Lighting Australian Caves

Elery Hamilton-Smith

P.O. Box 36, Carlton South, Victoria 3053

Introduction

Artificial lighting is, of course, absolutely vital to seeing caves except for those species fortunate enough to possess the capacity for echo-location. This paper is an endeavour to bring together details of the Australian experience in cave lighting, and will deal with it in three sections - exploration, public display and photography.

Although there has been considerable misunderstanding amongst cavers of the story of lighting, this paper will try to correct common errors, and to demonstrate that the outstanding feature of the Australian experience is the extent of innovation which took place here.

Exploration

The first people commonly both visited and lived and worked in caves. They used fire or fire sticks to light their way, and the remains of their lighting have therefore appeared as ash in archaeological excavations (Flood 1993). Few burnt sticks have remained, although scattered references to fire sticks being seen in the Nullarbor Caves occur in the *Eucla Recorder* (1898-1900). Similarly, the early Aboriginals do not appear to have knocked ash from their fire sticks by hitting them on the wall and leaving marks as the early people of the Mammoth Cave (U.S.) or of the Pacific islands did.

The first white arrivals also used fire sticks or brush torches. Augustus Earle (1826), in his water-colour which is the first documentation of a visit to the Wellington Caves, gives a graphic depiction of the use of these. Many years later, Broome (1886) was able to describe the technological advance of soaking stringy bark in kerosene! However, candles seem to have been the preferred lighting of many early explorers and are frequently mentioned in their accounts.

Petrol or kerosene lanterns were commonly used during the 1920's and later. Thomson continued to use petrol-fuelled mantle lamps throughout this exploration of the Nullarbor Caves.

Acetylene lamps were widely used over many years for other purposes in Australia, including home lighting, vehicle head lamps, theatre and photographic lighting and even camp lighting by drovers and cattlemen (Rauleigh Webb, pers. comm.). There are surprisingly few references to their use in cave exploration until the 1950s, although they were certainly used in guano mining in some caves.

The advent of contemporary speleology in the late 1940s and early 1950s certainly brought with it the use of both carbide and a wide variety of electric lights. The story of speleological lighting is continuously evolving (e.g., Michie 1993), and does not need further attention here.

Public Display

Organised public visits to caves commenced in this country at Wet Cave, otherwise known as Oakden's Cave or the Chudleigh Caves, and now known as Honeycomb Cave, at Mole Creek, Tasmania (Hamilton-Smith 1993). Descriptions of these early tours only refer to the use of candles, but a fine engraving showing visitors in these caves depicts the use of brush torches with plumes of smoke which again suggest the use of kerosene or other oil.

Similarly, early accounts of visits to Jenolan and other public access caves on the mainland refer to the use of candles. Photographs taken in the 1880s and 1890s show that spring-loaded holders with a shield to catch dripping wax were commonly used, each visitor being provided with one.

But Jenolan was the site of Australia's major innovations in cave lighting. The invention of magnesium ribbon in 1864 led in turn to lamps which burnt magnesium ribbon as a means of photographic lighting. These initially consisted of a reflector with a hand-operated roller to thread the ribbon through as it burnt. However, more sophisticated models, driven by a clockwork mechanism appeared later in the same year.

Caretaker Jeremiah Wilson was quick to recognise the value of these as a means of showing the Jenolan caves to visitors. It is not clear exactly when he commenced doing so, but Havard (1934) reports that the Whalan family had used hand-held ribbon prior to 1870, and doubtless Wilson did so at about the same time.

Regrettably, the known reports of his use of lamps and the exorbitant charges which he demanded of visitors are in undated press cuttings in the Mitchell Library (see Dunkley 1986). The first formal notice of testing an 'improved' lamp from Europe is in the Annual Report of the N.S.W. Department of Mines for 1898. In 1900, it was reported that the lamps had been purchased and modified. However, a magnesium lamp in use was shown in a view of the Exhibition Chamber in Garran's *Picturesque Atlas of Australia* (1886 : 153).

From about 1901, clockwork lamps were manufactured in Australia by Esdaile's, a Sydney firm of instrument makers. The use of these lamps spread to other Australian cave areas. In 1900, the South Australian Conservator of Forests and William Reddan of Naracoorte Caves visited Jenolan Caves, and amongst other things, arranged to purchase magnesium lamps. They were used at Yarrangobilly at least by 1900 and almost certainly used at the same time in other N.S.W. cave areas; introduced to Western Australia and to Buchan by Frederick Wilson; and used at Mole Creek. Their use continued into at least the 1930s.

