

Abstracts only

Ringling in the changes in Cave Tourism

Dr. Julia James.

In keeping with the conference theme “Winds of Change” this presentation will briefly give an overview of some of the recent changes in cave tourism.

Examples will be taken from caves on six out of the seven continents and include:

- New caves opened and old caves re-opened for tourism.
- Refurbishing of existing tourist caves.
- The ever-growing variety of tours.
- World heritage caves.

All changes will be assessed by the speaker and given a bell rating from 10 to 0, rankings that will definitely be open to debate.

Setting the Scene – Syngenetic Karsts in the Southwest of Western Australia

Ken Grimes

Western and Southern Australia have many karst areas developed on soft sandy limestones (calcarenes) which are quite differing to the traditional ‘hard-rock’ limestones found elsewhere.

These are the syngenetic karsts of the youthful Quaternary dune limestones and related soft-rock karsts of the Tertiary limestones (which also show some syngenetic features).

In syngenetic karst speleogenesis and lithogenesis are concurrent: caves and karst features are forming at the same time as the loose sediment is being cemented into a soft, porous rock.

The distinctive features of syngenetic karst are: shallow horizontal cave systems; a general lack of directed conduits (low irregular chambers occur instead); clustering of caves at the margins of topographic highs or along the coast; paleosol horizons; vertical solution pipes which locally form dense fields; extensive breakdown and subsidence to form collapse-dominated cave systems; a variety of surface and subsurface breccias and locally large collapse dolines and cenotes; and limited surface sculpturing (karren).

In the southwest of WA syngenetic karst occurs in the coastal dune calcarenites of the Tamala Limestone.

Many features are similar to those seen in Eastern Australia and elsewhere, however there are some interesting differences also.

North from Perth, there is a long belt of Quaternary dune limestones that continues all the way to Cape Range (which is mainly Tertiary limestone). Within this the most interesting karst areas are the Nambung Pinnacles and the Yancheep area.

At Yancheep dune limestone overlies a quartz sand aquifer and aggressive water enters from below to dissolve caves at the base of the limestone.

South from Perth there are a few caves and springs where the Swan and other rivers cut through the dune ridges. In the Leeuwin-Naturaliste region a belt of dune limestone up to 6 km wide contains numerous caves (see conference Field Guide for details). Early work by speleologists (e.g. Bain and Bastian) in this area contributed to the concept of syngenetic karst. The special aspect of this area is the shallow impermeable basement, which can guide the water flow through the dune sand above. The caves are best developed in the older more-cemented dunes and are of three types: *linear caves* formed by cave streams which follow buried valleys above the impermeable basement; *breakdown* systems, including the ‘inclined fissure’ type, which modify and can completely replace, earlier solutional caves; and the horizontal watertable *maze caves* of the Augusta area – the last are relatively rare in the Leeuwin-Naturaliste region but common elsewhere. Water tracing has mapped some conduit flows from stream sinks at the inland margin of the dunes, through intermediate through-flow caves to springs on the coast, but much of the underground water flow seems to be lost offshore.

Synergy driving innovation in Cave Lighting.

Dan Cove, David Head and David Rowling

There have been enormous advances made in recent years in the field of cave lighting. These advances have been made in lighting technology, most importantly the evolution of high intensity LEDs, in automation and control, efficient uninterruptable power supply and also in the overall underlying lighting design philosophy. It is important to realise the multi-disciplinary nature of the challenge presented when considering a new cave lighting project, as these advances are being made by individuals in potentially quite disparate areas.

The recent experience of relighting the *Orient* at Jenolan Caves NSW, highlights the necessity of a collaborative effort, as innovation in all areas was driven by a dynamic process of technology influencing design, but also of design philosophy forcing the continued development of available technology. The ultimate result of this synergy is a far superior cave experience than would have been achievable otherwise, and also provides a most conducive situation for the growth and development of the individuals involved.

Jewel Cave Redevelopment

Lindsay Hatcher

The Augusta Margaret River Tourism Association (AMRTA) recently received over whelming support from its membership, to undertake the well needed Jewel Cave Preservation and Redevelopment Project. The AMRTA, managers of Jewel Cave, are extremely excited about the project and are committed to cave management and tourism within the region contributing \$1.1 million of its own funds to the \$3.1million project.

The Jewel Cave project looks at eco-sensitive buildings and infrastructure that will compliment the natural environment, upgrading 50 year old wiring and lighting, creating an interpretive centre and cafe to increase education and visitor amenities and the re-vegetation (with endemic plants to the site) of the existing site to help recharge the water table and preserve site integrity.

Margaret River architects, Willcox and Associates have been awarded the contract to design and build the interpretative centre and café at the Jewel Cave site as part of the upgrade of the facilities. The Willcox and Associates concept was in keeping with our brief and in particular answered our requirement for environmentally sustainable features through its attention to passive solar design, natural ventilation, solar

water heating, insulation, water storage and efficiency, minimal artificial light and waste management systems.

