a hole under a pile of rocks, and promptly dived through the opening and dropped about eight feet below into the underground creek we had been following. Mr. Wilson and I followed, and found with joy that we had negotiated the fall and were standing in a roomy rockbound chamber'. [22]

Following this discovery Wilson supervised the installation of iron railings and wire netting in a manner similar to his work at the Jenolan Caves and in 1913 an artificial entrance was also constructed, enabling Royal Cave to be opened for public tours. Wilson's design and installation of the protective netting in Royal Cave are amongst the finest examples of this type of work in the world. In March 1915 Wilson decided to exhaust the known boundaries of Royal Cave and over a period of days, in company with caves employee William H. Bonwick, he followed leads and 'got into a new cave' with 'one very fine chamber of rich formation' and formed the view that 'It would be very easy to improve' for display as a tourist cave. In succeeding weeks Frank Moon helped Wilson and Bonwick to take soundings and complete their survey of the 'new cave' which was named Federal Cave. Over a period of years Wilson and Moon were assisted with much of the heavy 'hammer and chisel' work in the caves by William Bonwick, William Foster and Francis Hansford.[23]

Frank Moon worked with Wilson to install iron railings and wire netting in Federal Cave but he was not about in 1917 to witness its public opening On 4 May 1916, Moon, then aged thirty-five and the married father of three young girls, enlisted in the A.I.F. 38th Battalion and embarked aboard HMAT *Themistocles* bound for war in Europe. He was wounded once and served at Messines, Ypres, Passchendaele and on the Somme but even the turmoil of military service overseas did not dim his abiding interest in caving. Whilst en route to Europe his troopship docked at Cape Town and there he had his name and 'Buchan Caves' written on his hat: drawing the interest of 'plenty of men [who] came up to me to have a talk as they had been through the Caves'. In August 1916 he wrote to his three daughters,

> 'To My Dear Daughters …Tell mum to take great care of all my books + my trees I imagine I can see the Cootamundra wattle all in bloom up the Cave avenue
>
> Dad will find some new caves when he comes back I will have a look at the caves in England + see if they are as good as our Fairy Caves … Tell dad all the news when you write let me know how Cave Queen + Godess [sic] are looking + how many cows you milk + tell me if there are many people visiting the Caves at present'.

(Buchan Caves Collection), Report by Lands Department District Surveyor, dated 15 May 1907; Adams, *The Tambo Shire*, p. 246, for Governor's visit.

[22] Hercules Brown, 'Cave Hunting – A Wonderful Discovery', *The Police Journal*, Monday 2 February 1920, pp. 5-6; Correspondence from Victoria Police Museum to the author, 26 July 2006, for Brown's military and police service history.

[23] Parks Victoria (Buchan Caves Collection), Correspondence from F.H. Wilson to The Secretary for Lands, 27 March 1915, for Federal Cave discovery; 29 April 1915, for Moon taking soundings; Heritage Action Plan, p. 9, for Federal Cave infrastructure; Swift, 'This Man Spent 50 Years Underground', p. 3.

When serving on the front he often sent his best wishes to 'Mr Wilson' and his letters home frequently mentioned 'the caves', enthusing in 1918 that it 'was a record year to the Caves'. Buchan and its caves was a barometer by which Moon measured his time overseas and early in 1917 he 'earnestly hoped to be showing visitors through the caves in 1917' During his idle moments at war Moon wrote poetry and one of his longer poems included the stanza:

> 'Some day the call of peace will come and I will wander back;
>
> To walk with you and talk with you along the old Cave Track'.[24]

Moon returned safely to Australia in April 1919, resuming his position of caretaker at the Buchan caves. While Moon was away Frederick Wilson lived with the Moon family and then aged in his sixties and too old for battles afar, he laboured assiduously in Buchan with the work of preserving and promoting the caves. Wilson continued as Supervisor of the Buchan caves until his retirement, aged sixty-seven years on 31 December 1921, when he was succeeded by Frank Moon.[25]

Moon was passionate about the Buchan caves and for him it wasn't just a matter of work but a way of life. Together with his wife Sabina (nee Carragher) and three daughters he resided in a house known as 'Cave House' within the Buchan Caves Reserve. Sabina Moon initially sold cave tickets from the sitting room of the house and their daughter Queenie 'used to have to go round with a case strapped to her neck selling post cards of the caves'. His eldest daughter, born in 1908, he named Fairy after the Fairy Cave and when she married Buchan cave guide Francis James Hansford on 14 April 1930, the wedding ceremony was conducted by Reverend Albert Ethelbert Clark from Bruthen, in the presence of approximately fifty guests, inside the Fairy Cave in the *King's Chamber*, in front of what has since been known as the *Crystal Altar*. Frank Moon sought special permission from the Committee of Management for this ceremony and to this day it is the only wedding to have been performed in the Buchan caves. In accordance with her father's wishes, Fairy later named her first-born son Cave. [26] One of Frank Moon's abiding interests away from the caves was the owning and training of racehorses but even in that venture he was careful to retain a cave connection and his horses included Royal Cave, Cave Girl, Cave King and Cave Queen.[27]

Frank Moon worked at the Buchan Caves for thirty-four years, retiring at the age of sixty in 1940. In retirement he remained in Buchan, living at his home 'Hill View' and dividing his time between fossicking for gold and working on fire watch towers. In 1954 his contribution to caving in Buchan was honoured by the dedication of a memorial plaque at the entrance to the Fairy Cave and within the Cave Reserve there is a 'Moon Hill Walk' and the 'Frank Moon Memorial Children's Playground'. In 2001 his likeness formed part of the national *Peoplescape* on the grassed slopes of Parliament House in Canberra.[28]

There has long been discussion about who discovered the Buchan caves and precisely when and how that occurred. Clearly they have always been part of Indigenous Australia, spanning an evolution of millions of years preceding European settlement in the 1830s.

Debate still surrounds the dawning of this European discovery, with its attendant damage and despoliation but the role of Frank Moon in discovering and promoting the Fairy Cave is

[24] www.awm.gov.au, searched 19 July 2006, for Frank Moon's military service; Correspondence from Brian Hansford to the author, 11 August 2006, for Cape Town anecdote; Moon Family Papers held by Craig Woodgate, Buchan, for Moon's war service letters and poems, including letter to his daughters, 9 August 1916.

[25] Ackroyd & Hamilton Smith, 'An Idyllic Setting', p. 19, for Wilson retirement and Moon appointment.

[26] Mackieson, *A Brief History of the Family*; Kent Henderson & Marise de Quadros, *The Buchan & Murrindal Caves,* Henderson de Quadros Publications, Williamstown, 1993, p. 9; Interview with Woodgate Family, 18 June 2006; Sady, 'Buckan Mungie', Transcript of interview with Queenie Woodgate, n.d.

[27] Idem.

[28] Ibid; Michael McKernan, *The Peoplescape Celebrating Australians*, Hardie Grant Books, South Yarra, 2002, p.145.

beyond dispute and the Buchan caves stand today in part as a monument to him and the efforts of others like James Stirling, Albert Kitson and Frederick Wilson, who saw the beauty and potential of these caves as Nature's gift to natural science, exploration and tourism in East Gippsland. Frank Moon died, aged eighty-six years, on 27 April 1967 and is buried in the Buchan cemetery. During his funeral service the Reverend Frank Lowe spoke about Moon's affinity with Buchan and its caves and observed, 'When one thinks of Buchan one also thinks of Frank Moon … he was a true pioneer helping to lay the foundation of the very lovely Caves Reserve and it is a lasting tribute to his name'. In 2003, in words that might well serve as an epitaph for Frank Moon, noted speleologist Elery Hamilton-Smith observed,

> 'there is no question that Frank was the man who put Buchan on the map as a tourist site. He was such a salesman and such an enthusiast that he convinced the people of Victoria that this was the most wondrous discovery. You only need to look at the newspapers at that time to see what a sensation it was and that was very much due to Frank's talent for selling people about his enthusiasm. So he played a very important part and must never be forgotten'[29]

ACKNOWLEDGEMENTS

Thanks are due to many people who assisted with sources and material for this article but special acknowledgement is due to Trudy Sady, Elery Hamilton-Smith, Parks Victoria and the descendants of Frank Moon, for their earlier research on this subject and assistance with information

Dr Robert Haldane, an Associate of the *Gippsland Heritage Journal*, is an East Gippsland regional historian who lives at Buchan.

[29]Certificate of Death No. 9907/67 for Francis Herbert Arthur Moon; Funeral service notes of Reverend Frank Lowe, 29 April 1967; Elery Hamilton-Smith, Community Consultation Presentation re Heritage Action Plan for Buchan Caves, 20 May 2003, pp. 1-2.

'Ozone-whetted appetites and hearts devoid of care': cruising to cave-land in 19th century Tasmania

Nic Haygarth

> 'Would you like,' said the manager…, 'to have a look at Hudson's [Flowery Gully] Caves at Beaconsfield? They're well worth a visit.'
>
> 'Certainly,' was our prompt reply, 'always providing that you relieve us of all care, so that our personal enjoyment shall be our sole occupation.'
>
> 'There's a Special Excursion Party leaving by the SS CENTENNIAL for the Caves to-morrow [sic] morning at eight o'clock. You have only to come on board, and all else will be provided, in so far as the party is concerned, without further thought or exertion,' was the manager's answer.
>
> We assured him that upon those terms we would be there — and we were.[1]

But not for long. There have been few cruises to Australian tourist caves. Early 20th century Melbournians were encouraged to incorporate a Gippsland Lakes cruise into their coach or coach-and-rail approach to Buchan Caves, but this represented only a small part of the overall journey or was incidental to visiting the caves.[2] In Tasmania during the 1890s there were several organised trips to caves which were primarily a voyage, that is, by far the greater part of the journey to and from the caves was by water. Individual initiative exploited the discovery of caves near established shipping or cruise routes within reach of a major centre, but neither Mystery Creek Cave nor Flowery Gully Cave, the subjects of these cruises, flourished as an attraction, being at the nexus of tourism and heavy industry.

Late 19th century Australian steamer excursions owed something to the slow development of road and railway networks, the British Empire's maritime supremacy, the fashion of Aegean Sea cruises among Europe's elite and the popularity of 'taking the airs', that is, the idea that a cool, temperate climate was curative and invigorating, particularly that of mountains and the seaside.[3] Tasmanian cave cruises preceded the days of mass tourism. In fact, the masses were not invited, exclusiveness being guaranteed by price and, in the case of Ida Bay, by overnight travel. For many working class people, a public holiday presented the only chance to take an outing, whereas well-to-do locals and visitors often had more freedom of choice. Members of the latter class were not above morally censoring the former — particularly in the protest against Sunday travel, which allegedly prevented church-going and disrupted church services — in order to keep their recreational resorts to themselves.[4]

By the 1880s, when Tasmania's only well-known limestone caves were in the inland Chudleigh-Mole Creek district, moonlight cruises, often with a band playing, were conducted out of both Hobart and Launceston. The monument to the wreck of the convict transport ship *George III*, with loss of 139 souls, on Actaeon Reef in 1835 had already made Southport, south of Hobart, a destination for steamer excursions.[5] The *Huon*

[1] 'At Hudson's [Flowery Gully] Caves, Beaconsfield', contained in a letter from John Wat Tyler to Henry Dobson 9 March 1893, PD1/60, file no.103 'Correspondence Records 1892—6' (Archives Office of Tasmania)

[2] See, for example, Frank Whitcombe, *Guide to Buchan Caves and Gippsland Lakes*, Cunninghame Progressive Association, Cunninghame (now Lakes Entrance), 1908

[3] See Jim Davidson and Peter Spearitt, *Holiday Business: Tourism in Australia Since 1870*, Melbourne University Press, 2000, pp.24-38.

[4] Tim Bonyhady, in *The Colonial Earth*, Melbourne University Press, 2000, pp.102—12, discusses efforts to exclude working-class excursionists from Victoria's Ferntree Gully resort. For a Tasmanian example of the outcry against Sunday excursions, see 'Scottsdale' and 'Sunday Excursion Train to Scottsdale', *Daily Telegraph* (Launceston) 16 August 1889.

[5] David Young, *Making Crime Pay: the Evolution of Convict Tourism in Tasmania*, Tasmanian

and *Cygnet* together serviced the Franklin and D'Entrecasteaux settlements from Hobart twice each per week, but it was claimed that only the 50-ton, twin-screw, light-draught *Huon* could easily cross the bar between the Narrows at Southport, near Ida Bay.[6]

This was timber country. In about 1889 the relentless pursuit of logs reputedly led Ida Bay sawmiller Watt Tyler to the bank of a large stream. Intrigued that he could see no course through the cliffs ahead of it, he traced the stream until it entered the 'gloom' through a natural arch in the rockface now known as Mystery Creek Cave. The Tyler brothers later probed the opening for perhaps two kilometres, lighting the way with candles or lamps, but it was the limestone cliffs outside the cave which grabbed their attention.[7] A specimen of this 'marble' was said to have excited promises of business in England.[8]

Mystery Creek Cave (then known as the Queens or Ida Bay Caves) cruises had a variety of promoters. At a time when an attempt was being made to establish a tourist bureau in Hobart, these cruises served not only those taking the airs in exclusive company, but an appetite for new diversions and the 'sublime' (that is, the thrill of recognising man's small, powerless existence at the whim of mighty nature[9]). Local scientists and potential limestone miners also came aboard, including amateur anthropologist Horace Watson, better known for making two of Australia's earliest wax cylinder recordings.[10] Tasmanian Museum director and amateur naturalist Alexander Morton was thrilled by the glowworms and karst formations in Mystery Creek Cave, urging the Minister of Lands to protect the cave, which he (Morton) envisaged becoming 'one of the great attractions of the south'.[11] His description of the glowworm display was even noted by the journal *Scientific American*.[12]

The original limestone mining scheme at Ida Bay fell through in 1891, enabling tour parties during that year and the next to enter Mystery Creek Cave in peace. The report of a February 1892 cruise was drenched in reverence for untamed, ancient nature, including this description of the view from inside the cave's entrance arch:

> When they had got there a sight met their eyes, to which all else they had seen that morning faded into insignificance. The sun…pierced the openings in the leafy canopy above in long bright shafts of light which, falling upon the thousands of specimens of delicately tinted drooping ferns, mosses, and shrubbery, gave to the gaze of those who stood there admiring the effect, a sight to be remembered for years to come. The tints were exquisite, and the contrasts of light and shade were made up in detail, every minute portion of which was a separate study. Not a sound broke the silence of these solitudes save the murmur of the creek below, and the occasional chirrup of a bird flitting from branch to branch above.

The huge boulders scattered here not only impressed would-be limestone miners but invoked the sublime suggestion that convulsions of nature might entomb the party

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Historical Research Association, Hobart, 1996, p.58

[6] *Union Steam Ship Company's Tasmanian Guide for Visitors to Tasmania*, Launceston, 1891, p.63; 'The Queen's [sic] Caves, Ida Bay', *Tasmanian Mail* 20 February 1892, p.34

[7] 'The Queen's [sic] Caves, Ida Bay', *Tasmanian Mail* 20 February 1892, p.34. EG Innes, District Surveyor for Huon, in *Survey Department Annual Report 1890—1*, Parliamentary Paper 72/1891, p.16, recorded the discovery of limestone on the southern side of the Lune River and that 'a large area has been pegged off for mining purposes'.

[8] 'Hastings', *Daily Telegraph* (Launceston) 10 April 1891, p.4

[9] For a discussion of the sublime, see Trevor R Shaw, *History of Cave Science: the Exploration and Study of Limestone Caves to 1900*, 2nd edn, Sydney Speleological Society, Sydney, 1992, p.238; and Rosalind Williams, *Notes on the Underground: An Essay on Technology, Society, and the Imagination*, MIT Press, Cambridge, Mass, 1990, p.86.

[10] Musicological Society of Australia Newsletter, no.63, September 2005, www.msa.org.au/MSA_Newsletter63.htm

[11] 'Southport Caves', *Papers and Proceedings of the Royal Society of Tasmania*, 1891, pp.x—xi

[12] 'The Glow Worm Caves of Tasmania', *Scientific American* 23 November 1895, p.332

beneath the earth.[13] Lamps, candles and magnesian wire fortified an 1891 group, who after entering the cave were dazzled by its superior lighting system:

> Clustering round the roof and sides were millions of glow-worms [sic]. They glistened like diamonds, and with the light extinguished, one might conjure the story of the magic cave which brought to Aladdin such immense wealth. By the aid of magnesian wire the whole of the chamber was brilliantly illuminated.... Groups of stalagmites which, at first sight appeared to be statuary, stood prominently round the sides and in the centre, overhung with stalactites of curious shapes and wonderful purity.[14]

The 1892 party appears to have entered the Cephalopod Creek passage, well known until recently for its small waterfall:

> The sound of falling water proceeding from a small hole leading almost perpendicularly downwards induced some of the more curious to make a search in that direction. Pushing through crevices and crawling along ledges they came at length to a spot where the water of the creek rushed away to unknown depths and was lost in the darkness beyond ...[15]

The voyage itself held promises: a moonlit run down the D'Entrecasteaux Channel for the night owls, and sunrise over Bruny Island for the early risers.[16] The channel through the Southport Narrows was reportedly *so* narrow that at times the tourist could literally step ashore from the deck.[17]

Flowery Gully Cave, near the Tamar River, in northern Tasmania, had received sporadic attention since the mid 1860s. A timber tramway built almost to its door in 1853 had guaranteed its European discovery, possibly by a lime quarrier named Hudson.[18] The existence in this district of both iron and limestone, useful as a flux in smelting the former, guaranteed the cave an ambivalent future — but it took another 'Watt' Tyler to test it as a tourist attraction. In 1890 the manager of a Hobart skating rink, John Wat Tyler, apparently unrelated to the Ida Bay Tylers, had conducted a series of five 'Grand Excursions', day trips to attractions in the Hobart region. His biggest attendance seems to have been 46, including 16 ladies, for a Russell Falls railway excursion, a destination featured in today's Mount Field National Park.[19] He employed local guides and a Hobart caterer, in the manner of a professional tourism company. This was first-class travel for those who could afford it, whereas contemporary government railway excursions aimed at the low-budget end of the market. (while Tyler charged 21 shillings for transport by train and horse-drawn carriage, catered luncheon, guides, and tea on the return leg, even 20 years later the journey to Russell Falls alone could be made for only 11s 6d.[20])

Tyler's was a regime of bold public statements and, perhaps, private back-pedalling from creditors. It was 1892 before Tyler's Excursion Company briefly resurfaced — in Launceston — announcing plans to run an excursion voyage to the Melbourne Cup Races, trips to the Mole Creek Caves and other Tasmanian

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[13] 'The Queen's [sic] Caves, Ida Bay, *Tasmanian Mail* 20 February 1892, p.34

[14] 'The Queen's [sic] Caves, Ida Bay: Fine Marble Cliffs', *Hobart Mercury* 25 May 1891

[15] 'The Queen's [sic] Caves, Ida Bay, *Tasmanian Mail* 20 February 1892, p.34

[16] 'The Queen's [sic] Caves, Ida Bay', *Tasmanian Mail* 20 February 1892, p.34; 'Ida Bay Caves', *Hobart Mercury* 30 January 1893

[17] 'Ida Bay Caves', *Mercury* (Hobart) 23 January 1893, p.2

[18] For the timber tramway, see Miranda Morris-Nunn and CB Tassell, *Tamar Valley Industrial Heritage: a Survey*, Australian Heritage Commission and Queen Victoria Museum, 1984, pp.11—3. For Hudson as discoverer, see 'At Hudson's [Flowery Gully] Caves, Beaconsfield', contained in a letter from John Wat Tyler to Henry Dobson 9 March 1893, PD1/60, file no.103 'Correspondence Records 1892—6' (Archives Office of Tasmania).

[19] 'Mr Tyler's Russell Falls Excursion Party', *Mercury* (Hobart) 27 February 1890, p.2

[20] Peter MacFie, *Mt Field: The Evolution of Tasmania's First National Park 1830—1960: Draft*, Department of Parks, Wildlife and Heritage, Hobart, 1992, p.29

attractions. [21] Tamar River cruises from Launceston to George Town had then been operating for decades and, more recently, Beauty Point, the port for the new gold town of Beaconsfield, had been added to the itinerary. The enterprising tourism agent seems to have harnessed a Flowery Gully Cave excursion to Alfred Harrap and Sons' cruise on the Prince of Wales' birthday public holiday of 9 November 1892.

Tyler's exuberant account of this trip, penned in the third person as an advertisement for future tours, delivered his manifesto of the completely-catered tour. As the *Centennial* steamed down river, Trevallyn villas, representing Launceston's new-found mining wealth, gave way to 'fat corn and meadow lands'. This was in keeping with the image of colonial opulence and bucolic tranquillity that Tasmania wanted to sell to tourists. Tyler described a carefree indulgence for jaded businessmen and summer idlers:

> …as we travel smoothly onwards a light breeze arises, and in far spreading reaches of the winding and beautiful river the white wings of swift-moving small craft, pleasure boats, or what not dart hither and thither. And from afar off, borne faintly on the morning air, comes the sound of music on the water, and the ripple and murmur of light laughter and small talk becomes hushed and ceased. We are all enjoying too intensely the beauty of our surroundings to waste time in gossip or jesting.

The cave party disembarked, according to Tyler's account, 'with ozone-whetted appetites and hearts devoid of care'.

Horse-drawn vehicles which had travelled 46 kilometres by road from Launceston conveyed the party to their lunch venue, Beaconsfield's Ophir Hotel, and beyond to the undeveloped Flowery Gully cave. Inside the cave, Middletons Pass, a feature named after a gentleman who failed to pass through it, projected a similar jolly prosperity. Assistance by some of the young men allowed ladies to enter Flowery Gully's first chamber without difficulty, only to find that the 'Tasmanian devil' had left his brutal mark here in the form of graffiti.[22]

Tyler was ahead of his time. In 1893 he investigated running tours to Cradle Mountain, Mount Pelion West, the Forth Falls and other then quite remote north-west Tasmanian natural features.[23] This was almost two decades before Cradle Mountain's celebrated tourism operator, Gustav Weindorfer, opened Waldheim Chalet. When, in January 1893, Tasmanian premier Henry Dobson proposed to establish a 'tourist society' in Tasmania, Tyler recommended a system by which a tourist could book to tour Tasmania from anywhere in Australasia, through the Thomas Cook and Sons tourist agency.[24] This is exactly what happened. A Thomas Cook and Sons agency was established under the aegis of the Tasmanian Railway Department, which might partly explain the fate of cave cruises.

In 1893 there were further cruises from Hobart to the southern cave-land at Ida Bay, which remained a fresh diversion. 'We all tired of Brown's River [sic — a popular Hobart beach resort, later called Kingston], Fern Bower [Hobart's favourite fern retreat] etc', one excursionist wrote, 'as we have seen them all so often, so these caves will doubtless prove a pleasure to come for a great many for a long time.' [25] First-class meals were provided on board, and strong lights for the cave. The two-hour walk from coast to karst was reported to be magnificently scenic, and the cave, through which Mystery Creek runs, was described as 'always perfectly dry, there being no drippings

[21] 'Current Topics', *Examiner* (Launceston) 2 October 1892, p.3

[22] 'At Hudson's [Flowery Gully] Caves, Beaconsfield', contained in a letter from John Wat Tyler to Henry Dobson 9 March 1893, PD1/60, file no.103 'Correspondence Records 1892—6' (Archives Office of Tasmania)

[23] John Wat Tyler to Henry Dobson 11 May 1893, PD1/60, file no.103 'Correspondence Records 1892—6' (Archives Office of Tasmania)

[24] John Wat Tyler to Henry Dobson 9 March 1893, PD1/60, file no.103 'Correspondence Records 1892—6' (Archives Office of Tasmania)

[25] 'One of Your Many Visitors', 'The Ida Bay Caves', *Mercury* (Hobart) 2 January 1893

from the roof'.[26] A cabin on the *Huon* was reserved for ladies, and one, a 'well-known explorer', was said to be so excited by the prospect of testing the 'hidden wonders' for herself, that she travelled 70 or 80 miles (probably from the northern Midlands) in order to do so.[27] The only advice specific to her gender was to enter the cave no earlier than 11am, thereby allowing the moss to dry on the otherwise slippery logs ladies must negotiate in their restrictive garments. The Messrs Watson of Hobart's Vita Studio reportedly took what must have been among the earliest images of Tasmanian karst during one of these cruises.[28] Perhaps the heavy rains of January 1893 flushed out the glowworms, since none are mentioned in reports of that year. Instead, the highlights of this 'veritable fairyland' were the danger endured in reaching the most impressive sights, such as underground waterfalls; the mystery of the stream's destination; and the tones and echoes of the 'musical chambers', in which stalactites were played.[29] Departure of one service was even held back until 11pm so as not to interfere with Hobart social life, allowing patrons to enjoy the final performance by Williamson's Comic Opera Company.[30] Some cruises excluded the masses not only by price but by sailing on a week day — although the dates on which the *Huon* could be chartered would have been determined by its schedule of regular services to the Franklin and D'Entrecasteaux settlements.[31]

Tasmania may not have been ready for John Wat Tyler's vision of a pleasure cruise, because his Flowery Gully excursion appears to have been a one-off. Did well-to-do punters quail at his day trip fare of 12 shillings and sixpence? In the following year, 1894, perhaps 40 or 50 chose to pay either 5 shillings and sixpence (first class) or 4 shillings (second class) on the first government railway excursion (a day trip) from Launceston to the Chudleigh Caves.[32] That fare appears to have included guides, candles and transport from station to cave by local horse-drawn vehicle — every facility except food and refreshments. Some brought their own picnic baskets.[33] Curative air could be won cheaper in the mountains than it could on the river or the high seas, but at the top end of the market paying more was accepted and expected, guaranteeing exclusive company.

The *Huon*'s Ida Bay Cave cruises were also short-lived. Comparisons with New South Wales's already celebrated Jenolan Caves, while inevitable, were unrealistic, since Mystery Creek Cave's outer chambers, for all the wonder they had generated, contained comparatively few of the stalactites and stalagmites which generally engaged tourists. By the time Jenolan's assistant curator FJ Wilson was consulted for advice on how to develop Mystery Creek, the small market for this form of quality tourism may have been exhausted, the novelty of the cruise-and-caves double-act wearing thin.[34] By February 1893, the *Huon*'s proprietors were dropping the standard fare from 10 shillings to 7 shillings and sixpence in hope of filling more seats.[35] Through the following tourist season they appear to have advertised in vain.

This paper has so far not dealt with Exit Cave, through which Mystery Creek leaves Marble Hill, that is, the other end of what tourists in the 1890s knew as the Ida Bay Caves and what

[26] 'Ida Bay Caves', *Mercury* (Hobart) 25 January 1893, p.2

[27] Advert for Ida Bay Caves cruise, *Mercury* (Hobart) 28 February 1893, p.4; 'Ida Bay Caves', *Mercury* (Hobart) 22 February 1893, p.2

[28] 'Ida Bay Caves', *Mercury* (Hobart) 30 January 1893

[29] 'Ida Bay Caves', *Mercury* (Hobart) 30 January 1893; 'Ida Bay Caves', *Mercury* (Hobart) 23 January 1893, p.2

[30] 'Ida Bay Caves', *Mercury* (Hobart) 4 February 1893, p.3; advert, *Mercury* (Hobart) 22 February 1893, p.4

[31] 'Ida Bay Caves', *Mercury* (Hobart) 22 February 1893, p.2

[32] Advert for 'Chudleigh Caves' railway excursion, *Examiner* (Launceston) 2 November 1894, p.4

[33] 'One of the Party', 'Tasmania's Beauty Spots: Excursion to Chudleigh Caves', *Examiner* (Launceston) 10 November 1894, p.5

[34] Leventhorpe Hall, in 'Ida Bay and Jenolan Caves', *Mercury* (Hobart) 10 March 1893, p.3, details his correspondence with FJ Wilson.

[35] 'Ida Bay Caves', *Mercury* (Hobart) 9 February 1893

is today called Mystery Creek Cave. Exit Cave, now more celebrated scientifically than Mystery Creek Cave, and better known because of the recent battle to save it from Benders Quarry, was almost certainly known by the 1890s. The discovery of 'marble', and the establishment of a prospecting track which skirted Mystery Creek Cave soon after would have ensured exploration of Marble Hill during that decade. Edgar, Arthur and Albert Tyler certainly knew of Mystery Creek's exit from Marble Hill in 1900, when they guided the track-cutter and prospector Thomas Bather (TB) Moore through 'the large caves' (Mystery Creek Cave). Moore recorded:

> The Dentrecastreaux [sic — Mystery] Creek a large stream heading from the high lands Easterly [sic] from La Perouse runs through the caves and out at the other side of the Spur [sic] in which the Caves [sic] are situated to Recherch[e]…[36]

Known or unknown, Exit Cave was out of bounds to 1890s cruise excursionists, who already trooped more than six kilometres from their vessel to Mystery Creek Cave, without then tackling the thick scrub of Marble Hill in order to reach Exit. Moore, an amateur naturalist, noted carboniferous fossils in Mystery Creek, anticipating that the Ida Bay cave system's geology and biology would for many years be its drawcards. Limestone miners supplying a carbide producer and a zinc smelter would tread more of the Ida Bay karst than tourists.

Nor did Flowery Gully Cave have a substantial tourist career. Other caves were more decorative, more easily lit than Mystery Creek and more easily preserved than Flowery Gully, which was on private land in an established industrial zone. Wet Cave, Sassafras Cave and Cyclops Cave in the Chudleigh-Mole Creek district had already been marked for reservation by the government.[37] Even before railway excursions began, locals such as Dan Pickett and Thomas Haberle offered guided cave tours and catering, a tradition that would continue into the 20th century at Mole Creek. By contrast, both the Ida Bay Caves and that at Flowery Gully were at the nexus of mining and tourism, without the tourist economy and models of cave entrepreneurship that existed in the Mole Creek district.

The railway which helped popularise the Chudleigh-Mole Creek Caves was the first form of pleasure travel for the Australian working class, ushering in the affordable day-trip.[38] The foundation had been lain in 1871, when Tasmania's first railway line had been opened between Launceston and Deloraine in the north, bringing an urban population within 18 kilometres of the Chudleigh-Mole Creek Caves. In the economic 'good times' of the 1880s the middle class enjoyed more leisure time, and the Tasmanian parliament spent big on branch railways. The 600 kilometres of track laid down in the period 1883-91 included the Mole Creek Branch Railway, infrastructure which never served Ida Bay and Flowery Gully.

Taking the airs on or beneath the Great Western Tiers, and the 'Englishness' of rural northern Tasmania, with its rolling hills and hawthorn hedge windbreaks — even blackberries — proved popular. Fern gullies were all the rage. The fern bower of Westmorland Falls was marketed as an adjunct to the Wet Caves when the first excursion service on the Mole Creek Branch Railway was conducted in 1894. The westward expansion of settlement in this district early in the 20th century revealed new caves, including the present show caves, King Solomons and Marakoopa, while new discoveries at Gunns Plains and Hastings received local backing that Ida Bay and Flowery Gully lacked. Individual initiative and voluntary organisations characterised Tasmanian cave tourism up to about World War I, but ultimately it was the state government which shaped the present regime of 'show' caves at Mole Creek, Gunns Plains and Hastings, rail and road being the supporting infrastructure.

