Abstracts only

Australasian tourism market forces and the triple bottom line

Dave Bamford, TRC Tourism

An overview of key market influences, such as the Global Financial Crisis, and key markets, including emerging markets from countries such as China and India. The role of markets in tourism including the domestic, nature and adventure, cruise, and conference markets.

Creating Unforgettable Holidays – Profitably

Grant Webster, Tourism Holdings Ltd

In an industry that struggles to deliver above cost of capital returns, how do we continue to deliver to the customer?

The Waitomo Glowworm Cave - providing for its people

Peter Douglas, Ruapuha Uekaha Hapu Trust

A review of the recent history of the Waitomo Glowworm Cave and the ownership role of the Ruapuha Uekaha Hapu Trust. The issues and challenges facing the Trust and its future direction.

Geological background of karst in New Zealand

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Zealandia is a piece of Gondwana, about one-third the size of Australia, but most of its continental crust is underwater as submarine plateaux. The emergent part, New Zealand, covers about the same area as Victoria plus Tasmania, and carbonate rocks occupy about 3% of its area (compared to 4.7% in Australia). So karst is scarce in NZ, making its conservation all the more important. Before the present Australia-Pacific plate boundary was established at the end of the Cretaceous Period, about 80 Ma ago, Zealandia had been eroded almost to sea level. By 60 Ma the Tasman Sea had reached its full extent, the oceanic crust was cooling and the subsiding sea floor drew down the land, such that by 35 Ma only small low islands protruded above sea level. The sinking continental crust first accumulated estuarine sediments, then sheets of shell fragments, silty sandstones and mudstones. Deep burial compressed the shell layers into limestones. Sediment accumulation ended in the late Miocene-Pliocene once the present plate boundary was established and resulted in convergence and uplift. Uplift started about 15 Ma and accelerated around 5 Ma. This resulted in the emergence of tilted blocks of country bounded by faults. Erosion commenced immediately uplift occurred, so the marine sediments were dissected as they were uplifted. This removed most of the Tertiary sediments from the highest country leaving fragments round the edges where uplift was less intense. Consequently, there are remnant patches of Oligo-, Mio-, and Plio-cene limestones in many parts of the country, predominantly located on the flanks of ranges but sometimes found to 1500 m. These carbonates range from a few 10s to 700m in thickness. In some places, exhumation of the eroded basement has revealed more ancient carbonates, including marble bands in Fiordland and especially NW Nelson where they attain up to 1000 m in thickness and occur to 1875m above sea level.

Most karst development has taken place in New Zealand since plate convergence generated uplift, mainly over the last 5 Ma and especially in the last 1 Ma. By the early Pleistocene the Southern Alps began to form and gravel accumulations started to develop the Canterbury Plains. During uplift the Cenozoic marine sediments were simultaneously eroded leaving the remnant patches we see today. In NW Nelson the Ordovician marbles were re-exposed and our greatest caves (to 1026 m deep; to 67.2 km long) started to develop, a process that still continues. In western North Island, near Waitomo, the Oligocene-Miocene limestones were exposed in places by the early Pleistocene, but the evolving karst was overwhelmed about 1.25 Ma ago by a vast thickness of ignimbrite from the central volcanic zone. This has now been largely stripped off and karstification has resumed. Most caves in the Waitomo region are probably less than 250,000 years old. Meanwhile in eastern North Island marine shelly limestones of Plio-Pleistocene age were uplifted only about 1 Ma ago and these thin young limestones have been karstified only in the last 10,000 years or so.

Going Deeper - the Quadruple Bottom Line – People, Planet, Profit, *Papatūānuku*

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The conference theme is 'the triple bottom line'. Also known as 'people, planet, profit' – triple bottom line is a framework for looking at social and environmental outcomes, as well as financial outcomes – in short sustainability. More broadly for us, what does cave tourism really deliver for its stakeholders – financially, environmentally and socially? But can we go deeper? – to incorporate the fourth dimension, articulated in the title as *Papatūānuku*', but representing culture. Quadruple bottom line reporting requires an organisation to be responsible and accountable to all **stake**holders of an organisation, not just the **share**holders. The stakeholders of an organisation are anyone who is affected by the business activities of a company including shareholders, customers, employees and suppliers. The difficulty faced by many organisations is how to accurately reflect that responsibility and account for cultural values and other outcomes (social and environmental) in a cost benefit analysis. The assumption is that all four outcomes can have a quantifiable financial assessment to determine if they have been effective or not. I propose that money is not a useful measure of sustainability, and that there might another concept that could be applied – mauri.

