

ANDYSEZ 43 IS THERE LIGHT?

- Andy Spate

The "Bat Ladies" - part of a modern dance/song troupe that entertained the Cave Expo crowds



This ANDYSEZ might be seen as a trifle whimsical. But it illustrates, yet again, the breadth (and depth) of karst science. Cave guides may be able to raise this discussion with their clients – not on every tour please! It might provide some additional material when discussing non-light driven energy sources which provide the driving forces that support some extreme ecosystems.

At the Samcheok City, Republic of Korea, 2002 International Cave Expo, I was handed a copy of the *International Journal of Speleology* (29B(1/4) 2000). I visit this Journal occasionally and it often has much of interest (and only costs individuals 16 Euros (~US\$15) a year – but isn't that a kind of kangaroo?).

The issue cited above includes a number of interesting papers including:

- *Development, Management and Economy of Show Caves* (Arrigo CIGNA & Ezio BURRI) which lists "Some important show caves from all over the world". All Australian show caves are listed courtesy of Ernie Holland. Twenty-one Australian areas out of the 200 listed (of an estimated 800 world-wide!). Only four New Zealand activities.? It presents an excellent discussion of show cave management, economies and the environmental aspects of show cave development. Would that our governments and agencies be so interested...?

Hey Kiwis – could we have a listing of New Zealand show caves in the next Journal?

- *The Influences of Cave Tourism on CO₂ and temperature in Baiyun Cave, Hebel, China* (SONG Linhua, WEI Xiaoning & LIANG Fuyuan).
- A wonderful (and perhaps whimsical) paper by Giovanni BADINO (from Italy) titled "Is it always dark in caves?"

The answer to the question posed by Badino is "No"! As he says "It is always dark in caves, yes: but not *absolutely* dark..." [emphasis Badino].

I am going to attempt to précis Badino's paper to explain why caves are not dark. Badino's observations and calculations seem to indicate that Andrew Pavey's remark about $f2.8$ for three weeks may be applicable for eyes adjusted to visible light. Using ASA 400 film at $f1.4$ and allowing for reasonable reflectance from the cave walls, ceiling and floor a reasonable picture would seem to require somewhere between 20,000 and 4,000,000,000 years... Even Pavey won't wait around that long!

Read on, dear friends...

You will all have seen photographs of large tanks of water associated with nuclear reactors and other sources of radiation which exhibit a ghostly blue glow. This is light produced by Cerenkov radiation which is defined by the OED as "Light emitted by a charged particle moving in a medium at a speed greater than that of light in the same medium." You all know as well as I do that visible light travels quite slowly through limestone but you might not know that cosmic rays pass through rock.

The Earth is constantly being bombarded by radiation of many forms from outer space – much is dissipated in the atmosphere producing showers of particles of many kinds. At sea level, electrons, gammas, neutrinos and muons make up much of this radiation. At just a few metres below the surface only muons and neutrinos from cosmic rays are present. The muons are absorbed relatively early but the electrically neutral neutrinos can pass right through the Earth without interaction. If interaction does occur a muon might be produced which will travel through rock, water or air (caves) producing Cerenkov radiation.

Other light sources in caves are from secondary processes produced by radioactive minerals within the rock mass or from the luminescence of non-radioactive minerals stimulated by high energy particles from radioactive decay. Badino points out that these natural light fluxes in caves are very easy to detect (using instrumentation) but are not utilised by underground life forms. As far as we know... There are many places around the world where natural and artificial cavities are being used for the

study of cosmic rays and associated radiation and particles.

Badino discusses the processes of vision which are both complex and poorly understood. It would appear that the time resolution of any organism's eyes – that is the duration of Cerenkov and other light release occurs too infrequently for our eyes to respond. As Badino says “It is not strange that caves appear to us as dark: the general features of cave illumination do not fit with the vision parameters selected outside [caves] by life evolution.”

The Grotto Gigante is a very large cavern near Trieste, Italy. It is at a depth of about 100 m and a diameter of about 15 m. In this cave, using the average muon flux and the eye's surface area, we can estimate that within 100 seconds there will be only two muon interaction with the retina. This will produce about 50,000 photons each minute directly against our retina. This is about the same intensity of a 6th magnitude star which is defined roughly as the absolute limit for visual detection.

As Badino says “...it is difficult, but we may see it! So, it is probable that a part of phosphenes (the luminous impression due to the excitation of the retina by other than the impingement of light) that we may see in cave darkness is the visible part of cave illumination...”

Typical Korean cave interpretation sign usually found just inside the cave entrance. Most, as this one, have a map of the cave with chambers or features named, some pictures of cave features and some explanatory text - usually in Korean with abbreviated English texts. This is outside Seongnyugul (Seongnyu) Cave.