[36] TB Moore diary entry 24 December 1900, *Diary of Cutting Track from Hastings to Port Davey*, ZM5631 (West Coast Pioneers' Museum, Zeehan, Tasmania)

[37] See discussion in minutes of Deloraine Council for 1873 and 1879, MCC42/3/3 and MCC42/3/4 (Archives Office of Tasmania).

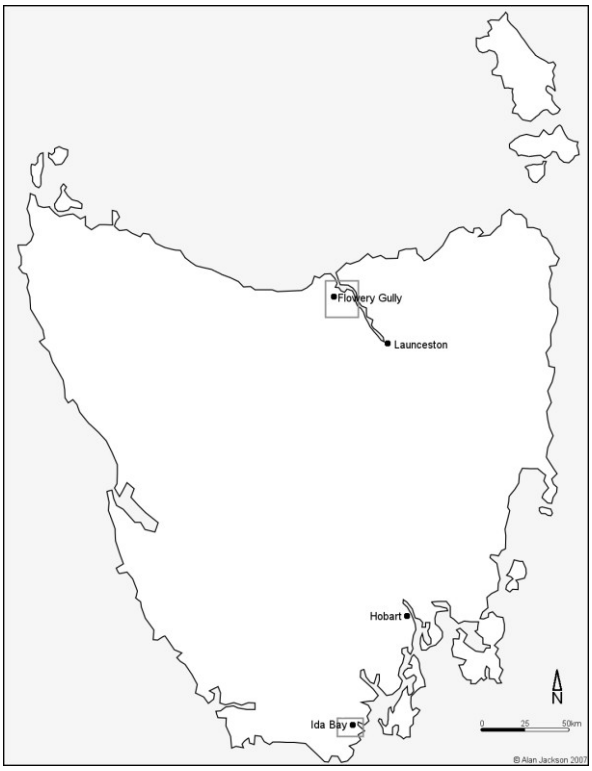
[38] CA Morris, *In Pursuit of the Travelling Man: a Study of Tasmanian Tourism to 1905*, BA (Hons) thesis, University of Tasmania, Hobart, 1974, p.vi

The author acknowledges the contribution of Arthur Clarke to research for this paper, finding illustrations for it and his helpful general comments.

'[Lune] Sugar Loaf from the Narrows at Southport' (Samuel Clifford photo, Crowther Collection, State Library of Tasmania)

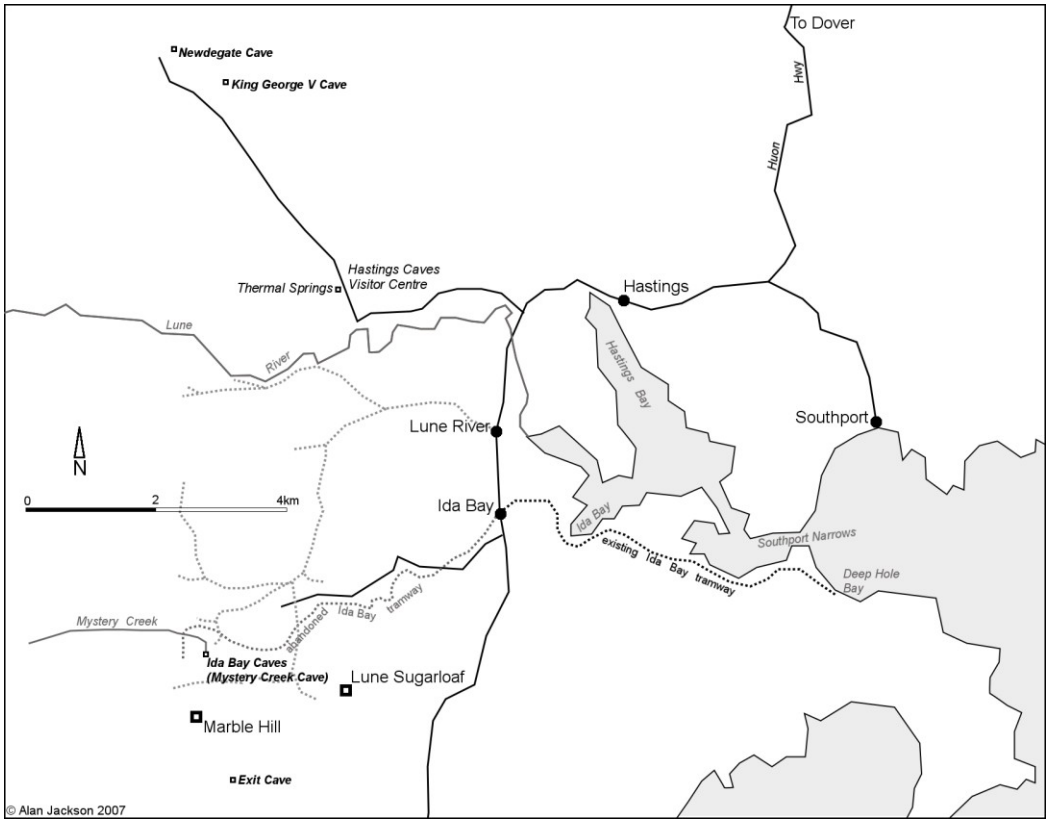
A cruise party aboard SS Huon in 1907 (Mike Simco Collection)

'Adamsons Peak from the Narrows at Southport'. (Samuel Clifford photo, Crowther Collection, State Library of Tasmania)

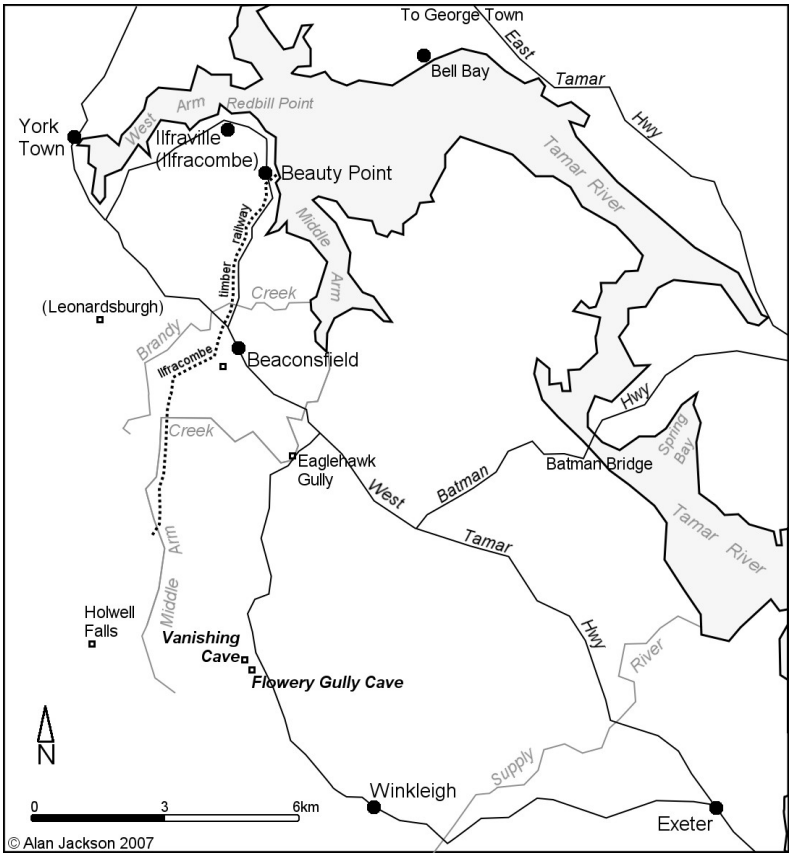


Overview map of Tasmanian cruises of the 1890s. (Alan Jackson)

Entrance to Mystery Creek Cave, JW Beattie photo from Weekly Courier newspaper 6-7-1914



Ida Bay Caves area (Alan Jackson)



Flowery Gully Cave area - Beaconsfield area (Alan Jackson)

Cave lighting in the early 21st century

Dan Cove & Dave Rowling

Over the past decade there has been a great deal of attention devoted to the subject of lighting show-caves, and many papers have been written and delivered on approaches to lighting various caves around the world. As a consequence of this focus, a series of 'first principles' have effectively been established to provide the current best practice guidelines for lighting or, as is more often the case, re-lighting, a cave. Work at Jenolan in particular in relighting the Imperial, Lucas and Temple of Baal has added significantly to establishing these principles. These basics are:

1. **Do not over-light:** A cave should be lit as a cave, and there should be no attempt to light the features as one would light an office or shopping mall. Subtle effects, the deliberate use of darkness, are often more effective and dramatic than the use of floods and 'blanket' lighting. Of course, the under-lighting of a cave should not be at the expense of the safety of visitors.
2. **Create a theme:** Rather than merely light a cave to 'make it pretty', lighting should be used as a tool to illustrate aspects of cave development, history etc. Avoid the "Thousand Shawl Effect", i.e. the somewhat forgivable tendency to light every single pretty shawl in the cave. Rather, lighting should be deliberately sequential, with each 'scene' leading logically to the next.
3. **Hide fixtures and cabling:** To the greatest possible extent without causing harm to the cave. The cave is therefore presented in as visibly natural a state as possible.
4. **Reduce power consumption:** This should be self-evident, not least for the clear environmental reasons of reducing CO_2 emissions, but also as reduced power requirements means greater possibility of supply via UPS during external power outage.
5. **Reduce heat:** The environmental impact of adding energy to the cave environment has been well documented in the scientific literature. Use of appropriate luminaires greatly reduces this impact.
6. **Use available technology appropriately:** Remote controls, bus controlled electrical systems, high lumen per watt output lighting, batteries/inverters, optical fibres – all have a place in the arsenal of the cave lighting designer but should be used as tools to achieve an end, rather than as the end in themselves as the most advanced automation software and control interface is nothing without the design philosophy behind it.

In addition to this list of first principles, at Jenolan we have also become increasingly aware of the importance of design in the lighting of a cave in creating a total visitor experience. Work in the Lucas Cave focussed on the questions of 'what' and 'why'…what do we want people to see in the cave and why do we want them to see it? The Temple of Baal took us beyond the senses into the uncharted waters of deliberately targeting an emotional response and asking 'how', how do we want people to feel, and how can we make them feel this way?

With this list in place, and with the presence of this thoughtful rationale behind us, it could well be wondered what remains to be added to the discussion about cave lighting. However, our recent experience has led us to suggest that there is more to be said and, indeed, that cave lighting will continue to be a dynamic process due to the changing demands and expectations of our visitors. Specifically there are three aspects to be discussed: the importance of ensuring future capability and compatibility, the importance of having a collaborative effort and fusing technical knowledge with expertise in cave interpretation, and finally, expanding on the concept of targeting the emotional response of the visitor, we should recognise the importance of using cave lighting design to confront and surprise visitors.

Future Capability

It is virtually impossible for any of us to imagine the technology of tomorrow. It can be easy to fall into the trap when replacing one lighting system with another to look with pity at the old system and wonder why it was installed in such a fashion, easily overlooking the fact that it may have been state of the art in its time and been installed with care and pride. Equally workers of the future may yet cast critical eyes over our recent celebrated achievements. Although it is impossible to predict what the exact shape of the future may be, it is possible to make some provision for advances in technology and to ensure that we will be able to adapt and incorporate, rather than be faced with the need to begin again from scratch.

The most obvious area in which to apply this philosophy is in the field of automation, control and data transfer. Rather than merely design a cave lighting system, we should be looking at parallel applications of technology in areas such as surveillance, remote access control and monitoring. The latter is a point often discussed but seldom implemented, however with the rapid evolution of environmental monitoring systems we would be remiss not to include the potential to incorporate them. Equally systems using Ethernet extenders on a single cat 5 data cable can be used to link the caves to a central data hub which serve as a high speed network enabling surveillance cameras and lighting to be controlled and monitored remotely. This has been used successfully at Jenolan in the development of the Nettle Cave self-guided tour. The forethought to install an optical fibre connection or a spare data cable now may well pay dividends in future years. As development of a cave is a labour intensive process, the maximum planning before work begins minimises future impact. A further Jenolan example is the concurrent installation of a water supply throughout every cave relit over the past decade.

Collaborative Effort

This point is not recognised as it should be. Other than in genuinely unusual situations, a single person will not possess the complete range of skills and knowledge required to light a cave to meet the fundamental list of first principles. This is addressed, at its most simple, by the pairing of an electrician with a cave guide or manager with experience in interpretation. Once again this may seem to be somewhat self-evident, but it has not always been acknowledged that the best electrician will not necessarily possess the knowledge of group movement and group dynamics, the essential pairing of lighting with interpretation, and the knowledge of environmental factors and cave conservation. Caving and SRT experience can also often be required in installing a cave lighting system and knowledge of minimal impact caving technique is essential. Equally, the best guide, caver or interpretive designer will struggle to realise the complex technical design required in this age of automation, and naturally the electrical work itself is impossible for non-qualified personnel. Hence we have the importance of a team, and a team that communicates and works collaboratively.

Once again we can look to the recent work at Jenolan to see the benefits of this collaborative approach. The actual lighting design for the Lucas and Temple of Baal came from the guiding staff, with guides also undertaking much of the labour in the sensitive cave areas. However the use of renewable energy technology, the uninterruptible power supplies (which are genuinely innovative, particularly the example of the Temple of Baal), and the control design and programming came from the Plant Electrician (who, unusually, also possesses formal qualifications in caving). Ultimately, it was the successful relationship between these elements that made the final product so much more successful than the 'old' management approach of appointing a single electrician the sole responsibility for re-lighting a cave.

Lighting that confronts and surprises

This may be the most curious addition to the list, but in many ways it is also the most important. Here we recognise that 'progress' must always be measured and evaluated. It is often assumed that lighting 'evolves', and that this evolution is commensurate to technology and use of updated fixtures. However, this tendency can ignore the very factors that have made caves places of such wonder and delight

for centuries. One of these factors is that, for the overwhelming majority of people, caves are an unfamiliar, even confronting environment and that exploration into this unknown constitutes one of the prime reasons for visiting a cave in the first place. Hence we should not eliminate this element of confrontation, and cave lighting can be used to put visitors too much at their ease.

An excellent example of applying this philosophy is the recent relighting of the Temple of Baal, where quite deliberately the lighting was designed to confound visitor expectations. This was achieved through deliberate use of darkness as well as audio and visual effects.

Further to this we must recognise as cave lighting designers and, indeed, as managers and guides, that the context of interpretation has changed. Tourism as an industry is under threat from such alternate recreational pursuits as shopping, home entertainment systems and gaming. Our response to this threat must be to remain competitive and to offer an experience that is fresh, new and unexpected. We live in an age of media saturation where every visitor to a cave system can reasonably be expected to possess an existing frame of reference, something that was certainly not the case 100 years ago, and would have been relatively unlikely even 20 years ago. However, if we can exceed or confound these preconceptions and expectations we will ultimately deliver something far more memorable and meaningful to the visitor.

In conclusion, the past decade has seen a profound shift in our approach to lighting a cave. We have developed a far more thoughtful and analytical approach to lighting. Technology has changed and we have changed with it though we have also evaluated the available options for their suitability rather than blindly embracing them. We have attempted to look to the future as much as possible and to make provision for inevitable future advances. We have discovered the extraordinary value in creating the right blend of expertise to create a team capable of rising to the artistic, interpretive and technical challenges posed by the cave. And finally we have accepted that what was once good enough may, today, fail to be adequate stimulation when viewed against the changing expectations and preconceptions of our visitors. A 'traditional' product may also fail to be sufficiently competitive in the recreational environment of the early 21st century.

Jenolan looks at challenges of interpretation into the 21st century

Grant Commins, Scott Melton & Ian Eddison

Jenolan Caves Reserve Trust

Background

Jenolan Caves has recently added a self-guided tour to its product range. The Nettle Cave stands prominent at the gateway to Jenolan Caves and would certainly not have gone unnoticed by the traditional occupants of the area. Since its discovery by Europeans in the 1840s the Nettle Cave has been witness to the onslaught of exploration, tourism, infrastructure development, abandonment and now re-development. Its beauty was enjoyed by many in its early history then closed and hidden away for 73 years. Its recent reopening has been generally welcomed but also subject to some criticism and controversy. From as early as the dreamtime to the present day the cave has been subject to "interpretation" by humans.

Using the Nettle Cave as a backdrop we will look at interpretation at Jenolan as it has progressed into the 21st century and the challenges ahead of us.

The Past

Jenolan like many other cave sites were remote areas and presented access difficulties. The railway across the Blue Mountains in the 1860s saw the beginnings of serious tourism but still a long haul by horseback or on foot from the railheads. Access improvements brought horse drawn carriages and then motor vehicles to the caves but it was still a long journey in those early days, with a large number of visitors taking advantage of the guest accommodation available. Visitor demographics would have generally been people of European descent, probably mostly British, well educated, reasonably affluent with similar values and expectations of their visit.

Jenolan's Nettle Cave with its relative easy access fulfilled the expectations of visitors into the early 1900s.

By the 1930s Jenolan was boasting presentation to the public of what can be argued some of the best-decorated caves in the world. The River Cave, Temple of Baal and the Orient Caves were leading interpretation into the era of "Cave Fantasy". Story telling revolved around European/ British themes. The Nettle Cave appears to have lost its popularity to these "prettier" caves and was closed in 1934.

Roads have now improved and the caves are a popular day trip from Sydney. Alternate transport has been considered with cable car access first proposed in the 1970s and again in the 1990s but never progressed.

Following the Second World War the large wave of non-English European migrants from Italy, Greece etc saw a change in visitor demographics. In the 1970s/1980s many immigrants from Asia began to make up a large proportion of visitors and through the 1990s to the present day we see many family groups descendent from the Sub Continent and the Middle East. This on going change in demographics has been a constant challenge to managing and interpreting the caves

Today's Challenge:

Cave site managers are at present going through a most challenging era. They carry the legacy of the tradition guided tours and the romance of the past into an era of regulations, demands and constant change. A site manager needs to be aware of and alert to the environmental issues of their individual sites and carry the responsibility of maintaining the operation within the codes of our own ASF guidelines and, like any other business manager, they need to meet customer expectation in an ever changing society of cultural backgrounds and client demographics. They must also remain on top of human resource laws, risk management, OH&S and possible litigation etc. The business must also perform within the parameters of a business plan and meet competition including electronic media not previously encountered.

We believe there will be a place for the traditional guided cave tour for a long way into

the future however for all the reasons stated above there has been a need to move with other ideas: -

Self-Guided Tours: The self-guided tour has been around for a long time. However at Jenolan it has been introduced to the product range for the first time during December 2006. It was in the planning for over 10 years and the subject of much debate as to its need and location. The decision was finally made to "re-open" the Nettle Cave, a twilight cave not shown to the public since 1932. Very different to the "dark" caves we all know and love at Jenolan. Many were concerned the Nettle Cave may be inferior to the other caves and not representative of Jenolan Caves. Quality of interpretation was seen to be essential for the success of the new product.

When addressing the interpretation it was decided to proceed with a high quality audio presentation. While contractors were employed to implement the system input and material came from scientific and industry expertise including our own team.

The opportunity was also taken to involve the local aboriginal people who have given a valuable contribution to the indigenous interpretation of the district. We believe this recent contact has also given our guides a much clearer understanding of the indigenous background of the area.

Still concerned about client acceptance of a self-guided tour it was decided to package the tour with the traditional guided tours. This combination of interpretation medium seems to have found success.

Since its introduction over 30,000 people have visited the cave with excellent feedback and only one recorded expression of concern about the product. The positive comments on combining the guided and self-guided products have been encouraging.

Meeting Customer Needs: The expectation of visitors to a cave site varies considerably and not all patrons will appreciate what **our** aims and objectives are.

Diversity of nationalities, often non-English speaking, with a broad range of religious and cultural backgrounds may all end up on the one tour. The self-guided tour with its multi language audio guide helps but tour guides must adapt to this multiculturalism with acceptance and enthusiasm as this has been and will remain an ever-increasing part of this country's society.

We provide specialised tours or adapt to cater for several sub groups within the one tour.

The way we deal with photography on our tours has changed in recent years with the introduction of digital cameras.

Theme Tours: Historic tours, Ghost tours, murder mysteries, musical performances and even the old fantasy based tours can play an important role in interpretation by focusing on special interest groups.

The recent upgrading of the lighting in the Temple of Baal has created an atmosphere where the interpretation is through the medium of light and sound.

Adventure Tours: Adventure tours attracted over 3000 visitors to Jenolan Caves during 2005/2006. Many of these people have experienced other forms of skill based adventure activities and interpretation is probably not a priority to them.

The expectation of these visitors can present a challenge and I believe cave site managers providing adventure tours throughout Australia are leaders in incorporating good interpretation into their caving and adventure activities.

Quality of delivery comes at a cost: Whatever the medium of delivery the quality must be maintained and this comes at a price. We all know the expensive nature of cave infrastructure, which in itself plays an important role in providing access and support to the interpretation at any site. Effective signage is also necessary and expensive.

The ongoing provision of a quality audio system for the self-guided tour at Jenolan has a budget of around 10% of the business operating expenditure.

Training plays a critical role. Staff involved in interpretation activities progress through a competency based training programme using both internal and external training resources. Through an alliance with the local TAFE College staff obtain nationally accredited qualifications in Tourism and Outdoor recreation including specialised training in interpretive guiding. Higher levels of

competency are recognised by progression through a grading/ remuneration system.

This programme has supported a high level of professionalism and self esteem among the guiding staff at Jenolan.

The Future:

The human spirit of adventure and thirst for knowledge will always make caves a place of interest and we will need to continue to adapt to change. Perhaps the future may see a cable car or monorail, better road access, advances in technology. All this places even further pressure on the environment and how we approach its interpretation. Will the "Guided Tour" become a thing of the past and fully automated processes take over?

To provide a valuable interpretive experience to our clients in the future we must: -

- Continue to focus on understanding the cultural diversity of our customers.
- Involve representation from other cultures including the traditional landowners. This will assist us to "get the message right" for both the deliverer and receiver
- Keep training up to date using current best practices in interpretative guiding.
- Use technology, but make sure it remains an interpretation aid and not the subject.

Access: Access into Jenolan Caves will be improved through either: One way road access and circular departure; multi-tier parking over existing car parks; multi-tier parking on the tops with a gondola, shuttle bus or light rail, monorail or transport pods on rail to the valley floor.

Determining factors will of course be cost but also energy changes for the transport industry, caused through environmental demand to fight greenhouse effects.

It is perceived that "Access to all" will be a goal of cave redevelopment and great attempts will be made to provide more access for the disabled, coupled with new innovations in people moving within caves to minimise visitation impact.

Aboriginal Culture: The Devils Coach House & Nettle Cave self guided tour at Jenolan Caves, includes commentary of a female Aboriginal elder. In the future, employment of Aboriginal staff is likely to occur; Aboriginal acknowledgement at the commencement or during each tour is very likely to become mandatory of guides.

The challenge for interpretation of Aboriginal culture in the future is the potential to over emphasise the Aboriginal culture to the point it becomes part of the product, therefore paid for, and in turn the importance of the culture and its role in the landscape is potentially lessened for the sake of tourism.

Photography: Photography is becoming a high demand component of tours and affecting time constraints and tour content. Photography in the future could even be banned.

The challenge for the future here is balancing the need of visitors to capture mementos of their visit and not restrict the important interpretive components of the cave tour. A memory stick containing cave images included in the price of each tour is a possible solution. The memory stick may even incorporate the temporary entry to the cave rather than a ticket as well as retained by the visitor for its images. Souvenir photographs of visitors at a major cave feature, is a likely new product; Photographic tours may be another product; There would likely be more structured photographic opportunities.

Demographics of tour groups: The multicultural structure of Australia's population is likely to continue and tolerance of other cultures will improve due to the shear weight of a diverse society. Human nature however will isolate and persecute certain minority groups.

The challenges of interpretation in caves such as Jenolan will be due to rapid improvement to current impoverished countries leading to increased multicultural visitation growth. These visitors will require continued education and reinforcement of how to care for and minimise impact while visiting caves.

Multi lingual interpretation devices are likely to be used even more.

Training: Interpretation of caves will be more automated through advanced technologies. Challenges will revolve around maintaining standards but keeping the human element.

Ticketing: Ticketing will likely become linked more to souvenirs and packaged into the pricing structure. A cave ticket could become a memory stick with temporary access to the cave via scanners and modern turnstiles and images of the cave will be incorporated in the memory stick as a tour souvenir.

Loyalty programs may be linked with national identification cards and may even take the form of microchips inserted under the skin in the wrist of visitors.

Development: To minimise long standing challenges such as lint in caves, our Management Plan indicates a desire to implement overalls for visitors and research is likely to continue to develop solutions to minimise this known impact of visitors. They may eventually walk through a vacuumed doorway prior to the first chamber of each cave. This would aim to remove lint, hair and dust particles from each visitor at each cave entrance. New access developments are likely to be researched and may eventually take the form of magnetic levitation devices, devised initially for the disabled but adopted for general public tours.

Built caves are likely to be considered for "New Product" such as the Glowworm cave in Mt Tamborine in Queensland. Cave sites such as Jenolan will likely form cooperatives with zoological societies and museum fauna and entomological departments and have built caves with habitats for captive breeding programs for cave biota, mammals, and human visitation.

Refurbishment: Refurbishment of caves will take two distinct directions, contemporary and historic.

One will head down the modern methods of visitor sensory stimulation, lint minimisation devices, and people moving systems. Interpretation may become very technical with lesser need for guiding staff.

Another direction will be based on maintaining caves that are in their original developed condition. Heritage views will be paramount and any development will follow the strictest heritage standards to maintain the cave in its originally developed form. Interpretation may follow traditional guided methods.

Technology: Futuristic engineering developments in holographic imaging, are likely to interpret caves instead of guides, demonstrating re-enactments from discovery through to fauna deaths. Technology will enable management to structure tours so precisely that the product is as consistent as a Big Mac at McDonalds. Tours will run on time every time and more tours will be able to be structured increasing product availability, accommodating more visitors and increasing gross revenue.

Creative cave tour guides will be employed for the heritage caves and cave fantasy will form a basis of the heritage cave tours. Other avenues for interpretative cave tour guide employment will be the merging of this role with that of zoologist in the "habitat for cave biota" built caves.

Synopsis

Economics however, will dictate less staff, more structured technical resources to present caves. Consideration of constructing caves such as a glowworm cave is likely.

Non-entry inspections to conserve tourist caves

Warren Peck

Past President of the Australian Speleological Federation

1. Introduction

Vandalism in Australian caves has been occurring for more than a century. Even tourist caves with extensive barriers and wire mesh to protect delicate cave formations are subject to occasional attacks by vandals with irreparable results. A new approach to the development and public inspection of tourist caves is required in the interests of cave conservation.

The author proposes the use of Remote-Sensing Techniques to convey to visitors the full ambience of a cave without the visitors actually entering it. This would involve the observation of a fragile cave from either an adjacent robust cave or from an above-ground observation centre.

2. Non-entry metal mining

There are sections of Australian operating metal mines where human access is not permitted for occupational health and safety reasons, yet mining continues using remote-controlled machinery overseen by remote-sensing techniques from a nearby tunnel or alcove in the mine.

3. Australia already has non-entry inspections of a tourist cave

Non-entry inspections of the Bat Cave at Naracoorte have proved popular with the general public whilst minimising the environmental impact on the cave and its bat population. A video link, using infra-red imagery, connects the cave to the above-ground Bat Observation Centre. Figures 1 and 2 are typical frames from the moving images seen by the general public on video screens. The bats are about the same size as a sparrow. These two still frames obviously cannot indicate the full extent of what the moving images convey to the visitors. Figure 3 shows a tour group in the Bat Observation Centre. These three figures were kindly supplied by Mr Steve Bourne.

- The Bat Observation Centre provides a non-intrusive mode of cave inspection, with minimal environmental impact for both cave and bats;
- Visitors can see cave features more clearly by video link, than would be possible during a conventional tour;
- The video link makes cave viewing possible for visitors with disabilities who would not otherwise be able to walk through the cave;
- Bat Cave visitors do experience a typical cave environment; as they do have a guided tour of the Blanche Cave to complement their inspection of the Bat Observation Centre.
- Video images often need some indication of scale – e.g. is the cave one metre or ten metres high?

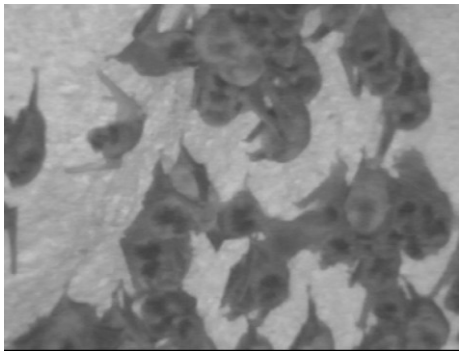


Figure 1. One frame of the video transmission from the Bat Cave

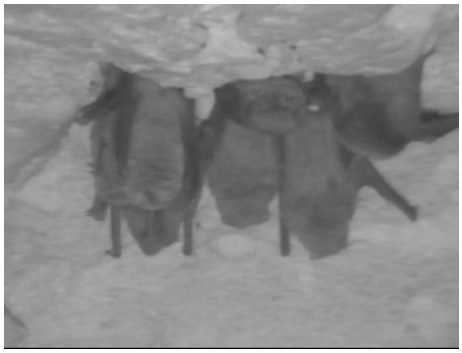


Figure 2. Close-up of a few of the bats

Figure 3. Cave tour in the Bat Observation Centre

4.0 Non-invasive tours of decorated caves

If applied to tourist caves, conventional video techniques would permit visitors to experience the full ambience of a delicately-ornamented cave without actually entering it. Whilst this concept is particularly applicable to previously undeveloped caves, thus avoiding the wholesale cave damage involved in the construction of paths and installation of fixed lights, it is also applicable to caves already open to the public e.g. a vandal-prone section of a tourist cave, or an alcove that can only be viewed by one or two persons at a time.

- A video link can be easily installed in an already developed cave that has power available;
- Real-time video link not essential for decorated caves without a significant bat population; a film or videotape or DVD could be made for regular screenings nearby.
- Instead of spending a million or more dollars to open a currently undeveloped cave, one simply films it;
- One can bring photographs to life with a movie;

The concept is the non-entry of the general public into easily damaged caverns and caves not previously only shown to the general public

4.1 How could it be done?

- Continue inspections of robust caves already open;
- Make a movie of a high value, unopened cave in a few days (compact digital cameras with 12 volt halogen lamps powered by rechargeable batteries and at least one speleologist / ranger / presenter in-frame for scale);
- Closed circuit TV – link from fragile area to another part of the cave with no accessible delicate formations

4.2 Where does the general public view a film / DVD?

- in a nearby cave or arch with plenty of space,
- or in a theatrette (suits visitors with disabilities)
- or sell copies for home viewing.