Exploring cultural heritage values of karst: the development of indigenous interpretation Jenolan caves

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Cave and karst areas have been important cultural sites throughout human history and prehistory. The interpretation of the cultural values of karst has often been seen as automatically secondary to the geological or other scientific values. At Jenolan Caves, NSW Australia, there was traditionally limited interpretation and little to no available information regarding the long association of Aboriginal tribal groups with the local area. The past 18 months has seen the development of a collaboration between the Jenolan Caves Reserve Trust and the Gundungurra Tribal Council which has led to the development of several new products including a self guided cave tour and surface walk both available as smart-phone apps. This collaboration has also dramatically improved general understanding of the connection of local Aboriginal peoples to the Jenolan area and to the cave system.

What Waitomo speleothems tell us about environmental change

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The most important information that speleothems can reveal is about climate. These days we hear a lot about climate change and what's likely to happen in the near future, but most evidence is derived from the Northern Hemisphere and we're not sure if predictions really apply downunder. So we need to determine if known NH climate events (like the Medieval Warm Period and Little Ice Age) are found in the SH. If this can be confirmed then it increases the likelihood that climate predictions will apply to both hemisphere – even if there are leads or lags in events. To reach unambiguous conclusions about this we need well dated high resolution data from the SH that can be compared to data of similar quality from the NH. The best interval to examine is the last 2000 years, because that's when the NH has its most accurate historical data and it's also the period of most relevance to our near future. This contribution will therefore focus on evidence from a 29.4 mm long section of a small stalagmite from Waitomo that grew from 59 BC to 2005 AD. It shows that temperature changes at Waitomo have been generally asynchronous with respect to the NH, except in the 20th Century when warming occurred in both hemispheres. Recent 'global warming' started in Waitomo about 1913 (25 years later than in the NH), but both the amount and rate of warming through last century was not unusual in the context of the last 2 millennia. It was about as warm and sometimes warmer around 1840, 1380 and 750 AD. The general conclusion is that on a centennial scale the SH and NH are generally out of phase, except in the 20th Century when global warming affected us both. although starting slightly later and being less severe (so far?) in NZ.

Dong Thiên Đường (aka Paradise Cave), a new world class show cave in north-central Vietnam

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During October-November 2012, Arthur Clarke and Siobhan Carter joined a group of American cavers on a specialist tour of wilderness caves and show caves in remote areas of central and southeast Laos and northern Vietnam. Promoted as "Focused Tours", run by Dwight Deal and Mary Fletcher, a highlight of their recent karst cave tour was the visit to Dong Thiên Đường (aka Paradise Cave) in the Phong Nha-Kẻ Bàng National Park of north-central Vietnam. Situated near the west branch of Ho Chi Minh Highway in the Quang Binh Province of north-central Vietnam, the park itself is quite remote nestled beside the small township of Son Trach and several smaller villages including the adjacent Phong Nha. Lying about 42km inland (west) from the South China Sea, by road it is about 500 km south of Hanoi and 260 km north of the port city of Đà Nẵng. The Phong Nha-Kẻ Bàng National Park is adjoins the Hin Namno Nature Reserve in Khammouan, in neighbouring Laos. Both regions contain zones of karstified limestone, each area being approx. 2,000 km^2. Listed in 2003 as a UNESCO World Heritage Area (WHA), the karst of the Phong Nha-Ke Bang National Park was first recommended for WHA nomination by one of ACKMA's founders and luminaries: Elery Hamilton-Smith. The national park derives its name from its magnificent Phong Nha Cave and its unique, biodiversity rich, Kẻ Bàng forest.

Aside from the historically known Phong Nha Cave, where tourists visit the huge, highly decorated chambers via motorised "dragon boats", the national park is particularly known for its Hang Vòm cave system and the more recently discovered Hang Sơn Đoòng. Commonly known as Sơn Đoòng, with its main chamber over five kilometres in length, 200 metres high and 150 metres wide, it has taken the title of the world's largest cave chamber away from Deer Cave in Sarawak. Prior to the 2009 discovery of Hang Sơn Đoòng (in Vietnamese: meaning Mountain River Cave), the Hang Vòm cave system was the largest and longest known cave in the Phong Nha-Kẻ Bàng park. Led by Howard Limbert, Son Trach resident and British ex-pat, the exploration of the Hang Vòm system commenced in 1990; the length now exceeds 35km.

