Crombie's Cave. A granite cave in New England, NSW

. . . . C.D. Ollier and J.M.B. Smith

Abstract

Crombie's Cave is a small cave near Armidale, NSW, formed when Powers Creek found an underground route through weathered joints in granite, and enlarged by stream abrasion.

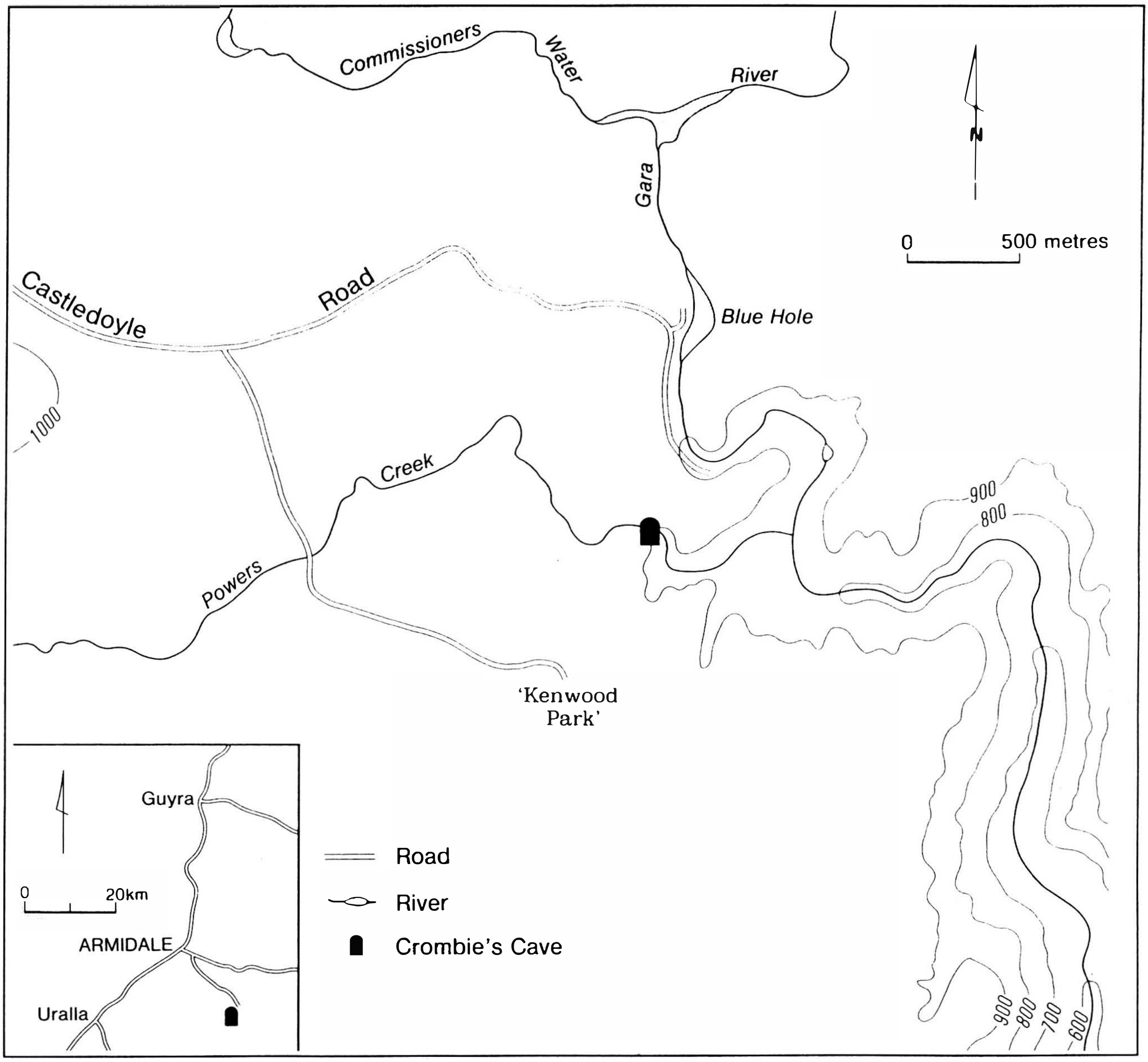

Figure 1. Location of Crombies Cave

Location

Crombie's Cave is located near the end of Castledoyle Road about 16 km eastsoutheast of Armidale on the northern tablelands, New South Wales, at an altitude of 900 m. It is in an area of Crown Land covered by a grazing lease, between the Gara section of Oxley Wild Rivers National Park and the property "Kanwood Park", at 846136 on the Hillgrove 1:250000 map (sheet 9236-1-N). It lies about one kilometre south of the well-known recreation site Blue Hole, and is most easily approached from that direction (Figure 1). Passing through the cave is the transient stream Powers Creek, a tributary of the Gara River into which it flows about 800 m downstream of the cave, in the upper reaches of Gara Gorge.