In the ACKMA Booth. Ms Bang Seoung Ju seeking information from Lana Little. Ms Bang was one of our very helpful volunteer interpreters.



Let's finish by quoting Badino's conclusions verbatim:

The cosmic radiation and other secondary effects are able to release visible light in underground cavities, mainly by the Cerenkov effect. The illumination increase linearly with the cavity dimensions.

These light emissions are largely used for cosmic rays studies, especially in Underground Neutrino Observatories, and generally speaking are able to give physiological effects, but the need for noise [in a physics sense] reduction forces the brain to disregard such weak signals in the construction of a visual sensation. This is the reason why caves appear to us as so dark.

It is easy, for us, to design “eyes” able to reconstruct images from light fluxes in caves, but they would be large and energetically expensive devices that could work only in large cavities. The Nature, more cleverly seems to have chosen different and simpler ways to give good detectors of the surrounding world to the underground life.”

I would bet that future research in the coming decades will reveal the use of Cerenkov or other light sources by underground life... Stand by!

SOME MORE ON KOREA...

- Andy Spate, Lana Little & Andy Lawrence

In my article in the last Journal I promised some more on Korea. I really don't have very much to add other than to reinforce my previously conveyed condolences to the people of Samcheok City, and Korea generally, on the appalling floods that visited the east coast not long after the Expo. About 30 people died in Samcheok City alone. Part of the

permanent Cave Expo display was extensively damaged as well as many homes and other buildings. Our colleague, Mr Kim Dongbin, tells me in a recent email that reconstruction is proceeding well and that the homeless will be re-housed before winter – which will be well underway by the time you read this.

The months since the Expo have reinforced my view that ACKMA did well in flying the Australia/New Zealand flag at the 2002 Cave Expo. Remember that the ACKMA posters are available to members for any special events you might have. Below are some paragraphs from Lana and Andy which give their perspectives from their viewpoints.

We hope that Mr Kim Dongbin, Mr Park In yong, Mr Lee Song-mo, Professor Woo Kyung Sik and perhaps others from South Korea will be joining us for the conference next year.

Lana Little comments....

The Cave Expo was a real eye-opener for me in lots of ways, and there's been a certain amount of flow-on of that effect to people I've been in contact with since my return. The International Cave Pavilion where the ACKMA booth was proudly on display became a little sub-community within the dynamic and loud environment of the Expo, itself wedged into the seething mass of humanity that is South Korea. Or so it seemed. Perhaps an Antarctic veteran like Andy did not find it so unusual, but for me it was quite novel to be communicating daily with Russians, Greeks, Italians, Belgians, Malaysians, Chinese, etc., not to mention Koreans. Thank heavens they all spoke a form of English, even if their Shrine was a bit lacking. Our volunteer interpreters were a great help.

Seongnyugul (Seongnyu Cave), Uljin City - the first show cave to be developed in South Korea. The picture shows the plant "room" (actually a cave chamber) near the entrance with switchboards and cave cleaning gear.



I learnt a great deal about caves and karst all over the world, and some of the posters and other material that we lugged back have really provoked some comment in Chillagoe. Only last week there was a Departmental District Meeting hosted here, and several participants were prompted to ask about the content of some of the posters and maps.

Likewise, there was strong general interest in the ACKMA material displayed in Samcheok, but it must be said that the 'market' was almost exclusively domestic. Not to say that there were not some useful and genuine contacts forged amongst the 'Foreign Participants' as a group, but the stream of faces flowing past the booth were Korean. Is this a surprise, and is it a problem? Sort of. I had no real appreciation of the strength of the South Korean economy before my visit - in the Asian arena it is second only to Japan.

The South Koreans have a strong habit of domestic travel in summer and do not seem to actively promote much international tourism. With the population density and prosperity as it stands, there's probably no real need. So while the locals were thoroughly EXPOSED to information from a range of countries, ACKMA was largely EXPOSED to South Koreans - but lots of them!

The booth hours were pretty long - it was definitely a good idea to have two persons sharing the load, allowing some time for expeditions to local attractions.

As well as visiting a number of strongly developed and heavily visited tour caves, I was fortunate enough to be taken into one undeveloped and spectacular cave, and also tagged along on a scientific monitoring visit to a tour cave that was closed due to flooding. The hardened tour caves sport a great deal of concrete and stainless steel, and coloured lighting is favoured.

There are also sometimes added attractions such as fountains and video screenings to amuse visitors. The choice of concrete and stainless steel is a pretty natural one in a country where there seems to be a cement plant in every valley and stainless is locally manufactured and available in profiles, patterns and finishes undreamt of here.

The Expo itself was a planned-in-detail, no-expense-spared affair, and the organising committee proved to be genial, gracious and generous hosts. In fact, the attitude of the wider community that we encountered was without exception friendly, sympathetic and helpful - they seem like a really great bunch of people.

