ANDYSEZ 64 - Speleothem ages yet again!
Andy Spate

She-who-must-be-obeyed has asked me to comment on this link to show caves in California.

https://www.atlasobscura.com/articles/how-to-decode-a-cave

Overall, it is a nice article. But three things come to mind:

- We don't find sodium carbonate in caves unless we are baking cakes.
- There isn't necessarily a tipping point between caves being eroded and having speleothems - plenty of stream caves busily eroding away have speleothems merrily growing at the same time.
- The dangers of talking about speleothem growth rates.

This last is a constant bugbear of mine. The decoding article says as a rule of thumb it takes "a cubic inch in a hundred years". Why here am I thinking that we should say a cubic inch a thousand years – much slower growth rates in Australia – laughs hollowly. Or is it a cubic centimetre a thousand years? Or as Tim Moore points out above a centimetre every 100 years. Tim's example at least has a 'concrete' starting point – 700 years ago.

Why do I keep worrying us all about this? A few years ago, I was in a show cave where the guide was asked about stalactite ages – the guide pointed at various stals and provided ages that were older than the bedrock in which they were found! I recognise that the age of things is one of the most frequently asked questions but so often speleothem ages are quoted based on little or no hard data. And no understanding of how and why ages are problematic. In last year's visit to the UK, I was exposed to cave guides talking about the ages of stalactites and stalagmites and shuddered about the 'information' supplied.

I talked about speleothem ages in ANDYSEZ 27 (https://ackma.org/Proceedings/andysez/as27.html) and ANDYSEZ 28 (https://ackma.org/Proceedings/andysez/as28.html).

I asked Andy Baker to comment on these – based on a recent paper of Andy and his co-workers which described dating stalagmites in annual layers. Andy's comments were:

I suggest that dating methods have improved, including the identification of annual laminae which means we can count at an annual scale. And that improved dating evidence suggests growth rates are very constant over time, which makes sense if you consider it hard to change the characteristics of a karst water store feeding the drip that persists for thousands of years.

I had a quick look at your ANDYSEZs and I suggest the growth rate 'variability' might be due to the very large uncertainty in the U-Th ages. You write that you ignore the error terms. What happens if you include the age uncertainties in your estimate of growth rate? And include that uncertainty in the growth rate estimates? I suspect you can get a wide range of possible growth rates. For example, you have 38800+/-2500 and 35000+/-2200 The uncertainty or error on a radiometric age was historically recorded as one standard deviation. What this means is that there is only 66% chance that the actual age falls within the plus and minus error range. If you double the plus and minus error range, then the actual age has a 95% chance of being within the plus and minus error bounds. Then, if you look at both of the examples in the ANDYSEZs, the age of the older (lower) analysis could be younger than that of the younger (upper) analysis, which is impossible. In other words, the dates are so imprecise that you can't use them to measure growth rates.

Andy Baker mentions above that "*that improved dating evidence suggests growth rates are very constant over time*". But look again at ANDYSEZ 28 and the image on the right. The periods of growth are clearly not constant over time – there are two, if not more, growth periods in this stalagmite from Castle Cave at Yarrangobilly (incorrectly labelled). There was a major hiatus between 35,000 years BP and 4,000 BP. What happened then? The last 'Ice Age'. But why the pause between those two periods?

What all this points out at why one should avoid that very commonly asked question – how old are these things? Safer to say that it is highly variable due to differences in regional environmental conditions!!!