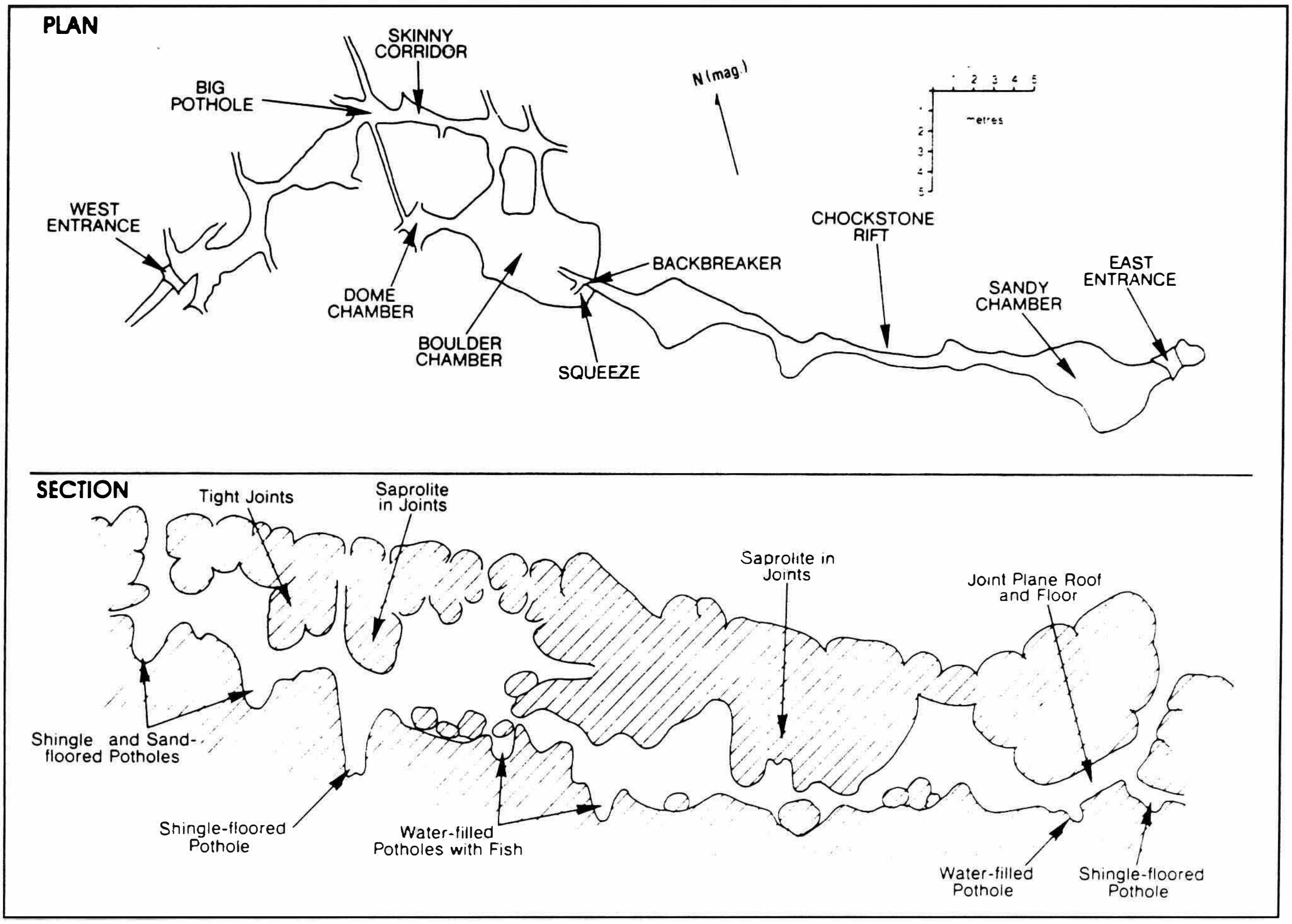

Figure 2. Crombie's Cave

Description

This is a very small cave (Figure 2), barely 65 m long, and is of interest only because of its unusual features and mode of origin. The valley bottom in the cave area appears at first sight to be little more than a mass of granite boulders, through which the stream trickles out of sight. However, the boulders range in size from about half a metre to 5 m across, much too big to be the bed-load of such a small stream. Furthermore, many joint planes in the granite have a consistent orientation showing that the granite is essentially in place. The cave is indeed formed within the granite bedrock.

The upstream entrance is a vertical climb between large boulders, with a descent of about 4 m. A few potholes are visible at the base of the entrance on the upstream side. The cave continues downstream between large boulders, and in places is quite narrow (about half a metre) in the form of rifts following near-vertical joint planes. The joint pattern controls the shape of the cave here. The main joint direction is 130°(mag). After about 11 m a vertical section is reached with a small dome in the roof, and a descent of about 5 m. This part of the cave is essentially one large pothole (the Big Pothole), with shingle and shallow water at the bottom. Beyond the Big Pothole the cave becomes once again dominated by joints, exemplified by the straight section called the Skinny Corridor. In this area good examples of saprolite-filled joints, and spheroidal weathering (described later) can be found. The boulders become somewhat more chaotic when a chamber (Boulder Chamber) is reached, and where light penetrates between some boulders of the cave roof. In the southern part of this chamber, leading