Although widely used for photography, I have not been able to find any record of ribbon lamps being used for cave display in other countries. It must be remembered that Australia of the 1880s was a relatively affluent country; few countries could have even considered Wilson's charges of twelve shillings per head for the ribbon used in a single tour! However, this should not obscure the fact of Wilson's sense of innovation and marketing being responsible for the widespread use of magnesium.

It is appropriate here to report one of the more amusing incidents of cave illumination. Tim Connelly, guide at the Margaret River caves, used the traditional candles together with a ribbon lamp to highlight the features of the caves. Then the special demands of World War One meant that magnesium ribbon was no longer available in Australia. Connelly wrote to the Hotels Board, who were his masters, seeking supply of an alternative lamp. This duly arrived in the form of a Lucas Brothers motorcycle head lamp, powered by carbide.

Connelly wrote back politely, thanking them for the very nice lamp, but pointed out that it was hardly adequate when a single tour party spread over as much as 80 feet of path way! The response was to forward a 'gasolene' (mantle) lamp. Connelly was delighted with it, but wrote seeking a supply of mantles. The Hotels Board clerk wrote back, pointing out that a mantle had been included with the lamp! Connelly's reply has not survived.

Returning to Jenolan, the next innovation was the installation of electric lighting by Col. E.C. Cracknell, experimentally on 22 July 1880, and permanently in 1884 (Havard 1934). This was not only the first use of electricity for cave lighting anywhere in the world, but it was well in advance of most street lighting systems. Ludovico Hart, who was one of the party of ten who assisted Cracknell in 1880, and who photographed the caves under their new illumination, wrote ,

. . . to convey the faintest notion of what the scene was like when lit up by the electric light is quite impossible, more particularly when different coloured glasses rendered the walls and stalactites red, blue, yellow, etc.

This first experimental installation relied upon electrolytic batteries, but the permanent installation was powered from a steam-driven dynamo in the Grand Arch. This would only provide sufficient power for 25 lights, and the need for extension soon arose. So, a Leffel wheel hydro-electric system was installed and drove a Crompton dynamo. This was further innovation in that it was the first hydro-electric plant in the country. (A later hydro plant also led to Australia's first fish ladder!) The most valuable historic relics at Jenolan include the Leffel Wheel and the original lighting in the Shambles (above the Chifley Cave) complete with its carbon filament globes and knife switches.

The other major light source in show caves has been acetylene gas from on-site generation. I have already referred to its very brief use at Margaret River. It was tried at Jenolan in 1900, but rejected for cave use because of its smell. However, it was used at least once for lighting a concert in the Grand Arch. But it was accepted and used for relatively lengthy periods at Mole Creek in Scott's Cave (1908-17), Baldock's Cave (1910-c.1925) and King Solomon's Cave (dates unknown). The guide at Gunn's Plains used a hand-held acetylene lamp for many years. It seems likely that such lamps were also used at Chillagoe because of the close association with mining, and certainly, when those caves were re-opened in the 1960's, guide Vince Kinnear had a stock of Queensland Drovers' carbide lamps for hire to visitors undertaking self-guiding tours. There are no other genuine records of such use, although it has been stated erroneously that it was installed at Naracoorte Caves.

Photographic Lighting

The story of photographic lighting is perhaps one of the more intriguing. Most early photographers used hand-held magnesium ribbon, and often obtained fine results. Some learned to move the ribbon about and so eliminated harsh shadows, but also led to the production of rather flat and uninteresting pictures. The most effective use of this method was probably by James H.A. MacDougall, initially at Buchan and later at both Yallingup and Margaret River in South-western Australia.

His photographs show the fine textured surfaces of cave decoration better than any of his contemporaries, and better than many modern photographers. It is so characteristic of his work that I can usually pick his photographs without needing to see his name on them.

Doubtless, some photographers used the ribbon lamps, but there is no record of this in the literature.

Jenolan proved an irresistible magnet to photographers; early photographers of note include John Paine, Henry King, H.C. Beavis, Charles Bayliss, Ted Cooke, Oliver Trickett, Ron Bailey, Ebenezer Caney, Joseph Rowe, J.J. McCarthy, George Rose, Harry Phillips, George Kitch and, of course, Anon. Those who came later included the famous Frank Hurley and Curator Tant Bradley.

However, the great cave photographer of the late 19th. century was Charles Kerry, partly because he had the opportunity to photograph many caves in N.S.W. within a few days of the first entry to them. He was also the most effective publisher of his images as postcards, cabinet or larger prints and souvenir booklets, selling probably hundreds of thousands of cards at Jenolan alone, and publishing series from all other major cave areas in New South Wales.

