To Dig or Not to Dig? – That is the Question.
A Philosophical and Physical Discussion.

Grant Gartrell – Part 2

Apart from having my own basic desire to explore, to find out more about the true extent of a cave system and why it is there in the first place, I have come to realize that while many of us in the community at large may have at least a casual fascination with caves, few really understand how, let alone why, they are formed, and what caves can reveal about our past. Unless and until we can materially improve both the broader community's perception and appreciation of the significance of caves and karst processes, we risk losing more and more caves as a consequence of ill-informed planning decisions.

The Nullarbor provides us with a classic example of this. To most of us it comes as a great surprise that such a "featureless" landscape actually has "features" hidden beneath it, and there is a general lack of understanding as to why such "features" exist in such a place. Very few except those familiar with the basic principles of karst really appreciate the nexus between the lack of features on the plain surface and the development of elaborate karst features below.

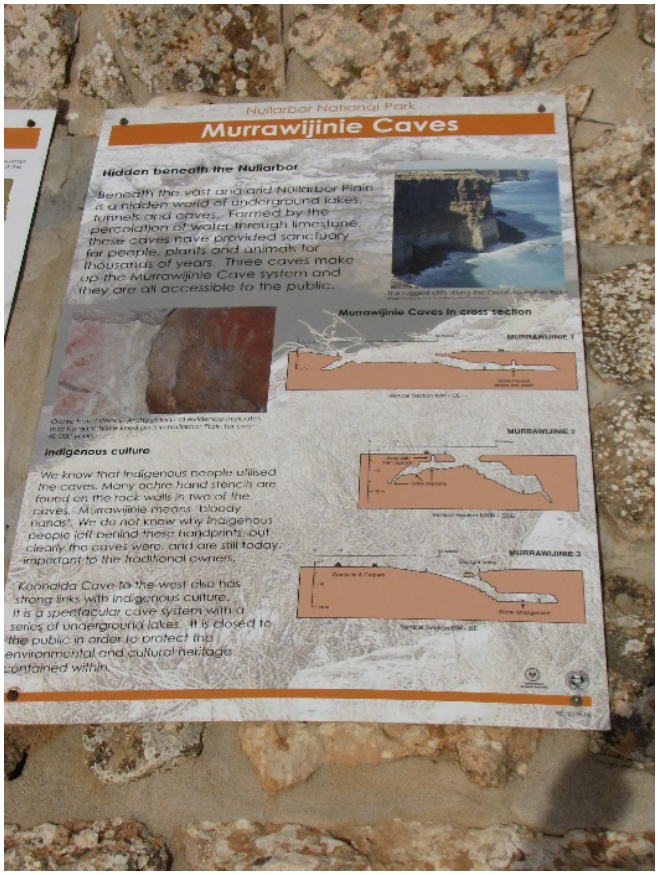

Image above: Murrawijinie Caves, Nullarbor, photo K. Dixon

Image left: Koonalda entrance with Fred Asplin on ladder

And yet the surface is truly far from featureless. Its features might be subtle, but they have a great bearing on what lies below.

Even though undoubtedly a low rainfall zone at present, that clearly has not always been the case, and were it not for the porous nature and solubility of the limestone strata which comprise the basic geology of the area, it would not be a plain at all, but instead have formed a network of ephemeral minor creeks draining into more successful major watercourses, and thence eventually to the sea. The fact that such an erosional drainage network has ***not*** formed over the tens of millions of years since those limestone beds were first laid down in the early to middle Miocene and progressively uplifted, is clear evidence that every square centimetre of that Nullarbor surface is an integral part of an amazing karst system of truly world significance, which should be recognized and respected as such.

A recent proposal to cover an area in which are located some of our most significant known Nullarbor caves with a large array of infrastructure for harvesting wind and solar energy has highlighted the divide between those that understand karst processes and those for whom such an understanding might be inconvenient. I cannot make the point too strongly. I re-emphasise that while the caves and other karst features are formed by dissolution of the limestones under the plain, that process actually starts right at the surface of the plain, and thus the surface of the plain is an integral part of the karst system generating those subterranean features.

Developing extensive infrastructure on the surface of the plain is pretty much on par with commissioning sewage farms or rubbish dumps to be located in the catchment of your city's reservoirs, about as appropriate as adorning the Mona Lisa or even the Sydney Opera House with paid advertising.