5. Case study

5.1Wombeyan's Olympian Cave

The Olympian Cave was discovered by the Sydney Speleological Society (SSS) in 1957 by swimming upstream along the underground river from the Junction Cave. It was subsequently also accessed by cave divers from the Fig Tree Cave to its north (see Figure 4). The access problems, the wholesale damage that would result from the construction of paths and steps within the cave and the need to conserve its magnificent dripstone formations, essentially rule out its opening for guided tours by the general public. It is an ideal candidate for non-entry inspections.

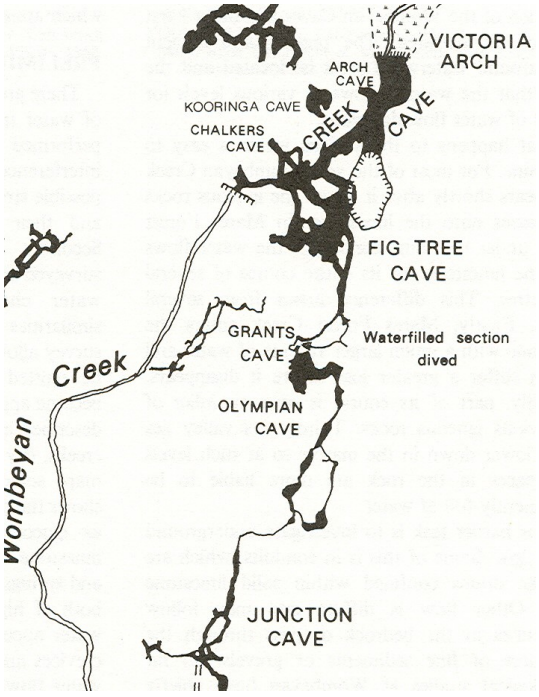


Figure 4. Olympian Cave Locality Plan

(portion of Fig.4.1, "Wombeyan Caves", by SSS, 1982)

The writer worked as a casual guide at Wombeyan in 1957 and 1958 and visited the Olympian Cave with a SSS member at the end of 1957. Figures 5 to 7 were taken by the writer in its magnificently decorated main chamber, which had been measured by its SSS discoverers, as being 60.4m by 60.4m by 59.1m high.

As there are virtually no bats and no other life in the Olympian Cavern, there would be no point in having a video link operating in real time to the two adjacent tourist caves. A well-produced documentary DVD, with at least one guide or presenter in-frame, would be able to show the general public the marvels of the cave. It could be made in a wide-screen format and shown on a big screen in the Opera House cavern of the Fig Tree Cave, for example, as part of a non-entry tour of the Olympian Cave. Such a tour could visit the Junction Cave first, so that the general public could see underground river flowing away from the Olympian Cave, then move into the Fig Tree Cave and finally terminate in the Victoria Arch. Visitors who undertook the Olympian Cave inspection, would experience the ambience of the Wombeyan underground environment, spending up to two hours underground, including the time spent watching the DVD. Other options would include showing parts of the DVD to the normal inspections of the Junction Cave whilst near the underground river. The self-guided Fig Tree Cave tour could also include viewing parts of the DVD. But only the special Junction plus Fig Tree cave tour, would be called the Olympian Cave inspection and would see the full DVD.

The two cave Olympian Cave tour would be in high demand but numbers on each tour would have to be restricted due to the limited number of visitors that can comfortably inspect the Junction Cave at the one time. A premium admission fee would be appropriate since two caves would be entered during the tour. A small theatrette could be built near the guide's office for those unable to traverse the Junction and Fig Tree caves but keen to view the full DVD.

Figure 5. A highly decorated Archway about 6 m high

All of these Olympian Cave photographs would have been improved by having a human figure in-frame to provide an indication of scale. Any documentary DVD made for screening to the general public would certainly need to include a guide or a presenter in-frame. This is a major reason for preferring the screening of a documentary DVD to a real-

time video-link from the Olympian Cave to the Fig Tree Cave. However, an optional real-time video link could be established from the underground river near the Olympian Cave back to one of the existing platforms in the Junction Cave. It could be used to monitor the stream flow and to show the visitors some of the difficulties of accessing the Olympian Cave.

There will be ample scope for innovation and lateral thinking when non-entry inspections are being developed.

6. Reference

Sydney Speleological Society, 1982. Wombeyan Caves, Occasional Paper No.8, ISBN 0 95 99608 4 8, (224 pp.)

Figure 6. Massive twin pillars on a sloping flowstone floor with a total height of about 20 m

Figure 7. View across the Olympian Cave. The furthest visible formations are over 50m from the camera

Interpreting the Mount Gambier cenotes (sinkholes) within the Kanawinka Geopark

Ian D Lewis

Latrobe University (Bendigo Campus), Cave Exploration Group of South Australia, Cave Divers Association of Australia

Note: Throughout this paper the term "cenote" is used, for although the general local name for these features is "sinkholes", it is the cenote form which is geologically unique.

Cenotes of the Limestone Coast

The South East of South Australia is a vast karst plain of flat-bedded "soft rock" tertiary limestone which is shallow 200kms inland around Bordertown and Kingston, but gradually deepens towards the sea south of Mount Gambier and which contains over 1000 caves. These features together with the rugged coastal cliffs, the terra-rossa wineries of Coonawarra and the extensive use of limestone ashlars for local buildings have given the region its tourist name - "The Limestone Coast" - which has become a very successful tourism and marketing strategy and a great choice of name.

Of the 1000 caves, there are several hundred sinkholes of all shapes and sizes. The thirty or so which contain water directly beneath their entrances are known in karst terminology as "cenotes" - large circular vertical-sided pits dropping into clear dark freshwater lakes. They occur in the deeper limestone zone from Mount Gambier to the southern sea coast, and more may continue offshore although now drowned and possibly sanded by the sea.

They are mysterious and controversial. Cave divers have died in them in earlier decades (Lewis and Stace 1980). Hell's Hole may be the largest cenote in the world. A number of cenotes have been used as rubbish dumps with some since cleaned and rehabilitated. They contain an array of biotic life, some species of which are unknown elsewhere. Even the term "cenote" is a conflict of various unresolved definitions. Cenotes occur on private property, forests and farm lands with a corresponding diverse mix of landowners.

Locally known as "sinkholes", the cenotes have acquired a sinister reputation as "killer holes" due to the drownings of 13 scuba divers exploring vast water-filled caverns beneath them over a period of 5 years in the 1970s. This little-deserved reputation has retarded public appreciation of the uniqueness of these features and until more recently has obscured the interesting scientific and historical information being collected by cave divers on research projects.

Why the term “cenote”?

The term "cenote" (pronounced say-noh-tay) is of Mayan origin and is used to describe similar features in the north-eastern province of Yucatan, Mexico. The word loosely means "natural well" and has been used to describe thousands of the karst features across the Yucatan limestone plain which led to water below. Maya settlements began over 3000 years ago and some cenotes became the focus of later Mayan cities. The most famous cenote is Chichen Itza, the large and terrible circular well into which so many human offerings were sacrificed over the centuries (Thompson 1938). Many more are found in the Caribbean islands and those drowned by the sea there are known as Blue Holes.

As the first cenotes were described by early archaeologists investigating the remains of the Maya civilisation (Mercer 1896), karst terminology has absorbed the term "cenote" for these generally cylindrical features. As such it can be applied to the identical features of the Gambier karstfield in South Australia. The common local name of "sinkholes" in the Limestone Coast is applied to all depressions, wet or dry, along with some circular draining areas, small swamps, runaway holes as well as the cenotes (Lewis 1976).

When is a cenote not a cenote?

Different definitions and descriptions exist; (i) cenote is a term used by the Maya for any subterranean chamber that contains permanent water (Thompson 1938), (ii) a cenote is a partly water-filled wall-sided doline (Marker 1975), (iii) cenotes are formed by the collapse of a cave which is currently filled with water (Duckeck 2007). A well-known Mount Gambier feature illustrates the confusion - Umpherston's Cave is not a cave but a sinkhole in local terminology. It is currently dry, so it is not a cenote, but had a lake for the last 120 years when it *was* a cenote! Its geology has not changed and only the water has gone, so is it still a cenote or not? We need to decide, as it is a prime geological tourist feature of the city and the Kanawinka Geopark (fig 1).

The three examples in fig 1 also illustrate one of the debates over the definition of a cenote - the original Mayan use of the name would include all three types, some karst geomorphologists would only apply it to Little Blue, while others would also include Bullock Hole but not The Shaft as it only has a solution pipe entrance!

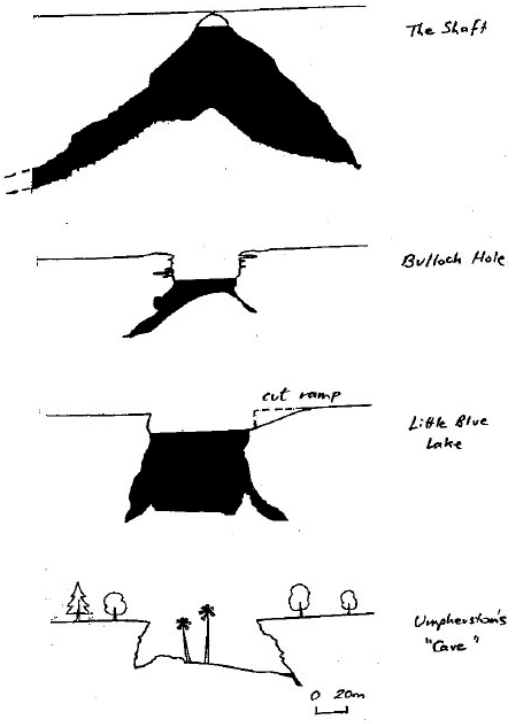


Figure 1

Cave diving in the Mt Gambier cenotes

The Mount Gambier cenotes have an international reputation for spectacular cave diving conditions in crystal clear water, deep and massive submerged caverns and a range of differing types. They all have easy vehicle access on farmland or in forests, compared to jungle conditions in the Yucatan or boat access to the Caribbean Blue Holes.

Water temperatures are fairly constant at 15 degrees C. Daylight directly floods the large chambers or is filtered through a pale green curtain of algae which is present at certain times of the year in the upper layers of the water. Divers may visit a specific cenote several times before they can develop a true appreciation of its size, shape and direction.

Geology — the collapse process and giant chambers

Some of the large passages are gigantic, where a cave diver is like a fly on the wall. The large volumes of limestone have presumably been removed by solution as divers have found no evidence of streamways at depth (Lewis 1984). These might have been expected during the Pleistocene when sea levels and the aquifer surface level were 120 metres lower than the present day and the climate was considerably wetter (Grimes and White 2007). An old concept was that past lower water tables weakened the limestone by dissolving multiple horizontal phreatic layers at different depths in the cenotes causing their collapse. This has never been substantiated as divers have never observed such layering effects in the walls of any cenote at any depth.

Progressively the roofs of the chambers collapsed forming large boulder piles. Individual rock slabs can be enormous - bigger than a house in some cases. The bottoms of Ten-eighty Sinkhole, The Black Hole, The Bullock Hole and The Shaft all show this effect. Eventually more roof collapsing occurs until the cavern breaks through to the surface above, forming a typical cylindrical pit with a lake - the true cenote shape. Little Blue Lake is an excellent example (fig 2).

The cave diver mapping programmes show the collapse sequence (fig 1). The surface gives no indication of the vast passage system in The Shaft and the tiny lake was only revealed in the 1930's when a small solution pipe broke through after the landowner's horse shied away from the ground. Collapse of the overhang

there will open the cavern to a cenote profile (e.g. Bullock Hole) while possibly part-blocking deep lower passageways with massive rock collapse. Likewise, the Bullock Hole entrance will enlarge by collapse producing a circular cenote similar to Little Blue.

Most of the deep cenotes are found in one area west of Mount Schanck, in the zone of greatest concentration of faults and joints (Marker 1975). The limestone here is over 150 metres thick and the large deep passage at the bottom of The Shaft approaches 120m depth, accessed by divers using new mixed-gas breathing technology (T Payne pers com 2007). Cenotes close together are likely to be roof collapses into a single long deep passage system beneath.

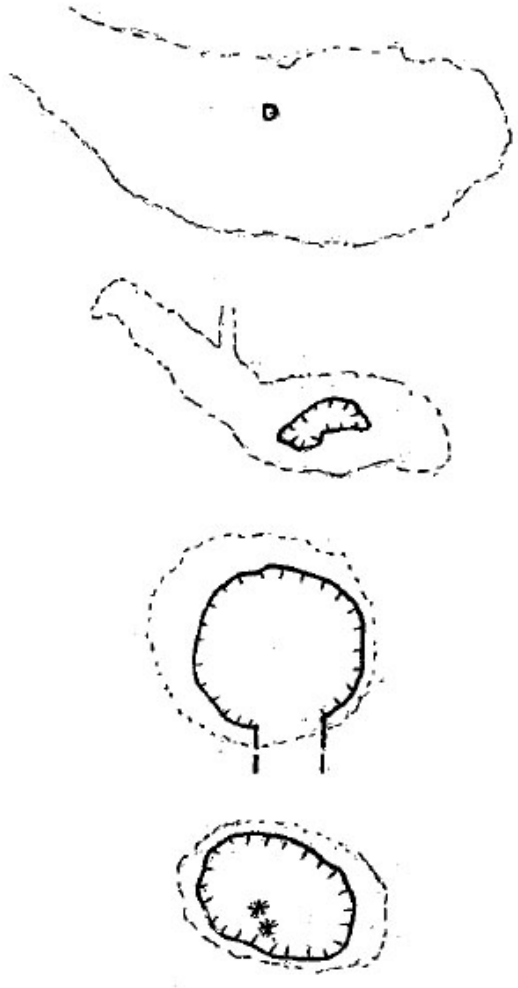


Figure 2

What's at the bottom?

The floors of most cenotes are rock collapses, sometimes covered with sand and silt cones from surface soil or old dune infills such as in the walls of Hell's Hole. Trees are found at the bottom but on examination it appears that most of these were pushed in by early settlers clearing the land. Later additions of car bodies, dead sheep and coils of wire etc provide ample evidence of 150 years occupation of the area by Europeans - not a distinguished record.

More interesting items range from a wooden hay rake complete with original iron wheels sitting in 25 metres of water, various road signs, training lines for cave divers, an old International truck cabin, an Austin utility, a Morris 1100 and a butter churn.

Scientifically the cenotes contain extensive arrays of stromatolites from the surface down to more than 30 metres (Thurgate 1996). These bio-geo growth forms are common in cenotes but rare across the world, being more renowned as a marine form (eg at Monkey Mia in Western Australia). Huge specimens are also growing up the walls of Mount Gambier's Blue Lake crater from more than 20 metres depth continuously to the surface. In local cenotes only a very few stalactites have been found below water, in complete contrast to the prolifically-decorated cenote passages of Yucatan and the Blue Holes.

A rare aquatic species - syncarids - have been found in abundance throughout the waters of the cenotes and caves along with many small freshwater sponges at all depths, sometimes in dark zones (Horne 1988). Introduced redfin perch have grown to good size in the shallows of some cenotes, sharing space with water boatman aquatic beetles. Recent studies on the water chemistry have identified variations in calcium and other ion precipitation rates depending upon temperature and seasonal exposure to sunlight. Some fossils have been recorded in deep water but the best concentration has been found in a shallow cave entrance pool - not a cenote but a cave by karst terminology.

The aquifer and the spectacular springs

The water occupying the cenotes is an "unconfined aquifer" which does not operate under pressure as it is exposed to the atmosphere in cenote entrances and swamps. It is directly filled from rainwater and surface soakage and moves slowly southward through the limestone to several coastal springs

(Waterhouse1977). The biggest of these is Ewens Ponds - three 10m deep springs which are flooded basin-shaped dolines. The second-largest discharge is at Piccaninnie Ponds, an 80m deep rift in a complex coastal system and which was a huge spring in past geological time. These ponds would be "cenotes" in Mexican terms but not as defined by karst geomorphology.

Both Pond systems are world-renowned freshwater diving sites within National Parks. The excellent visibility of the water is due to the dissolved carbonate chemicals that naturally occur in it. These act as nuclei for attracting silt particles together, which then sink to the bottom. This clears suspended silt from the water and gives rise to the powdery silt layers on the ledges, walls and floors of the sinkholes.

... and an alternative theory ...

Scientists have their ideas about the cenotes, but people who lived in the areas well before settlement had a different perspective. In the folklore of the Boandik tribes, the following explanation is given -

> The story is set in the aboriginal dreamtime period when a giant man called Craitbul and his sons lived in the area we now know as Mt Muirhead near Millicent, west of Mount Gambier. The men lived for a long period in this region digging in the ground for food with their bare hands and sticks. What they collected they then cooked over a large oven which they made (the volcano of Mt Muirhead).
>
> One night they were attacked by their enemy and fled east to a new area where they felt safe once again. They constructed a new oven and began digging for food once more, creating the sinkholes we know today. However one day they found to their alarm that the oven fire had gone out because it had filled with water (the Blue Lake crater in the Mount Gambier volcano). A further oven was dug by Craitbul but it also filled with water (probably the Valley Lake crater in the Mount Gambier complex).
>
> Two more ovens were made nearby (Mount Schank) but they too were extinguished and drowned out, leaving Craitbul and his sons so dejected that they left the area in search of a place where they might live undisturbed, but no one knows where that place is.

Nomination and philosophy of the Kanawinka Geopark

UNESCO retains a listing of approximately 150 Geoparks across the world, mainly divided between China and Europe but with an increasing range in other countries as the concept gains in popularity and nominations are put forward. Recently the western Victorian Volcanic Trail extending into the South East of South Australia has been nominated as Australia's first Geopark (fig 3). An international assessment team visited the region in mid-2007 and confirmation may be at the first International Geotourism Conference to be held in Perth WA in August of 2008.

During the assessment trip a frequent question by locals was how the declaration of such a park would further restrict them in the use of their land. The reply was consistent - the Geopark is a concept, not a legal delineation, and that owners of geological features of significance could involve themselves in the Geopark or not as they choose - there is no obligation or power of overrule. UNESCO does not want to restrict land use - the underlying philosophy is to use geological features to encourage local initiative and develop business opportunities around geological themes for the benefit of their communities (McKnight et al 2007 - see this issue).

Volcanoes and karst

The initial nomination theme was based on the Volcanic Trail until it was realised that the western end of the volcanics (in South Australia) had emerged through another major geological feature - the vast limestone plain with its 1000 cave and karst features. This contains world-class cave diving attractions, the distinctive cenotes and the World Heritage Naracoorte Caves fossil deposits, all of which contribute to the naming of the region for tourism purposes as "The Limestone Coast". Strangely the World Heritage Caves at Naracoorte are not included within the nominated Kanawinka Geopark, being a few kilometres to the north of the boundary.

The cenotes have long been recognised by cave divers, but rather less so by the local

population until more recent years when water pollution issues have drawn more community concern and attention. An interesting geological link between volcanoes and cenotes is a developing theory that deep volcanic gas rising through the groundwater has acidified it in the zone where the most concentrated cenotes have developed around the Mount Schank volcano, Australia's youngest at 4000BP (Lewis 1984, Webb 2001).

The most obvious link between the volcanics and the karst is the famous Blue Lake at Mt Gambier, a large volcanic crater which was punched through the underlying limestone creating a beautiful large lake revealed as the surface of the aquifer. It is the region's tourism icon.

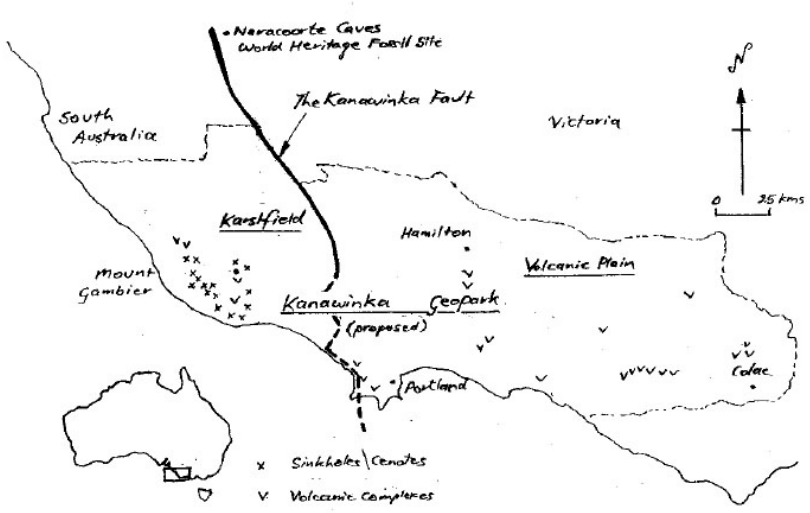


Figure 3

Why the name "Kanawinka"?

Running diagonally across the Geopark region and almost dividing it is a large and ancient fault line - the Kanawinka Fault. In general terms, it separates the volcanic uplands and plateaus which contain most of the Volcanic trail in Victoria in the east from the limestone plain and lowlands to the west in South Australia. It is therefore an excellent focus across the Geopark and very appropriate to select its name for the task.

The Kanawinka Fault is far older than the volcanoes and the limestone but through periodic reactivation has developed a modern-day scarp varying in height from 10-100 metres in height running for more than 100km from Naracoorte in the north towards Portland in the south where it joins a series of smaller high faults that extend the scarp to the sea. Its movement is partly responsible for the origin of the major Naracoorte Caves (Lewis 2008).

The name Kanawinka was applied to the faultline by a renowned geologist who assessed the regional geology from Portland to the Victorian border near Naracoorte in the 1950s (Boutakoff 1963). He used the name of a prominent local property "Kanawinka" homestead which lay on the line of the fault approximately halfway along its length.

In turn, the word Kanawinka has been interpreted from its Aboriginal origins as meaning "The Land of Tomorrow". There is no available explanation as to what this interpretation actually means, but it is generally taken as an expression of forward-looking optimism, also appropriate to the nomination of Australia's first Geopark.

Human interaction with the limestone and the cenotes

There are some obvious examples of human use of the limestone apparent from a general drive around the Limestone Coast region - white limestone roads, extensive use of large creamy-coloured limestone ashlars for building

stone, quarries and roadside scrapes, and several tourist caves - Tantanoola Cave, Umpherston's Cave, The Cave Gardens, Englebrecht's Cave, Princess Margaret Rose Cave and the World Heritage Fossil Caves at Naracoorte.

Of vital importance is the vast freshwater aquifer underlying the whole karstfield, which has defined the use and appearance of the region. This allowed regional-scale human development of rich dairying, grazing and cropping farmland, a major softwoods forest industry and a proliferation of quality vineyards. The Blue Lake is the water supply for the City of Mount Gambier, the largest city in the Kanawinka Geopark.

One adaptation of the cenotes are sloping stone access ramps which were hand-cut or blasted into the circular sides of them in early years for stock to access the water, damaging the original circular cenote shape although not obscuring them (fig 2). It did not occur in the Mexican cenotes of the Yucatan, so this is a distinctive local artefact. Fortunately a number of Mount Gambier cenotes were not modified in this way (e.g. Hells Hole and Umpherston's Cave) so the natural form can still be found locally.

The ramps were cut at a time around 1900 when the water table was particularly high but reduced rainfall since then has lowered it below stock access levels. On the positive side, the ramps provide swimmers and cave divers with direct and easy access to the water, which is a big component of more recent human usage of the cenotes.

In recent decades water quality issues, initially triggered by concerns about the Blue Lake, expanded awareness and further research that has resulted in a series of major rehabilitation programs in many cave and cenote entrances by the removal of a century's rubbish including discarded fuel and chemical drums etc.

Umpherston's Cave and the Cave Gardens are two beautifully-gardened cenotes within the city of Mt Gambier which have had public access for well over a century. Umpherston's Cave (which is actually a cenote) was privately landscaped in the 1880s and has been extensively renovated in the original European garden style. The Cave Gardens are constructed around a large cenote at the very centre of the city around which the town grew. Mt Gambier is known historically as "The City around a Cave". Right from the beginning these two cenotes were part of and appreciated by the community. Both are maintained by the council as sites of welcome (for more information see abstract in this publication entitled "Umphy and The Man").

Management, interpretation and promotion of cenotes within the Kanawinka Geopark

As the Kanawinka Geopark becomes established, the interested public will want to know more about the features unique to it. The volcanoes are already linked across the Geopark by the well-planned "Volcanic Trail" promotions. A possible similar "Cenote Trail" could be developed for the Limestone Coast.

Field trips have already trialled two such Trails - to the southeast of Mt Gambier and to the southwest, with common linking points at one or more of Ewens Ponds, Little Blue Lake or the volcano at Mt Schank which provides a spectacular elevated view of much of the karstfield. Each runs for 4-5 hours but could be combined with a lunchbreak to a full day of cenote/karst /volcanic visitation.

Part of the experience would also involve an explanation of the significance of the term Cenote and its international rarity, some stories associated with the Limestone Coast cenotes, the significance of the limestone itself over which they are travelling and the vital role of the aquifer including its spectacular exposure at the Blue Lake itself. These themes have also been trialled as they form part of tertiary environmental, catchment and geological course studies and field trips.

At Naracoorte, the link between the aquifer, local wines and produce is already strongly developed - this approach would lend itself well to a Cenote Trail as it travels through dairy, seafood and vineyard countryside. A cross-linking of the Cenote Trail with the Naracoorte Cave World Heritage Fossil Park would provide both venues with a continuity of karst themes and encourage the visitors to stay the extra day in the Limestone Coast, motivated and intrigued by their new understanding of the significance of the western half of the Kanawinka Geopark.

Cenotes or Sinkholes?

While geologists and geomorphologists may insist on using the term cenote, the local use of the term sinkhole is strong and long-lived. Consideration must be given to continuing this local tradition, so the title sinkhole although geologically generic may need to be given its place. A "Sinkhole Trail" may have more attraction to the visitor than a "Cenote Trail", which is a more obscure term.

It seems more consistent with a Geopark theme to utilise both names. This promotes the awareness of the type-name cenote and why it is significant, which therefore places them in true international perspective. However, continuing the local use of the term sinkhole is consistent with the strong theme which UNESCO Geoparks place on enhancing the use of local input and innovation.

In either case, it would be the intention that sinkholes and cenotes are sufficiently curious and attractive to draw the interest, enjoyment and education of a travelling audience. The cave divers know it - now its time for the locals and the world to share the cenote experience in the Kanawinka Geopark.

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Evolution of management models at Jenolan Caves, NSW, Australia

Peter Austen & Alan Griffin

Jenolan Caves Reserve Trust

The privatisation in 1989 of accommodation and commercialisation of cave tours at Jenolan was part of the Greiner Government's overall reform agenda which focussed on the application of New Public Management Principles.

The acquisition of the 99-year accommodation lease by government in 2006, provided a timely opportunity to examine the implications of the management reforms introduced in 1989. The analysis indicates the business model adopted in 1989 had more to do with the commercial issues at Jenolan than the introduction of New Public Management principles.

The lessons learnt should aid the development of long term management arrangements for Jenolan and ensure the preservation of its natural and built assets for future generations.

Introduction

Jenolan Caves is situated approximately 120 kilometres west (as the crow flies) and 2.5 hours drive from Sydney on the western side of the Blue Mountains.

Since its discovery by Europeans in 1838, Jenolan Caves has remained one of Australia's significant tourist locations and a site known for its innovative strategies for protecting the geological and heritage assets of the area.

However, its dual role as a popular tourist location with over 220,000 visitors a year and a site of geological and heritage significance, creates the possibility of conflicting management objectives. In order to balance these objectives, the NSW Government, in 1990, separated the responsibility for managing the hospitality services provided by Caves House from the management of the caves (both tourist and wild), and the reserve in general. At the same time the Government entered into a lease arrangement with the private sector to operate the hospitality services.

Due to issues arising from the separation of management responsibilities, these arrangements were modified in 1995 with the responsibility for managing the lease, the caves and the reserve being brought back together within the Jenolan Caves Reserve Trust (JCRT) reporting to the Minister for Environment. At that time it was also decided as the management of Jenolan was a specialised activity it should remain outside of the mainstream public sector.

However, the separation of the hospitality services from the cave operations proved increasingly dysfunctional and, following a review, it was determined that the preferred option was to have one operator, managed by the Parks and Wildlife Division of the Department of Environment and Conservation, manage all services provided at Jenolan.

Having traversed a full circle, the Government is now considering new management arrangements at Jenolan. This paper examines the influences that determined previous decisions regarding management of the reserve and identifies the lessons gleaned from the experience of alternative management arrangements at this popular tourist and strategically significant environmental location.

Historical Overview

The area we know as Jenolan Reserve and its caves was well known to the Gundungarra and Wiradjuri indigenous peoples who left many artefacts and other evidence of their use of the area.

European contact purportedly commenced around 1838 to 1839 with a runaway convict James McKeown using the area as a hideout. Around 1840 the pastoralist James Whalan made the first reported contact with the Caves. Over time visitation increased and with it damage from the souveniring of cave formations (speleothems). This resulted in the

colonial government reserving the area to protect the natural features. The Fish River Caves Reserve was gazetted in 1866 preceding the establishment of Australia's first national park (the Royal) by 12 years and the world's first national park Yellowstone by 6 years. (Note: Yosemite was granted as a public trust in 1864).

The area is rich with European heritage including but not limited to:

- The first hydro-electric system in Australia
- The first use of electricity to light caves anywhere in the world
- The 1895 limestone bridge (de Burgh's Bridge) in front of the Grand Arch
- Caves House with the first wing constructed in 1898 and subsequent additions in 1907, 1914 and 1923
- A number of other buildings dating from around 1895.

Due to its natural and rich cultural heritage, in 2004 the whole reserve was placed on the State's Heritage Register and consideration is now being giving to placing it on the National Register. The reserve also forms part of the Greater Blue Mountains World Heritage Area.

Initially the Jenolan Reserve was managed by the Lands Department until 1879 when responsibility was transferred to the Mines Department. The NSW State Tourist Bureau became responsible for the Reserve upon its establishment at the beginning of the 20th Century. This arrangement continued until 1989, although at times the Tourist Bureau was part of larger agencies including the Chief Secretaries Department and the Department of Railways[1].

Management Arrangements

Prior to 1989 management of the Jenolan Reserve was undertaken within a mainstream government agency using cash flow accounting although it would appear Caves House was treated as a separate cost centre. There is also evidence that Caves House was financially cross subsidised by revenue from the tourist cave operations.

With the election of the Greiner Government in 1988, Jenolan Caves was not immune from the ideologies of free market and New Public Management. In response to the Government's agenda, a decision was made to separate the hospitality services (accommodation, food and drink outlets) and the reserve management (including the tourist caves). In addition, it was decided that the private sector would be better placed to manage the hospitality services and accordingly a 99 year lease was granted over Caves House.

Administratively, the lease was managed by the Jenolan Caves Dedicated Area Reserve Trust administered by the Tourism Commission of NSW whilst the reserve and the caves were managed by the Jenolan Caves Reserve Trust (JCRT). Both bodies were to be self funding and reported to the Minister of Lands.

