ANDYSEZ 38

LET'S TALK ABOUT SOMETHING OTHER THAN LIMESTONE – PSEUDOKARST

- Andy Spate

We have had some discussion about caves and other karst features and processes in limestone and magnesite in earlier ANDYSEZs. I may have touched on dolomite as well – if I haven't I think that we can just say that it behaves in much the same way as limestone only the solution rate is slower but roughly the same amount ultimately can be dissolved. It should be added that "limestone" and "dolomite" are fairly inexact terms.

Utterly, strictly and pedantically speaking limestone is $CaCO_3$, dolomite is $(CaMg(CO_3)_2)$ and magnesite is $MgCO_3$. However, all three are part of a spectrum running from pure limestone, through dolomite to magnesite with calcium being the only metal present at the limestone end and magnesium the only metal present at the other. Astute students of ANDYSEZs will remember that the CO_3 bit is made up of carbon (a black solid) and oxygen (a colourless gas). These latter combined with a silvery metal produce a transparent solid – oh the sweet mysteries of life!

The term pseudokarst refers to landforms which are analogous in form to those produced by solutional processes. Depending on one's perspective and biases, just what constitutes pseudokarst is a wide open question. A cave-dwelling bat, for example, might feel that a culvert pipe or a gold mine might be a fine pseudokarst cave.

The British Cave Research Association's *Dictionary of Karst and Caves* (Lowe and Waltham 1995) defines pseudokarst as:

> A landscape containing karst-like features as caves and dolines, but not formed by bedrock dissolution as in true karst. Pseudokarst embraces volcanic landscapes with lava caves, cryokarst or thermokarst formed by ground ice melting in a permafrost environment, and situations where mechanical soil piping has occurred producing depressions and pipes, as occur commonly in areas of loess cover.

Lots of new words there – which we won't worry about further. Although I will add that soil piping is widespread in Australia – and not in loess. The British list doesn't include glacier caves and similar karst-like features in ice. Or lots of other places where pseudokarst occurs – such as sea caves.

The breaking down (=weathering) of minerals in non-soluble rocks such as granites and other igneous rocks results in many forms which resemble karst. Excellent examples of things that look like solution pans and runnels are often seen on granite. Sometimes very large features such as some of the lakes on the Monaro of southern New South Wales (developed in granite) and the so-called circular structures (developed in laterites) along the tropical coasts of Queensland look like karst depressions.

However, there is an important difference between solution of soluble rocks and the chemical weathering of "non-soluble" rocks in that karstic solution produces very little solid material (because of the basic purity of the rocks) in contradistinction to chemical weathering. Removal of the solids derived from chemical weathering requires different transport modes (see discussion in Jennings 1985, pp 3-5).

Grimes (1974) has produced a useful discussion of pseudokarst forms emphasising that many landforming agencies can produce karst-type landforms.

(INSERT FIGURE)

I must emphasise that the dividing line between true karst and pseudokarst is very ill defined. [How often have you heard me make a statement like that. The human urge to put things in neat pigeonholes is repeated thwarted by the processes of nature. For example, the sandstone Natural Tunnel at Hilltop (near Picton) has probably developed by non-karst processes by mechanical removal of sand grains by water running along joints. In contrast, the formation of the sandstone Whalemouth Cave in the north Kimberleys has probably been expedited by solution of silica aided by the higher temperatures pertaining in the north. However, as in karst caves, once turbulent flow is established physical and chemical erosion can and do take place simultaneously. Jennings (1983, 1985) should be consulted for the details of both the process and Whalemouth Cave itself.

The Western District of Victoria and north Queensland have any fine lava caves and volcanic shafts with Mount Hamilton and Mount Eccles, respectively, being among the best examples. The Mount Hamilton cave is around 1,200 metres in length and is a most unusual lava cave because of the number of bifurcations. Lava caves are chiefly formed when molten lava continues to flow out from under a solidified surface layer. The Undara lava cave system in north Queensland is of international significance for geomorphological and biological reasons.

Allied to true pseudokarst (whatever that may be) is subjacent karst. This term, coined by Jennings (1966), refers to caves and dolines produced as a result of collapse of non-karstic rocks into voids produced by solution processes. Other authors refer to it as interstratal karst. Voids produced by non-karstic processes - hydrothermal removal of an orebody for example - would result in a pseudokarst feature. The Big Hole, near Braidwood in southern New South Wales, is believed to be a classic subjacent karst doline - and one which should be visited! Slaven Cave, near Lithgow, is most probably a similar feature, albeit roofed. Again it is difficult to prove its origin

but the current investigations, driven in this case by economic considerations, should assist in providing an answer (James and McIntyre 1989).

REFERENCES

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CLASSIFICATION OF KARST AND PSEUDOKARST (after Grimes 1975)