LANDSCAPE EVOLUTION OF THE NARACOORTE KARST AREA IN THE LATE CAINOZOIC

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The Lower Southeast of South Australia and a substantial part of southwestern Victoria is a limestone karst province, which comprises extensive areas where cave and karst development is limited, interspersed with areas of atypical intensive karst development such as at Naracoorte.

At Naracoorte dolines, uvalas and blind valleys characterize the surface karst. The caves range from simple single passages to complex multi-level mazes, and passages trend predominantly northwest/southeast. Cave walls and ceilings retain evidence of solutional features such as large non-directional scallops and bell holes. The caves contain a range of fossiliferous clastic sediments and dated speleothems. The fossils accumulated through pitfall entrances in several episodes during the Middle Pleistocene (100,000 - 400,000 years ago).

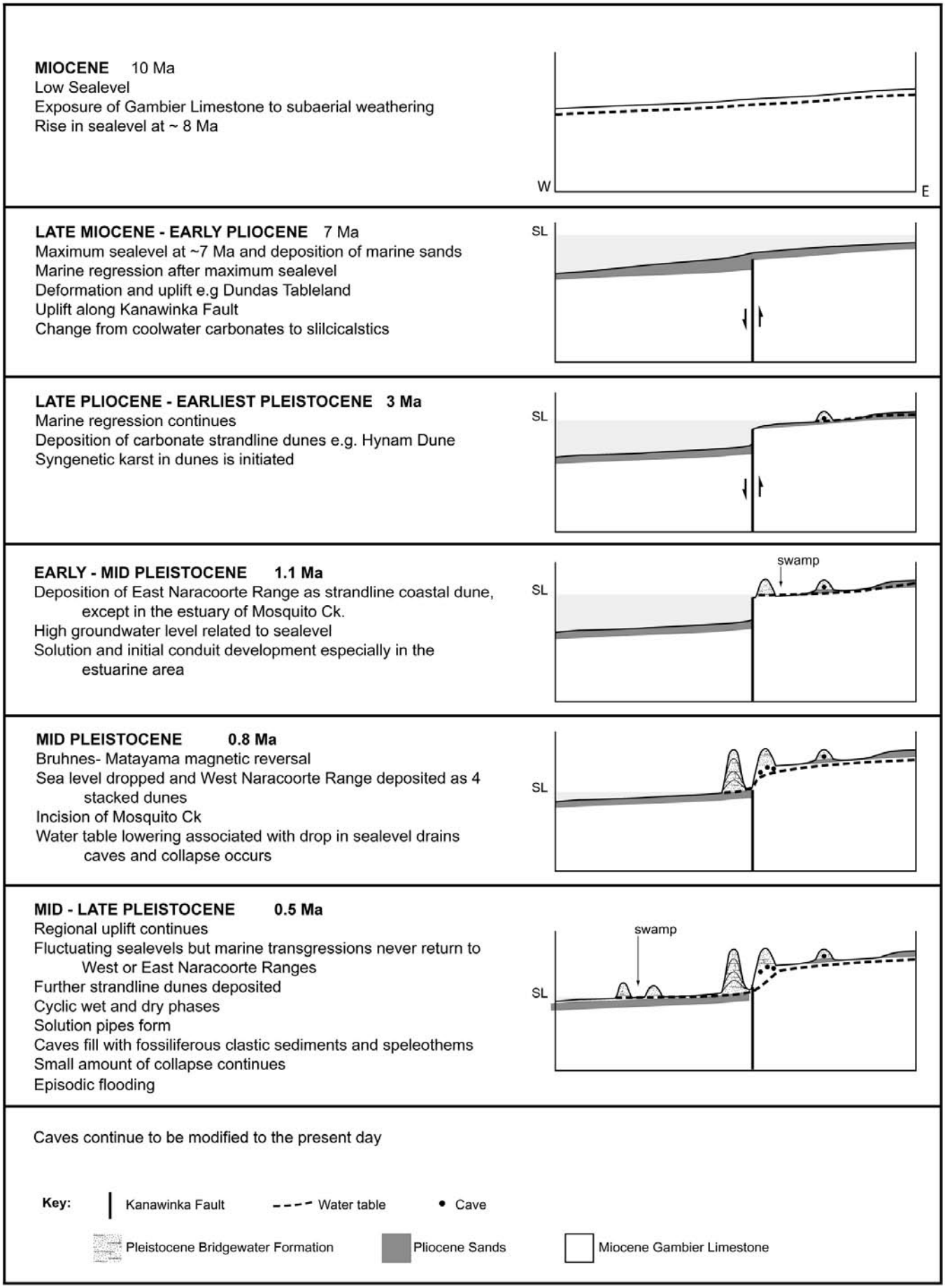
The development of the Naracoorte karst is constrained by the age of the enclosing Gambier Limestone (Oligo-Miocene), and probably is later than the maximum sea-level transgression at ~7 Ma. The following Pliocene-Pleistocene regression deposited a series of subparallel beach dune ridges, becoming progressively younger seaward.

Cave formation occurred in a relatively narrow window of time between uplift along the Kanawinka Fault in the late Pliocene, and the draining of the caves by a sea level fall at ~800 ka, when deposition of the West Naracoorte Range occurred. The main period of cave development began during deposition of the East Naracoorte Range at ~1.1 Ma, as prior to this the cave area was flooded by the sea, and no cave formation could occur. The caves may have initially formed along the freshwater/seawater interface extending inland from the East Naracoorte Range, and were subsequently enlarged by groundwater flow as sea level fell between 1.1 Ma and 800 ka. Because the water table was not stable for a substantial period of time, there was no preferential development of passages at a particular elevation.

The incision of Mosquito Creek postdates uplift along the fault and occurred during the period of sea level fall. As the water table dropped due to sea level fall and creek incision, the caves partially, then completely, drained. Most of the collapse that characterises many of the Naracoorte caves probably occurred progressively as the water drained from the passages; at least some collapse entrances could have formed at this time.

Solution pipe entrances have formed since the main cave development, intersecting the older main cave passages and enabling sediment accumulation. Cyclical wet and dry conditions occurred over the last 500 ka as landscape modification occurred throughout the Pleistocene to the present.

The overall landscape history of the Naracoorte area during the Pliocene/Pleistocene shows the speleogenesis was controlled by oscillating sea level, coastal deposition and tectonic movements on the Kanawinka Fault. This model integrates the cave morphology and the processes with the groundwater and long-term landscape data. ■



Landscape evolution of Naracoorte area since the Miocene.