It is anticipated that the whole project, including the new car parks, the building and the work within the cave will take approximately two years to complete. The full plans and working drawings are available to view at the ACKMA 2009 conference and the AMRTA is excited to be able to walk delegates through the project. This project has been at least twenty years in the development and the AMRTA would like to thank past managers and committee for having the foresight and commitment to ensure the stunning Jewel Cave is preserved and protected.



Filling the Gap – the role of a non-government karst conservation organisation in Australia

Jay Anderson and Alan Briggs

This presentation outlines the development of a new Conservation Group in WA. The Caves and Karst Conservation Foundation is set up under the WA National Trust, specifically to protect and conserve caves and karst areas. To use the American terminology, the Foundation is effectively a ‘Conservancy’.

The National Trust has many attributes that set it aside from other public and private organisations. The National Trust is set up under a State Act of Parliament, and has approval under the Australian Taxation Office to operate as a charity bringing with it tax deductibility for donations of land and money. The National Trust is an active organisation with an impressive list of credits and is well respected internationally. The National Trust (WA) is involved in a range projects and outcomes regarding conservation and interpretation of the State’s natural heritage.

The National Trust has the ability to establish conservation appeals for a range of natural heritage projects. In this case we are establishing an appeal for cave conservation. The appeal will be managed by a

committee established under the Council of the National Trust of Australia (WA). The Purpose of the Appeal is to receive donations of land and money to conserve the values of caves and karst and to educate the community for the protection of these values. The Appeal is referred to as the 'Caves and Karst Conservation Foundation Appeal'.

The Appeal is operated by the Caves and Karst Conservation Foundation committee – a separate group of people who also manage The Caves and Karst Conservation Foundation. The key constitutional objectives of the Foundation are:

- To conserve and protect caves and karst systems as natural assets.
- To interpret caves and karst systems.
- To educate the community about caves and karst systems and their values.
- To provide leadership in environmental management and natural heritage management of caves and karst systems.
- To facilitate the increase of scientific knowledge about caves/karst

This new organisation will fill the gap between the ASF, ACKMA and state Conservation Agencies. The Foundation will be active in project management – seeking to raise funds to put back into cave and karst management. The Foundation will be in a position to provide support to private land managers and non-government cave managers. The Caves and Karst Conservation Foundation will bring 'caves' to the general public, fostering a desire for people (other than speleo's) to be involved in the conservation and interpretation of caves and karst systems.

Woodvale Swimming Pool Collapse

Ross Anderson

Caves and Karst are some of the most vulnerable ecosystems in the world. The Karst Landscape on the Swan Coastal Plain (including Yanchep National Park) represents an important part of the earth's geological diversity. The limestone in this area of Western Australia exhibits unique characteristics due to the nature of its development.

The geology of the northern suburbs of Perth comprises, in part, a large area of coastal Aeolian limestone (also known as: Tamala limestone and Aeolian calcarenite), observed as a series of distinct landforms roughly parallel to the coast. Several authors have recognized three main units that occur from east to west: The Bassendean Dune system, the Spearwood Dune system and the Quindalup Dune System

During March 2007, a sinkhole developed in a backyard of a residential property in Woodvale. This resulted in the collapse of a swimming pool and the loss of around 44,000 Litres of water overnight. During the months that followed, local and State Government agencies and other service companies assessed the situation without resolution.

In July 2007, Ross Anderson of Dissolved Rock Pty Ltd, contacted Mike and Sonja Pilkington to make the offer of assistance in the investigation of subsurface conditions and possible remedial actions that could be undertaken to stabilise the sinkhole that was evident in the rear north western corner of their property.

The offer entailed a site visit to the property to undertake on ground investigations using Ground Penetrating Radar (GPR), downhole camera equipment and a surface inspection of the property and surrounding neighbourhood.

It was assessed that the connection to the ground surface displayed in the backyard of the property was most likely a solution tube rising from a cavity at or near watertable level. The Perth Ground water atlas estimates that the ground water in the Woodvale area is approximately 15.5 metres AHD. Using available information and cave data an estimate of limestone thickness was made.

Two reports were submitted to the land owners and parliament member Judy Hughes. In the following months the property was bought by the government and remedial works undertaken to fill the depression.

The property was then sold by the government with a notification on the title and restriction of use for the rear northern section of the property. Acknowledgements: Lex Bastian, Ian McCann, Jay Anderson, and Greg Joyce.

Urbanisation and Karst Systems – living with karst in Western Australia

Ross and Jay Anderson

Urban development and its associated impacts is one of the major karst management issues within south-west Western Australia.

The unique karst system that runs along the WA coastline faces many issues: water abstraction, catchment vegetation, impacts by development, visitation and management impacts. Protecting the karst system from current development and the impact of Perth's expanding population is a huge task.