Some people who might be truly appalled by concepts with which they are more familiar might take a little longer to fully understand that simply calling a concept a "Green Energy Hub" does not necessarily make it green.

I can understand why some cavers like to keep cave locations a closely guarded secret and access to caves as constricted as possible. Yet this may still be risky, particularly where there is competition for land use. It might be a better strategy to establish the likely true extent and significance of cave systems, and tell the world about it, prior to planning decisions being made that could jeopardise the future of those systems.

I fully understand the desire of some of the more sensitive specimens of the human race, and, rightly or wrongly, I count myself amongst them, to leave only soft footprints upon the earth. Yet I support the need to gate some caves as well as improve access where appropriate to do so, not only for cave rescue situations and for the development of tourist caves, but also for initial exploration and later community assessment for application of appropriate conservation measures.

The most common argument raised against any such alteration by people who are unfamiliar with the not particularly intuitive physical principles pertaining in such situations is that restricting or opening up a cave passage might dry out, or otherwise alter the cave atmosphere. For further discussion of those physical principles, please refer to my companion article on the physics of cave air flows.

The following examples may provide a useful guide for better decision making in the future.

Alteration to Cave Access / Routes – no, yes or maybe?

The "No" Case (no justification for alteration to cave access / routes)

There is a cave in the Flinders Ranges containing an awkward constriction affectionately known by a few remaining old geezers as the eight and a quarter inch squeeze. In my younger days I felt a sense of achievement on a par with the cavers' party trick of climbing through a coat hanger when I successfully negotiated it. Like most people, including palaeontologist Neville Pledge, now retired from the SA Museum, I don't fit through either anymore. Neville even had a cartoon of his rite of passage through it painted on his caving helmet. It just wouldn't be the same if we chipped it out and made it half a metre wide. Why would you? The whole purpose of negotiating that squeeze is that it presents a challenge which would cease to exist if it were enlarged. There are no surprises awaiting us beyond it. We can already go around the easy way to get to the other side. Nobody would ever even think of attempting to rescue an incapacitated caver through it any more than they would contemplate passing a caver on a stretcher through a coat hanger.

Our conversion fifty-six years ago to the metric system may have put the kibosh on it anyway. I haven't even once heard it referred to as the 20.95 cm squeeze.

The "Yes" Case (justification for sensitive alteration to cave access / routes)

If, after a careful survey, we become aware of a breeze coming out of a hole too small to get through, or to get past any other way, some of us have an itch to scratch a few rocks out of the floor, or whatever it takes to check out why that breeze is there. It is sufficient at this stage to simply be aware that the breeze must come from somewhere, and quite possibly somewhere interesting. One of the first questions little children like to ask is "Why?" I must have been quite annoying as a child. I still ask "Why?" Sometimes the answer is simply "Why not?

As part of a team effort (it is good to have other people to do most of the work) I and others have scratched that itch many times over the years and located many caves and cave extensions as a result. Purists are not obliged to visit those sections of cave discovered this way but might be surprised at how little that leaves for them. Seventy-five years after Naracoorte's Victoria cave was first developed as a tourist cave, such a breeze led us to a more than ten-fold increase in the size of the cave as well as the fossil deposits which gave us the new name of Victoria Fossil Cave, the principal reason for South Australia's currently only entry on the UNESCO World Heritage Register. I was skinny back then, half a century ago, but so keen that I happily scraped skin off my chest first accessing the new chamber.

We could hardly expect those that followed, including David Attenborough, to do the same, although it might have made interesting colour television. This, and every other related discovery has contributed to the growth of the knowledge database through an amazing group of young and more senior researchers making continuous scientific advances in both the understanding of karst processes and the development of our palaeontological record. It is most comforting to know that my finely honed, but nevertheless basic expertise at scratching away at rocks can lead on to such lofty and inspiring outcomes.

Cave tourism, done well, is an essential element in raising awareness in our communities about the importance of caves, which can all too easily become unfortunate voids in limestone which less speleologically inclined specimens of the human race may consider to have been principally put on earth to be mined, or, as has already been mentioned above, improved by the addition of infrastructure that only engineers could love.