Located at an elevation of 200m, the Dong Thiên Đường (Paradise Cave) entrance to the Hang Vòm system was discovered in 2005. The entrance chamber is 150m wide and 100m high with some of the massive stalagmite formations extending almost to the rooftop. Paradise Cave (Thiên Đường in Vietnamese) was opened for tourism on 3rd September 2010; with reportedly multi-million dollar expenditure, the site was sensitively developed in a very short period of time. From the vehicle park, tourists are taken by battery-operated golf car buggies 1.6km to the gathering place where a gently graded wheelchair pathway or steps climb 100m to the cave mouth reception and kiosk. Entry to Dong Thiên Đường costs 120,000dong (about AUS$6.00; NZ$7.00). The standard commercial tour of the first 1.1km of this massive cave is self-guided along well designed elevated walkways with viewing platforms all with good railings to contain the visitors and well lit with state-of-the-art LED lighting (and no coloured lights). From the far end of the walkway, an adventure caving option provides the opportunity for adequately equipped visitors to have a guided "wild cave" experience going a further 6km into the Hang Vòm system. Continuing along the silty clay and sandy floor, you pass through massive 40-100m high chambers and 300-400m long straight passages, crossing small creeks and wading shallow pools, walking to the Vom Grotto with its sandy beach below the 255m deep "Daylight Beckons" (Tang Hole) skylight shaft. The round trip including the developed show cave section is about 14km, with lunch and bottled water provided at the halfway point, below the "Daylight Beckons" shaft.

The International Union of Speleology

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The International Union of Speleology has now been in existence for over 60 years. The first International Congress of Speleology was in France in 1953. Since that time there has been a International Congress of Speleology every four years, in fourteen different countries. It was in the USA in both 1981 and 2009.
The next Congress is in Brno, Czech Republic on 20th to 28th July 2013. The International Union has a Management Bureau of thirteen people. Under the umbrella of the organisation come a number of working Commissions with such titles as, volcanic caves, hydrogeology, speleogenesis etc. There is currently a list of nearly thirty Commissions, some are more active than others, associated organisations to the UIS is, the International Show Caves Association which is also associated with ACKMA.
More recently regional bodies have been formed, including Central America and Europe.

The structure of aquatic macro-invertebrate communities within cave streams

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Cave aquatic macroinvertebrate communities are structured by a host of abiotic and biotic factors unique to their environment resulting in variations between cave and surface aquatic communities. Primarily, cave stream invertebrate communities are presumed to be resource limited with a dependence upon surface-derived energy resources, such as FPOM and CPOM. This dependence upon surface derived energy was assessed down a longitudinal gradient within a cave stream using stable isotopes of carbon and nitrogen, pre-conditioned replicate algal tiles, and leaf packs. Furthermore, I investigated the potential for cave aquatic communities to subsidise subterranean terrestrial communities. Resource additions and stable isotopes confirmed that cave aquatic communities were resource limited and dependent upon surface derived materials, with an isotopic signature similar to that of C3 plants. Seston, benthic FPOM, and epilithon (i.e. bacterial, fungal, and diatom communities) were the most important basal resources within the cave, compared with seston, benthic FPOM, and filamentous algae outside of the cave. CPOM did not appear to be readily incorporated into the food-web. Furthermore, in the absence of an alternative carbon source aquatic derived energy would seem to support subterranean terrestrial predators, such as glow-worms, harvestmen, and spiders. Therefore, both aquatic and terrestrial cave invertebrate communities, including the iconic glow-worm populations, were supported by surface originating organic material, intricately linking their health to that of the surface system, leaving cave communities vulnerable to surface land-use changes.

Towards managing the carbon dioxide partial pressure in caves with both anthropogenic and non anthropogenic sources

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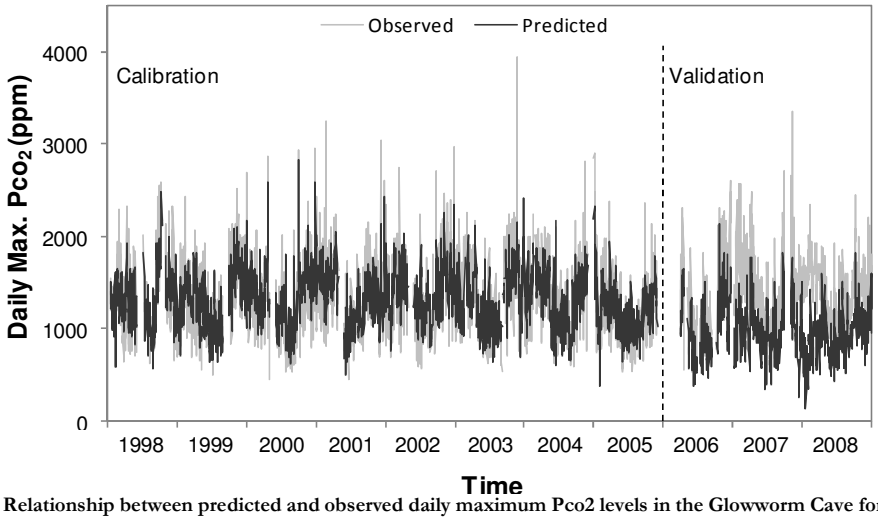
Based on historic data operators of the three Waitomo tourist caves (Glowworm, Ruakuri and Aranui) have been required to maintain the partial pressure of carbon dioxide in the cave atmospheres to less than 2400 $ppm_{(v)}$. Ten minute monitoring since 1998 has shown most exceedances of this limit has come from visitor respiration and exceedances have mostly been avoided in recent years by careful management of visitor numbers and passive ventilation. However one or two exceedances have occurred each year when no visitors were present. Non anthropogenic sources of high carbon dioxide partial pressures were observed in glowworm cave following periods of intense rainfall with exhalation from both stream and drip waters. A linear regression model involving the previous day mean P_{CO2} tourist numbers, temperature gradients, rainfall and Waitomo Stream discharge successfully predicted the daily maximum P_{CO2} for Glowworm Cave.