It is uncertain why it was decided to separate the commercial businesses at Jenolan and have a government agency run the tourist and adventure cave business and the private sector manage the hospitality businesses. There is no doubt there was a view that the private sector could manage a hotel more efficiently than the public sector and that the granting of a long term lease would alleviate the necessity of expending public monies on a much needed upgrade of the hotel.

However, the separation did not follow the funder-provider or regulator-operator models of New Public Management. Whilst it transferred the cost of capital upgrades to the private sector, the separation of the businesses increased their combined operating costs (marketing, corporate overheads, etc) and this duplication in administration increased government's costs.

One credible argument put forward is that political pragmatism led to the separation of the cave and hospitality businesses. Retention of the cave tour business within government was preferable to facing a public backlash against the privatisation of such iconic assets and the negative perception that the risk of damage to the irreplaceable cave features would be increased.

[1] State Record NSW - Online search: http://www.records.nsw.gov.au/indexes/cgsdetails.aspx?849

Following the election of the Carr Government in 1995, the administration of the lease, the reserve and the tourist/adventure caves was centralised within the Jenolan Caves Reserve Trust (the Trust) which, under the new arrangements, reported to the Minister for the Environment. Whilst this eliminated the duplication in administrative and co-ordination costs within Government, the problem of increased operating costs at Jenolan still remained.

The Trust Board was primarily comprised of representatives from various stakeholders. Initially in 1989 it was made up of 4 members representing government agencies. It was expanded in 1990 to 7 members by adding stakeholders including the local council and the lessee. In 1992 it was expanded to 9 members by adding representatives from heritage and speleological groups. Finally the Board was reorganised and expanded to 11 members in 1997 by adding external representatives from the Aboriginal Land Council, the Nature Conservation Council and the National Parks Association.

Another factor that impacted the administration of Jenolan was the Trust's business model. As well as Jenolan, the Trust was responsible for the Wombeyan, Abercrombie, and from December 1997, Borenore Karst Conservation Reserves. Under its self-funded model, the Trust was responsible for the day-to-day maintenance costs and minor capital works. Although Treasury grants were available for significant capital upgrades, the Trust, as a separate small off line agency, experienced difficulties competing against the mainstream government priorities of health, education and policing for capital funds.

The Trust's self-funded model was compromised by low visitation levels at the smaller reserves where, at best, Wombeyan broke even in cash flow terms, whilst the other two reserves required supplementation from the Jenolan businesses for their day to day management costs. Although Jenolan made a steady return, it did not return the profit needed to reinvest in essential cave and above ground infrastructure, let alone cross subsidise the other reserves or fund environmental programs.

Review into the management arrangements

With the support of the Trust Board, the Hon Bob Debus, Minister for the Environment, initiated a special review of the Trust by the Council on the Cost and Quality of Government in 2003.[2] The review found the Trust had been managing its finances without recourse to recurrent funding, despite long standing structural and commercial impediments caused by the business model established in 1989. It was determined that the business model was unsustainable. The Review recommended that the Trust be disbanded and the responsibilities for managing the reserves be transferred to the Parks and Wildlife Division within the Department of Conservation (DEC) and the option of integrating the operations at Jenolan be investigated by an Administrator appointed to implement the Review's recommendations.

The Minister and the Trust Board adopted the recommendations and an Administrator was appointed in January 2004. Subsequent studies building on the Review's work have identified the advantages arising from transferring the non-commercial reserves to DEC, such as:

- greater co-ordination and consistency of karst management in NSW through locating the management of the majority of karst areas in NSW in one agency;
- availability to other karst areas of cave conservation and management expertise developed by the Trust;
- access to a greater degree of support activities such as management of salaries, fleet, information technology, finances, etc than the Trust had been able to afford. This reduces overheads and allows increased funding to be provided to the upkeep of the caves and reserves;
- access to increased legal, marketing and advertising expertise and support available within the larger organisation (DEC);

[2] Jenolan Caves Reserve Trust Special Review (October 2003) Council on the Cost and Quality of Government.

- access to a wider range of expertise and services for management and maintenance of the aboveground reserves (identified as a problem with the Trust's operations);
- improved co-ordination in the management of the Blue Mountains World Heritage Area covering Jenolan;
- improved career path opportunities for staff;
- greater access to Treasury funding for capital improvements as part of an inner budget government agency.

The advantages of having an integrating the businesses under one operator at Jenolan include:

- single responsibility for the quality of visitor experience rather than a split arrangement;
- single responsibility for marketing the destination to the various user segments;
- shared resources;
- attracting experienced and reputable employees and operators in eco-tourism to the Jenolan precinct by providing a critical mass in business turnover;
- a significant reduction in the combined corporate overheads.

In adopting the recommendations of the Review and various studies, the Government established a State Karst Management Advisory Committee supported by a specialist Karst Conservation unit located within DEC. It also transferred the Wombeyan, Abercrombie, Borenore and Jenolan Reserves to DEC, with the Jenolan visitor zone to follow upon resolution of management issues relating to Caves House and the finalisation of a new Plan of Management for the Jenolan Reserve.

Negotiations with the then lessee of Caves House to integrate the commercial businesses at Jenolan failed. The Government subsequently acquired the lease and issued an Expression of Interest for an operator to manage the businesses at Jenolan under a 21 year lease/licence arrangement. The investment required to upgrade Caves House to a contemporary standard, depressed regional tourism conditions and the cost required to undertake due diligence resulted in a poor response to the EOI. The Government is currently running an integrated business operation as an interim measure until a final decision is made on the long term management arrangements at Jenolan.

The Government has injected $2.9M into outstanding capital and maintenance works within the caves and above ground and some $2M to carrying out catch up maintenance within Caves House.

The Future

The Government is currently considering its options which include managing the site using in-house resources or entering into a management agreement with a private operator. Regardless of what option is adopted there are a number of fundamental lessons learnt from the arrangements in place between 1989 and 2006. These are:

- the businesses at Jenolan have to be managed as an integrated operation irrespective of whether they are managed in-house by government or by a private sector operator. Caves House, built originally to reflect the romantic and picturesque relationship with the caves and targeted towards wealthy travellers[3], is economically unsustainable on its own as it is too large for a boutique operation and too small for a resort type facility;
- there is a need not only to achieve, but also be seen to achieve, a balanced approach towards conservation and commercial objectives. This requires a division of the day to day responsibilities for managing the commercial businesses and regulating compliance with conservation and heritage requirements. This division is required regardless of whether the businesses are being managed in-house by government or by a private sector operator;

[3] Jenolan Caves Reserve Trust Heritage Asset Management Strategy (Dec 2006) Golden Mackay Logan

- a strategic tourism development plan, including a financing and implementation plans, is needed with clear role definition for the various stakeholders and government;
- a Board made up of various and disparate stakeholders is not regarded as best practice. A report from a 2003 review into governance boards discourages representational appointments to Boards of commercial entities as they "can fail to produce independent and objective views".[4] A key reason for the success of the JCRT Board despite significant challenges was the strong leadership qualities provided by the former Chairs; [5]
- a small dedicated agency managing a reserve such as Jenolan is not efficient or financially viable. Small agency overheads are double that of a large agency and access to financial, legal, marketing, information technology and human resource expertise is limited and far more expensive due to its limited buying power. The Trust was able to effectively develop a remarkable degree of expertise in cave management and science, however, its expertise in other areas (e.g. management of the above ground reserve) was limited;
- the future operation must meet both government and community expectations in respect of cultural, environmental, social and heritage standards. In addition, the needs of the various stakeholders at Jenolan must be considered;
- the most effective method of maintaining Caves House as a heritage asset is to use it. Deferred expenditure for a heritage asset is generally considerably higher when it is left idle for prolonged periods;
- despite attracting on average around 220,000 visitors per annum over the last 6 years, the businesses at Jenolan have never been self sustaining to the point where they are able to invest in long term major capital upgrades to infrastructure. The physical and environmental constraints will always limit visitation at Jenolan to around 275,000 per annum. Even with this level of visitation, it is probable Jenolan will always be dependent to some extent on government supplementation.

Discussion

The recent history of management regimes at Jenolan provides an interesting test case for assessing the feasibility of the public sector management reforms so popular both nationally and internationally during the 1980s and 1990s.

There is no doubt one of the prime objectives of the application of free market and New Public Management principles at Jenolan (the 99 year lease over Caves House and the establishment of a self funded Trust respectively) was to eliminate inefficiencies by removing the restrictions associated with direct government control.

The social and environmental factors unique to Jenolan, however, meant such a generic reform model had to be tailored to fit and so never had a chance to establish its full worth. The experience at Jenolan was generally the case in other instances where diverse business structures adapted the reform model to fit their particular circumstances. With hindsight, it is plain to see the model never had an opportunity to fully prove itself and its various mutations has led to the merits of New Public Management principles being questioned by many commentators.

In Jenolan's case these factors included:

1. *Cost Shifting.* A key objective of the management reforms was to reduce the drain on the public coffers by transferring the responsibility for the required upgrade of Caves House to the public sector and to have the Jenolan Cave touring business (seen as a cash cow) subsidise the other karst reserves at Wombeyan, Abercrombie and Borenore. Regardless of the ideological merits of

4 Review of the Corporate Governance of Statutory Authorities and Office Holders (2003) John Uhrig for Commonwealth of Australia

5 Jenolan Caves Reserve Trust Special Review (October 2003) Council on the Cost and Quality of Government.

this objective, no comprehensive business modelling was undertaken to ascertain its long term sustainability of this objective.

2. *Political Pragmatism*. Many commentators have observed that this factor is common to the introduction of New Public Management reforms [6]. This is not a criticism as it is essential that Government ensures any reform takes account of the particular circumstances of the case under consideration. In Jenolan's case there was a concern not to privatise the caves which not only are of iconic nature nationally and internationally, but also hold a special interest in the hearts of the residents of NSW. There would be very few residents who did not visit Jenolan as part of their school curricula. This pragmatism led to the separation of the Caves House businesses from the cave tours thus creating some of the problems with the business model.

3. *Business Model*. The size of the commercial businesses at Jenolan and the income received was not sufficient to allow the business managed by the Trust to make the necessary long term investments required to protect and maintain the rich and diverse range of natural and built assets at Jenolan. The Trust was only able to meet its day to day commitments by deferring major upgrades and capital works.

4. The separation of the ownership of the businesses to meet political needs (reference 2. above) also meant the model was inherently inefficient with the doubling of indirect costs such as payroll, marketing and so forth. This situation was exacerbated by the need for Jenolan to cross subsidise the other reserves and the changing nature of the tourist industry (e.g. cheap air fares, changing family interests, etc.) in regional NSW which significantly dampened the growth in visitation numbers.

5. The final issue with the business model was that not only was the Trust expected to run the cave tour businesses on a commercial basis, it was also expected to be the regulator, particularly in the conduct of the businesses and in maintaining and protecting the wild caves and above ground areas within the reserve. The regulatory role did not receive any assistance from the State's Budget.

In hindsight, it is apparent the business model adopted for Jenolan was the most significant factor which led to the failure of the management reforms instigated in 1990.

On the positive side, the reforms did bring a commercial approach to the management of the reserve particularly with the introduction of accrual accounting and a detailed understanding of the true costs of various activities undertaken across the reserve. This in turn led to operational efficiencies and an overall reduction in operating costs. In this regard the objectives of the reforms undertaken in 1990 were partially achieved.

The model also allowed the Trust to develop significant expertise in the management of karst environments and the availability of this knowledge through a centralised unit within NPWS will also be an important legacy.

Conclusion

The overall results in implementing the management reforms at Jenolan has raised questions of the effectiveness of commercialisation of government businesses particularly in respect of iconic environmental/heritage assets where there is large interaction with social and cultural issues.

However, experience has shown the problems were more basic than the philosophical or ideological debates of the merits of New Public Management principles. The basis of the problems experienced was more related to the business model adopted and the fragmentation of effort and resources. These decisions were driven more by the desire to shift costs off the Government's books rather than an ideological debate about management models.

6 Strategic Planning: Is it the New Model (Nov 2006), Professor Geoff Gallop: Address to the Institute of Public Administration (NSW)

Nevertheless, the empirical trialling of these management arrangements has provided the Government with invaluable lessons and a good basis from which to consider the long term management arrangements at Jenolan.

The Government's major objective is the preservation of the natural and built assets at Jenolan for future generations. The question currently being considered is what management arrangement can deliver this key objective most effectively and efficiently.

Source Material

Jenolan Caves Reserve Plan of Management (1988) Tourism Commission of NSW and NSW Department of Lands.

Jenolan Karst Conservation Reserve Draft Plan of Management (July 2006) Department of Environment and Conservation

Jenolan Caves Reserve Trust Heritage Asset Management Strategy (Dec 2006) Golden Mackay Logan.

Jenolan Caves Reserve Trust Special Review (October 2003) Council on the Cost and Quality of Government.

Review of the Corporate Governance of Statutory Authorities and office Holders (2003) John Uhrig for Commonwealth of Australia

Strategic Planning: Is it the New Model (Nov 2006), Professor Geoff Gallop Address to the Institute of Public Administration (NSW)

The big step from carbide to electricity: cavers re-light Ruakuri Cave

John Ash

There have been some fine ACKMA papers in the last couple of years - on re-lighting Lucas Cave and the Temple of Baal Cave at Jenolan as well as a delightful diversion to fibre optics at Kelly Hill Caves on Kangaroo Island. Then there is the work of Neil Kell who talks about being creative, inspirational, insightful and arty but is pragmatic enough to say "no light … no access" – and doesn't that set the scene.

This paper is a 'retrospective' in the sense that it is looking back on a project already completed – or possibly it is an 'introspective' in that it deals with personal feelings of achievement (or lack of) with regards to tackling the re-lighting of Ruakuri Cave, Waitomo, NZ.

As with most caves, Ruakuri has seen a progression of lighting –

1904 – 1926: Tallow candles and lanterns

1926 – mid 1940s: mainly bare 110V, 60W incandescent bulbs

mid 40s – 2004: 110V indirect lighting. Sheet brass luminaries with banks or two or four 60W "daylight blue" incandescent bulbs.

2004: a mixture of 12V Quartz/Halogen and LED luminaires.

The politics have been just as interesting with original consultation coming from the Director of the NSW Tourist Bureau, the first system being installed by the Electrical Branch of the Public Works Department, the first criticism being launched by the NZ Tourist League, an upgrade being carried out by the Department of Industries and Commerce, Tourist and Publicity, maintenance and improvements being undertaken by the Ministry of Works, upgrades by roaming electricians met on the street, scoping reports from lighting consultants and finally a complete re-wiring and lighting by roaming electricians, cave guides and cavers.

Tight time frames and possibly unrealistic budgets built our pragmatism right at the 'coal face' – virtually, "here's over 1 kilometre of state of the art walkways hidden away in dark passages – light them!". The re-lighting process consumed around 4500 man-hours, supplied by electrical contractors, as well as the better part of $375,000. Those statistics in no way acknowledge the considerable input from friends, staff and other interested parties.

Apart from a few unrealised hi-tech "dreams", when we compare the result with the scoping plan that resulted from our early collective cave memories and consultation, we almost succeeded – that is, in keeping a cave *feeling* like a cave.

Throughout the project we learned a lot of "don'ts" and it is these that probably provide the most useful framework for any future project.

Don't presume to know what visitors will want to see or how they will feel.

In Black Water Rafting we called them the "flat-liners" The ones who, when surveyed, rated "terror" 10/10 at every survey point on their adventure caving experience. And we always thought that we ran "FUN" trips. Wrong!

Even a brief, focused survey can give you a significant amount of information about what you are trying to achieve and what would be the best strategy to achieve it – and certainly if you have achieved it. This was one of the shortcomings of our project. The fact that the cave had been closed to visitors for nearly 20 years and entirely new sections were being opened, precluded compiling any useful client feed back – even from guides.

In the marketing world there is that old adage that, "your branding is not what you think you are but what they (the customers) think you are". It is the customers gut reaction to the experience that is important.

Don't forget that caves embrace the "unknown" - so too do lighting budgets.

We became involved in working with budgets set by quantity surveyors and outside 'experts' with very little knowledge of the underground environment and how expensive it can be to try to put together equipment that will sustain a viable tourist cave business in the long term. We would venture that a few thousand dollars spent sending selected key stakeholders to a similar cave development somewhere would have laid a great 'foundation block'.

As it was, we tried to focus on making everything as cost-effective as we could.

Don't try to 'cut corners or to 'mix and match' too much.

Outdoor stainless steel light fittings were on sale at a tenth of the price of those usually specified by lighting consultants!! Buy!

But what about when they suddenly change the maximum wattage rating and they turn out to be IP 62 (protected against dust and vertical drops of water) instead of IP 65 (Protected against wash-down water sprays)?

We knew that #304 stainless steel would withstand corrosion but might tarnish and that we probably didn't need to go to #316 stainless (which has an addition of 3% molybdenum) as there were unlikely to be any solvents, acids stronger than food acids or chlorides in the cave. So, with the addition of selected heat-resistant O-rings and seals and a little copper anti-seize/galling thread paste we made things work.

And then there were the LED luminaires made out of polypropylene plumbing fittings that had to be skimmed ever so slightly to fit 50mm MR16 light units.

And what about the Hella truck and marine LED fittings used for track lighting??

It all works, but we wonder whether or not more design continuity could have tempered the energy output.

Don't underestimate the human 'wattage' that it will take to effectively light a cave.

Ever been on a rescue in a challenging cave system and then evaluated the human effort required to make it a success? Well getting material back into a cave can be just as challenging as getting it out.

Until we had walkways in place, everything that went into Ruakuri either had to swim in, be lowered down a 65m shaft or sent zinging down a 65m borehole. Everything! And there was no power in the new sections of cave!

This meant that, although we refined our "lighting kit" down to a bunch of 12V gel-cells, thin leads, portable luminaries on tripods and a box of digital camera gear, there was still a huge human input into getting gear on site and comfortably 'composing' the lighting effects we judged to be acceptable and aligned with the product branding.

Don't stop listening, questioning, researching and networking.

What happened to the correspondence with Neil Kell going way back and the dinners with Andy Spate where we just didn't ask the right questions? We missed out on valuable networking opportunities by becoming too engrossed with the task at hand. Too focused and too blinkered. "Don't ask them it will only make things more complicated." We undoubtedly could have saved ourselves quite a bit of frustration and time if we had taken advantage of our professional networks. Luckily we managed to fill some of the void by latching on to anything that gave off a lumen.

Technology is changing extremely rapidly and the lighting system put in this year could easily be redundant next year. It is difficult to keep up but thankfully most cave operators and cave professionals are only too willing to share their experience and expertise and the internet has become an electric forum to be reckoned with. We tried to keep everything very simple – probably because that was our frame of reference. There is no Clipsal C-bus system, infra-red remotes, choreographed light displays or music in Ruakuri. Perhaps there should be.

Don't assume that consultants will "just tell you what you already know" (or tell you anything for that matter).

We 'inherited' a consultant and had an exciting trip underground with him and exchanged passionate concept plans. We really had no idea of his credentials, apart from the fact he lit the Auckland Sky Tower.

Then we 'lost' him when he was taken out for a month or two with an injury and followed that with a meeting where he showed us lots of coloured lights.

Had he heard what we talked about? Did he have a feel for the subterranean environment? What was his hourly charge out rate? How many visits would he have to make and what support would we have to provide? Somewhere amid all of these questions Mick Chalker's booming Wombeyan wisdom urged us to "use local resources", which we ended up doing. I suspect that our final decision was based on a lack of initial choice.

Don't forget that, not only is electricity like water – it doesn't like water.

Capacity, capacity, capacity – although with C-bus and newer LED luminaires this is not so much of an issue. We elected to go with a hard wired, two way switching system and mainly Quartz/Halogen dichroics because it was familiar territory and a supplier could provide bulbs with a consistent colour temperature in a wide variety of wattages and beam angles. This gave a great deal of flexibility especially as the MR16 fittings meant that we could just replace luminaires with LED units as the comparative wattages of the latter increased.

However, some of the electrical contractors were not too vigilant about working out loadings, voltage drops and installing the appropriate wiring. With a 12V 'pressure' system a few of the 'pipes' could have been a bit larger.

Ruakuri is a wet cave. So far we have not experienced any leakage issues (as they have recently in the Glowworm Cave) and this could be because we made every effort to house cables in dry conduits or run them alongside suspended walkways, attached to support members.

Don't try to be the consummate "peacemaker", politician and team player.

We ended up with two sets of engineers, two different local electricians, a Quantity Surveyor, the Department of Conservation (and for a while a consultant) all having input to some degree or another. Responsibilities became blurred in some areas, performance was not necessarily critically evaluated and there were definitely 'walls' where there should have been constructive, open communication.

As a result, what should have turned out to be an on-line uninterruptible power supply turned out to be an "almost but not quite". The glitch is easily rectified but it illustrates a case where an autocratic leader would not have allowed local politics and fragile egos to affect solid, sensible outcomes.

Don't forget that old wise statement that says, "you can do twice as much if you go at half the speed".

Previous ACKMA authors on cave lighting – Daniel Cove, Neil Kell, Michael Kidd, Russell Commins, Andy Spate … .have all stressed what seems to be obvious – the need for thorough planning and the need to take the time to make sure that all interested parties understand the objectives and the game plan. Time taken for daily meetings to review progress and discuss the next schedule of work is time well spent.

The records from these meetings give continuity and allow for clear task-oriented roles as well as accountability. Send the impatient 'toe-tappers' home - and, make sure that you actually have a comfortable physical space in which to meet!

Don't forget that impacts can be long term as well as short term.

We were lucky in that our Resource Consents demanded that we closely monitor the cave environment – both before and after the project. This meant that we had a baseline of information from which we could detect change.

Temperatures were only allowed to move by one degree Celsius and humidity was to be kept in the 95-100% range. Sensitive formations were also photomonitored. While the latter might only ring the alarm after the effect the other two can inform about insidious change, which could result in irreversible damage. And the neat part is that we can control some of the parameters (type of luminaires, output, wavelength, temperature, intensity, on-time, distance from source to target….) in order to operate as close to our natural baselines as possible.

Don't forget to "leave no footprints".

Our Resource Consents also decreed that we should remove all of the accumulated 100 years worth of previous infrastructure! While we are still completing this task the process did instil in us an ethic to minimise our own impact and to make sure, within feasible limits, that all of our inputs could be removed. As a result, light fittings are held in place by slender 1mm stainless steel pins, sit on loose rocks or are bolted directly to the prefabricated walkways; switching and control boxes are held to handrail stanchions with a couple of bolts and trunk wiring can be pulled back through conduits and sent off to the lucrative scrap metal market.

Don't think that the job has been done the moment the switch is turned and the door opened.

How we vividly remember the opening day – the pride, excitement and celebration - and the scurrying around in the shadows to tweak things up. Then there was the state of exhaustion before the feedback starts to sink in and you realise that you haven't finished. There are the surveys and the review process and the exposure of blank canvasses or areas of over indulgence. Lighting a cave leaves a legacy and it is this legacy that will wake you at night or ensure that you keep a box of speleological paraphernalia under your bed.

On reflection, the old timers did a damned good job considering the limitations and knowledge of their time. We trust that we have done the same.

Ruakuri Cave - environmental management & development

Dave Smith

Department of Conservation

Abstract

Ruakuri is a Waitomo, New Zealand, cave recently re-opened to visitors. The cave has a number of valuable features including significant speleothems, sediment deposits, cave fauna and historic values. It operated as a show cave from 1904 to 1988. The recent re-development (by a major national tourism operator, Tourism Holdings Ltd), included a new tunnel entry, a new internal tunnel, relighting, and new pathways. The cave traverses three tenures of land: private land, road reserve and Scenic Reserve. The development was subject to the conditions of environmental resource consents from two local authorities and the concession process of the Scenic Reserve. The cave is of great significance to the local community, especially to local iwi.

Environmental management and development had to take into account this complex range of tenures, interest groups and statutory requirements, the values of the cave, the effects of tunnelling and other in-cave works, and the potential effects of visitation. Environmental monitoring and management regimes were established to protect the cave through the development stage and into the operational phase. Examples included airflow management, tunnelling monitoring, speleothem protection, sensitive walkway development and lighting systems.

Introduction

Ruakuri Cave lies in the Waitomo Valley, a few kilometres above the well-known Waitomo Glowworm Cave. A flaggy horizontal Oligocene limestone (25Ma) surrounds most of the cave. The cave comprises about 3.88km of passage and is #23 on the New Zealand cave length list (#9 around Waitomo) (NZSS website, 2007). Vertical development is about 60m. A long stream passage (the Okahua Stream, used for Black Water Rafting tours) is found at the base level, with an overlying set of palaeo-stream passages. Some of these are at quite different orientation to the current stream. Progressive retreat of the Huhunui side stream has created a set of incoming passages along one side of the cave, the oldest of which is the dry Drum passage, the youngest is the wet Twin Tomo entrance. The cave has two major shaft entrances. In addition to genesis through stream development and downcutting, there is major rockfall in an old wide part of the cave, the Holden's Cavern – Rockfall passage series. Thick tephra soils and a variety of vegetation types overlie the cave.

The cave has very important connections to the local community. The main entrance was used as a place of shelter (charcoal layers and rat bones (Ritchie, unpublished)) while journeying between the Waipa valley and the coast. That same site is also one the most important publicly known urupa (burial sites) in the local area, and is registered with the Historic Places Trust. The main entrance area is in the process of being returned from Scenic Reserve to the local iwi (local Maori people). For the caving community, Ruakuri was the site of the first serious accurate cave survey in New Zealand, by the Tokoroa Caving Group in the 1960s. One of New Zealand's first computers was used to crunch the data, at night by caving employees of New Zealand Forest Products. The cave was developed and opened for tours in 1904. The history of the cave tours, closure of the cave, and issues around the re-opening are covered in Martin (2003) and elsewhere in these Proceedings.

Values of the cave

Ruakuri Cave was rated in the New Zealand National Geopreservation Inventory (Worthy, 1990) as B3, meaning it is of national significance ("B") and unlikely to be damaged by humans ("3"). It is cited for its geomorphology/length and its significance as a tourist cave.

The values of the cave are summarised in Table 1.

Table 1: Environmental values of Ruakuri Cave

Geomorphology	Cave length of 3.8km. Long and large streamway for Waitomo area.
Geology/lithology	Not unusual for area.
Speleothem deposits	Major collection of calcite speleothems in the Mirror Pool area. The inner end of Holden's Cavern contains one of the more notable assemblages of evaporation-derived speleothems in the Waitomo area.
Sediment deposits	Potentially significant laminated sediment deposits in the lower Drum passage: layers of silt, sand and gravel with flowstone laminates (Williams et al, 1999).
Cave fauna	Site of first discovery of a trogolobitic pseudoscorpion in NZ (Miller pers comm). New species of millipede (Dalodesmidae) found 1998. Significant glowworm display along main stream. Diversity of fish species in cave including long-finned eel, koaro and torrentfish. Good range of habitats and typical Waitomo cave species found including troglobites. New hydrobiid snail species await description (Haase, unpublished).
Flora	No significant values known. Good example of twilight zone flora in original tourist entrance.
Biogenic deposits	A typical range of fossils have been found in the cave (bird, frog, skink). All have been surface rather than stratigraphic deposits.

Natural values of the cave have been affected by changes in land use and the use of the cave for tourism. Both the autogenic and allogenic catchments have been modified from temperate rainforest to include farmland and plantation forests. Low-intensity stock-grazing occurs in both catchments. A road cut lies across the top of the cave. Show cave tourism from 1904 -1987 left a legacy of corroding fittings, decaying timber and concrete. More recent adventure cave tourism has enhanced weirs, added dams and heavily trafficked the streamways with unknown but probably limited effect on aquatic ecosystems. In recent years some important doline and streamsink areas around the cave have been retired from grazing and re-vegetated.

Major values for protection in cave development

The Ruakuri development proposal incorporated coming in through the Drum Entrance (a closed set of 44 gallon drums placed by cavers through a dig in the 1960s), avoiding the original main entrance. A circular route was sought to link up two dead-end passages in the Holden's Cavern – Rockfall Chamber area. A complete refit of lighting and path structures was required.

Three key environmental issues were of consequence to this proposal.

Firstly the Drum passage appeared to be quite old and had speleothem and sediment values worthy of protection both for their intrinsic value and for potential scientific study. Strong protection from physical damage and climate change was warranted.

Secondly the 'Rockfall Chamber – Mirror Pool' area was a 'deep cave' zone of highly attenuated humidity and temperature range with good speleothem displays and a large fauna habitat area. Protection from climate change was the key requirement here.

Thirdly the evaporite speleothem array at the end of Holden's Cavern needed protection from physical damage by visitors and changes to cave climate.

As well as these key issues other effects, many common to all caves, needed to be considered:

- carbon dioxide and climate effects of visitors
- sediment control associated with the entrance structure
- flows of fauna, air and water at the new entrance and internal tunnel
- vibrational effects of entrance structure construction and other works
- effects of lighting systems
- physical effects of structures through a range of passages

Substantial re-development was in passages that contained little but bedrock, or were previously developed. In these areas the marginal effect of the development was not expected to be great.

Environmental controls

Several major controls were in place to guide development and protect the cave. Foremost was the wish of the development team to work to high standards and use best practice in order to protect the cave. Underlying statutory controls were provided by a set of 'resource consent' conditions for the whole cave, and a set of 'concession' conditions for the Drum passage and entrance structure.

Resource consents are issued by local authorities over public and private land to address resource management issues and the effects of use on soil and water conservation, vegetation, natural features (e.g. caves) and the like. Consents for the Ruakuri development were issued by both the Regional and District Council to an early developer who then moved on. The consents were inherited by the final developer/operator of the Cave. They contained comprehensive conditions around monitoring requirements, retention of expertise, airflow management, sediment control, tunnelling, cave climate management, management plans, bridge construction and toilets.

Table 2: Summary of key resource consent conditions

Regional Council

- Approved development plan describing methods and procedures
- No works in waahi tapu
- Archaeological survey of entrances
- Standard sediment control procedures. No more than 10% increase in stream suspended sediment levels
- Restrictions on disposal of excavated material only at sites approved (by cave experts)
- Removal of remnants of previous tourist operation
- Expert approval for removal or damage to any cave features
- CO_2 limit of 2400ppm
- No more than eight days between tunnel penetration and complete climate control system. Temporary air flow minimisation at all times.
- Humidity to be kept at 92±8% in Holden's Cavern – Rockfall Chamber – Mirror Pool area
- Temperature to be kept at 14.5±3°C in Holden's Cavern – Rockfall Chamber – Mirror Pool area
- Airflow to be managed to prevent adverse changes to speleothems and fauna habitat in the Mirror Pool – Rockfall Chamber area
- Inert materials for structures. No internal combustion engines to be used
- Climate monitoring
  - Drum Passage: CO_2, dry bulb, wet bulb, rock 2cm, rock 8cm
  - Stream passage: Wet bulb, dry bulb
  - Bridal Chamber: CO_2, dry bulb, wet bulb, rock 2cm, rock 8cm
  - Holden's Cavern: Wet bulb, dry bulb
  - Outside: Dry bulb, Soil moisture
- Other monitoring
  - Glowworms: two quadrats at main stream
  - Other fauna/flora: single survey 12 months after tunnel entry

- Speleothems: Photomonitoring various sites 12 months after tunnel entry
- Suspended sediment: Daily in local streams during excavation period.

