

## Australian Caves Without Roofs

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While “caves without roofs” have only recently been recognised in parts of Europe, they have been recognised in Australia since the 1870s. Some of Australia’s most significant Cainozoic vertebrate fossil deposits at Wellington and Wombeyan in New South Wales and at Riversleigh in Queensland occur in, or are closely related to, unroofed caves. Ongoing palaeontological work in the World Heritage Fossil Site at Riversleigh, karst documentation in northern New South Wales, karst mapping using differential GPS at Wellington and recent reconnaissance fieldwork has shown that these features are more common than was previously thought. Caves without roofs offer an opportunity for new insights into the development of Australia’s ancient landscapes.

### Historical Reports

Geologists and vertebrate palaeontologists have recognised and speculated about unroofed limestone caves in Australia since the 1870s. THOMSON (1870) noted that bone breccia and stalagmite bases were exposed on the surface at Wellington Caves in central New South Wales (Fig. 1) and concluded that: - “what is now the surface of the ground has formerly been the floor of a cave”.

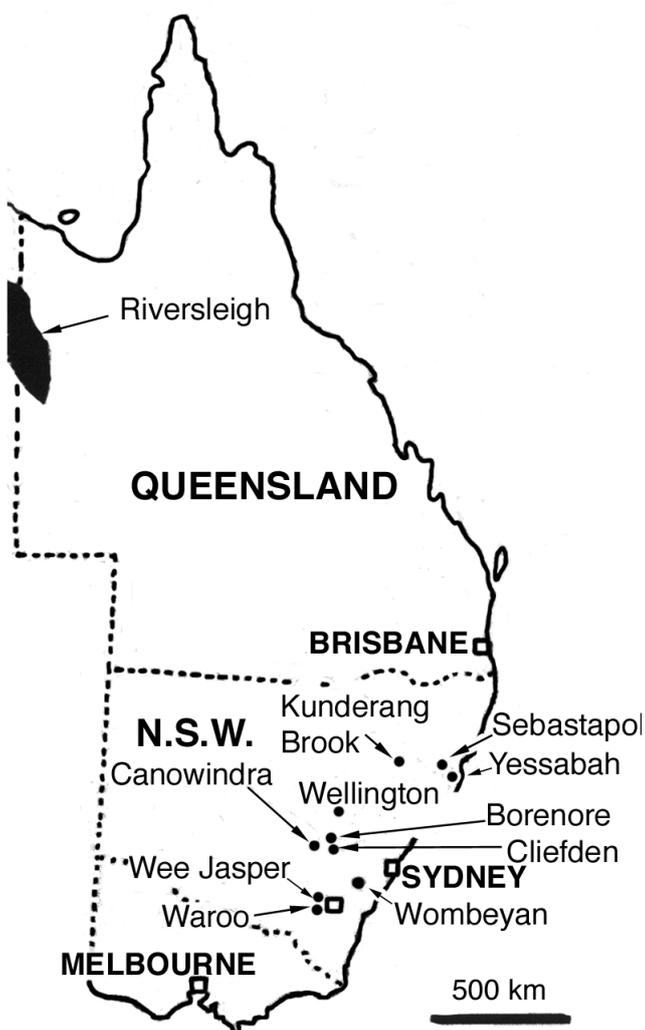


Figure 1. Eastern Australia

Wellington Caves was the location where marsupial fossils were first discovered in Australia in 1830.

In the early part of the 20th century Wellington Caves was disturbed by phosphate mining. As well as mining underground through filled caves the miners exhumed some filled unroofed caves (Fig. 2)

Another significant vertebrate fossil site, described as an unroofed cave, is the “Broom Breccia” deposit at Wombeyan Caves, New South Wales. This deposit yielded the remains of the Mountain Pygmy Possum, *Burramys parvus*, thought to be extinct until the discovery of a live specimen in 1966. BROOM (1896) considered that the: “...deposit is evidently the remains of the floor of a cave, the whole roof and sides have long been weathered away.”

### Recent Observations

Unroofed caves received little further attention until vertebrate palaeontologists, working at Riversleigh in northwest Queensland (Fig.1) on Cainozoic vertebrate fossils in Cambrian and Tertiary limestones during the 1980's, recognised that some of their richest sites were unroofed caves (ARCHER et al, 1991).

Unroofed caves came to light during detailed karst mapping at Wellington Caves using differential GPS techniques in 1999 and 2000 (OSBORNE, 2001). Soil patches within massive limestone outcrops, which had previously not been mapped, were found to have a similar shape to the plans of structurally guided phreatic caves developed in the underlying rock. The mapping also revealed cave-shaped depressions with limestone walls 0.3 m to 0.5 m high and a smaller number of cave-shaped depressions with obvious walls, some curving, 1 m or more deep.

While there has yet to be detailed study of any of these features, reconnaissance fieldwork and checking through photographs suggests that caves without roofs occur in a number of Australian karsts. Caves without roofs occur at Borenore, Cliefden, Canowindra, Wee Jasper and Waroo (Fig. 1).

These karsts and developed in folded Ordovician to Early Devonian limestones, located in river valleys or gently undulating landscapes in the Western Slopes of New South Wales.

At Wombeyan Caves, where the Broom Breccia occurs, marble is exposed in topographic basin surrounded by steep hills of volcanic rocks. Streams have incised valleys into the floor of the basin, resulting in an incised plateau landscape of residual ridges. The Broom Breccia site is located high on one of these ridges. It consists of a circular depression in dense marble, approximately 2 m in diameter and 0.5 m deep (Fig. 3). Well-cemented bone breccia forms the base and coats the sides of the depression. While there is much further work to be done at this site it appears that the site is the intersection of a tube-like cave passage, rather than the “floor of a cave”.



Figure 2

Figure 2 Excavated cave Without Roof at Wellington Caves



Figure 3

Figure 3. The Broom Breccia Site, Wombeyan Caves - The breccia is located in the bottom of the depression directly in front of the man second from the right

In a quite different geological and topographic setting, unroofed caves occur at Kunderang Brook, Mt Sebastapol and Yessabah in gently-dipping Permian limestones exposed in deeply incised valleys and residual hills on the coastal plain of northeastern New South Wales (Fig 1).



There are many quite complex surface solution features developed in these karsts in addition to those that are clearly unroofed caves. These include pits, pinnacles and a range of complex depressions that have been greatly modified by the development of karren. It is possible that some of these features are remnants of interstratal caves from which the upper confining bed has been removed.

### Discussion

Caves without roofs appear to be more common in areas of lower relief and on plateau surfaces where surface lowering is the principal mechanism of erosion, than in areas of high relief where valley incision dominates.

It is possible that 19th century geologists and palaeontologists were able to recognise unroofed caves because they were isolated from concepts of karst geomorphology that were developing at the time in Europe. Modern study of caves without roofs is just beginning in Australia; we have to make up for over 100 years of inaction.

### References

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