Relationship between predicted and observed daily maximum Pco2 levels in the Glowworm Cave for the calibration period 1998 – 2005 (R2 = 0.56; Nash-Sutcliffe = 0.56) and the validation period 2006 – 2008.

Ruakuri Cave showed a different problem with a side passage (Drum Passage), into which a newly constructed entrance was placed, regularly displaying continuously rising P_{CO2} when outside temperatures exceeded cave temperatures throughout the diurnal cycle. A natural source of undersaturated infiltration waters containing at least 6000 $ppm_{(v)}$ appears to be active. Management of this can be achieved increasing ventilation.

Cave science: sampling for science in caves

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Calcite speleothems have become a significant component of research into past environments, especially climate research. A particular strength of speleothems in this regard is their unique ability to be accurately dated over a long period of geological time by either U/Th or U/Pb dating techniques. Stalagmites are also useful as they contain a range of climatic and environmental proxies such as oxygen and carbon isotopes, trace cations and organic compounds. How can such scientific sampling be managed and what restraints need to be placed? Do we want or need the science? Speleologists and cave managers cannot ignore the pressures for samples and need to understand the valid requirements of the science whilst balancing the need for good cave management. If we understand in general terms why particular numbers of samples are required, we will gain the best from the science without seriously damaging caves. This presentation will look at issues relating to cave conservation and makes some suggestions regarding scientific sampling, publication and use of science.

People, Planet, Profit…Palaeontology!

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Palaeontology – the study of ancient life – has long been a fascinating subject for young and old. Interest in bones and fossils has skyrocketed over the past decade as documentaries, books and popular films bring the past to life (what modern child does not know the animated Ice Age films?). Cave systems are natural repositories for collection of bones, and the constant temperature and humidity permit excellent preservation of past life in karst areas. Cave palaeontology can teach us much about our world: the past, present and perhaps even the future (importantly, distributions of animal species through periods of climate change).

Cave products reflect the significance of the area, and include cultural, geological and palaeontological values. Jenolan Caves is moving forward from a past focus on crystal, with more than one string to its bow. Today's savvy visitors want more. The palaeontological record tells a story, one that not only enthrals visitors but lends itself to development of targeted tours, activities and programs. Palaeontology provides a popular conduit bringing current scientific ideas/cave science to a broad audience. Naracoorte Caves in South Australia is internationally recognised for its remarkable fossil deposits and has parlayed this into a highly successful caves operation. However, although Jenolan Caves boasts many superlatives, including the discovery that Jenolan has some of the oldest open dated caves on earth, palaeontology has never been adequately explored over the years. My aims as a vertebrate palaeontologist working at Jenolan include the discovery of potentially rich fossil deposits, identification of this material and publication of results to a wide audience, adding a deeper level of interpretation and scientific integrity to the Jenolan visitor experience.

All aspects of the 'Jenolan experience' have commercial value, and in recent years Jenolan has become increasingly more mainstream. Palaeontology is undeniably a major drawcard. To that end, Jenolan is incorporating palaeontology into forward marketing plans as one of three main initiatives for 2013-2014. Plans include palaeontology-themed activities and tours (Musser, 2012), palaeo-themed product lines and production of peer-reviewed scientific publications on cave fossils (Australian Ice Age megafauna). One of the highlights of the program will be the re-opening of the Nettle Cave 'dig', a highly significant deposit of small mammal bones collected under an owl roost along the path of the complimentary self-guided Nettle Cave tour. Interaction between palaeontologist and visitor will provide a unique opportunity to engage in 'live science', establishing a vital connection for visitors to our past, re-energising the visitor experience and encouraging repeat visitation – 'win'win' for people, profits and palaeontology.

References

Musser, A. M. (2012). *Off the Track with Stones and Bones: Bringing Jenolan Caves' Past to Life.* Journal of the Australasian Cave and Karst Management Association, **89**, pp. 10-12.

The Auckland Lava Caves

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Auckland is a city of almost 2 million built on 50 recent basalt volcanoes. These have lava tube forming flows, and have produced more than 100 caves. Aside from the obvious interest of the caves, there is the association of caves with the various civilisations that have lived on top of them from the original Maori to modern suburbia. The effects of developers, bulldozers and sporadic council protection will be discussed along with a little geology to set the scene.