Karst Development at Naracoorte, SA: Why There?

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ABSTRACT

The Lower Southeast Region of South Australia and a substantial part of southwestern Victoria form a limestone province with discontinuous areas of intensive karst development such as Naracoorte, where the relatively high density of caves is atypical for the karst province as a whole. The Naracoorte caves have attracted a great deal of interest and research since the discovery of extensive Pleistocene vertebrate fossil deposits in 1969. The solution pipe entrances to some chambers acted as pit traps, and in Victoria Fossil Cave, large, now extinct animals like the thylacine, marsupial lion (Thylacoleo), giant kangaroos and diprotodontids fell into the cave, and are preserved in the extensive bone deposits. The fossils accumulated in several episodes during the Middle Pleistocene (100,000-400,000 years ago). The entrances to the Naracoorte caves are either vertical solution pipes less than 1m across and up to 20m deep or collapse windows. Both open into horizontal systems of collapse chambers floored by rubble cones and connected by low, wide, solutionally sculptured passages often partially filled with sediment. Sand from dunes on the surface sometimes falls into the caves through such solution pipes to form distinctive sand cones. The sand plugging the pipes may collapse from time to time to form a surface sinkhole. Phreatic passages, sometimes with spongework, are present, particularly in the lower levels near the water table, where they may be partially filled with clay. Caves that reach the water table have still, shallow pools with calcite rafts on the surface; the level of these lakes has fluctuated over time in response to changes in the regional water table. The longest cave, Victoria Fossil Cave, has over 3000m of an extensive rambling network of large collapse chambers and smaller connecting passages, some very well decorated. Naracoorte cave passages show a preferential northwest-southeast alignment, more or less parallel to the Kanawinka Fault which cuts through the host Gambier Limestone as a cliff-line formed originally by fault movement, but later modified by wave erosion. The fault has moved in the last few million years; the uplifted northeastern side is topographically higher.

Karstification at Naracoorte may have started when the sea retreated and first exposed the limestones to weathering around 15 million years ago. Cave formation probably slowed when the sea returned ~5 million years ago and covered the area for 2-3 million years. Around 900,000 years ago the sea advanced to the Naracoorte area for the last time, forming the sea cliff and sand dunes there. The caves may have been flooded by this sea level advance. Blanche and Alexandra Caves contain columns and flowstone (not yet dated) that have been extensively dissolved, exposing their internal layering, and suggesting that the caves were flooded after the speleothems had formed. The Naracoorte caves have remained dry since then. In Victoria Fossil Cave the oldest flowstones, growing directly on the floor of a chamber, are over 500,000 years old. Calcite deposition in the caves occurred during times when the climate was relatively wet, most recently about 20,000 years ago; there is only limited speleothem deposition at present.

It is uncertain why cave development at Naracoorte is so extensive, but it may be reflect a greater input of aggressive water at this location, perhaps from the nearby Mosquito Creek, and possibly accentuated by uplift along the Kanawinka Fault. Alternatively, there may be structural control of groundwater flow, so that it has been focussed by a greater concentration of joints and fractures in this area.

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