- Reporting – various reports to Regional and District Council required

District Council

- Many of the same conditions as above
- Annual monitoring reports required for first five years then every two years subsequently
- Expert advisory group to be retained with oversight on all technical/analysis/environmental monitoring matters; risk management, environmental effects
- Cave Management Plan to be prepared for approval
- Cessation of tours if climate parameters exceeded for more than four days
- Daily log of visitation, works, maintenance, events etc
- Constraints on parking, vehicle access, nature of external buildings, landscaping, noise limits, and signage

Part of the land was Scenic Reserve administered by the Department of Conservation and thus needing a "concession" or permit over those parts of the Cave. Concession conditions particularly addressed the entrance structure, lighting and feature protection of the upper Drum passage, and airflow management through the Drum passage. Concessions provisions are, as might be expected, generally tougher than resource consent conditions as the latter pursues sustainable management while the former is based on conservation of a Scenic Reserve.

Department of Conservation (Drum passage only)

Entrance development

- Climate monitoring system
- Approved vibration monitoring system
- Sediment control on surface works – cover, diversion, sediment traps
- Pollution intercept measures in place. No use of chemicals, fuels etc in cave without further permission
- Sealed robust impermeable airflow barrier to be in place throughout development until replace by approved airflow control systems
- Surface landscaping plan
- Peer reviewed construction plans

Passage development

- Pathways of inert materials with provision for controlled, contained washdown. Allowance for the natural flow of water through the Drum passage. Barriers to be provided to protect natural features. Detailed plans to be approved.
- All sediment banks etc to only be removed under supervision of person qualified to assess significance of any cave feature. Fossils, speleothems and sediment samples to be retained and provided.

Cave operation

- Drum passage condition targets
  - Air temperature: 12.5±1°C
  - Humidity: 95-100%
  - Carbon dioxide: max 2400ppm
  - VOCs: nil (i.e. no use of combustion engines)
  - Air velocity: minimal
  - Litter, lampenflora: nil
- Monitoring station to be maintained in upper Drum passage
  - Wet and dry bulbs: every 30mins
  - CO_2: every 10mins
- To be reported to Lessor every six months
- Energy inputs (e.g. light, noise, vibration) to be minimum necessary. Lessor may set standards.
- Drum passage cave conditions to be maintained conducive to a troglophile community (upper end) grading down to a mixed troglophile/troglobite community (mid-passage) through minimal but non-zero nutrient input, avoiding compaction of soft sediments,

inflow water free of contaminants, rat control if necessary

- Lighting plan to be approved. Minimum lighting necessary for aesthetics and safety, positioned for minimal lampenflora growth and surface desiccation. Low heat output and only switched on when necessary.
- Annual operation plan including environmental plan

Pre-development studies

In the application process for both consents and concessions, the onus is on developers to study and describe the effects of their developments. To this end Auckland University were contracted to undertake baseline studies, describe the values of the cave. This study (Williams et al, 2004) also made a number of recommendations for cave development, many of which were incorporated in consent conditions.

Managing airflows

Climate is poorly understood in Ruakuri Cave, as befits any cave with 8 entrances, several different streams and several levels of development. The classics appear to be in place: cool air flowing out the bottom entrance on summer days, warm air flowing out the upper entrances on winter days, core areas of highly attenuated temperature and humidity range, and greater variability close to entrances. Circulation patterns in the mid-range entrances and the complex central area around the streamway are yet to be fully understood.

Pre-development data for the Drum passage over six months showed highly attenuated temperature, barely varying from the regional average temperature of about 12-13°C. This suggested little influence from the outside, despite the small holes around the Drum entrance and the high thermal conductivity of the drum covering. Trials showed some stratification of temperature within the passage (of the order of 0.2°C), suggesting that there might be a light circulation cell driven from the lower end of the Drum passage where it emerges high above the main stream passage.

The main Rockfall-Mirror Pool chamber showed similar temperature attenuation, varying around 12.8 – 13.2°C. Infrared irradiometer (highly accurate) spot readings confirmed this Hobo data. The far end of Holden's Cavern showed more variation, ranging 8-12°C, and particularly showed some response to cold temperatures outside.

Relative humidity was continuously measured in Holden's Cavern using wet and dry bulbs and was continuously around 95-105%. This sort of result (i.e. above 100%) has often been recorded at Waitomo and is an artefact of the difficulty of measuring humidity accurately. Accurate spot measurement with an Assmann psychrometer gave all readings over 95%.

Airflow data through and after the construction period has shown no change i.e. no airflow has been recorded other then when the door was left open for periods during construction. Two ultrasonic anemometers are in use, at the Drum passage and at the end of Holden's Cavern, both continuing to show no airflow. It is possible that these passages within caves have airflow behaviour similar to single entrance caves, with airflows close to the surfaces (as studied by Amar (2005) at Aranui Cave). If this is the case the ultrasonic anemometer may not be picking up such subtle flows due to the size and shape of the instrument.

There were two key requirements – protection of the Rockfall chamber area from 'outer' air through an airlock door system in the excavated internal tunnel, and protection of the Drum passage by installation of airlock doors at the tunnel base. Sonic anemometers are in place next to both the excavated connections and have not shown any significant increase in airflow. This is supported by temperature and humidity data. Short-term elevation was experienced during construction and development however short-term change (an hour or half day here and there) is not thought to be critical in its effects on the cave, it is longer term or cumulative change that seems most important to avoid.

Carbon dioxide

Carbon dioxide management has always featured high on the list of management priorities in the Waitomo Caves area. The well-researched environmental limit of 2400 ppm exists for the nearby Waitomo

Glowworm Cave, and this figure was applied as a limit for Ruakuri Cave. In fact speleothem deposition is far more active in Ruakuri then the Glowworm Cave so the figure is probably a conservative one.

Pre-development CO_2 readings ranged from atmospheric to 900 ppm in core climate areas. The Mirror Pool – Rockfall area was consistently slightly above atmospheric levels. A distinct rising and falling pattern was evident over several days, with some diurnal variation superimposed.. Elevation has been recorded from time to time on the Waitomo Glowworm Cave in the absence of visitors. It is possible that work parties contributed to some elevation but it seems more likely that Waitomo's caves have a natural source of CO_2 not previously described. One possibility is that the elevations may be due to degassing of CO_2 from the extensive water bodies in each cave. This theory is currently being studied in the Glowworm Cave.

All the data collected until recently (using Vaissala detectors logging every 10 mins on a Campbell CRX10 logger) had suggested that carbon dioxide elevation was unlikely to be a significant issue in Ruakuri Cave in the medium term. Visitation rates seemed moderate, while the cave is high volume and seems well ventilated. The highest carbon dioxide level recorded to date until recently had been 1800 ppm, recorded on the opening day when 300 people visited the cave in a few hours. In April 2007 more recent downloads showed several spikes over 2400ppm, including early morning levels above 2000ppm. Clearly the management of the cave will need to be re-assessed in the near future and perhaps become more active.

Entrance caisson and tunnels

The historic state of the Drum Entrance is unknown. A rock and clay blockage was penetrated by cavers and lined by a series of 44-gallon drums, hence the name. But was this debris only emplaced by the cutting of the road (metres above) early last century? This was resolved with an agreed position – that the preferred state for the Drum passage was virtually no airflow, highly attenuated water flows, and limited troglophile access. For engineering reasons the large entrance caisson (vertical drop) and connecting tunnel (horizontal drop) were moved back twenty or so metres from the original entrance. This had the benefit of leaving the original entrance area ostensibly intact. Thus if the artificial entrance was tight in terms of exchanges, the desired conditions would be achieved through the old entrance remaining effectively unmodified nearby. Troglophiles and air still retain their original 'access rights' through the Drum connection (one drum collapsed, which was probably beneficial in terms of cave security).

Silt fences were used during the construction period while PVC strip curtains allowed easy access for workers while providing effective control on airflow. These were later replaced by permanent twin airlock doors which provide airflow control to this day.

Sediment from the excavation was disposed of outside the Ruakuri Cave catchment. Dumped household rubbish was removed from one part of the doline and replantings are underway. Shot rock and an upstand pipe were installed in the base of the original drum entrance to preclude silt entering the streamway. With these water flow barriers, replanting of the doline area, and redirection of the runoff from the road above, the water discharge curve is probably closer to its natural state than pre-development.

Vibration control

The effect of vibration on caves, and speleothems in particular, seems variable and difficult to predict. No doubt lithology, tectonic structure, passage layout, speleothem structure, distance and vibration source combine in many ways. For the Ruakuri development, two methods were used to look at vibration, a set of drop sheets under speleothems, and a vibration detection machine. Monitoring in itself is not management, and the detection of any adverse effects would trigger a cessation of whatever vibration was taking place pending re-assessment. After setting the conditions for construction, the excavation method was changed away from piling, reducing the risk of vibration effects. The detection methods were kept in place and throughout the course of the construction period no adverse effects were observed: no bits of stal appeared on the drop sheets and the vibration machine did not register any events above the 0.5mm threshold

(theoretically capable of detecting a person walking past).

At one point a large rock needed to be blown during tunnel thrusting. A sediment bank was observed to move as a result, but there was no motion detected on the bedrock or attached speleothems. An earthquake well down the North Island was detected.

Lighting systems

Much of the previous lighting infrastructure was removed or overhauled as part of the development. Low voltage (12V) lighting was used through most of the cave, with LEDs in the upper part of the Drum passage. After a year and a half of operation the first shades of lampenflora have just started appearing in two locations.

Protecting physical features of the cave

A diversity of physical features was conserved through the Ruakuri development. During entrance construction protocols were in place for discovery of bones and laminated sediments; while any speleothems encountered were put aside. In the Drum passage channel samples of sediment banks were kept. Representative areas of sediment bank were retained and again sediment removed was searched for bones and any other significant features.

Sediment and speleothem samples have been provided to the University of Waikato to reconstruct some of the history of the Drum passage.

The protection of floors during cave development and in management has a less than stellar history around the world. So much of our cave heritage lies underfoot, from bone deposits to rimstones, from fauna habitat to sediment layers. Airflows and water flows move across floor surfaces yet they have been routinely constructed upon with little allowance for their features and processes. One of the foci for the Ruakuri development was to place greater value in this area. To that end suspended walkways have been used extensively in new passage development. As well as protecting cave floors, such walkways also reduce the uncertainty (and risk) where the substrate is suspect or unknown. Wire hangings do compromise the aesthetic outlook from the walkways but the overall benefit to cave feature protection is clear. Acrylic shielding has been used to prevent visitors accessing a number of speleothems. During construction, financial penalties were promoted to contractors for breakage of speleothems, to the point of having price tags hanging on some speleothems. As amusing as this seemed to the caving people involved, it certainly seemed to speak the language of the contractors and was quite effective in sharpening their attitudes to the cave.

Two speleothems were accidentally broken by contractors, and a large flowstone-stalactite shield cracked as the interconnecting tunnel head broke through nearby. The latter was bolted back onto the wall. Two area of passage, each a few metres were long, were deliberately removed to facilitate access to the required width specification for the cave.

The Drum passage became a major commuter route before its walkways were installed, so temporary protective measures were used. Specially sourced large semi-airfilled rubber rings protected surfaces while supporting scaffolding planks, grating and the like that then took the traffic. During the construction of walkways, walls were cordoned off to preclude damage. Any angle grinding or steel drilling was done over a collector, while plastic cutting and grating used hose and a carpet runout to collect offcut and shavings.

Summary

Ruakuri Cave was re-developed for tourism in the last few years. The cave is a valuable one and has many features deserving of a high level of protection through development and operation of the cave. A comprehensive set of monitoring and reporting conditions have been set for the cave and are in the process of being implemented. Effective air control has been achieved in important areas and direct damage to physical features of the cave has been minimal. In particular, careful work practices and the use of suspended walkways in the narrow Drum passage has helped protect numerous fine scale and under foot values.

This has been the most significant infrastructural development in a New Zealand cave since the 1920s.

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International recognition and management of caves and karst

Elery Hamilton-Smith, AM, D.App.Sci.

Introduction

Many members of ACKMA were involved in the preparation of the IUCN Guidelines for Care and Karst Protection (Watson et al 1997) and part of the time at the 1995 ACKMA Conference was devoted a very important meeting to discuss the content of those Guidelines.

The Guidelines document has since been utilised worldwide as setting a standard that might be observed in cave and karst conservation. It was formally adopted and integrated into the official policy of the US National Parks Service, has been extensively used in Australia and New Zealand and to varying degrees in virtually all other countries. It is now undergoing a review and redevelopment in the light of experience since its publication and of growing awareness of the problem that it did not deal adequately with such topics as biodiversity management, management of archeological and palaeontological sites and tourism management. It is thus timely to provide some overview of current issues across the world. Commencing with the international and then looking at some of the national implications.

International Recognition

During the period 1968 to 1971 the Man and Biosphere program was developed within UNESCO and this led to the establishment of Biosphere Reserves in many part of the world. The role of these has gradually evolved and today the Biosphere Reserve is used widely as the basis for negotiating sustainable programs of land management. In many cases, the core of the Biosphere Reserve will be a protected area often a national park and sometimes a World Heritage area. In these situations the Biosphere Reserve provides an invaluable form and process for buffer zone management.

At about the same time, considerable discussion came to be focused on wetlands and at a meeting at the city of Ramsar (Iran) established the Ramsar Convention on Wetlands. Initially, this gave particular attention to the protection of birds particularly those who were migratory. Again Australia played a significant role because of our remarkable migratory birds who follow an enormous figure of eight migratory route between Siberia and Southern Australia. However, the Convention is now very widely focused on wetlands as a whole and is one of the important forums for examining the effects of climate change. Also, as a result of a paper prepared by Andy Spate and Elery Hamilton-Smith for the 1996 Ramsar Conference in Brisbane, a new category of subterranean wetlands was recognised. The first site registered internationally under this provision was Skocjanske Jama in Slovenia but a number of others have since been added.

Meanwhile, and since the remarkable international effort to conserve great Nubian monuments in the Nile valley, discussions have been taking place for a considerable time on the recognition of sites of Outstanding Universal Value. This culminated in 1972 with the establishment of the World Heritage Convention probably well known to all ACKMA members. There are now some fifty cave and karst sites recognised as World Heritage and others are currently in the process of assessment and consideration.

The 1982 Charter for Nature gave particular emphasis to biodiversity and, as valuable as this is, it tended to detract attention from sites that did not demonstrate great value for the 3 F's (Fur, Feathers and Flowers). It has taken some time to adequately redevelop recognition of geological features (Dingwall 2005) or of marine sites.

Most recently continuing international concern about giving much more attention to geodiversity has resulted in the development of Geoparks with well-established networks now in China, Europe and now rapidly developing in Australia.

Processes of International Recognition

Concern has often been expressed about the need for clear criteria and processes for

recognition at the international level. While initial recognition of World Heritage sites more or less accepted all nominations, the World Heritage committee has taken the lead in demanding a particularly thorough process of assessment and inscription (UNESCO 2005).

Continuing with World Heritage as the primary example of rigorous selection, any nominated site must meet one or more of ten criteria in order to establish Outstanding Universal Value (OUV) and the extent to which it meets any of the criteria is decided by rigorous comparative analysis with similar sites. It must also meet various conditions of integrity including authenticity, appropriate boundary definition, the intact character of the site and evidence of appropriate and adequate management capacity to ensure sustainable management.

Good News and Bad News

The major good news is that at both international and national levels there has been a remarkable growth in the number of recognised and adequately protected karst sites. Although the quality of management varies widely from country to country, there has been a significant improvement. A number of countries have used rapid assessment and decision-making processes and have also undergone immense changes in thinking about nature conservation.

This process means that some of the long standing conservation oriented nations have now fallen behind the front line of thinking and action. The current serial nomination in progress on the South China karst demonstrates the remarkable creativity and thoughtfulness in assessment and nomination; a very high quality indeed of commitment to good management and proper protection to karst values; and leading edge in site presentation to the public (at the same time, I should note that China and the United States have something in common – they manage to offer the best and the worst of everything). I could cite many other examples but there is not time.

Probably the major bit of bad news is that there are some countries that still suffer the problem of the right hand never being aware of what the left hand is doing. Thus at one presentation in Vietnam recently, I heard the Provincial Government proclaiming how highly they valued a World Heritage area was and how well they would look after it for all time. At the same time they pointed to their dramatic success and rapid progress in building a new coastal highway that is causing unbelievable sedimentation and other environment damage.

The National Geographic Society's annual monitoring and rating of World Heritage sites (National Geographic Traveller 2006) highlights further bad news. They pointed to the great increase in tourism numbers to a point for which management was totally unprepared and totally unable to cope. The point was made that conservation objectives of World Heritage were being neglected in order to pursue an amusement park ideology for mass tourism.

Turning Back to the National Level

I trust it is clear that we can no longer be complacent about our own standards in neither resource management nor visitor management. We should seek out, as some members are already doing, opportunities to learn from others.

Grande Caverne - a new show cave for Rodrigues, Mauritius

Greg Middleton

Abstract

The caves of the calcareous aeolianite of South-West Rodrigues (Mauritius, Indian Ocean) have been known since at least 1786 when the first bones of the extinct, flightless solitaire were collected from them. One cave, Caverne Patate, has been operated as a show cave for a very long time and, since flaming torches were used for lighting until 1990, has suffered considerably from soot deposits. Most of its accessible speleothems have been souvenired.

In 2001 Mauritian/Australian naturalist and entrepreneur, Owen Griffiths, conceived of a project to restore the native vegetation of part of the aeolianite plain of SW Rodrigues, reintroduce giant tortoises to the site and provide visitor access to the underlying caves. In due course a lease of nearly 20 hectares was obtained from the Rodrigues administration, a new company, François Leguat Ltd, was established to run the project and a program to breed the necessary tortoises was commenced on Mauritius. The author was invited to advise on the opening of Grande Caverne as a guided show cave and Caverne de la Vierge as a guided 'adventure' cave and to provide interpretative material. A Rodriguan with a natural history background has been engaged to run the cave tours and late in 2005 was given on-the-job training in South-West Western Australia through cooperation with the Augusta-Margaret River Tourist Bureau (Caveworks).

Planning of pathways in Grande Caverne commenced in September 2006 and initial tests of cave lighting were carried out. Recycled plastic planking is to be used for the pathway surface, supported by polyethylene pipe where it crosses sediment floors and steel framing where it is elevated. Handrails will be provided where necessary. The principle guiding the design and installation of the pathway is that it should have minimum impact on the cave and that all structures should be fully removable.

It is likely that lighting will utilise 12 volt dichroic lights but consideration is also being given to the use of state-of-the-art large 24 volt LED arrays. Complex lighting control systems will be avoided in favour of a simple physically-switched system which can be serviced by local personnel.

Current planning would have the giant tortoise and cave park open about late-July 2007.

The island of Rodrigues

The island of Rodrigues is situated in the Indian Ocean about 600 km east of Mauritius – and 5,000 km west of Australia. It is 108 sq. km in area – a little bigger than Maria Island (a part-karst national park off the east coast of Tasmania with a permanent population of about 5) and has a population of around 40,000. The direct depredations of humans and the progressive removal of much of the island's natural vegetation since people first settled there in 1691 (North-Coombes 1971) has led to the extinction of much of the endemic fauna, especially the birds and tortoises, and flora. Today virtually no area of natural habitat exists on the island; all of the original plant communities are considered extinct (Strahm 1989).

While the basement rocks of Rodrigues are of volcanic origin, there are small areas of aeolian calcarenite on the coast (Halliday & Middleton 1996), principally in the south-west (see Fig. 1). The major outcrop, about 800 ha in area, comprises Plaine Corail to the west and Plaine Caverne to the east, cut by the deeply incised Rivière Anse Quittor.

The island achieved a level of political autonomy during the planning of the project, with the creation of an elected regional assembly in 2002. Approvals gained from the central government had to be re-negotiated with the Regional Administration before the project could get underway. There is strong local support for the project which should have significant tourism, environmental and educational benefits.

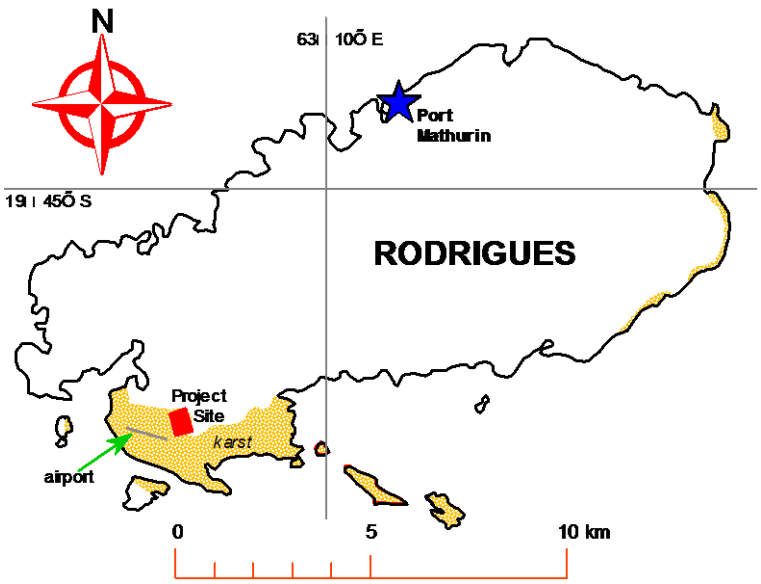

Fig. 1. The island of Rodrigues, Mauritius, showing the distribution of karst (aeolian calcarenite) and the location of the giant tortoise and cave project.

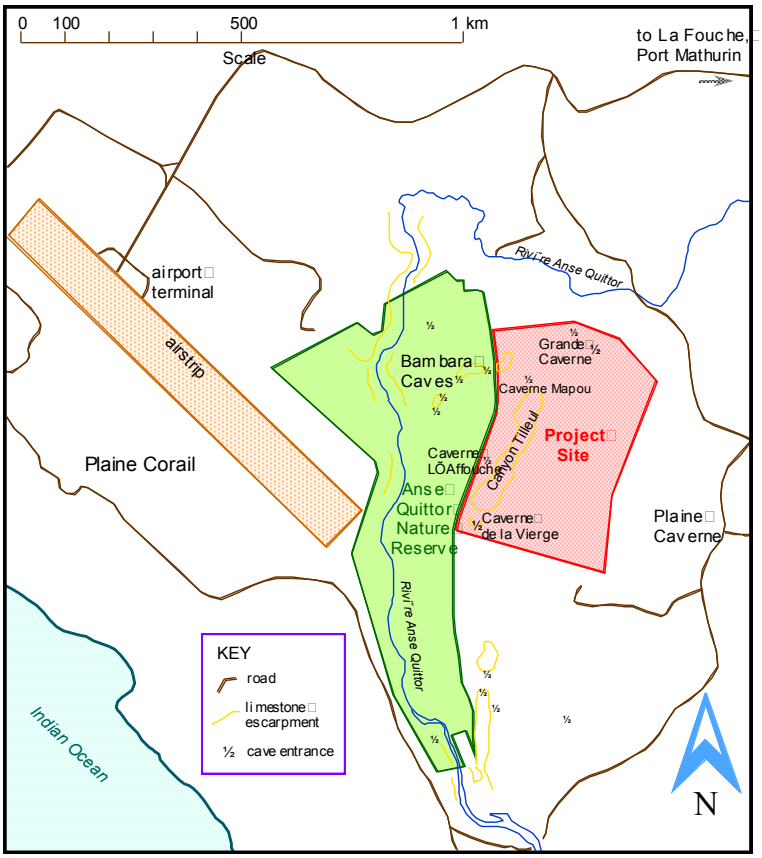

Fig. 2. Plan showing the project site in south-west Rodrigues and the location of the principal caves

The Giant Tortoise and Cave Park project

In the Plaine Caverne region, immediately east of Anse Quittor Nature Reserve, a private company, François Leguat Ltd[1], is establishing a 20 ha habitat reserve for the re-introduction of giant tortoises (Fig. 2). The calcium-rich karst area is ideally suited to the raising of the tortoises and, while the two endemic species *(Geochelone vosmaeri* and *G. peltastes)* have long been extinct, most of what we know of them has come from remains preserved in the caves underlying this area (Griffiths 2001). The project involves introducing analogue species of tortoises from other Indian Ocean islands *(G. gigantea* from Aldabra and *G. radiata* from Madagascar), restoring as much of the original palm savannah vegetation as possible and opening two of the caves to visitors. Grande Caverne (also known at times as Caverne Tamarin) will be opened for guided tourist visits; Caverne de la Vierge will later be made available for 'adventure tours'; other caves on the site will be kept in their natural state for *bona fide* research.

It should be noted that another cave, Caverne Patate, is already operated as a show cave by the regional government, further east on Plaine Caverne. Tours have been run for many years with no specialist expertise, no plans and virtually no controls, resulting in the cave being severely degraded (Figs. 3, 4) (Middleton 1998, 1999). Minimal facilities are provided, hand torches (formerly flaming; now electric) are carried and the guides have no training and little understanding of geology, speleology, management or interpretation. There will inevitably be competition between the two operations and it is to be hoped that standards at the government-run cave will improve as a result.

Tourism is still in its infancy in Rodrigues and data on visitor numbers is scarce. The number of arrivals by plane in 1999 was 45,000, comprising 11,000 Rodriguans, 25,500 other Mauritians and 8,500 from overseas. It would be useful to know the number of visitors to Caverne Patate but the practice of selling a permit to each 'party', regardless of size, would make this data of limited value. Visitor numbers are expected to rise following the recent lengthening of the airstrip (allowing larger planes to land) and approval for the construction of two new hotels. At present the main tourist activities relate to the marine environment and local crafts. The tortoise park/cave project would significantly add to the 'inland' attractions.

Fig. 3. For about 200 years – until 1991 – visitors were conducted through Caverne Patate with the aid of flaming torches. The accumulation of soot in the cave has been highly destructive.

Fig. 4. Mauritian stamp of 1985 showing an entrance to the Caverne Patate system and a man holding flaming torches of the type used for illumination until 1991.

The overall aim of the giant tortoise and cave project is to restore, to the extent practicable, the natural environment within the project area to provide an enjoyable quality 'natural'

[1] François Leguat, a French Huguenot, was the first settler in Rodrigues, in 1691-93. The company is headed by Owen Griffiths, an Australian/Mauritian zoologist who runs 'La Vanille Réserve des Mascareignes' on Mauritius.

experience for visitors and the local community and to provide a facility for research and training in conservation biology for Mauritius (Griffiths 2001).

Specifically in relation to the karst and caves, the vision for the project is:

- the two caves restored where necessary and possible[2];
- the range of karst features effectively protected and managed;
- conditions established under which visitors can experience and enjoy the surface karst features and underlying caves in safety;
- through interpretation, visitors gaining an understanding of the geological, geomorphological, palaeontological, biological and historic features of the Rodrigues karst; and
- the local community gaining an understanding of their environment and, from that, developing positive attitudes towards the maintenance of their remaining natural heritage (including areas that can be restored).

The primary theme of the whole project will be environmental protection and rehabilitation. The results of failure to protect the environment are dramatically demonstrated by the extinction of the giant tortoises and the solitaire, the remains of which have been preserved in the caves, the stripping of the original vegetation and, on a smaller scale, the destruction of speleothems in the caves. Positive aspects will be emphasised through the restoration programs, relating on the large scale to the vegetation, at the species level to the tortoises and at the micro level to the repair of some speleothems.

Presentation of Grande Caverne

The author was involved in development of the original concept plan for the project in 2001 and since 2005 has been advising on those aspects involving the caves and, in particular, the appropriate development of Grande Caverne (Fig. 5).

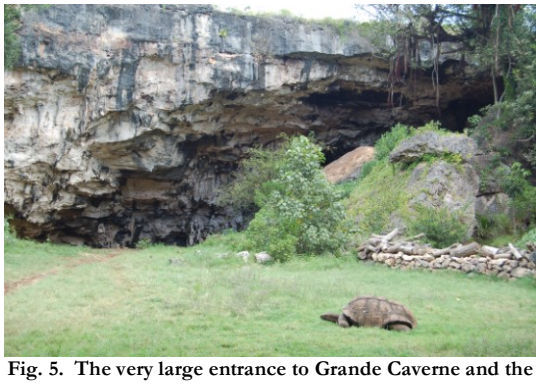

Fig. 5. The very large entrance to Grande Caverne and the first of the giant tortoises to be (re) introduced to the reserve.

The route for a pathway has been selected (see Fig. 6) and pegged out on the ground. The route has been selected on the basis of:

- taking the visitor through the major parts of the known cave;
- providing views to most of the major recognised features;
- accessibility – generally a roof height of at least 1.6 m has been aimed at and a width of at least 1 m. Excavation and cutting of rock will be kept to a minimum and every effort will be made to avoid impacting flowstone.
- ease of construction – the walkway will lie on flat sediment surfaces where they are available.

Walkways will utilise recycled plastic planking, known as "Replas" and manufactured in Western Australia. Where the path crosses sediments the planking will be supported by polyethylene piping, 110 mm in diameter which will simply rest on the floor. Where rocks – mainly roof breakdown – have to be crossed, elevated steel structures will be erected. In some places small bridges will be required and where changes of level are involved, staircases will be required. In general these will be keyed into the bedrock and concrete structures will be avoided wherever possible. The guiding principle will be to make any structures removable without having a long term detrimental impact on the cave. Handrails will be provided where necessary. There will be platforms at good viewpoints (Fig. 7) where information will be provided about the cave.

[2] There has been discolouration of accessible speleothems during generations of uncontrolled visits, breakage of speleothems (in places pieces remain) and cattle have been allowed to use the entrance chamber of the main cave for shelter.