Kerry certainly used hand-held ribbon initially, a variety of lamps, generally of the blow-through type, and then flash powder. It is of interest to read a little of the advice in his 1903 paper on cave photography:

It is commonly known that of the hundreds of dry plates and spools of film exposed yearly within the Jenolan Caves, an almost incalculably small percentage only are so manipulated as to produce satisfactory reminders or records.

. . . if some special formation is being photographed, and the light is retained in one position, detail may be lost from one portion of the subject, whilst heavy conflicting shadows will result in another. I have found it to be of great advantage to move the light in various directions during exposure . . . for the purpose of breaking up shadows.

The best lamp is one having a fairly large reservoir, holding from one to two ounces of powder and giving a flame up to 18 inches or two feet in length.

In the case of mystery formations, almost all of them are transparent 'helictites' and require special treatment . . . to use a quick weak flash from the side.

The paper is not unlike what might be published in a popular photography magazine today. It contains much sound advice, together with interesting examples, and the statement that:

The man (sic) *who would systematically explore the caves and make photographic records of them should be of muscular build and have great strength and endurance. One is constantly forced to place himself in most awkward positions and places, perhaps himself and his camera on an extremely narrow ledge where it is necessary to remain for some time. In climbing about I have had many falls and have in cave working smashed up three camera beyond repair.*

Despite his good advice, and the number of his cave photographs with remarkably even lighting and fine definition of detail, most are so evenly lit as to totally lack any sense of magic. Not surprisingly, some of his helictite photographs are probably his best. His friend, Oliver Trickett, who made no claim to photographic expertise, often produced much more interesting photographs even when using precisely the same camera position, simply because he used light more imaginatively.

Kerry was also a fan of new technology - what we might today call a 'gear freak'. He owned and used the incredible Cirkut Camera for taking panoramic photographs of immense size, but in particular, he experimented with the development of blow-through lamps. These were built for him by his friend H.J. Quodling, and probably they achieved the greatest of all such lamps, fitted with six heads and a pump-up air reservoir (Millar 1981 : 10).

At this point, we need to trace something of the history of the blow-through lamp and its evolution. It was invented by a Paris photographer, Gaspard Felix Tournachon, generally known as Felix Nadar. Trained as a surgeon, Nadar turned to journalism, play-writing and cartooning, and the latter led him in 1852 to photography. As an enthusiastic balloonist, that led him to the invention of aerial photography (in 1858) which he patented and used to good effect.

In 1861, having become expert in the use of artificial light in the studio, he decided that in addition to being the first to take photographs above the earth, he would be the first to photograph underground, and embarked on a project to photograph the Catacombs of Paris. This venture was a great success, but the use of electricity proved cumbersome and expensive.

Various photographers experimented with ways of burning magnesium power, including Larkin in 1866 with a primitive ancestor of the blow-through lamp, but most turned to various chemical mixtures. In the 1880s, experimenters turned again to the blow-through lamp, and the first truly successful version was developed by Paul Nadar, son of Felix (Howes 1989). This became widely accepted and used by French cave photographers, and as we have already seen, by Charles Kerry in Australia.

By 1905, and perhaps earlier, the blow-through lamp was a mass-production item in Australia, and both their own 'Austral' lamp and various others were being marketed by Baker and Rouse (c. 1905).

When Captain Maitland Thomson commenced caving on the Nullarbor, he found that H.G. (Gwyn) Watson of Ceduna had already photographed the caves, using blow-through lamps which he had built himself. He lent his lamps to Thomson, who used them with great success.

Then in 1955, soon after I first became acquainted with Thomson, he expressed considerable regret that he no longer had such a lamp. Shortly afterwards, I was able to buy a secondhand Austral at Camera Supply in Flinders St., Adelaide. After some discussion, and with the help of other CEGSA members, this was mounted on a fire extinguisher cylinder with a pump, and was presented to the Captain with our compliments.

Later developments include those by Fairlie-Cunninghame (n.d. but 1957), who produced a lightweight device using a meteorological balloon to pressurise the propellant air. Crowle modified this to further reduce weight and powder consumption. Hill (1966) probably made the most important contribution to the effectiveness of blow-through lamps by recognising the very different character and properties of high density magnesium powder, developed for use in rocketry practice. His version also had a carefully controlled powder flow rate, and so exposures could be much more accurately calculated, and he developed an exposure calculator to accompany it. Finally, Poulter (1977) developed a still further improvement, using liquid petroleum gas as a propellant.

However, with faster films, great improved electronic flash technology, and different practices in lighting for photography, the blow-through lamp, despite its perfection in Australia, is probably becoming nothing more than a historical relict.

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