There have been a range of karst issues and outcomes to date. In some areas, speleologists have been able to work with landowners, developers or the local Government to assess a proposed subdivision for caves and karst features. Speleologists are sometimes not involved or are not allowed access to land to make appropriate comment on potential impacts to caves and karst or advice is disregarded.

A lack of timely consultation with specialists or a lack of understanding of the complexity of karst, can result in environmental damage. It is important that all who are involved in management and planning decisions within karst systems, are aware of the IUCN Guidelines for Cave and Karst Protection. Likewise, the EPA have Guidance Document 33 – for Planning and Development – including a significant chapter on karst.

This paper discusses two case studies within the karst system. One locality has had significant impacts on karst features, despite the features being identified by speleologists.

Plans for part of this area include installing a road that will bisect land with a large number of caves and karst features – and the karst system that exists in native Tuart bushland is at risk. In the other locality, speleologists have been able to contribute to the protection of the karst in a proposed subdivision. As a result, the part that contains karst may be either incorporated into a bushland reserve or be purchased by the Government to add to the National Park.

The Speleological groups are working with numerous local groups and Government agencies to improve recognition of environmental management and safety issues associated with karst in the area.

The paper reviews the outcomes and considers the key issues. As Perth's population increases, subdivision and development will continue to occur. Karst impacts will continue unless there is a change in attitudes regarding the importance of karst and karst features, and their management. A collaborative approach is essential to achieve appropriate management of karst in this area. This paper will propose some options for successful outcomes.

A Snapshot and History of the Leeuwin Ridge

Brian Combley

A series of Photographs of the area and the caves both historic and current with a broad overview of historical events affecting the Leeuwin Ridge Karst Area. The photos include aerial photos of icons of the area such as Cape Naturaliste Margaret River and Cape Leeuwin along with historic locations such as Caves House, Ellensbrook and Wallcliffe House.

When to Turn the Tap Off

Brenton Knott

The climate operating over the south-west of Western Australia is changing, notably with reduction in rainfall. Concomitant with this, there is increased pressure of land-use, some of it showing remarkably little ecological wisdom. One of the major regional aquifers is the Gnangara Mound between the Swan and Moore rivers. The Mound reached an elevation of about 70 m asl and, on its western slope, assisted in the formation of caves in the area of Yanchep National Park with cave streams lined by tuart (*Eucalyptus gomphocephala*) tree root mats. This reliable food supply supported a diverse, abundant and zoologically important groundwater fauna.

In the summer of 2000/2001, the streams dried, and the government response has been to remediate the situation – by restoring local mounds within selected caves. I will review briefly the fauna, the history of the remediation, and suggest that it is all futile given that it is not possible to predict reliably future climate of the region.

Climate Change and Karst

Andy Spate

Karst and their dependent environments have been around for a long time. Consequently they have been exposed to much climatic change through time. Taking just the last 66 million years through Tertiary and Quaternary times we have had much hotter, wetter, drier and colder conditions. These have shaped karst environments, their processes, biota, sediments and so on. What we have today has survived these climatic swings plus, perhaps the impacts of environmental change brought about by a number of human invasions.

Global warming, whether produced by natural processes or humans inputting greenhouse gases such as carbon dioxide and methane, will produce climate changes. These may not produce warmer weather in region x or y. The pulls, pushes and interrelationships of atmospheric and oceanic circulation make understanding the impact on terrestrial environments where we live extraordinarily complex. It may mean that some places are colder and/or wetter rather than just warmer.

If it is difficult to say what happens in regions x and y, it is going to be difficult to even more complicated to predict or understand what will happen to karst processes. These processes produce and maintain the karst environments we manage, research and enjoy today. This paper explores some impacts of climatic factor change on karst processes.

Bioluminescence in cave glow-worms: signs of altered circadian rhythmicity

David Merritt & Arthur Clarke

Glow-worms emit light from cells in the malpighian tubules to attract prey into their webs. They are found in suitable wet caves as well as in rainforest settings. Forest glow-worms cease glowing on exposure to light so they glow only at night. They possess a circadian rhythm of light output, demonstrated in the laboratory through their ability to maintain cyclical glowing for many weeks in constant darkness. Because glow-worms reach high population levels in caves where they do not receive strong daily resetting stimuli, we investigated whether cave glow-worms are rhythmically bioluminescent. We developed a remote time-lapse digital imaging setup to record light output levels at 10 minute intervals for up to 5 days. Analysis of light output of the Tasmanian glow-worm, *Arachnocampa tasmaniensis*, and the New Zealand glow-worm, *A. luminosa*, in wild caves established that both species maintain strong rhythmic light output. The time of peak light output is different to forest glow-worms: cave populations glow most brightly when it is daylight outside the cave and most weakly during the night: they are completely out of phase with adjacent rainforest populations. We discuss the possible basis of the phase-shift and synchronization within caves.