I took the opportunity on the way home to call in to Mulu and see what Brian and Sue Clark were up to. It had been ten years since my previous visit, and while some things were unchanged, others were unrecognisable. Brian was not one of the latter, though he is looking very fit and happy - the place and the job obviously suit him. Brian and Sue made me extremely welcome and comfortable, and I thoroughly enjoyed my time in the jungle with air to breathe and room to move, before it was time to head back to work.

Andy Lawrence comments....

It was with mixed emotions that I left Sydney on the 7 July 2002 bound for South Korea to represent Jenolan

Caves and ACKMA at the International Cave Expo in Samcheok City on the East Coast of South Korea.

Firstly I felt sadness for the Jenolan Caves Reserve Trust representative who was originally scheduled to attend the Expo but had to pull out just a week before due to family illness. But also I felt great excitement at the chance of visiting a country I had not seen before as well as the prospect of being an Australian representative at this major international caving event.

The Expo was a huge undertaking, with a multi million dollar budget assisted by government funding. The Prime Minister and many of his cabinet attended the opening ceremony which included a great mix of speeches, dance, music, national pop stars (causing a mosh pit frenzy of thousands of screaming teenage fans), fireworks and an interesting release of thousands of helium filled bat shaped balloons.

The first week's visitation to the Expo exceeded expectations. I believe that there were close to 1 million visitors over the 30 day event. During the busiest time of the day we estimated around 5,000 visitors per hour passing through the international pavilion.

My official duties at the Expo included assistance in setting up the ACKMA display with Andy Spate and attending to our booth alongside 19 other Internationals, 2 Korean groups and three additional booths exhibiting regional Chinese foodstuffs and other manufactured goods.

A wide variety of international speleological interests were represented at the Expo, international pavilion exhibitors included:

- Ajanta and Ellora Caves – India
- Andalousian Museum of Speleology – historical stamp and postcard display
- Australian Cave and Karst Management Association
- Benxi Water Cavern – Chinese showcave
- Bi Yung Cave – Chinese showcave
- Cango Caves – South Africa
- Caves of Borneo – Malaysia, mainly Mulu Caves exhibit
- Caves of Brazil – Brazilian school Speleological educational group
- Caves of Wollonia – Belgium
- Bulgarian Speleological Society
- Greek Caves Myth and Reality – Greek anthropological display
- International Show Cave Association
- International Union of Speleologists
- Kungur Ice Cave – Russian showcave
- Frasassi Le Grotte – Italian showcave
- Korean Society of Environmental Science
- Korean University of Caving Federation
- La Venta Exploring – Italian Speleological group
- Lebanon Speleological Society
- Russian Union of Speleology
- Skojanske Park – Slovenian showcave
- Yellow Dragon Cave – Chinese showcave

The reception we received from the expo visitors was invariably warm, friendly and curious. One noticeable difference that I found in comparison with Australian trade shows was that as many Koreans appear not to have encountered many foreigners, we the exhibitors, politely referred to as “booth managers” were as much the focal point of interest as the exhibit.

The Expo organisers were particularly impressed by the ink bat stamp that Andy Spate had brought. The crowds of children around our booth waiting to get their bat stamp attracted a lot of attention both from visitors and media. The Expo volunteers (similar in style to the Sydney Olympics) were a great help as many had translation abilities.

Whilst there were a few pre Expo organisational glitches that were sorted out for us in the early stages of the event, daily operation was generally very efficient and was a great credit to the Korean organisers.

It was great to be able to mix with other international speleo representatives in the pavilion, although it was a test of stamina to be able to attend the booth for twelve hours until 9.00pm then head off until the early hours of the morning for more networking with the internationals (and more curious locals) in Samcheok city's infamous “rock and roll bar”.

As the 2002 IUS symposium was held in Samcheok at the same time as the Expo I was fortunate in being able to accompany some of most highly respected speleologists in the international caving arena on several field trips to both adventure and show caves.

A good example was Hwanseon Cave, located about half an hour south west of Samcheok. With a visitation of around 600,000 people each year it has been well hardened for tourism by extensive elevated stainless steel walkways. Karst interpretation for this self-guided tour is good, using multi lingual signage.

The section of wild cave that we saw comprised of some sporting active vadose passage followed by some higher level drier sections nicknamed the assault course, the latter having been discovered around 20 years ago by the Korean University speleos.

The full extent of the system remains unknown, as the cavers have been told not to explore any further and apparently cave permits are hard to obtain from the controlling government body.

Thanks to Andy Spate for his company and dedicated work in coordinating the Australian stand, Samcheok City Expo organisers including Mr. Kim Dong Bin, manager of international liaison, all the Expo volunteers, Dr. Kyung Sik Woo, the Korean University of Caving Federation, Julia James and Jason Hong, for their hospitality and assistance in providing lasting memories of a wonderful country.