Yes, limestone is a resource, and sometimes difficult decisions may have to be made. But those decisions need to be based on adequate information and expertise.

In the case of the Victoria Fossil Cave, it was particularly good fortune both that the cave occurred within the relative security of a state reserve, and that our initial exploration party included the palaeontological expertise of Rod Wells. At that time the Naracoorte Park was a National Pleasure Resort, operated by the South Australian Tourist Bureau. The park has since been re-dedicated as a National Park, managed by the Department of Environment and Water.

It took a moment to first realise that the corrugated edges on many of the silt encrusted rocks protruding from the surface of an extensive silt deposit were in fact rows of teeth, that what we were looking at were segments of a sea of bone. It quickly became clear to me that Rod had caught an amazingly prescient initial glimpse of the rest of his life and research career stretching ahead of him. While it was obvious to me that the bones were interesting, and special, Rod had studied his field so well that he could tell me not only their names, but what they had for breakfast. I am serious! That's why their teeth have evolved the way they have. A truly amazing detective story that runs rings even around Sherlock Holmes! From the vantage of half a century of hindsight, it is no surprise to me that the now Emeritus Professor Rod Wells AM over his life earned the title of "Father of Palaeontology" at Flinders University.

He was undoubtedly immediately aware of the significance of the find, although more than 95% of the huge original bone deposit even to this day remains undisturbed, buried in deep, stratified, protective cave silt. As work progresses in the safe and enthusiastic hands of the following generations, the find continues to exceed even Rod's expectations and becomes ever more fascinating due both to the quality of the research and the amazing advances in science over the ensuing decades. That detective story just keeps getting better and better! The current carefully planned active research program ensures that this will remain the situation for centuries.

It was also particularly fortunate that on the day of the discovery we had the late Ern Maddock with us. A senior manager with the Tourist Bureau, Ern was looking at a different area of the Victoria Cave at the same time, with a view to improving the movement of visitors, and as soon as we told him of our discovery, he realised that the visitors to the cave would appreciate sharing the detective story as well.

Far too often, the people that get to decide the future of our karst heritage are miners and quarry operators with little or no karst expertise. I remember an incident a long time ago in which a Mines Department officer advocated permanent closure of the Victoria Cave when a rock fell and bent a wheelbarrow while some work was being carried out on a dug entrance tunnel. Being in a park dedicated to caves probably saved the Victoria Cave from being classed as a nice enough little hole that would be better off in a dump truck.

If you consider that I may perhaps be unduly flippant or intemperate with such descriptions, please check out the 18th Report of the Environment Resources and Development Committee of the South Australian Parliament into Sellicks Hill Quarry Cave. It is 130 pages of well-chosen words arising from an enquiry into the destruction of a significant cave system by a quarry operator. The subject matter remains so important to me that I am shocked at how difficult it is to track down a copy of this report after 27 years. Did the then government particularly want it to go away, or is it just that society thrives on forgetting a lot more stuff than it retains? If you would like a copy but cannot find one, you are welcome to send me an email (farm@blueberrypatch.com.au).

Cave rescue expertise is another aspect of caving that cavers understandably wish to avoid, but really appreciate having, just like a good ambulance service. Improved access may be essential in some cave rescue situations. If you ever had any doubts about community interest in cave rescue, just cast your mind back to 2018 and the rescue of the soccer team in Thailand that riveted pretty much the whole world to their TV screens. Think for a moment about those young soccer players themselves, their natural curiosity and sense of adventure. Just about anyone who has ever been in a cave or who has been interested in caves, casually or otherwise, shares a bond with those lads. We breathed a huge sigh of relief, tempered with sadness for the Thai Navy Seal who lost his life, for the soccer team, their families, and for every person involved when the incredible rescue effort succeeded.

But I also breathed a sigh of relief on behalf of caves generally, and cave science. My Sellicks experience leads me to believe that some people in the mining industry may latch on to any negatives, whether actual or simply capable of being misinterpreted that way, to justify to themselves that caves are intrinsically dangerous and that they are carrying out a public service by getting rid of them wherever possible. In my naïve youth I attributed such mindsets only to Southern Quarries and our Mines Department, but there was an outbreak not long ago of something similar at Juukan Gorge in the Pilbara. The broader Australian community expressed disgust at Rio Tinto's collective corporate behaviour over Juukan Gorge and made it clear that the Western Australian State Government had nothing to be proud of, either. Both parties are surely hoping that the destruction of one of the oldest archaeological sites in Australia will be long forgotten a quarter of a century from now. It is hard not to draw close parallels with the Sellicks Hill debacle.