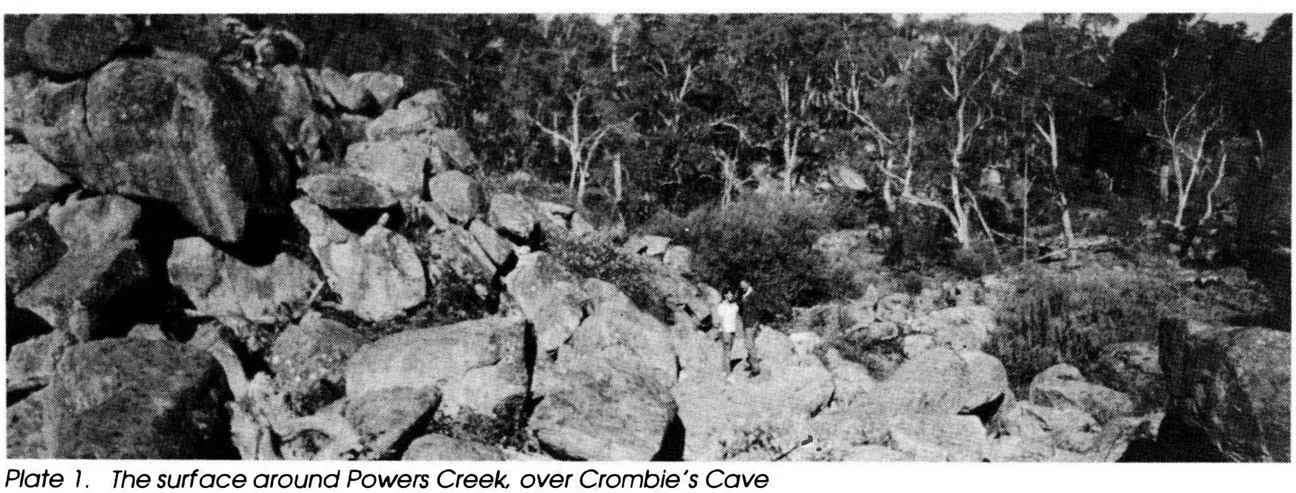

Plate 1. The surface around Powers Creek, over Crombie's Cave

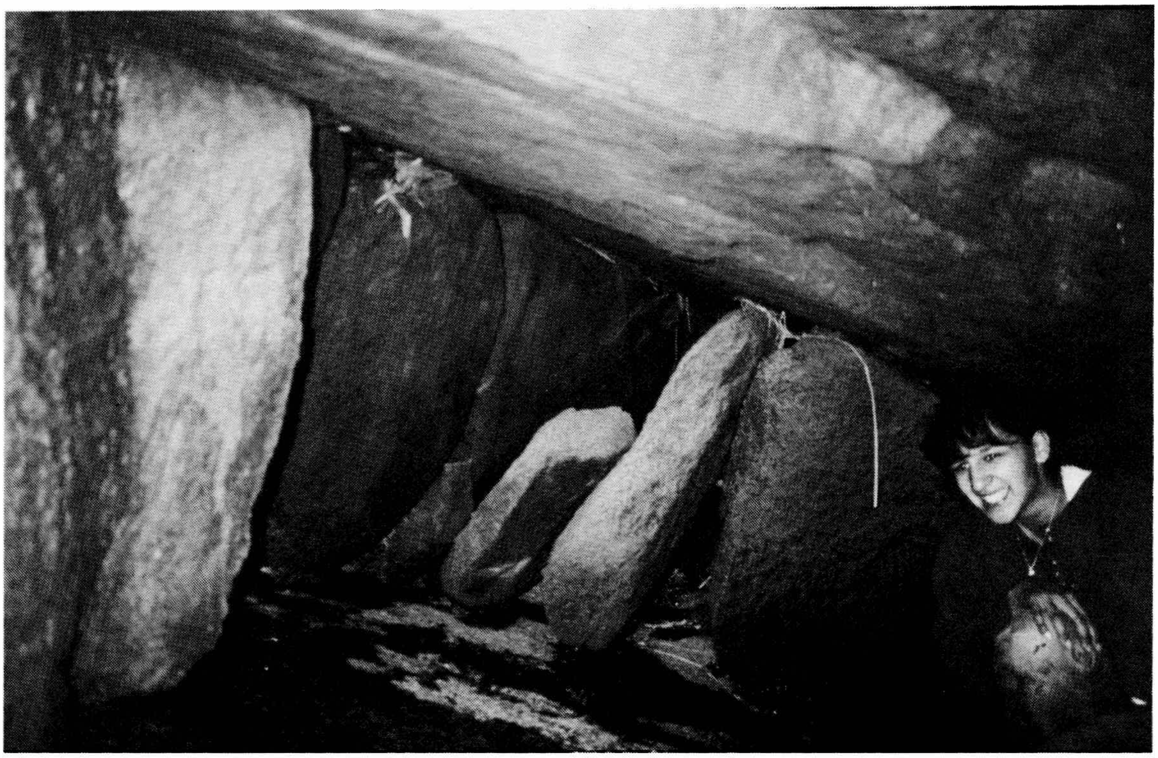

Plate 2. Angular joints in Sandy Chamber

out of a depression between two boulders, occur two alternative routes through to the next, lower section of the cave. The route usually taken is a narrow, unpleasant crawl called the Squeeze which leads directly into a narrow slot containing a chockstone (the Back Breaker). Potholes to either end of the Squeeze are water-filled and contain fish and yabbies.

Beyond the Back Breaker the cave is joint dominated, as narrow rifts with chockstones, but the flat planes and angular blocks show that most of the rock is essentially in place and has moved very little. There are a few small chambers, but they are of no significance. The cave terminates at Sandy Chamber, about 5 m below the surface. Both the floor and the roof of the chamber are essentially joint planes in the granite, dipping at 25° in direction 290° (mag). Most of the cave between the Back Breaker and Sandy Chamber has permanent pools. Sizeable potholes up to a metre across are found at the downstream end of Sandy Chamber.

Formation Of The Cave

The cave is formed by a stream working its way underground in an area of granite. The granite is extensively jointed, and the opening of joints, perhaps simply by pressure release at the surface, provided some access to water. Once a cave is formed, hydrostatic pressure during times of flood might further widen the joints, enabling yet more water to be carried underground. Furthermore, part of the granite was extensively weathered by chemical alteration along joints, so that it consisted of rounded and angular corestones separated by saprolite (weathered rock in place). In several parts of the cave, and especially near the Big Pothole, the saprolite can be observed, still preserved in the joints, in seams up to about 15 cm thick. Otherwise there is little indication of weathering, except for some spheroidal weathering, with single shells about 1 cm thick on rounded corners of joint blocks both on the ground surface and inside the cave.