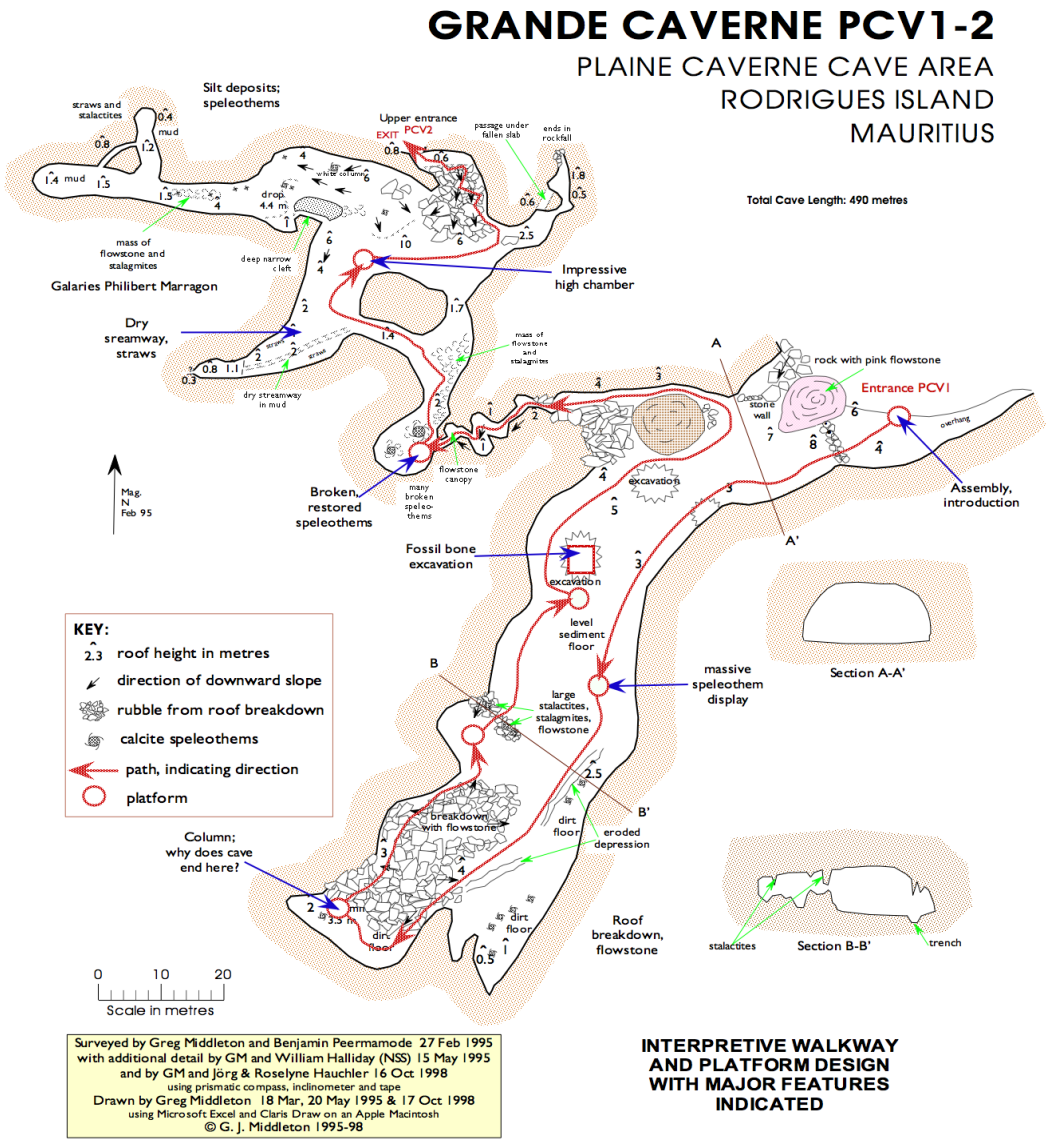

Fig. 6. Plan of Grande Caverne showing generalised route of walkway and major features.

Fig. 7. The first platform will provide this fine view of some of the largest decorations in Grande Caverne.

Fig. 8. Old palaeontological excavation site in Grande Caverne. The recovery of solitaire and giant tortoise remains from the caves date from 1789 but most excavations were carried out after Cuvier's identification of solitaire bones in 1830 (North-Coombes 1971). Some excavators made no effort to restore sites they investigated, as here in the main chamber of Grande Caverne.

Lighting will be provided by a combination of large light-emitting diode (LED) arrays and dichroic (halogen) lights. Simple control systems will be employed, comprising switchboards at platforms. Lighting and wiring will be concealed. Low level track lighting will be provided on the walkway as required.

Interpretation will be provided through displays in the visitor centre, publications, signs and on the guided tours. The chief guide has received practical cave interpretation training at Margaret River in Western Australia, thanks to the cooperation of the Augusta-Margaret River Tourist Bureau and CaveWorks. Tours will start from the visitor centre and will thus cross part of Plaine Caverne in order to reach the cave. This will give opportunities for the guide to explain elements of the geology, topography, the karst landscape, the vegetation and its restoration, native fauna and human history. In the cave, interpretation will focus on the nature of the aeolianite, cave-forming processes, speleothems and the importance of the cave as a palaeontological site (Fig. 8).

In the future it is planned that Caverne de la Vierge, a somewhat smaller cave than Grande Caverne, will be opened for adventure tours, where visitors will carry individual lights but still be supervised by a guide. A pathway will be marked through the cave but will not be constructed.

Conclusion

The opening of Grande Caverne as a show cave – as part of the giant tortoise and cave park – is expected to make a significant contribution to tourism in Rodrigues, will result in the on-going protection of the cave and its rehabilitated environs and provide a valuable educational facility for the island.

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A comparison of the South China karst World Heritage nomination with similar areas under the Earth's history criterion

XIAO Shizhen, XIONG Kangning, CHEN Pindong

(Institute of South China Karst, Guizhou Normal University, Guiyang 550001)

中国南方喀斯特世界遗产提名地与相似地区关于地球历史标准的对比研究

肖时珍, 熊康宁, 陈品冬

(贵州师范大学 中国南方喀斯特研究院, 贵州 贵阳 550001)

Abstract: Any site to be listed as a world heritage should be of outstanding universal value. The "South China Karst" is now in application for world natural heritage. The nominated property (Phase 1) comprises three internationally acclaimed karst areas in Yunnan, Guizhou and Chongqing in south China (Table 1). The problems that whether the South China Karst is of outstanding universal value and how it is characterised are urgent to be solved. The paper have the South China Karst compared with similar sites both at the national and international levels, both on the world heritage list and not. Comparative analysis of the South China Karst with the similar karst areas in the world under the world natural heritage criterion (viii) (earth's history) have been made from the point of view of geology, landforms and their evolutions. Uniqueness of the South China Karst is discovered and come to the conclusions that it can be well satisfied the criterion (viii).

Keywords: The South China Karst, Comparative analysis, Earth's history criterion

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摘要:任何地点要想成为世界遗产都必须具有突出全球价值。"中国南方喀斯特"正在申报世界自然遗产。其第一批申报地由中国南方的云南、贵州、重庆的三个具有世界典型性的著名喀斯特地组成(表1)。"中国南方喀斯特"是否具有突出全球价值、其价值如何体现等问题都亟待解决。本文将中国南方喀斯特与相似地区(既包括国家范围内的也包括国际的,既包括世界遗产地也包括非世界遗产地)进行对比,着重按照世界遗产第八条评定标准(地球历史),从地质、地貌及其演化等角度进行对比分析。发掘"中国南方喀斯特"的独特性,并得出"中国南方喀斯特"充分达到世界遗产第八条评定标准的结论。

关键词:"中国南方喀斯特",对比分析,地球历史标准

1. Introduction

China has more than 1,250,000km² of carbonate rock outcrop (China karst research group, 1979) that occupies 13% of the total country. Thus it has one of the highest proportions of karst in the world. The South China Karst area, covering nearly 500,000km², lies mainly in Yunnan, Guizhou and Guangxi, but extends into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong. It contains an outstanding series of karst landforms - from tropical to subtropical - plains, hills, mountains and plateaux. *The South China Karst* is the title of this serial world heritage nomination by the Chinese government. It is being serially nominated for world heritage listing because, although not contiguous, the nominated areas are located in the same geological-geomorphological region, unified by their karst topography, and because the nominated areas incorporate a range of features within a single geographical region (karst region of south China). Each of them represents a typical karst landform and its on-going process, thus are irreplaceable parts of the entire nominated property. It covers a total area of 146,016ha; with the core zone and buffer zone separately 47,588ha and 98,428ha

Pursuant to the Operational Guidelines (Paragraph 132), for a nominated property, "A comparative analysis of the property in relation to similar properties, whether or not on the World Heritage List, both at the national and international levels, shall also be provided." All sites of the serially nominated South China Karst (first phase) are proposed to meet the criterion N(viii) – in that they are outstanding examples representing major stages in the earth's history including the record of life, significant ongoing processes in the development of landforms and significant geomorphic and physiographic features; so the comparative analysis of the South China Karst with the similar sites in the world under the criterion (viii) is specially important.

Table 1 Geographical coordinates and areas of the South China Karst (Phase 1)

Nominated Sites	Coordinate (Central)	Region (County and Province/City)	Area (ha)
Shilin Karst	N 24° 47' 30" E 103° 16' 30"	Shilin Yi Nationality Autonomous County, Kunming City, Yunnan Province	Area of nominated sites: 12,070 Buffer zone: 22,930 Total: 35,000
Cone Karst	N 25° 13' 15" E 107° 58' 30"	Libo County, Southern Guizhou Buyi and Miao Nationalities Autonomous Prefecture, Guizhou Province	Area of nominated sites: 29,518 Buffer zone: 43,498 Total: 73,016
Gorge Karst	N 29° 13' 48" E 107° 54' 12"	Wulong County, Chongqing City	Area of nominated sites: 6,000 Buffer zone: 32,000 Total: 38,000

2. Physical Geography

2.1 Terrain

The South China Karst is situated in the second and third Geographical Altitude Zones (GAZ) of China, extending 1,380km from west to east and 1,010km from north to south. The Yunnan-Guizhou Plateau is located in the second GAZ with an altitude ranges from 2,000m to 1,500m in the southeast. The plateau has been deeply incised by rivers as much as a 1,000m. Here the relief amongst the karst landforms ranges from 100m to 300m. The terrain of Shilin Karst Site is high in the east and north, low in the west and south, rising from 1,720m to 2,203m. Libo Karst Site is high in the west and low in the east, with a mean altitude 747m. Wulong Karst Site slopes down to the Wujiang R. from south to north.

2.2 Climate

The South China Karst is in three climate zones: subtropical warm-temperate, humid-

temperate and humid-monsoon. The southeast monsoon from the Pacific Ocean, the southwest monsoon from the Indian Ocean and the cold airflow from the Tibetan Plateau combine to generate a large climatic gradient. The mean annual maximum temperatures across the region range between 14°C and 26°C, the mean annual rainfall ranges from 1,100mm to 2,300mm, and the mean annual evaporation ranges from 1,000mm to 1,800mm. The wet season is between April and September and contributes between 72% and 86% of the annual total.

2.3 Regional Geology

The South China Karst is on the carbonate rocks of the Yangtze Massif. The stratum outcrops are of the Sinian, Cambrian, Ordovician, Devonian, Carboniferous, Permian and Triassic periods. Limestones, dolomites and dolomitic limestones are the main rock types with some mudstones and shales. South China was subjected to a number of ocean invasions before the Mesozoic in which the carbonate strata were laid down. In the late stage of Triassic, these were uplifted, folded and faulted by tectonic activity during the Indo-China, Yanshan and Himalayan Movements. The earliest carbonate sediments are the Dengying Formation of Sinian and then more carbonates were widely deposited in the Palaeozoic, especially during the Devonian, Carboniferous, Permian and Triassic periods. Resulting in a great depth of carbonate rocks (up to 10,000m in Guizhou and Guangxi) that are both folded and faulted; these strata are rich in fossils.

2.4 Karst Landforms

In the complex geological structure and favourable tropical-subtropical climate, a suit of karst landforms is well developed, such as cone karst, tower karst, stone forest karst, gorge karst and so on. The three sites of the South China Karst World Heritage Nomination (Phase 1) are respectively the represents of the landform sequences. It is regarded as the classical manifestation of a series of karst landscapes that have largely developed in a humid subtropical climate.

2.5 Hydrology

The South China Karst has two major catchments, which are the Yangtze River and the Pearl River separated by the mountains Nan, Miao and Wumeng. In the northwest, the Yangtze River has cut three deep gorges. Its tributaries, for example, the Wujiang, also cut deeply into the Yunnan–Guizhou plateau to form gorges. In south, the Pearl River rises in the Shilin of Yunnan its tributaries the Nanpanjiang, the Beipanjiang and the Hongshuihe are also deeply incised into the edge of the Yunnan-Guizhou plateau and Guangxi Basin to form gorges. The Shilin Site is positioned in the Nanpanjiang catchment on the upper reaches of the Pearl River; the Libo Karst Site is located on the middle reaches of the Dagouhe and the Hongshuihe in the Pearl River System. The rivers that influence karst development of Wulong Gorge Karst are the Furongjiang, Yangshuihe and Muzonghe of the Yangtze River.

3. Comparative Analysis under the World Natural Heritage Criterion (viii)

3.1 Geology

The geology of the South China Karst is very unique. Two distinct features set it apart.

First, the virtually uninterrupted sequences of massive crystalline limestone and dolomites outcropped in the South China Karst is very hard, huge, thick, pure and old, spanning from Cambrian to Triassic Period. The carbonate rocks can accumulate to the thickness of several kilometres, with rock type-diversity and global significance. This is ideal for the development of karst. But in the main karst areas of other countries, the karst regions mainly distribute on younger carbonate rocks characterised by less diagenesis and soft lithology. For example, in southern Australia, Mediterranean coastal areas, London basin, Central Europe and Eastern Europe, there are massive Mesozoic carbonate outcropped. Although there are the Mesozoic carbonate in central America (Cuba), the Tertiary carbonate is most broadly outcropped (Puerto Rico and Jamaica); in addition, the Neogene and Paleogene carbonate are main rocks in the Nullabor plain of southwestern Australia, Paris basin, several states of eastern America and Caribbean karst regions. The wonderful

pinnacle karst in Mt Kaijende, Assegai karst of Palawan, Tsingy de Bemaraha, Gunung Mulu National Park are much younger than that of Shilin Stone Forest of the South China Karst. The formations of Libo and Wulong sites are also older than many other similar sites. Therefore, the South China Karst earns the best geology conditions for the karst development and keeps a lot of old information of the earth's history.

Second, this area has undergone crust movements from the late stage of Triassic, especially Himalayan Movement from the late stage of Tertiary, a slow epeirogenic uplift during the Cenozoic Era, exposing broad plateaus of gently dipping to horizontal carbonate strata (Sweeting, 1978). Plentiful fissures and joints developed, which greatly increase secondary penetrability and create favourable flowing passage, consequently leading to hasten corrosion and erosion. The movements have intensively effected the development of the South China Karst and the wonderful pinnacle karst, cone karst and gorge karst formed and well developed. Take Wulong gorge karst for example, these old, massive and hard limestones were folded and fractured during the numerous tectonic uplifts that occurred at Wulong and raised the area as part of the Yangtze massive. The fracturing of limestone increased secondary permeability of the carbonate rocks allowing penetrating waters to establish underground routes that with time resulted in extensive cave systems and deep river gorges. The last uplift took place in the Quaternary and the limestones were uplifted over a 1000m. So, the Wulong site not only exhibits the gorge karst system, but also reflects the earth's history. Similar phenomenon can hardly found in other parts of the world that recorded the evolution history of the world.

3.2 Landforms

With the impacts of the very unique geological conditions and the ideal climate for the development of karst, a wide variety of typical landform types with global significance occurred in the South China Karst Nominated Property. Because of crust movement from the late stage of Triassic, especially Himalayan Movement from the late stage of Tertiary, these broad karst areas were tilted uplifted to form gigantic slope areas with the elevation difference of 2,000m, high in northwest and low in southeast, in which typical pinnacle karst, cone karst and gorge karst have been developing and form a entire tropical – subtropical karst landform succession. In addition, each type of the succession can be compared with the similar landscapes in the world to gain the uniqueness.

In the Shilin Stone Forest, the shape of Shilin stone forest is very typical and greatly varied. A stone pillar or column may take the shape of pillar, needle, tower, mushroom and so on. The pinnacles are decorated with karren as fins and flutes. There are emergent pillars called "stone teeth". Therefore, they have been the focus of substantial research into stone forest development and are generally accepted to be among the most varied in the world. The Shilin Stone Forests display pinnacles of highly diverse morphology when with other major pinnacle karsts in the world which are dominated by one main shape.

The cone karst of the Libo sites also is better developed with more typical cones in many diverse environments than those of Jamaica, Cuba or other areas. The height of cones in Libo varies from 100 to 300m, the slope ranges from 45° to 47° and cone symmetry is outstanding. Whereas, the majority of cones in other areas are mainly hemispherical, with slopes about 30° and heights are less than 100m. Specific examples are the cone karsts of Gunung Sewu of Java and the Arecibo-Manati region of Puerto Rico. In the Cockpit Country of Jamaica, the slopes are 20-30° (Sweeting, 1989) and the height of the cones is even smaller. The height differential between the Libo cones and those of the world is a result of the greater tectonic uplift that has taken place at Libo. The cone karst is the dominant landform at Libo, but in many sites with similar conditions and in the subtropics cones are mixed with towers in varying proportions. Besides, the sites contain many generations of cones in the following karst assemblages fengcong-depression, fengcong-valley and fengcong-gorge, providing supporting evidence for the geo-history of the area, evidence that is often not available in other karst areas in the world.

In the Wulong area, the Yangshui River drops 1,415m over a distance of 26km, producing the steep gradient required to incise the limestone

plateau and form a gorge. Its tributary rivers have also incised the karst. Thus in the nominated site, there are many canyons and gorges. These illustrate that the gorges form from the combination of processes, they are mechanical erosion, chemical solution and the opening of cave passages by collapse of the bedrock.

In addition to the outstanding examples of Shilin Karst in Yunnan, Cone Karst in Guizhou and Gorge Karst in Chongqing, a wide variety of surface and subsurface karst landforms occur in the nominated sites including fengcong, fenglin, karst hills, stone teeth, depressions, dolines, natural bridges, multi-level caves and plentiful speleothems.

In a word, the most typical tropical – subtropical karst landforms and significant geomorphic and physiographic features have been exhibited in the South China karst. Most other sites just include one main karst features. It is difficult to find another place in the world that shares such a diversified and classic karst landform succession in such a not large continuous area.

3.3 Evolutions

Compared with other celebrated karsts of the world, the evolution and morphogenetics of each site of the South China karst are very complex, very long and a lot of information has been keeping, which makes the South China karst the model site for the researching of tropical – subtropical karst landform evolution.

The Shilin Stone Forest has a long and multi-phased evolution, which has been influenced strongly affected by the basalt and basalt tuff lying on the thick and pure limestone and by the Eocene red sediments. These covering rocks have allowed the subjacent karst development. This has not been the case in other pinnacle karsts. Under a humid and hot tropical environment, denudation and planation have taken place (Budel, 1977). The pure and massive carbonate rocks of lower Permian were corroded beneath Eocene "red beds" to develop rounded forms. After the late Neogene, particularly in mid Pleistocene, the area was uplifted and formed the Yunnan Plateau 1,700 to 2,000m above sea level. At present, the stone forests are being exhumed. The first phase of stone forest evolution was as early the early Permian and the last, the fourth phase, still in proceeding (Liang Yongning, 2000). The Madagascar, Malaysian and Papua New Guinea pinnacles have a single-phase evolution. The evolution of Madagascar karst is very much younger and more simple than Shilin Stone Forest; the limestones are younger (Jurassic to Miocene), the modern morphology developed during the Pliocene and Pleistocene, and the geological structures are more simple (faulted monoclinal relief). The Mulu pinnacles in Malaysia and the Mt Kaijende pinnacle arête karst in Papua New Guinea have developed over the last few million years, whereas the Shilin Stone Forests have a multi-phase evolution spanning some 270 million years. The Shilin Stone Forests are therefore of considerably greater geomorphological and geological interest (Ford, Salomon and Williams, 1997).

The evolution of Libo cone karst is very valuable in that two different evolution models can be found in a very short area: the west and east banks Zhangjiang R. In the west bank of Zhangjiang, trending eastwards from the plateau around Mawei, the cone karst has undergone rejuvenation from fenglin-valley to fengcong-valley to fengcong-depression to fengcong-gorge, with the linear distance and landform elevation difference are approximately 40km and 720m respectively. However, cone karst evolution on the eastern bank of the Zhangjiang is different that it is in a normal sequence: fengcong depressions to fengcong valleys. Caves are found at four levels in the cones, testimony to cone karst evolution and change since the Neogene. There are violet-red travertine and grit deposits in the highest caves, which are the peneplain sediments from the late stage of the Pliocene. It is not easy to find such different evolution models in the world.

The evolution of Wulong karst shows how the gorge karsts form under the interactions among caves, rivers, natural bridges and giant dolines (tiankengs). The Tianlong, Qinglong and Heilong Bridges together with the Qinglong Tiankeng and Shenying Tiankeng and the associated caves illustrate how a deeply incised large river can form a series of natural karst features. They together compose a unique karst gorge system. The river first forms a cave by mechanical erosion and chemical corrosion,

then collapse processes form large cave chambers, which may evolve into tiankengs. Wall retreat of these giant dolines further opens the cave into a gorge in which small remnants of the cave roof remain as bridges. The final stage will be the collapse of the bridges and only a gorge or canyon remains. It is extremely rare to see all these evolution stages of a gorge karst in one area.

In summary, the South China Karst exhibits many paleokarst features and very complex evolutions from last stages of the Sinian, Silurian, Permian, Triassic (the late stage of Indo-China Movement), Mesozoic and Paleocene. Each of these periods of karstification provides evidence as to the evolution of the earth's history.

4. Conclusions

Compared with the similar sites of the world under the criterion (viii) of earth's history, the South China Karst nominated property is unique at least in the following aspects.

- The South China Karst has a distinctive character, which arises from both its geological and climatic history. It spans almost all eras of geological history and so many areas are very ancient. The limestone primarily comprises early hard and compact rocks of low porosity. While some areas remain virtually as they were first deposited, others have been subject to extensive tectonic change. Few areas have similar physical characters in the same latitudes.
- The South China Karst demonstrates richest karst landform diversity, containing classic pinnacle karst, cone karst and gorge karst. Their geomorphological morphogenetics, the development series from the watershed and paleo planation surface to valley, plain and modern gorge are unique. It is difficult to find another place in the world that shares such a diversified and classic karst landform succession in such a not large continuous area.
- The South China Karst comprehensively reflects a remarkable complex evolution of karst landscape features with well-preserved historical evidence. Similarly, the structural integrity of the limestone provides for large and relatively stable caves and other subsurface forms. Thus, many features of the karst only occur in China and are not truly comparable with landforms of somewhat similar superficial appearance in other countries.

To sum up, the Stone Forest in Yunnan is obviously different from the pinnacle karst of tropical islands. Its development is a result of a combination of fissure and both sub-aerial and sub-soil corrosion; the cone karst in Guizhou is a combination of both rejuvenation development, a renewal of features on the older karst geomorphology and a normal evolution of the most typical cone karst. The karst landscapes in the nominated sites of Wulong are dominated by a gorge karst system as the result of tectonic uplifts from the Quarternary. The three sites jointly display on-going geological processes and reflect karst development and evolutionary processes under different geological conditions. The South China Karst demonstrates the unique geological history, evolutionary processes and on-going karst geological processes at different locations, development stages, types and successions. In view of its extremely richest array of karst features and their on-going complex evolution processes, the South China Karst (Phase 1) Nominated Property provides exceptional "textbook" examples in this field unequalled by continental sites elsewhere and it can be well satisfied the criterion (viii).

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Conservancies and show caves in partnership; a case study of the evolution of a relationship

Emily Davis[1] & John Sagendorf[2]

[1]Northeastern Cave Conservancy office manager [2]Howe Caverns general manager

In the late 1980s the staff of the National Speleological Society (NSS) Fiftieth Anniversary Convention approached Howe Caverns, New York State's major show cave located between Albany and Cooperstown in upstate New York, to see if the convention Howdy Party could be held on the property. By the late 1980s Howe had welcomed nearly 12 million visitors, at about 200,000 per year, for its first 60 years of operation. Howe Caverns is a linear cave which still supports the creating underground stream, running the entire length of the cave along the tour path. Upon visiting the cave we found that the staff did not see the cave as the cavers did. The cave had large pockets of moss and signatures of modern visitors were apparent wherever the trail was close enough to the wall for someone to write in pencil or lipstick. There were pockets of coins in pools and on ledges. It was not that the managers and guides did not care, they just were not attuned to seeing that this was not the way a cave should look.

The local cavers and volunteers who were working on the NSS Convention visited Howe several nights between that first visit and the very successful Howdy Party on July 1, 1991. Buckets of coins were removed from the river and mud shelves, moss was brushed from the walls using bristle brushes and dilute bleach solutions. Wire brushes had to be used to remove the signatures. Although this was rough on the cave, it was better than leaving it as it had been because that encouraged more graffiti. The managerial staff was pleased with the result. This started a relationship that has developed and flourished to this day.

For many years after the '91 convention, Howe Caverns hosted a winter Helderburg Hudson Grotto meeting and clean up at Howe in January. The local cavers (at first) and then many of the region's cavers would gather for a pot luck supper in the Caverns restaurant (which was closed in the winter) and then go down in to the cave to continue the work started in 1989. Projects including removing old cement and wiring cables, cleaning moss from high surfaces, and cleaning coins and gum out of the river made the cave look better every year. This became so successful that this year the event will have to be limited to local grotto members as there is just not that much to do.

The relationship has been most apparent between the Northeastern Cave Conservancy Inc. (NCC) and the current management of Howe Caverns. When the NCC decided to purchase a woodland with several caves and many sinkholes just north and up dip of Howe Caverns the management of the Cave donated $500 to the purchase of the land.

As we all know, conservation has become more "mainstream" in the last few years. Howe Caverns offers their visitors photos of their family and friends in the cave. Howe Caverns has taken conservation to heart by changing their photo studio from a chemical run studio in the cave to a color photo copy and digital color studio on the surface. They also have stopped encouraging visitors to throw coins in the river on a formation known as "the turtle". It was suggested that a coin drop be placed on the walkway near "the turtle". Guides now include a message of conservation and explain why it is not appropriate to throw coins in the stream; and they suggest that if people want to throw coins, they throw them in the coin drop and contribute to the Northeastern Cave Conservancy Inc. This process has netted approximately $1300 a year for two years in a row. The cave stays cleaner, metals are not added to the water table and the NCC has a large part of their annual expenses covered by the coin drop.

Every year Howe Caverns has a special event on Earth Day weekend. The Northeastern Cave Conservancy Inc. has a table and shows cave cleanup videos, has a photographic exhibit and talks to visitors. This exposure to the general public is very valuable to a small land trust.

In 2004 Karst Waters Institute wanted to honor Art Palmer for his work in the field of Karst. Howe Caverns jumped at the chance of having many of the country's top karst scientists visit the cave and have a dinner party to honor a local scientist. Not only did they work hard to provide a locally prepared, fine meal at a very reasonable price, they also provided free local beer for the evening. The ambiance of looking out over the Schoharie Valley while enjoying a very special evening was memorable for the visitors.

The Caverns has donated money, time and creative energy while the conservancy has worked to promote the education of the staff and develop more scientific guide presentations. Recently the NCC sponsored the National Cave and Karst Management Symposium. Members of the conservancy were determined to make this one of the best meetings of this type ever. Howe Caverns came on board three years before the event and when the staff was planning an all day field trip, Howe encouraged us to finish the trip at the show cave with an early evening event. The management provided food, wine and beer as well as trips through the cave for 100 people, all gratis. They also had staff attend the session during the week and learn from cave managers nationwide.

The relationship has become an integral part of cave conservation in the region. The staff and members of both organisations have a full understanding of each others' role and treat each other with respect and appreciation. The Tour Manager at Howe Caverns has served as an elected volunteer member of the NCC Board. The relationship continues to develop and has been the impetus for another show cave in the region to follow suit. Recently Natural Stone Bridge and Caves in the Adirondack Mountains has invited cavers for a variety of events and has placed a coin drop box on their property for the NCC. Cavers led by Thom Engel have been mapping the property for the last several years and his geological study of the property won an award at the NSS convention.

The ongoing relationship between the cave and conservancy has expanded the awareness of both organisations. A show cave, after all is a managed natural feature. Developed and commercially run tourist caves often manage and protect larger areas of cave and karst as well as serve as a public face for the underground world. Increasingly show caves can see conservation activities as a part of their natural function. And conservancies can see that working with show caves serves their mission in valuable ways.

Of significant importance to a conservancy/ show cave relationship, like any relationship, is commitment and dedication by both organisations. There must be the recognition of purpose and understanding of the mutual benefits. It is recommended that at least one key person from each organisation volunteer or be appointed to serve as liaison and contact with the other organisation. Successful relationships are dependent on regular contact and communication. Experience shows that this type of structure places personal responsibility and enhances the flow of regular communications.

So, what does this mean to your conservancy? The caving community is a finite community. To expand our vision and to protect more caves and karst we must find ways to go beyond that community in both fund raising and for general support. Working with a show cave to teach cave conservation to the general public brings the public and the cave conservation community together for a cause and both benefit.

History of cave conservation; New York State, USA

Emily Davis

Northeastern Cave Conservancy

New York cannot look with pride upon its early cave conservation history. In 1831 John Gebhard explored what was called Ball's Cave and is now called Gage Caverns. When they first found it "Its sides were covered by crystalline masses of calcareous Spar; and the roof by stalactites." Over the next few years John Bonney and John Gebhard stripped the cave of formations in the name of science sending them to museums and universities all over the US. In 1945, Sims said "Tons of rare minerals have been removed from the rooms of this cavern to adorn the cabinets of practical geologists." The collecting mentality was at its height and it would be over a century before the preservation mentality came into play. In a 1842 NY Daily Tribune, a tourist wrote "Formerly there were many stalactites dependent from the roof but they have long since been carried off." Meanwhile a spectacular cave was destroyed. We will return to Gage Caverns a little later.

Howe Caverns was also explored and developed as a show cave in the mid 19th century. Although Howe depended on the beautiful speleothems to make his living, he could hardly have sold tours in a barren tunnel of a cave, he often sold formations to tourists as souvenirs. Evidence of broken formations can be seen in many areas on and off the tourist trail today.

We have found several methods of protecting caves in New York over the years. The most successful method to date has been the acquisition of caves and then limiting the access. The second, oddly enough, is make access easier. The third is the attempt to pass State cave legislation. The protection of the ground water is tied into cave and cave life protection.

Although McFails cave and the surrounding caves and sinkholes, had been explored in the 19th century it was not until the 1960s and 70s that the cave was explored with modern techniques. The cave itself has some deterrents to vandals and trespassers. The Ack's Shack entrance is a tight narrow traverse and the 100 foot long, foot high crawl at the bottom is less than inviting. After major exploration and a breakthrough extending the length of the cave to over 5 miles, the Cornell Grotto purchased the land surrounding the entrances to the cave and donated the land to the National Speleological Society in the mid 1960s. There was a great deal of controversy over the NSS owning caves mainly because of liability issues. McFails was the NSS's first cave and the ownership problems would appear again.

A gate was placed on the Ack Shack entrance after a death from hypothermia in the entrance passage in 1968. Another cave on the property, Cave Disappointment, could not be gated because of the size of the entrance but there are so few formations in this cave that it was not deemed a problem as far as conservation is concerned though there have been rescues there.