Sellicks Hill and Juukan Gorge Caves, while having totally different origins, are both for me compelling arguments for the "Yes" case. The Juukan Gorge caves were anticlinal rock shelters containing the oldest known continuous record of aboriginal occupation in a remote part of Australia. Essentially wind-eroded surface features, they were a testament that a cave does not have to be large or deep to be a valuable, indeed irreplaceable, site for the preservation of our historical record.

It is hard to believe that either Rio Tinto or the Western Australian Government would have handled the matter as they did if they had any prior appreciation of the storm of adverse publicity their action was about to unleash, but perhaps they did and felt that they could simply tough it out. While many would simply assume this and attribute it to arrogance, I don't want to lay blame on anyone for this quite unnecessary failure, but I cannot help feeling that if the communication processes could have been better prior to the event, then the tragic destruction, for that is undoubtedly what it was, could have been averted. That would have been in Rio Tinto's and the WA Government's interests, as well as those of the broader community. It should not have cost Rio Tinto much to secure the site and it would have been a positive story that enhanced their reputation, instead of the exact opposite.

Similar comments apply equally to Sellicks Hill. We may have thought that we were communicating adequately with both Southern Quarries and the Mines Department, but communication is only illusory if the message that you think you are transmitting doesn't elicit the responses you are expecting. Even though we might think we are speaking the same language, if the words conjure up different historical associations on opposite sides of the table, then the message isn't getting through, and communication is not really happening.

Whether it is possible to make the appropriate translations and get the message through is not at all clear, but what is clear is that the Mines Department people and the quarry operators were in the main just people trying to do their jobs to the best of their ability. We, with our special perspective on the caves in contention, were not communicating adequately, and nor were they. We might have thought otherwise at the time, but it is clear in retrospect that we were not speaking the same language. "Inconvenient isolated cavities" is not an accurate translation of the concept of an extensive and integral karst drainage system, and all the environmental consequences that concept should convey. On top of that we were reluctantly bound by a confidentiality agreement insisted upon by Southern Quarries as a condition for our continued access to the cave. This seriously restricted us from soliciting additional expertise or community opinion in support of saving the cave.

The destroyed section of the Sellicks Hill Quarry Cave was ***not*** just a few accidental cavities in a mineable resource, but a section of an extensive and integral karst drainage system, a significant underground valley which would enjoy better legislative protection and be treated with far more care and concern if it were a more familiar and better understood classic surface erosion valley. Some of this cave must still remain in close to pristine condition outside the current boundary of the quarry. How do we get the message through?

The only way I know to be able to make a case for preservation of such caves is to prove not only that they are there, or could reasonably be expected to be there, but to explain why they are there and why it is important that they are there. We need to be able to shine a spotlight on them and make the community at large aware of them, to open them up sufficiently that the quality of the resource cannot be denied, and can be peer reviewed, and to do so early enough in the planning process that there can be no question of the issuing of mining leases to compromise their future prior to an obligatory and well-informed environmental assessment process. In the case of the Sellicks Hill limestone, for the want of more comprehensive remote detection techniques, cave air flows are possibly the best indicator that we currently have as a guide to the scale of the cave systems generating them.

But before discussing cave values themselves in more detail, we should recognise that in addition to the "Yes" case, and the "No" case, there must also be one in between, the "Maybe" case.

The "Maybe" Case (possible justification for alteration to cave access / routes)

The Jenolan Caves in New South Wales is a wonderful assemblage of largely interlinked tourist caves that have been progressively discovered and developed over a long period of time. Two particular tours, the Orient Cave and the Temple of Baal, were originally accessed by first negotiating several other sections of the system. I am told this involved climbing up and down about 1400 steps, leaving most visitors completely puffed out before they even got there.