As the stream eroded its bed and followed widened joints, it would erode the soft saprolite much more than the hard corestones, and so cut down its bed until more and more of the water was carried underground. Thus the cave has some sections that are very angular, dominated by little-modified joints; a few parts that are rounded by old sub-surface weathering; and some potholes and concave curved surfaces formed by abrasion by the underground stream.

This is the mode of origin of several other granite caves, such as Labertouche in Victoria, which is slightly bigger than Crombie's Cave (Ollier, 1965, 1984; Finlayson 1981), and several caves in Girraween National Park in Queensland (Finlayson, 1982). Commonly caves of this formation, especially if the corestones are rounded, appear to be little more than a jumble of boulders. Crombie's cave is distinctive in that the angular joint planes are very well preserved, partly because the pre-weathering was not as extensive as in Labertouche and some other caves, and partly because we are seeing an early stage in the development of a granite cave.

In discussing granite caves in Victoria, Finlayson (1981) suggested three possible relationships between the weathering and the erosion of the cave:

- The weathering and erosion may be almost contemporaneous, with the weathering just ahead of erosion.
- The weathering may be ancient.
- The alteration of the granite may be hydrothermal (created by hot water, probably related to igneous intrusion of the granite itself). In Crombie's Cave only situation (2) is plausible and deep weathering of granite is very well known and documented in the Armidale region. The weathering may well be of Mesozoic age, and is certainly older than 30 million year old basalt lava flows which in places overlie deeply weathered granite.

The other interesting feature of these caves is that the river has not only lowered its course by erosion of saprolite, but has actively worn down parts of its bed by active grinding (corrosion) and the formation of potholes. Evidently the stream did not find a course that ran

Plate 3. Multiple potholes, West entrance

continuously across saprolite, but occasionally crossed solid rock, and in these parts downcutting had to be by mechanical erosion. Such potholes are not common in the Victorian granite caves, though Finlayson (1981) recorded some bedload gravel and polished and scalloped boulders. Abrasion features are reported in Queensland where Finlayson (1982) recorded that *"The cave morphology clearly indicates that once the flow path is open, abrasion becomes the major process."* He described the River Cave as having *"water worn polish"* and Goebel's Cave has a *"bedrock floor pitted with scour holes which contain sand and gravel."* His photograph of Goebel's Cave shows potholes and scours similar to those of Crombie's Cave.

A stream needs a bedload of "tools" to erode its bed. Granite weathering itself provides sand and clay, and although sand can be effective in long term erosion it is not likely to form large potholes up to over a metre across like those found in Crombie's Cave. Sandy Chamber and potholes near the west entrance are floored by typical granite sand. The larger potholes contain pebbles of a variety of rock - sandstone, silcrete and chert - but not granite. It is perhaps important in the formation of this cave that the catchment, though small, contains a variety of hard rocks that can provide pebbles.

Cave formation was probably enhanced by the location of Powers Creek close to a steep gorge, which means that it was in a good position for vertical incision.

Life In The Cave

The cave is home to creatures that would usually live in the stream and are by no means remarkable. We observed yabbies, frogs and mosquito fish (*Gambusia affinis*), an exotic fish introduced from southeast U.S.A. but now widespread. Earlier visitors have recorded water spiders, lizards and frogs. The whole cave fills with water after heavy rain, so there are no bats.

Discovery

The cave was discovered in 1973 by Bob Crombie, a National Parks and Wildlife Ranger at Glen Innes, who noticed "a stream pouring out of a granite wall."

Caving

The cave can be traversed without equipment, but a rope is helpful at the entrances and at the Big Pothole. The Squeeze is an unpleasant tunnel leading to the Back Breaker, where a caver has to manoeuvre with body bent awkwardly through a narrow opening without slipping into a crevice. At least one girl has been stuck here and had to be rescued by pushing from below (standing chest deep in water) and pulling her legs from above (Smith, 1981).

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