In 1978 the Hall's Hole entrance was dug out and the land surrounding it was purchased. This entrance, although it has a 65' entrance drop, provided much easier access to the cave. A gate was placed on the entrance to protect both the foolish, who might enter the cave without the correct equipment, and the beautiful formations of the cave. It has also been used to help restrict access during winter as the cave has been found to be a major bat hibernaculum with over 5000 bats.

The purchase and gating of McFails cave has succeeded in protecting one of the most beautiful and the longest cave in the state. We have only had two forced entries into the cave in the time the gates have been in place.

Knox Cave has been known since the late 18th century. It has suffered the fate of many of the areas caves. Largely stripped of smaller formations it was still interesting enough to merit development as a show cave in the early 20th century. Boardwalks, staircases and electric lights were placed in the cave. A roller skating rink was placed outside. All of this fame would come back to haunt us in the 1970s and 80s. In 1960 the commercial venture of Knox Cave was ended. The cave changed

hands several time in the next few years finally being bought at tax auction by Dr DeLisa. The doctor had a very good relationship with local cavers and in 1970 asked them to gate the cave for him. Each lock placed on the gate lasted only days before it was broken. Too many knew of the cave, it was on some road maps until 1996.

In 1971 members of the Boston Grotto removed much of the old wood in the cave including a rotting staircase at the 20 foot entrance drop into the main room. They had brought materials to place a ladder in the entrance but it was not done soon enough. Locals and out of town inexperienced visitors climbed down clothes line, tree branches or anything else they could find to enter the cave. The parking lot became a party site with trash and beer bottles broken everywhere both in the cave and out. The local cavers tried to keep it cleaned out but it was trashed again in no time. The Knox fire department threatened to blast the cave shut as they were called to pull people out of the cave on several occasions. Dr. DeLisa attempted to donate the property to the NSS but before discussions could be complete there was a death and a major injury on May 3 1975 from falling ice at the cave's entrance.

Dr DeLisa was named in a suit and discussion of donation of the cave was halted. The NSS did not want to get involved in a cave with so many problems and recreation was not a goal, so a non-profit organisation was formed to accept donation of the cave after the suit was settled. The North Eastern Cave Conservancy owned Knox Cave as of January 1979.

This was not the end of Knox Cave's problems. The constant stream of trespassers continued to leave trash everywhere on the property and over 300 'No Trespassing' signs were to be torn down in the next 10 years. An attempt to place a gate at the junction of Knox cave and the access road to the cave lasted a short time. In 1988 an active protection campaign was entered into. The land was patrolled often, as many as 5 or 6 times a week to start with and then as often as 1 or 2 times a week. The signs were replaced weekly and over 100 people were arrested in 1988 and 92. Sixteen ton of rock riprap were dumped on the property line to prevent cars from driving onto the property. The rocks, the arrests and new neighbors moving into a house in sight of the access road have cut trespassers down to a small fraction of previous years.

Other New York caves have been gated to protect formations and bats, some more successfully than others. Surprise or Mystery Cave has had several gates but they have all been destroyed, the most recent by a cutting torch. Caboose Cave has had two different gates since its discovery in the mid 1970s. This one was destroyed but the new one has not been breached.

In all of the previous cases there is easy access to the caves to those with the correct equipment during safe, for either the cavers or the cave life, time of year. The NSS or Northeastern Cave Conservancy's ownership does not mean the end of sport caving but a protected environment. The cases of easier access meaning better conservation are shown in the cases of Knox and Gage where ladders placed in the caves mean fewer rescues which improves the chances of the caves being safer and less likely to put them into the news which causes more visitation and more destruction. The NSS has used both method 1 (limited access) and method 2 (easier access) in its cave ownership. Gage Caverns is owned by the National Speleological Society. Each cave must be considered individually to decide how to conserve it.

There are actually two other ways to view cave conservation through access control which I haven't mentioned. These are our least favourite ways of dealing with cave access. The all or nothing method of cave control. The all method is to have no control whatsoever. This is commonly called a "sacrifice cave". Knox was one of these and Clarksville caves were also considered sacrificial caves. These caves have constant visitation, constant trash and frequent rescues. To control them would take numerous gates, thousand of man hours and constant frustration. The theory is that if we leave them open, the party cavers will leave the other caves alone. The nothing method of control is best for the cave and does not allow for experienced careful cavers. This method is the complete and total closing of a cave by the owners; either by filling it in as the cave on Ice Cave road or just refusing permission to enter like Skull Cave or Church Cave. These cases may change but not without some help from a cave law with protection against owner liability. Occasionally by good relations with the local

cavers as in the probable opening of Hailes Caves to limited trips.

The third major method of cave conservation (in many states) has been the passing of laws which protect caves cave formations, cave life, and cave owners from liability. At this time 28 states have cave protection bills of some type. Most protect all of the aforementioned areas. Virginia has even been able to test its law in court when a tourist was seen breaking a formation and attempting to remove it from the cave property at Endless Caverns. The culprit was convicted. Many other states post the entrances of both show and wild caves with simplified copies of the cave protection bills. New York made its first attempt to pass such legislation in 1979 as bill 5668-a. It was never passed.

In 1990 Assemblyman Paul Tonko presented a new bill which stalled and was re introduced in 1991. There were many problems last year. Some disliked the protection of wildlife as only one type of bat in the state is endangered. And it was argued that if some one wanted to shoot a deer in a cave entrance they should be able to. Senator Cook introduced the legislation in the senate as well but finally it came down to the Assembly being willing to pass the modified bill without an owner liability protection clause and the Senate wanting to pass it only with the owner liability clause. It was at an impasse. We are trying with Assemblyman Tonko's help to put the bill through again even without the owner liability clause because we feel that some of the bill is worth more than none of the bill. The bills were dropped in 1994 but there is rumour they will be revived this year.

This is where we stand in cave conservation. The cavers of the state are having to protect caves in a piecemeal fashion. The acquisition of other major caves, including Clarkesville and Onesquathaw by the North Eastern Cave Conservancy, seem imminent if there are no unforeseen problems but we are having to re-invent the wheel each time a new owner buys a cave property or someone breaks a gate. A cave conservation bill would certainly simplify matters.

Interpretation workshop: if you've seen one cave, have you seen them all?

Steven Bourne and Cathie Plowman

What happened last time you visited a show cave as a member of the general public? Typically you went on a guided tour. The guide welcomed you to the cave and asked you not to touch anything as the oils in our hands would damage the cave. You were invited to ask questions and to use your camera.

Your guide probably told you the story about how the cave was 'discovered' (i.e. its discovery by Europeans) that the limestone had its origins on the sea floor as well as information on stalactites, stalagmites, columns, straws and other speleothems. You might possibly have heard about helictites and given various reasons for their gravity-defying growth. At some stage the guide would have turned out the lights to show you the cave in darkness. The guide may well have commented on how great the acoustics were in the cave and asked if anyone in the audience wanted to sing. Its unlikely anyone did.

The guide's commentary probably dominated the tour and you might have had to listen to (and laugh at) a profusion of well-used jokes. Certainly there was almost no opportunity for silence, quiet reflection or time to look where you wanted to rather than being shown. While there are exceptions to the general pattern, there is such a common structure to cave tours that the phrase 'you've seen one cave, you've seen them all' is one familiar to many cave guides and one which generally angers them.

But regardless of the sincere and hospitable efforts of guides, for the most part, there is a remarkable uniformity in show cave experiences. This is despite other possibilities and ideas being presented at Ackma conferences and other forums over the past 30 years.

Research by tourism organisations shows today's travelling public are far more discerning and are seeking *experiences*. So how do we deliver different experiences in caves? Guides and managers have a suite of possibilities for differentiating their tours.

Firstly there are a range of options besides the traditional guided tour with a commentary and, secondly, the use of thematic interpretation enables endless possibilities for guided tours with both variety and powerful long-lasting messages.

Not all alternative possibilities will lend themselves to every site, nor should we want them to. Exciting and vibrant cave tourism will host a range of opportunities.

A discussion with guides at Naracoorte Caves in 2006 included the following as alternatives to the standard tour:

- See several caves with one guide so that the same information is not being repeated.
- Photographic tour that focused on giving people time to take photographs rather than commentary.
- Adults only tours of Victoria Fossil Cave (as young children become bored and restless).
- Family focused fossil tours.
- Story telling in Alexandra Cave for children rather than a tour.
- Having 'open cave' at Tantanoola Cave' where people could roam around for as long as they wanted to rather than have a structured tour. (This idea has now become the standard way of experiencing Tantanoola Cave.)
- Children re-enacting the journey of children from the past as they explore Blanche Cave (this was done in January 2007 as part of the Australian Speleological Federation conference).

While those who manage caves and guide tours in them have many opportunities to enjoy caves, the people they guide have very limited opportunities to enjoy these inspiring places. The experience of the visitor is often less than rich, inspiring and memorable. A not

infrequent comment is 'that the guide seemed bored' or 'the cave was boring'.

While there are a range of possibilities for enabling the community to enjoy caves besides the traditional guided tour with a commentary, this tour option will probably remain the way most people experience caves. The remainder of this paper will outline thematic interpretation which enables different tour commentaries to be developed with powerful and memorable messages.

Like most interpretation, cave interpretation usually involves a mix of interesting facts, snippets and stories about the topic, in this case a show cave. The range of topics talked about generally includes:

- speleothems;
- history as a tourist cave;
- development of facilities; and
- management

This type of tour generally evolves from the new guide following a guide who has been at the site for some time with the new guide learning information off the more experienced guide. While guides might be told to 'develop their own tour' the realities of busy schedules and limited training and time to develop tours makes for the style of tour described above. Once a guide has found something that works for them, they are unlikely to alter it.

This is interpretation that 'proceeds without focus or direction, as it were trying to say everything and nothing at the same time' (Ham, 1992)

What makes thematic interpretation different? Instead of going into a cave and saying everything that you know about it, you develop a theme (and eventually several of them).

When people think of themes in relation to caves they often think of topics like history, cave decorations, glaciers, water or cave fauna. In thematic interpretation terms, these are topics not themes, but great themes can be developed from these topics.

An interpretive theme is expressed in a whole sentence. It has a subject, verb and full-stop. It is the point that you want to make about the cave. It's the 'so what, the main idea, the 'big picture'.

In considering the topic 'water' from the above list, there is an endless array of information that could be incorporated into a cave tour. Technical details and interesting words such as phreatic, vadose, aquifers and conduits can be shared with visitors. But what will actually conveyed to the visitor?

However, if you develop a theme to communicate an idea about the cave to your visitors you will have a whole idea to develop your tour around. So, the topic of water could become:

Water is the artist at work in Marakoopa Cave,

or

Water is the life of the cave.

Likewise other topics in the above list can be developed into powerful and memorable themes such as:

History:

You can be a detective trying to answer questions about what you see in Blanch Cave.

Cave decorations:

Within this cave you will discover some of nature's oldest masterpieces.

Cave fauna:

Hidden amongst the spectacular are the caves secret citizens.

The topic is the subject matter, while the interpretive theme is the message you want to convey to your audience.

With a little effort, themes allow guides and managers to unlock their creativity and have a varied number of tours. The same things won't be said on every tour. While some information can be used for more than one theme, information can be left out if it doesn't support the theme. Visitors are in for a new tour, rather than hear one they've heard before.

While interesting, amazing and mind-blowing facts are easily forgotten, a strong theme will be remembered long after the facts that support it are forgotten.

However, themes don't just happen. They require thought, preparation and creative energy which mean that guides need access to training, resources, paid time to develop their

tours and, perhaps most of all, encouragement to develop thematic tours rather than just repeat the tour they usually give.

As with any interpretation, the development of themes need to consider not just what the mission of the cave reserve mangers is, but what visitors are interested in. How much do we know about what visitors want and how much do we attempt to accommodate this when developing tours.

In his paper at Conference No 11, Hamilton-Smith presented the idea that 'the tour program should offer a menu of options—defined and explained just as in a good restaurant menu.' This is rarely done with cave experiences and where it is it is the logistics of the tour like time, steps to climb, admission prices or cave features are noted. If a range of interpretive themes were developed for a particular cave, then the tour program, and cave promotional material such as the internet, could reflect this and visitors could choose a theme which inspired their interest.

While creating variety presents challenges to managers and guides, the rewards are more meaningful cave experiences for visitors and more satisfying and varied options for those who present cave tours.

This presentation preceded a workshop on thematic interpretation which 24 people attended. The participants organised themselves into five groups and each group chose a cave to work with.

The groups then wrote a list of general topics that could be talked about during a tour of that cave. Related topics were then grouped together and a single topic area was selected. The groups then developed an interpretive theme for their selected topic area. Hence, a lot of the topics were disregarded. Having an interpretive theme means that you can immediately leave out material that does not help to communicate that theme.

The groups were asked to write their interpretive themes down so that they were very clear about what their theme was.

The interpretive themes that were developed were:

Water links all the other parts of cave development together.

Walking through an ancient sand dune will blow you away.

Travelling under a galaxy of glowworms is like a journey under the night sky.

Water carves caves in many ways.

Our cave is a gallery of sculptural forms using many tools.

If bats start to disappear from an area you can be sure that something either has—or is about to—go very wrong!

The groups then listed the five or fewer main ideas that they would use to develop their theme on a tour in the selected cave. Why five or fewer main ideas? Ham quote Miller (1956) that human are capable of making sense of 7, plus or minus 2, new and separate ideas at a time. Therefore, as soon as more than five main ideas are introduced some of the audience will be left behind. Once left behind, they will lose attention and switch off.

The five main ideas that the workshop groups developed to support their themes are in the appendix.

In summary, while cave presentations both in Australia and many overseas countries generally follow a similar pattern, there are alternatives available. Firstly, there are a range of possibilities besides the guided tour. Secondly, the use of thematic interpretation means that a variety of tour messages can be developed. The use of interpretive themes means that guides will be talking about different things, and a guide working in just one cave, can have a range of interpretive presentations. There's no reason at all for visitors to feel like 'you've seen one cave, you've seen them all.'

References

Ham, Sam H, *Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets*, 1992.

Hamilton-Smith, E, *Interpretation: Past and Future*, Australasian Cave and Karst Management Association, Conference 11, Tasmania, 1995

Buchan Caves: Workshop on thematic interpretation

Group1:

General topics for cave tour:

- Bones
- Water
- Limestone
- History
- Flora

Theme developed from these topics:

Water links all the other parts of cave development together.

Five or fewer main ideas to support the theme:

1. Ocean (water) created limestone through:
    - Coral polyps
    - Shells
    - Mud (water and dirt)
2. Rain (water) falls through the sky collecting carbon dioxide, then seeps through the soil collecting more…
3. Streamways conduct water thought the cracks and cave passages, e.g.:
    - Meandering passage
    - Scallops
    - Gravels
    - Channels in-cuts
4. Dripping water deposits calcite in many water-like forms, e.g. flow-stone, Frozen Niagara, The Rapids.

Group 2

General topics for cave tour:

- Sand dune
- Water

Theme developed from these topics:

Walking through an ancient sand dune will blow you away.

Five or fewer main ideas to support the theme:

1. Consistency of rock is sand (touch example).
2. Water, wind, sea level changes (use of prop to show water movement through sand and cementing to form limestone).
3. Water flow through dunes and limestone forms caves (white ant building house analogy).
4. Fossils in limestone and layering (sand dunes layers, shells etc).
5. Re-formation of sand beds in cave where stream.

Group 3

General topics for cave tour:

- Glow-worms and darkness
- Glow-worms and habitat
- Glow-worms and water
- Glow-worms and food
- Glow-worms and cultural history

Theme developed from these topics:

Travelling under a galaxy of glow-worms is like a journey under the night sky.

Five or fewer main ideas to support the theme:

1. Culture
2. Habitat and lifestyle
3. Food and fishing
4. Changing times (life cycle)
5. Environmental protection

Group 4

General topics for cave tour:

- Scallops—flow: how fast and direction.
- Whirlpools—flow patterns, time, tool (millstone)
- Solution tubes—structural cracks in materials
- Stylolites
- Pendants

Themes developed from these topics:

Water carves caves in many ways. Our cave is a gallery of sculptural forms using many tools.

Five or fewer main ideas to support the theme:

1. Materials—Types of rocks. Structural elements.
2. Tools—Chemistry, abrasives (gravels and stones), time, bats.
3. Somewhat sensory—sculpture, sound.
4. Active and passive—sculptor looking for opportunities, viewer looking at results.

Group 5

General topic for cave tour:

- Bats

Theme developed from this topic:

If bats start to disappear from an area you can be sure that something either has—or is about to—go very wrong!

Five or fewer main ideas to support the theme:

1. There are many species of bats and two main groups of bats (big and small).
2. Insectivorous bats maintain a natural balance.
3. Without the large bats native forest would decrease, causing a chain of linked extinctions.
4. Threats to bats include clearing, disturbance, illegal shooting, chemicals and aerial spraying.
5. Bats are not blind and don't get stuck in your hair.

Workshop summary: responding to change in cave management

Steve Bourne, Elery Hamilton-Smith and Andy Spate

Many feel the quality of cave management is falling; we found ourselves in a number of informal discussions on exactly this at the recent Australian Speleological Federation Conference in Mount Gambier. When the broader context is examined, it is not just caves, but parks in general, even at the highest level of World Heritage. Presumably, World Heritage sites should be the best managed, as the sites with outstanding universal values to be showcased to the world. A National Geographic survey of 415 World Heritage sites, undertaken by over 400 independent, suitably qualified people, found the standard of management across these sites had declined significantly since 2004. Identified causes for this decline were mass tourism, inappropriate tourism products and commercial and industrial development. There is a strong conflict between tourism and heritage management on one hand and a focus on economic return on the other.

The discussion raised a number of specific issues relating to cave management in Australasia

- Funding, and in particular, funding mechanisms; funding is usually dispensed on an annual basis with little chance of carryover into the next financial year. Long-term plans are difficult if not impossible to implement with current arrangements so we are failing to encourage a holistic management approach.
- Leadership - political aspirations influence direction, with this influence flowing through to administration.
- Training - training of staff to enable them to deliver professional customer service has, like all education in Australia, suffered in quality and availability.
- Communication - clear lines of communication are not always maintained.
- Directions of government - in some cases the environment is now low on the political agenda, and is being overshadowed by industries such as logging and mining.
- Geodiversity is low on the political agenda - environmental concerns are dominated by biodiversity and failure to recognise the importance of geological heritage in holistic landscape management.
- Public versus contracted management or private ownership

Some successes in cave management in Australasia

- Some valuable trans-boundary cooperation – e.g. Alpine Parks Committee in Victoria, NSW and ACT, including development of indigenous involvement and the legal authority across SA and WA border.
- The increase of the Department of Conservation budget in NZ to $380M has lifted the value of the environment.
- Community input is being achieved in several areas in a variety of forms, including Friends groups, stakeholder committees
- Increasing awareness of the environment through interpretation although difficult to measure effectiveness. However many areas are using a "grass roots" approach, focussing on a educational approach with clear environmental messages e.g. Wee Jasper
- Controlling development in catchment areas eg Waitomo, Tasmania
- Training successes- Jenolan Caves has industry accredited training through TAFE; WA sharing training across three agencies
- Redevelopment of caves in recent times- eg Temple of Baal, Nettle Caves (Jenolan) Ruakuri Cave (Waitomo), Wollondilly Cave (Wombeyan), South Glory Cave (Yarrongobilly) with others in planning phase, eg Jewel Cave (Augusta Margaret River), Orient and River Caves (Jenolan)

It was noted that Australasia is still leading the way in cave management, but we recognise and share with some excellent overseas examples;

Skocjan Caves in Slovenia and Carlsbad Caverns in US.

The issues raised can be summarised into three areas;

- Governance - Australia has three tiers of government, but governance – "the art of working out the best way to manage things", is lacking. Governments work in political term cycles and a lack of continuity reduces effectiveness.
- Holism and openness - a lack of clear direction and understanding of principles. A lack of finance and support.
- Ambiguities of roles – many conservation agencies have been forced to raise much of the costs of protection and conservation through tourism development, and often suffer in quality of both resource management and visitor experience.

A theoretical commentary from Elery:

This is very much a personal perspective growing out of my professional experience on policy analysis and development – don't blame Steve or Andy for it!

The political environment of modern western countries has come to be dominated by a set of ideas generally known as the Neo-Liberalist hegemony. This has a significant influence on conservation policies and we are only just learning to develop an effective response to it.

It all developed at the time when, soon after becoming prime minister, Margaret Thatcher said,

> *"We must recognise that the world is changing. There is no such thing as society. There is only people and they are either winners or losers"*

If there is no such thing as society, this makes government pretty redundant. Governments have moved to increasingly fragmented decision-making and petty regulation. To quote Zygmunt Bauman, relying upon government "is like taking a flight from Paris to New York, and half way across the Atlantic, discovering there is nobody in the cabin up front"

So, social capital and social responsibility is being subsumed into an individualised society, managed by a market-based economy; public responsibility, e.g. environmental management, is increasingly being transferred to the private sector. Having an individualised (Thatcherite) society means that it is up to individuals to ensure they become winners rather than losers

So: the gap between rich and poor is widening

Even the winners are out on their own, particularly if anything goes wrong, so

> *There is great concern about risk. Risk Management is now the world's biggest industry …*
>
> *It is not just about excessive and often ridiculous over-regulation but "it now includes all the bureaucrats who must spend their lives filling files with evidence that neither they, their organisation nor their political masters can ever be held responsible for anything" (Ulrich Beck)*

So, the bad news is that the common good of our parks and other aspects of our environment is suffering from our economically fundamentalist, risk-obsessed and often-inept governments who fight for the next election but not the next generation.

The good news is that . . .

- The private sector is now accepting and turning to a much greater sense of social responsibility, and
- The community sector can develop, and is increasingly developing, skills in governance, and from that are able to move back to genuine quality of management

Conclusion

Despite the issues raised, it is clear that individuals can make significant impacts. This may be at a local or site level, a regional level or at a political level. The long-term sustainability of Australasia's cave and karst will be determined by the impact of these willing individuals and their abilities combined for more effective management. Development of this capacity is a key role that ACKMA can and often does play.

(if anyone wants to read more widely about the issues raised here, particularly the nature and influence of Neo-liberalism, Elery can provide an annotated bibliography)

Abstracts only

The Archaeological Significance of Buchan Caves

Josephine Flood

The limestone caves of Buchan have proved highly significant in revealing both past culture and environment in south-eastern Australia. Rich faunal deposits have been excavated by Norman Wakefield at Pyramids Cave, Josephine Flood and Jeannette Hope at Cloggs Cave and Paul Ossa at New Guinea II. These provide a consistent, dated sequence of fauna spanning the last thirty millennia. Cloggs Cave is of particular importance in the debate about the extinction of megafauna in Australia for its lowest layer contains a mandible of the extinct short-faced kangaroo *Sthenurus orientalis*, dated to 21,700 +1250/ -1050 BP (ANU- 1220).(NB this is a revision of the previously published radiocarbon age). This is one of only three firmly dated 'late' occurrences of megafauna in Australia. Rock art is extremely rare in Victoria but Buchan caves contain two examples, macaroni-style engravings in New Guinea II and a painting at Cloggs Cave (analysis of pigment from the latter show it is natural pigment mixed with animal fat and therefore of Aboriginal, not modern origin). Prehistoric artefacts have also been found in several caves in the Buchan region (those excavated by Flood, Ossa and by the late Alexander Gallus (in East Buchan II) are now in the National Museum of Victoria in Melbourne). Twenty millennia ago Cloggs Cave and New Guinea II were occupied by hunter-gatherers, using stone and bone tools to manufacture wooden artefacts and skin cloaks. The oldest human occupation yet discovered dates to about 21,000 years at New Guinea II, a similar antiquity to the oldest artefacts excavated by Flood in the small, granite rock-shelter of Birrigai in the ACT. This indicated human presence at least on the fringes of the Snowy Mountains at the height of the last ice age. Aboriginal people have lived in the region continuously ever since, as much younger tool types attest in Cloggs Cave, New Guinea II and EB II.

These findings show the tremendous potential cultural and scientific significance of even small, unprepossessing caves and rock-shelters, and there is a need for much further research to be carried out in southeastern Australia. Regarding site protection, none of these caves or rock-shelters are suitable for public entry and metal grilles and padlocked gates are in place at most of them, but they do need regular monitoring by site managers to prevent damage from burrowing animals etc. Informative interpretive panels would also aid public education and understanding and the cause of Aboriginal reconciliation. I would be happy to provide the content for roadside signs in the region of New Guinea II and the Lower Snowy River open air campsites (near the NSW-Vic border) and for Cloggs Cave near the bridge from where the cave is visible.

Linaker landscape

John Hawker

The Buchan Caves Reserve is more than just limestone caves. The Reserve is greatly admired and valued for the impressive collection of exotic trees planted along Spring Creek Valley in amongst the indigenous Yellow Box, Manna Gum, and Blackwood and on the hillsides, the rare Buchan Blue Wattle. In 1929 Hugh Linaker prepared a landscape plan for the Reserve, providing a planting list, sketch of the avenue trees, and a rustic shade house. His plan showed predominantly exotic trees although natives were not excluded and included eucalypts, she-oaks and wattles. While the colourful deciduous trees have become a major tourist feature in autumn, the planting also includes many fine conifers; pines, cypress and redwoods. Linaker, born in Ballarat on 4 June 1872, was one of nine children. At the age of 14, he was apprenticed as a gardener to the Ballarat Gardens. After 14 years at Ballarat, he was awarded the post of curator of the Ararat Gardens out of 96 applicants. He held this position from 1901 to 1912, when he became Landscape Gardener at Mont Park Hospital for the Insane. Around 1933 he was appointed State Superintendent of Parks and Gardens. During his career Linaker was responsible from 1912 for the design and maintenance of the grounds of all mental hospitals in the State. He was also involved in the design of the grounds to the Shrine of Remembrance in 1933, the Yarra Boulevard beautification scheme Yarra Bend National Park and Mount Buffalo National Park. Linaker's advice was sought by many country municipalities for the planning of public parks and gardens including Ararat Botanic Gardens (Alexandra Gardens),

Alexandra Park, Stawell, Herbert Gardens, Box Hill, Princes Park, Maryborough, and the Pioneer Women's Memorial in the Domain. He planned the plantations for the model township of Yallourn and the Road Plantations on Geelong Road. He advised also on the gardens at Stonnington, Malvern, Carn Brea, Hawthorn and at Burnham Beeches, Kallista. In 1938 Linaker prepared a plan for the draining of Lake Augusta (now the sunken oval) at Castlemaine. Linaker was a frequent lecturer and an inaugural member of the Victorian Tree Planters Association formed in 1926. Hugh Linaker died on 10 October 1938 at the age of 66. Linaker is regarded by many as the leading landscape gardener of his generation in Victoria, and in one sense was a successor to William Guilfoyle.

Lighting for Darkness

Neil Kell & Andy Spate

Within the darkness of a cave – any light will have a dramatic affect. The issue is – how can we utilise this contrast between the natural environment of cave darkness and the introduction of artificial lighting technology? How much should be lit? And, further, how this can be done with minimal impact on the cave both in the short and long term? This presentation addresses some of the issues confronting those who light caves for public viewing including such issues as *lighting for access*, *lighting for atmosphere* and *lighting for protection* of the cave resource. It deals with practical philosophies for cave lighting emphasising sensible and low(er) cost approaches.

High intensity LED lighting

David Head

This Powerpoint presentation deals with high intensity LED lights being developed by Weidmuller Pty Ltd. It describes their properties and demonstrates a variety of LED fittings manufactured for cave use in Australia. Some of these have been used at Jenolan and Wombeyan caves and their use is being considered at other cave sites in Australia and South Korea. Examples of their use will be shown in the presentation during the Cave Lighting Workshop.

Karst environments in New South Wales: issues, directions and unevaluated karst values

Stephen Reilly & Russell Commins

Within New South Wales there are approximately 430 deposits of limestone or dolomite, most being less than 2 square kilometres in outcrop extent. About 100 of these deposits are cavernous and could be described as karst environments. Other deposits show little evidence of karstification on surface exposures but may contain significant groundwater dependant ecosystems (GDEs) or buried palaeokarst features, however this has not been assessed. There are also a small number of pseudokarst features of various origins. Although many of the largest and significant karst environments are contained within reserves, two thirds of NSW karst environments are located in privately owned land. Significant research and assessment of karst in NSW has been undertaken including a comprehensive database of caves developed by the Australian Speleological Federation, an NGO. Many of these studies are confined to a limited number of recognised karst sites or features. Numerous locations lack documented assessment of key karst values. An accurate state GIS karst layer that maps karst environments, key features, catchments, tenure and threatening processes has yet to be developed. The need for urgent further documentation of NSW's karst environments is supported by existing findings that indicate some of NSW's karsts are the most complexly evolved yet found and contain a high diversity of cave invertebrates with a high degree of endemism. Recent research confirms some caves at Jenolan Caves are 335 million years old, making them the world's oldest known enterable caves. To improve karst conservation outcomes in NSW there is a need to clarify, prioritise and address karst

issues and threatening processes. There is a need to undertake research and documentation of many karst environments, compiling the information in a GIS/database of NSW karst that may be utilised by state agencies and local governments who are involved in land use management and planning for private and public land. With many karsts located on private land there is a need to enlist owners in partnerships towards karst conservation through the provision of advice, conservation agreements and funding of conservation works. Some key karst environments would benefit if acquired into the state reservations system. In recognition of the importance of karst environments the State government has recently legislated to form a state Karst Management Advisory Committee (KMAC) and resourced a Karst Conservation Unit (KCU) within the Department of Environment and Conservation. KMAC has a strategic planning and advisory role, advising to the Government through the National Parks Advisory Committee. The KCU has been functional since July 2006 and has developed a work plan and is undertaking a range of projects in line with identified priorities. Only recently formed KMAC will to contribute advice and direction to the KCU. Current projects of the KCU are discussed along with some karst issues identified at a forum of karst managers and researchers held in March 2006.

Umphy and The Man

Ian Lewis

Umpherston's Cave is a prominent cenote in an attractive park on the approaches to Mt Gambier in the Limestone Coast of South Australia. Entry is free and visitors walking across the park are very surprised to see terraces of hydrangeas, lush curtains of ivy, two tall palm trees, possums, barbeques and a waterfall within the sinkhole. There are a number of important reasons behind this European presentation of a unique Australian natural geo-feature. Close to the site of the first settlement of the city in the 1830s, the cenote (and its hidden twin nearby) were initially part of the prosperous property of a prominent and innovative local farmer, James Umpherston, who in the 1880s decided to beautify it along the lines of an imperial garden with a dinghy on its sizeable lake. By the 1960s all this had been completely buried by industrial rubbish from the Forest Operations Mill which had taken over the old farm. The mill's Regional Administrator, Ken Norton, decided to clean and restore it. He led and motivated the large mill's Social Club for almost 20 years, sometimes in direct conflict with his employers and using company plant and equipment whenever they could get it to haul and clean out the cenote. The unexpected discovery of the original lost garden terraces at the bottom was a highlight. An enthusiastic, redoubtable and strongly ethical man, Ken had to deal determinedly with the mill politics and management issues generated by the staff involvement. Since the cenote was restored, Ken has devoted the last 18 years full-time since his retirement to maintaining and beautifying the park and gardens as a tribute to the forestry workers and for the greater community, for which he was recently awarded an OAM. He has now turned his energy to the hidden twin sinkhole….