To obviate the need for this, a four-hundred foot (130 m) tunnel known as the Binoomea Cut was driven in sideways to provide direct access. Many New South Wales Cavers would know it well. It is an interesting story, but for another day. The tunnel was drilled and blasted without vibrational damage to the delicate decoration to which it was providing access. Presumably the blasts were designed and monitored with this in mind. It was also equipped at each end with well-sealed and insulated doors to ensure the maintenance of the original humidity and temperature regime of the cave atmosphere. It has now been in place and effectively achieving its objective for over 67 years.

Why is it on the "maybe" list? Its construction was not essential for establishing the existence of the section of cave to which it gave ready access. On the other hand, given the tourism status of Jenolan and a reasonable fitness profile for those you would like to be able to visit the cave, then there is a very strong case for it. As well as its purpose, the manner in which the project has been carried out will influence its placement on the sliding scale between the "No" and the "Yes" cases.

To me the Binoomea Cut is an asset for Jenolan to be proud of, and a valuable demonstration that we need not be afraid of creating such structures, provided that we do so carefully and sensitively and make a good job of it.

How Do You Value a Cave?

A number of places around the world have now developed methodologies for placing realistic monetary values on trees. It might take as much as two hundred years, or even longer, to replace some trees. Quite conservative costings in some circumstances arrive at values for a tree of the order of tens of thousands of dollars. This might initially sound overly generous but consider the collective loss in property valuation to a higher-class leafy suburb in just about any capital city if all the more mature trees were removed, especially with the increasing incidence of climate change induced extreme weather events.

While there has certainly been interest in several parts of the world for establishing a valuation methodology for caves, I am not aware of anyone formally adopting such a scheme, but it is high time that we did. Nobody has yet worked out how to replant a cave and have it mature in 200 years. Timescales for cave development should be factored into the valuation and are somewhere between 10,000 and a million times greater than that for a tree.

The concept of value means quite different things to different people. Southern Quarries considered the cave under their quarry to have a negative value. The airspaces created a potential hazard for their heavy machinery, the cavities themselves didn't register on the weighbridge, and drilling cavernous ground tended to flex the drill rods for their diamond drills sideways, jamming them. In that regard, we had something in common with Southern Quarries. Although we wanted the cave, we didn't want it to be under their quarry any more than they did. It was a serious failure of government that the quite obvious signs of karst development were not recognized and properly evaluated when approval was given for the quarry to be established there in the first place. This exposed the quarry workers initially to a significantly higher than expected level of risk which was later substantially mitigated by calling in cavers to evaluate and delineate the cavities.

Developing a methodology for assigning monetary value to caves is not going to be easy, but it is simply not a fair proposition to suggest that just because someone wants to mine a particular area of limestone, the government should therefore artificially set a value of zero for any karst features related to that limestone. There would be no significant difference between that proposition and the idea that our State's Parliament House has a nominal value that should similarly be re-assigned to zero in the event that a mining company wanted to dig it up. Ah, but that is different, do I hear our politicians saying? Not if you bother to think carefully about it! And like the trees, you could build another parliament house much quicker than you can replace a cave.

Surely our society is no longer so naïve that we would consider it to be in our interest that the fox remains in charge of the henhouse. While it might take a good deal of thought, a much fairer proposition would be to assess the limestones in terms of the most current science of karst processes to ascertain the overall cost to society of the destruction of such an actual or potential asset, and balance that against the net returns to the state from the quarry taking into consideration the loss of that asset, the availability of alternate resources, and so forth.

A similar situation relates to the already mentioned proposal to erect an extensive renewable energy farm, with associated infrastructure, across vast expanses of the Nullarbor to the North of Eucla. Considering the lack of any information to the contrary, it would appear that the preliminary calculations for such a scheme are predicated on assigning a zero-dollar value to the land itself. Are we being expected to consider that one of the World's most extensive karst provinces, that some consider should be nominated for World Heritage listing, should be of no value whatsoever and quite expendable? Davey et al, recommended World Heritage status in an Australian federal government funded report in 1992.

It would be quite irresponsible to plan a project such as this without a proper and thorough environmental impact assessment, and it is really difficult to envisage the resources, both financial as well as human, that would be required to complete such an assessment with any rigour before the technology proposed, the wind turbines and solar panels, extensive cable networks, service tracks, security fencing, battery arrays, ammonia plants, perhaps some "fifo" construction and maintenance camps as well as some more permanent accommodation, utility services, rubbish dumps, sewage treatment plants and other ancillary capital structures, becomes obsolete. Even if the Western Australian Government doesn't yet appreciate the resources required to carry out an adequate karst assessment process as distinct from a greenwash, members of the Mirning community who have been linked to the proposal should be all too aware of Juukan Gorge.

On the basis of extrapolating the distribution of known Nullarbor blowholes, which were usually and not surprisingly found close to known tracks, it was carefully estimated that the Nullarbor would have well over 100,000 such features. To that figure can be added a large number of relatively shallow, extensive and generally well-decorated caves, few of which would have accessible adventitious entrances, thought to have developed under the margins of most clay pans along the edges of vast numbers of low limestone ridges.

Image above: Abrakurrie main chamber

Image above: Weebubbie Collapse Doline, K. Dixon

Image left: Mullamullang entrance

And of course, the number and extent of incompletely explored deep caves would be expected to increase significantly as well. Many existing deep caves, also accessed through adventitious entrances, such as Mullamullang, Abrakurrie, and Weebubbie have tantalisingly strong airflows emanating from entrance rock-piles. Such Nullarbor rock-pile airflows are the rule rather than the exception.

It is pleasing to see that the next, normally biennial conference of the Australian Speleological Federation is to take place in Ceduna in 2023 for a special focus on the Nullarbor. There is enough work there for the field trips to run for decades.

Compelling arguments for digging.

Some cave digs may be not only desirable, but downright urgent. We lost the Sellicks Hill Quarry Cave not only because we were unable to prove in time when problems first arose that it was there, but because nobody other than cavers were ever able to access the main chambers and be impressed by them.

Simply looking at a preliminary video is not an adequate substitute. Don Goodfellow, the Quarry Manager at the time, under the guidance of caver Mac MacDonald, was prepared to give it a try and managed to negotiate the toughest of the squeezes, which earned him a good deal of respect from the cavers. Eventually he became uncomfortable proceeding any further and so had to be guided back out again before we could have the opportunity to show him the chamber in which we could park a couple of Boeing 737 aircraft if only we could work out how to get them through the squeezes as well.

It is hard to argue that access to such a system should not be made easier by whatever means is available when the alternative through lack of such access is an increased likelihood that the entire cave system might be removed by quarrying. A meaningful environmental impact assessment prior to approval of the quarry could well have altered the course of history. It didn't happen, and once the quarry was established, so was the politics.

Even though the quarry eventually ran into difficulties because the hypothetical cave system turned out to be very large and very real, the quarry operators wanted to be overly generously compensated to cease their operations. Not wishing to discourage miners that might be prepared to invest in the state by giving any unnecessary lip-service to the notion that environmental matters might need consideration for future mining proposals, the government would not either come to the party or even argue for a more realistic compensation figure and thus the fate of the cave was sealed.

We have yet to gain access to what must undoubtedly remain of another significant cave system at Myponga after the government of the day, even further back in time, and again per the Mines Department, made no significant attempt to ascertain the karst development of limestone beds underneath the site of the dam wall for a large reservoir (See Centenary Cave, *ACKMA Journal 123*, June 2021). Reminiscent of advances already noted in the sciences associated with palaeontology, advances in the technology of infrared cameras may have an important role to play in determining the most promising access location through the detection of temperature differences of airflows rising from cracks in the ground.

Where to from here?

It would be in everybody's interests to have more accurate information prior to embarking on such projects, and until we do so as a society, and learn from our mistakes, we are destined to repeat them!

While these events happened 30 and 60 years ago, has there been any meaningful change yet to the attitude of the general community to theoretical caves as compared with those for which you can buy tickets? Even today, as far as we can ascertain, *out of sight* still very much means *out of mind*. For most people I think the explanation is simply a basic lack of comprehension.

I was on a ferry crossing the Murray River many years ago. We were heading for Punyelroo Cave at Swan Reach and started talking to a nice old chap on the ferry. He told us about a cave in the banks of the river he visited a long time ago. "You know," he said, "that cave goes right through and comes out at Waikerie. I went into it so far on one occasion that I almost needed a torch." After that we decided to talk about something else.