Karst and pseudo-karst in Victoria: an overview

Dr Susan White

This paper will give an overview of the many caves and related landforms known in Victoria. Some are true karst but others are volcanic caves and pseudokarst. These features have scientific, recreation, aesthetic, conservation and education values and are an important part of the state's heritage. The karst and pseudokarst features are the result of the following natural processes: solution, precipitation, volcanism, weathering, piping, and wave action. Some karst is buried under the volcanic flows of western Victoria. Solution and precipitation, primarily of carbonate rocks is the single largest group. These fall into two main groups at widely separated in geological time: karst in the Palaeozoic limestones, mainly in the eastern part of the state, and that in Cainozoic limestones which are found from East Gippsland to the South Australian border. The next largest group is the volcanic caves of the Western District Volcanic Province which have a wide range of features, many of national and international geological significance. Significant features are found in a range of other rock types including granitic rocks, quartz sandstones and silcrete.

Celebrating Planet Earth: UNESCO Assisted GEOPARKS in the Australasian-Pacific Region

Joanne McKnight[1], Susan Turner[2] & Dr Susan White[3]

[1]Chair, Volcanoes Discovery Trail Committee [2]Convenor, Australasia-Pacific Geoparks Network
[3]Convenor Standing Committee on Geological Heritage, Geological Society of Australia

The recent initiative by UNESCO to establish a worldwide Network of Global Geoparks has important implications for Australia, especially western Victoria and southeastern SA. The Geological Society of Australia and various state government departments have been documenting geological sites of conservation and heritage value for over 30 years. The Geopark Network aims to promote geological sites for geotourism, education and research. The Geopark model most likely to be effective in Australia is a 'grass-roots' approach where local communities in conjunction with different levels of government take responsibility for their own region. Comparison with some of the European Geoparks Network provides useful examples. An informal network of people interested in forming Geoparks in Australia and the South Pacific has been formed. A formal application for a Global Geopark is currently underway for the region known as the Kanawinka Geopark, extending across the South Australian and Victorian borders. This Geopark is concerned predominantly with the volcanic landscapes of the Western District Volcanic Province and its geological context. This presentation will outline aspects of the proposed Kanawinka Geopark. The area proposed, extends from Colac and Red Rock to the coast of South Australia past Millicent and north to Nigretta and Wannon Falls and the base of the Grampians. This area has significant volcanic caves and associated karst areas and is of interest to both CEGSA and VSA. Since 1998 the local government bodies of this region commenced operation of the Volcanoes Discovery Trail Committee to promote the region and link geology with tourism. Important aspects of Geoparks are the links between the geology and the people, their stories, culture and history that build into a sustainable source of geotourism, bring jobs to rural and indigenous people and in turn help protect sites of importance and promote geoheritage complementing the work of the interested non government and government organisations.

From bones to beetles: Tasmanian caves as biological repositories

Arthur Clarke & Nic Haygarth

Prior to their attraction as tourist visitor destinations, caves were heralded as sites for biological study. Although the allure of glow-worms in Tasmanian caves has captured the imagination of many observers and scientists alike, most of the early biological interest in caves centred on the study of bone deposits. In the early 1840s, during the infancy of organised structures for natural science in Tasmania, naturalists and scientists were encouraged to look at the bottom of caves for bones. An initial fervour of activity occurred in the mid-1840s, with the discovery of bone deposits in caves on the eastern bank of the Tamar River, in northern Tasmania. Some twenty years later – with the encouragement of Professor Owen – Messrs Whintle, Allport, Krefft and other members of the Hobart-based Royal Society of Tasmania unearthed extant and extinct mammalian species from "ossiferous deposits" in caves west of the Derwent River, just north of Hobart. In the early 1880s, the searches for mammalian skeletal remains in caves at Mole Creek lead to the discovery and description of the first Tasmanian cave invertebrate: the Tasmanian Cave Spider. Although interest in the bone deposits of Tasmanian caves continued well into the 1900s, the focus of cave biology studies had broadened to encompass the range of invertebrates, including extinct species collected as bedrock fossils in caves and/ or the surrounding limestone. From around the turn of the 20th Century, the study of living species in Tasmanian caves included the first collections of cave crickets, harvestmen and other cave dwelling spiders, together with an on-going interest in the taxonomy of the Tasmanian Cave Spider and cave dwelling glow-worms. In 1910, a cave at Ida Bay in southern Tasmania yielded several new species, giving rise to description of the first cave adapted beetle from Australia.

From 44 gallon drums and cavers to concrete, 'caissons' and engineers – creating an entrance shaft into Ruakuri Cave, Waitomo, New Zealand

John Ash

Setting: Ruakuri Cave is situated at Waitomo Caves, New Zealand. It is a 5 km plus network of large vadose river canyons and smaller phreatic passages cut through a fault-bounded block of Oligocene Otorohanga Limestone. The system has three main levels of passages, two dry entrances, three walk-climb in stream entrances, two abseil shafts, one siphon, one excavated entrance, two possible digs and three reasonable question marks.

History: In 1904 tours accessed the cave via a sloping rock debris pile leading down into a wide passageway at the base of a 60m high cliff face. Over the last 4-500 years New Zealand native Maori had used this entrance, and higher openings in the cliff face, as a *waahi tapu* or burial site. In 1906, after paying compensation to the tour pioneer, James Holden, the government took over the operation. On Waitangi Day, February 7, 1988, the cave was closed to dry tours as a result of a land dispute between descendants of James Holden and the government operator at the time, the Tourist Hotel Corporation (at that stage THC also operated the Glowworm Cave and Aranui Cave). Subsequent cultural issues ensured that the *waahi tapu* entrance would not re-open. The dry tours ceased to operate. For the next 17 and a half years the Holden family investigated alternative means of accessing the cave. These included: 1989-1992: Consulting with the Department of Conservation and Maori elders (*kaumatua*) for a culturally acceptable means of re-opening the traditional entrance. This negotiation was finally abandoned. 1993-4: Tunneling into the upstream section of the cave and creating a boat ride to link up with cantilevered walkways that would connect with the old tour route. This initiative stimulated competing activity from a neighbouring landowner. Eventually it resulted in the Holden's purchase of 5 acres of adjoining land, thereby ensuring the protection of this section of the cave. 1994: Enlarging the stream entrance used by Black Water Rafting adventure tours. A few quick cash-flow calculations ensured that the wetsuit-clad, cave rafters were left in peace. 1995-2000: Engaging a developer to obtain relevant Resource Consents and to investigate excavating and enlarging the Rimrock extension – a passage that was extended, explored and mapped, with the assistance Black Water Rafting guides, in 1996-7. The extremity of this passage was connected to the surface by drilling from a ground survey point. Further investigations involved a baseline report on the cave climate, trials with a 40,000 psi rock-cutting water blaster and consulting with underground pipe-thrusting experts and theme park ride designers. In the final analysis the term "open cheque book engineering" was coined. The developer went into voluntary receivership. 2000-2003: Forming a new partnership with APR, one of the consulting companies involved in obtaining the Resource Consents, and The Legendary Black Water Rafting Co. (BWR). This partnership acquired the assets of the former developer, which included the consents and ten 2.4m by 2m concrete sewer pipes. Focus now shifted from the Rimrock passage to the Drum entrance, which had been excavated by recreational cavers and lined with 44 gallon drums in 1968. It was situated about 80m north of the previous site, just within the Ruakuri Bush Scenic Reserve administered by the Department of Conservation (DOC).

Engineering: Because this section of cave lay under crown land administered by DOC, a concession needed to be applied for and a new set of conditions added to those in the original Resource Consent. The developers now had to monitor: the cave climate for: • air flow • temperature • humidity • carbon dioxide and • volatile organic compounds • vibration and speleothem damage • stream sediment loads • air and water pollution • cave sediment excavations • cave biota and • energy inputs. Limits of acceptable change were established and standards were set for all earth and engineering works. Engineering designs evolved - from simply enlarging and shotcreting the existing Drum entrance, to sheet-piling a cylinder directly at the entrance, to sinking a caisson offset from the entrance and tunneling into the cave. The approach depended on how much geotechnical information one was prepared to collect, engineering expertise and creativity, tenacity and the size of one's cheque book. In 2003, Tourism Holdings Ltd (THL), who operate the Glowworm Cave and Aranui Cave, made an offer to purchase the Ruakuri development as well as the Legendary Black Water Rafting Co. At the time THL were New Zealand's largest tourism operator; they had the capital backing and the move

made strategic sense. Back to a three cave operation. Extra geotechnical drilling was carried out and the nature of the fault line on which the Drum entrance was situated was evaluated. It was then decided to proceed with an excavation off-set from the present cave access and connect this to the entrance chamber by a tunnel. Contracts were let to construct a top-down caisson that would be shotcreted to a wall thickness of 300mm. Geotechnical cloth and plastic drainage grid would be installed around the perimeter of the structure to maintain the hydrological integrity of the host ground. Detailed surveying was carried out to calculate the final baseline of the excavation and the orientation of the inter-connecting tunnel. This information was critical if speleothem damage within the first chamber was to be avoided or minimised. The inter-connecting tunnel was to be formed by pipethrusting the ten surplus 2.4m diameter sewer pipes from the floor of the caisson directly into the cave. It would pass beneath the original 44 gallon drum entrance. Consent parameters were continually monitored and temporary 'airlock' doors were installed in the pipe tunnel prior to breakthrough into the cave. Once access to the cave proper had been achieved, in-fill sediments in the Drum passage were hand excavated and removed by wheelbarrow, skip and crane. Sediment floors and banks were channel sampled for later analysis. Buried, broken speleothems were also marked and collected for later study. Steel formwork was then attached to the walls of the entrance cylinder in preparation for the pouring of a 150 metre, 1 in 10, spiral concrete access ramp. Power supply cables were readied for feeding into the cave before the entire structure was roofed over. 'Airlock' doors were installed in the entrance and exit openings to the caisson as well as in both ends of the inter-connecting tunnel and a water 'shower' established – dripping from the roof onto a large piece of karren in the centre of the floor. The latter feature gave some degree of control over the humidity and temperature of the air in the entrance cylinder. The finishing touches involved theming the outside of the structure that protruded above ground level with gunite, to make it look like, and blend in with, surrounding karst outcrops - and burying, landscaping and planting the roof. Finally, on July 28, 2005, after addressing all of the stakeholders' needs and having staff swim 200 metres to work for eighteen months, dig out 300 tonnes of silt by hand, mix 1000 cubic metres of concrete and lose 10 kilograms in weight each, a 17 and a half year project reached a successful conclusion. Ruakuri Cave re-entered the tourist arena as an innovative 1.2 km long, dry, wheelchair accessible journey.

Ruakuri walkways – practical cave engineering

Van Watson

Recreational Cavers started an adventure caving business in a 'Tourist Cave'. Much later on they got to design and fit a new 'Tourist Cave Tour' into that cave. This is what happened.

Ruakuri cave – guiding the product

Van Watson & Angus Stubbs

What we knew then? How guides came into the BWR/ Ruakuri fold, where they got their passion for caves and how BWR moulded its guiding style. What we did. How we perceived the Ruakuri product could be guided, trials and training and how we started guiding the product. Modifying how physical constraints, Client expectations and Guiding X factors change how the trip runs. The future – How do we tap into a guide's passion for their profession and consistently deliver a quality, memorable product.

The story of SPAET Cave, British Colombia, Canada

Paul Griffiths & Carol Ramsey

SPAET Cave was a karst cave located on privately owned land near Victoria, the capital city of the Province of British Columbia. Beyond its natural attributes, the small cave had considerable historical, cultural, aesthetic, scientific and educational value. In particular, elders and other informed members of local First Nations had articulated the spiritual value and cultural meaning of the cave site. SPAET

Cave was ultimately destroyed by land development activities authorised by government entities, seriously harming British Columbia's evolving reputation for cave conservation and environmental stewardship. While primary forestry activities in British Columbia may no longer pose as great a threat to cave and karst resources as they once did, population growth and urban sprawl have placed SPAET Cave and other caves on privately owned lands in the Greater Victoria area at risk from land development activities. The SPAET Cave site came into conflict with a $5 billion development project described as the largest of its kind in British Columbia, with two major hotels, two golf courses and plans for 5,500 homes.

This paper examines the application of existing legislation, regulations, policies and practice guidelines in the case of SPAET Cave. There are currently no provisions in provincial legislation to require protection or special management for caves on privately owned lands in British Columbia, except by special circumstance. BC also has a comprehensive set of voluntary best practice guidelines for urban and rural land development. These guidelines recognise caves as environmentally valuable and sensitive resources. The story of SPAET Cave will illustrate why private land developers in British Columbia cannot always be relied upon to automatically or voluntarily protect and conserve valuable and sensitive caves or karst resources. While the story of SPAET Cave is not exactly a new one for British Columbia, it is hoped resolving the problems discussed in this paper will make it easier to avoid future cave losses

Škocjan Caves Park, Slovenia – Visions

Tomaž Zorman

Due to their exceptional significance, the Škocjan Caves were entered on UNESCO's list of natural and cultural world heritage sites in 1986. In 1999, the Caves were entered on the Ramsar Directory of Wetlands of International Importance as the first European Ramsar site in accordance with the guidelines for the designation of underground wetlands. In October 2004, the Škocjan Caves Park was included in the world network of biosphere reserves MAB – "Man and the Biosphere" as the "Karst Biosphere Reserve"; all of this was under the auspices of UNESCO. By 2004, there were only 19 locations in the world, including the Park, that participated in all three of the above mentioned programmes. The Park is also part of the European network, Natura 2000, which is aimed at the conservation of areas of internationally important animal and plant species and natural habitats. The protected area of the Park covers 413 hectares and encompasses three villages, Matavun, Škocjan and Betanja, with a total of 67 inhabitants. The area of influence of the Škocjan Caves Park covers about 45,000 hectares and includes the entire Reka River watershed. The Škocjan Caves Public Service Agency, established by a Decision of the Government of the Republic of Slovenia, began to operate in 1997. The highest body of the Park is the Agency's Council which comprises the representatives of various ministries, local community and the Slovenian National Commission for UNESCO. Since its establishment, the Park has been fostering exemplary co-operation with local inhabitants in the area of natural and cultural heritage protection, cultural heritage renovation and organisation of various activities. Biodiversity in the Park is an important and valuable feature. It represents unique evidence of the Earth's history and geological development in the area as well as enabling the preservation of data in the genetic code of all rare and endangered animal and plant species while shaping the history of the area and its inhabitants. This enables an original approach to environmental education. Special attention is paid to young people with far-reaching goals such as building awareness of nature and the problems of social activities in such areas as economy and politics, education for tolerance and respect, responsible action and use of knowledge. The Park's management carries out work programmes in accordance with the Programme for Protection and Development of the Škocjan Caves Park (a management plan) as well as professionally and responsibly managing our natural and cultural heritage.

Karst issues in an hydro-electric power proposal: Iralalaro-Paitchau karst, Timor-Leste

Susan White[1], Greg Middleton[2] & Nicholas White[3]

[1] Latrobe University Environmental Geoscience, & Victorian Speleological Association [2] Sydney Speleological Society, & Southern Tasmanian Caverneers. [3] Australian Speleological Federation Conservation Commission, & Victorian Speleological Association

The proposed Iralalaro hydro-electric scheme in far eastern Timor-Leste would divert water from the Irasiquero River upstream of the Mainina sinkhole to a tunnel through the Paitchau Mountains leading to a power station on the coast. The Iralalaro-Paitchau Mountains area is a karst region, containing a wide range of karst-related landforms and features. These include a large polje, collapse dolines, sinkholes, blind valleys, karren, caves and springs. A substantial component of the hydrology is underground and the area relies on underground water for almost all of its water supplies. The area has significant surface and underground geodiversity and biodiversity. The proposal, as currently formulated, appears to have a number of significant limitations which, unless adequately addressed, could cause significant cost overruns and/or seriously undermine the scheme's viability. Estimates of the construction costs appear to have underestimated the risks and costs of drilling, tunnelling and de-watering the karstic terrain, and as a result are inadequate. Understanding of the relationship between the lake and the watertable is inadequate, as are stream flow records, with consequent implications for sustainable power generation from the scheme. The karst has not been subjected to a thorough and detailed study by experts in this specialised field, and the implications of the karstic nature of the terrain appear to have been poorly understood. A full investigation of the hydrology, caves and karst features of the region is essential. The proposed hydro scheme is incompatible with the maintenance of many of the natural and cultural values which give the area its special significance and ecotourism potential. It jeopardises proposals to provide protection to the special environmental values of the area and could damage precisely the features most likely to attract adventure tourists, putting at risk the development of tourism in the region. The people living in the environs of the proposed scheme appear ambivalent about the possible benefits. A lowered regional watertable may affect the entire population and agricultural production east of Los Palos. The existing proposal inadequately addresses the problems of the very limited infrastructure in the area. There are serious questions as to the ability of the proposed scheme to provide the claimed electricity output on a continuing basis at the currently estimated costs and with the suggested low levels of environmental impact. Despite the serious inadequacies in the investigations and documentation there are indications that the Timor-Leste Government is likely to approve the scheme.

Poster presentation: Preliminary microclimate study of forested karst sinkholes, Nimpkish River area, northern Vancouver Island, British Columbia, Canada

T. R. Stokes[1], P. A. Griffiths[2] & Carol Ramsey[3]

[1]Terra Firma Geoscience, 1480 Sherwood Drive, Nanaimo, British Columbia, Canada, V9T 1G7
[2]Cave Management Services/KarstCare, 544 Springbok Road, Campbell River, BC, Canada, V9W 8A2
[3]Campbell River, British Columbia, Canada

A preliminary investigation into the microclimatic conditions of forested karst sinkholes was carried out in the Nimpkish River Area of northern Vancouver Island, British Columbia. The 'Karst Management Management Handbook for British Columbia (BC)' best practice guidelines indicates that some forested sinkholes on karst (particularly ones of larger dimensions) likely have their own microclimates, and thus possibly support ecologies with habitats for specific types of flora and fauna. Forestry companies who identify such features are advised to leave a two tree-length reserve area around such sinkholes, plus a surrounding management area if required for windthrow mitigation.

However, in reality little is known about the characteristics of forested sinkholes that generate microclimates in coastal British Columbia, and also what are likely forest stand conditions or attributes that define such a microclimate. Therefore the goals of this project were to firstly determine the nature of the sinkhole microclimates using near-ground air temperature as a proxy indicator for microclimate, and to secondly examine what characteristics of forested sinkholes (such as size, depth, and overall shape) govern their ability to generate a distinct microclimate. An additional goal was to assess how timber harvesting operations might affect sinkhole microclimates, and to determine whether simple field techniques could be developed to monitor these effects.

Two large sinkholes were selected for the study in the Nimpkish River area of northern Vancouver Island – one forested and one where the trees had been clearfelled up to the rim of the sinkhole. The forested sinkhole is approximately 30 m in diameter and 7-10 m deep and is located approximately 75 m from the edge of a clearcut. The 'logged' sinkhole has similar dimensions to the forested sinkhole and is located within a clearcut. Temperature data loggers (LogTag Recorders - Model TRIX-8) were deployed in an array in and around each of the three sinkholes.

Nine of these data loggers were used to monitor the air temperature at each sinkhole – four on the sinkhole rim as defined by the upper slope break (at the north, south, east and west cardinal directions); four on the midslopes (at the north, south, east and west cardinal directions) and one at the drainage focus of the sinkhole. A series of control sites were set up in the surrounding forested and clearcut areas. These data loggers were left in place and set to take measurements at intervals of every ¼ hour from June to December 2006. Three of the warmer days of the summer (June 28, 29 and 30, 2006) were initially chosen for detailed analysis to identify trends and patterns of air temperature changes. Preliminary analyses of the three-day period have indicated that air temperatures for the clearcut control site ranged from 0°C to 35°C, while the forested control site ranged from 4°C to 23°C during the same period. Temperatures at the drainage focus of the logged sinkhole ranged from 2°C to 24°C, while those at the drainage focus of the forested sinkhole ranged from 5°C -15°C. Temperature ranges for the rim and midslopes of the forested sinkhole were somewhat similar to the forested control site. However for the logged sinkhole, the rims had similar temperature ranges to the clearcut control site, while midslopes had slightly lower upper range values compared to the clearcut control site.

From these data it is apparent that the range of air temperatures in the drainage focus of the large forested sinkhole is much narrower than those of the forested control site. The drainage focus is in fact distinctly cooler (by 8°C) than the forested control site during the warmest time of the day (mid-afternoon), while it is slightly warmer (by 1°C) during the coolest times of the day (early morning). It can therefore be reasonably inferred that these temperature differences could lead to distinct microclimatic conditions at the drainage focus, possibly with increased potential for ground moisture

retention and higher ambient relative humidity. In addition to this, it can be speculated that this drainage focus could provide different habitat or ecological niches as compared to the surrounding forest. Interestingly, the air temperatures recorded at the midslopes and rims do not appear to be too dissimilar to the forested cover control site. This may require more investigation. A significantly greater range in temperatures is also apparent between drainage foci of the logged sinkhole and the forested sinkhole (2°C - 24°C and 5°C - 15°C, respectively). This difference provides some indication as to the level of disturbance that surrounding logging activities can have on the microclimates at the base of a sinkhole of this size and shape.

In conclusion, our preliminary findings show that large forested sinkholes do exhibit distinct microclimates that can be measured and defined to some extent using air temperature as a proxy indicator. A key outstanding question is how important is it to preserve these microclimates at the base of these sinkholes, and what size of tree buffer is most suitable or reasonable? It apparent that these sinkhole microclimates are likely important for certain specific fauna and flora, but are they are also probably essential for the karst hydrological and geomorphological functions and processes that occur within and around forested sinkholes. In the larger picture of karst management in coastal British Columbia, this research should be considered only as a first step in evaluating the impacts of forestry activities on forested sinkholes.

Temperature data loggers appear to be a reasonably inexpensive method to monitor microclimatic conditions, and can potentially be used by forest companies to ensure the effectiveness of their karst management strategies for sinkholes with distinct microclimates. This is critical for the new era of the results-based forest practices in BC, where professional reliance and the use of routine-level effectiveness evaluation indicators are becoming more and more important.

Conference acknowledgements and introduction

Welcome to the Conference

A very warm Victorian welcome to all delegates to the 17th Australasian Conference on Cave and Karst Management, organised by the Australasian Cave and Karst Management Association (ACKMA) Incorporated. The conference is hosted by *Parks Victoria* and the small country township of Buchan located in East Gippsland, Victoria. For many of our delegates this will be your first visit to this part of Australia so the following information is provided as an introduction to Buchan and the East Gippsland area. Buchan is one of the Victorian's oldest European settlements dating back to 1838 when early white settlers ventured here in search of grazing land. It is nestled between the foothills of the Alpine and Snowy River National Park (Australian Alps) and the 90 mile beach and is best known for its beautiful limestone caves, spectacular high country scenery, river gorges, tall forests, rainforest and dry rain shadow woodlands. Within the small township of Buchan lies the Buchan Caves Reserve which has been in operation since the early 1900s and is significant for its geological, cultural heritage, environmental and landscape values. The story of Buchan Caves first began with the discovery of Fairy Cave on the 18th March 1907 by Frank Moon. He was an incredible enthusiast and such a salesman he helped lay the foundation of the Buchan Caves Reserve and indeed put Buchan on the map as a tourist site. This year marks the centenary of the Fairy Cave and although this event was celebrated earlier by the local community, celebrations to mark this occasion and the role that Frank Moon played at Buchan Caves will carry over into our conference week. The first white person to visit Royal Cave (1910) and Federal Cave (1915) was Fredrick Wilson who after many years experience at Jenolan was appointed to manage the caves at Buchan and set them for public viewing. He erected wire netting fences and handrails throughout both Fairy and Royal Caves. He helped preserve the caves at Buchan that otherwise would have suffered at the hands of early vandalism. A lot is owed to Fredrick Wilson for his wonderful workmanship and recognition of his contribution will also be celebrated. Visitors to the caves soon learn that the reserve is as equally beautiful above the ground as it is below. Much of the charm and character of the reserve today can be contributed to the original landscape plan designed by government botanist Hugh Linaker. The Reserve is now admired and valued for the impressive collection of beautiful exotic trees that provide a stunning array of colour in autumn. Since the work of our early pioneers the Buchan Caves Reserve has become one of Victoria's major tourist destinations. It consists of 260 hectares and is part of an extensive karst area containing hundreds of caves. Buchan is a special place, of which we are very proud. It provides a wonderful example of Indigenous and European cultural heritage – which is central to the17th ACKMA conference theme. Thank you for making the effort to attend our conference. We hope you enjoy your time spent with us.

Dale Calnin, Conference Convenor

Acknowledgements

So much work, particularly over the past two years, has gone into to planning the 17th Australasian Conference on Cave and Karst Management (ACKMA 2007) at Buchan. As Conference Convenor I have been overwhelmed by the support and assistance given to me during this time and for that I would thank the following people and organisations. Firstly, the Conference Organising Committee comprising Kent Henderson, Andy Spate, Prof. Elery Hamilton Smith, Dr Susan White, Nicholas White, Miles Pierce and Steve Bourne for their valuable time and input. To Kent and Andy particularly for the tireless work behind the scenes and their invaluable assistance and guidance throughout.

- To my colleagues in *Parks Victoria* – Allison Marion, Leanne Hodge, Matt Holland, Scotty Graham, Dave Harper, Gail Wright, Carole Young, Robyn Calnin, Dennis Matthews, John Senior, Dennis Ward, Ray Supple, Catherine Bessant – who have worked tirelessly in various working groups to ensure the success of this conference. Leanne and Matt particularly have contributed enormously, coordinating accommodation, transport and endless other logistical needs – thank you so much.

- Special thanks must be given our conference coordinator Allison Marion. Alli's contribution to this conference has been outstanding. Her planning and organisational skills have been exemplified and without her the conference would not have succeeded.
- To *Parks Victoria* for your support throughout and for allowing the conference to be at Buchan Caves Reserve.
- To the *Friends of Buchan Caves* group for their continuous dedication and work effort in the lead up to the conference in order to finalise their low voltage lighting display in Federal Cave. 'Friends' members assisting during the Conference include Peter and Marg Robertson, Glenn Baddeley, Miles and Rhonwen Pierce, and Nicholas White.
- To Dr Susan White and Ken Grimes for putting together the Conference *Field Guide* and Kent Henderson for Conference *Handbook*.

Sponsors

Parks Victoria is a major sponsor of the event, contributing resources and staff time to organise and manage the event. East Gippsland Shire Council provided the funding for the conference satchel. Wyanga Park Winery provided a candlelit dinner cruise for two people. To the local Buchan community, thank you for the way you have welcomed, assisted and supported the conference. Caterers, local suppliers and community groups have been remarkably helpful to ensure that the visit to Buchan by conference attendees is comfortable and enjoyable. Finally I thank all attendees for making the effort to attend the 2007 conference – particularly those who have travelled great distances to be here and all who are contributing presentations, assisting with field inspections, or assisting in some way to ensure the success of the conference. I sincerely thank you all for your contribution and support. Yours in Cave and Karst Management,

Dale Calnin, Conference Convenor.

Volunteers assisting at the conference

All of whom have the grateful thanks of the Organising Committee

Parks Victoria Team:

Allison Marion	Leanne Hodge	Matt Holland	Dave Harper
Scotty Graham	Robyn Calnin	Carole Young	Phil McGuinn
Gail Wright	Dennis Matthews	Graham Parkes	Ricky Mullet
Yas Aley	John Rogerson	Maree King	Daryl Burns

Friends Group of Buchan Caves

Buchan Caves Staff:

Gail Calnin	Annemarie Henderson	Robyn Benton	Kate Kenyon
Keith Greenwood	Heather Johnson (Daly)	Dean Phelan	

BUCHAN PRIMARY SCHOOL ASSISTS ACKMA!

The Buchan Primary School children have prepared historic figurines of people who have made a significant contribution to the history of Buchan and the Buchan caves. On each of the figurines features a description of the person it represents and the role that they have played. The figurines are situated at various locations around the Buchan township and the Buchan Caves Reserve and will help orientate delegates throughout the conference week, or be enjoyed as part of a self guided walk.

The Conference Organising Committee would like to sincerely thank the Buchan Primary School children and staff for their efforts.

Conference Photo, Buchan, Victoria (K. Henderson photo)

List of delegates

(alphabetically arranged)

1. Jay Anderson
2. Ross Anderson
3. John Ash
4. Peter Austen
5. Glenn Baddeley
6. Dr Claire Baker
7. Serena Benjamin
8. Steven Bourne
9. George Bradford
10. David Butler
11. Dale Calnin
12. Deborah Carden
13. Michael Chalker
14. Peter Chandler
15. Dave Chitty
16. Brian Clark
17. Ian D. Clark
18. Arthur Clarke
19. Neil Collinson
20. Grant Commins
21. Russell Commins
22. Travis Cross
23. Tony Culberg (& Pat Culberg)
24. Brett Dalzell
25. Emily Davis
26. Geoff Deer
27. Trish Deer
28. Albin Debevec (& Doroteja Debevec)
29. Rolan Eberhard
30. Ian Eddison
31. Brett Farquharson
32. Ken Grimes
33. Grant Gartrell (& Merry Gartrell)
34. Alan Griffin
35. Karen Griffiths
36. Elery Hamilton-Smith (& Angela Hamilton-Smith)
37. Jayme Hatcher
38. Nic Haygarth
39. David Head
40. Nick Heath
41. Kent Henderson
42. Ian Houshold
43. Geoff Kell
44. Neil Kell
45. Kim Ryeon
46. Ian Lewis
47. Moira Lipyeat
48. Christie Mahony
49. Greg Martin
50. Derek Mason
51. Mary McCabe
52. Scott Melton
53. Dr Neville Michie (& Lyn Michie)
54. Tony Mitchell
55. Renee Mouritz
56. Graham Parkes
57. Dr Warren Peck
58. Miles Pierce
59. Rhonwen Pierce
60. Veronica Pfitzner
61. Cathie Plowman
62. Barry Richard
63. Geoff Rebbechi
64. Stephen Reilly
65. Peter Robertson (& Marg Robertson)
66. David Rowling
67. Bian Rumei
68. Chester Shaw
69. Dave Smith
70. Andy Spate
71. Robert Tahi
72. Don Tumney
73. Dianne Vavryn
74. Mike Warner
75. Van Watson
76. Rauleigh Webb (& Samantha Webb)
77. Nicholas White
78. Dr Susan White
79. Candice Williams
80. Ann Wood
81. Graham Wood
82. Peter Wood
83. Philip Wood
84. Stephen Wood
85. Xiao Shizhen
86. Tomaž Zorman (& Alenka Hrib)
87. Robert Bednarik
88. Dr Robert (Bob) Haldane
89. John Hawker