The late Elery Hamilton-Smith AM some years ago convened a workshop in Orange, NSW to bring together for discussions members of the caving community and major players in the limestone mining industry such as representatives of Blue Circle Cement and others. It proved to be a worthwhile idea, and both "sides" of the equation should benefit from continuing the conversation when it can be arranged. I attended from South Australia, as did Roger Matthews, at the time Senior Mines Inspector with the South Australian Mines Department. I liked and respected Roger, whom I had met through our mutual interest in Sellicks Hill, and I was pleased to see that the SA Mines Department supported the concept of the workshop sufficiently to approve his attendance. As a side trip to the workshop, some of us visited the Cathedral Cave in Wellington, NSW. The main dry section of Cathedral includes a large flat-floored chamber with a most impressive central stalagmite "mountain". I stood quietly alongside Roger in that chamber as he himself became increasingly quiet and reverent, in response to the atmospherics. After sharing with him an appropriate period of silence, I very quietly told him that while I also was impressed by that chamber in Wellington's Cathedral Cave, we could have fitted the whole thing into Sellicks Hill Quarry Cave, the implication being that we could have shared a similar spiritual experience at Sellicks Hill. Apart from quietly saying something like "Oh my God!" he got even quieter, if that was possible. Such is the complexity of communication that we were clearly sharing a common language, which in this case was silence!

On the other hand, at an enquiry convened jointly some years before by the Mines and Environment Departments, a different Mines Department Officer tried to discredit the cavers' description of the Sellicks Hill Quarry Cave as having cathedral like dimensions by producing a slide showing a cross-section of the main chamber with a cross-section of Adelaide's St Peters Cathedral at the same scale superimposed upon it. His representation showed clearly that the main body of the cathedral fitted well within the dimensions of the chamber, and yet he accused us of misrepresentation because his diagram showed the cathedral spires poking up part way through the roof of the chamber.

Perhaps he would have considered the cave differently if he had actually had the opportunity to stand in it and quietly absorb the atmospherics of it. Perhaps he had dreams of Adelaide being promoted as "The Gravel Capital of Australia". I guess you cannot please them all!

But we do have to try. We have little choice in the matter. Caves clearly need our advocacy. Who else is going to advocate for caves if we don't? Intelligent cave tourism should help tip the scales in favour of conserving caves rather than having them destroyed inadvertently by mining or lack of expertise in karst matters and should surely be an opportunity to increase community awareness of the need for conservation of caves in general, which should in turn help us to avoid repeating the mistakes of the past and improve the outcomes for future quarry operators and dam builders. With a bit more thought, a bit more investigation and more sensitive planning we could have had our quarry and our dam, as well as the caves, while at the same time wasting a lot less money.

Historical Quotes

From *An Introduction to the Geology of New South Wales*, 1922, p39, CA Süssmilch, F.G.S, third edition, revised and enlarged, with 100 illustrations and maps, Angus and Robertson, Sydney.

"In the limestones at Jenolan, Wombeyan, and Yarrangobilly occurs that wonderful series of caverns whose majestic proportions and infinite variety of form have made them world-famous. The caves occur where stream channels cross the limestone belts and have resulted from the action of water charged with carbon-dioxide dissolving away the limestone. River gravels, containing water-worn boulders up to 12 inches or more in diameter, are frequently met with in these caves, even in those high up on the hillsides, giving evidence of the fact that the river at one time flowed through them, as. in fact, it still does through those at the lowest levels. Percolating rainwater has subsequently ornamented the walls of the eaves, with the beautiful stalactitic and stalagmitic formations, whose bewildering beauty is a never-ending source of wonder and delight to visitors."

CA Süssmilch (1875-1946) was "at one time president of the Royal Society of New South Wales, and also was president of the Linnean Society and a trustee of the Australian Museum. He was honorary secretary of the Society for Crippled Children." Short obituary in *The Age*, 10 December 1946.

From *De Rerum Natura (On the Nature of Things)*, Book 1, line 313, Lucretius, ~ 55 BCE

"stillicidi casus lapidem cavat" – A constant drip hollows a stone

De rerum natura is a first-century BC didactic poem by the Roman poet and philosopher Lucretius with the goal of explaining Epicurean philosophy to a Roman audience (Wikipedia).

Editor's Note:
This is possibly the earliest reference to karst related material!

If anyone comes across more gems from the past that they would like to share in future journals, please send them to me for inclusion