GEOMORPHOLOGY OF THE SOUTH-WEST CAVING AREA

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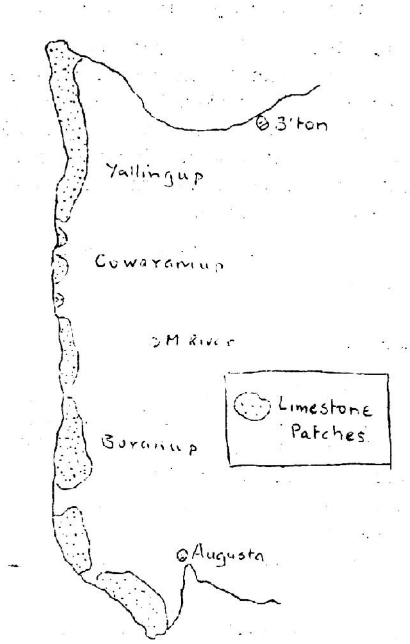
The south-west caving area stretches from Cape Naturaliste to Cape Leeuwin and is wholly contained in the Naturaliste-Leeuwin Horst. This ridge is bounded on the west by Saint-Smith's "step fault" and is made up of hard crystalline pre-cambrian granite, granite-gneiss and allied rocks, overlain on the west by the Old and New Dunes of the Pleistocene age. These dunes have been blown over the granite basement to heights of over 700 feet [210m] and consist of consolidated limestone underlying the geologically more recent sand drift.

The coastal limestone, part of the Geraldton-Albany belt, is not a continuous belt; it is broken in parts by perennial streams such as Margaret River, Turner Brook and Cowaramup Brook. The belt varies from one to three miles in width. Speleologically speaking, the chief areas are the Augusta, Boranup, Margaret River, Cowaramup and Yallingup areas. These limestone patches contain the most caves. Within each area, caves are often limited by swamps or dunes.

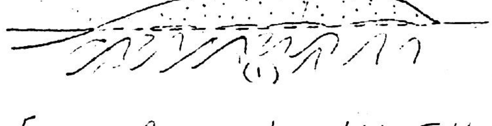


Fairbridge and Teichert have estimated the limestone to be about 40,000 years old. The chief characteristics of the limestone are less vigour of topographic form; a greater maturity in soil profile; numerous hard, jagged outcrops; heavy vegetation; numerous caves and depressions. The limestone is extremely hard in the "caprock" zone and presents a smooth, greyish appearance when newly cut. Often found in the caprock are small cavities filled with calcite. The limestone immediately beneath the caprock is often very friable. The caprock shows its granular origin.

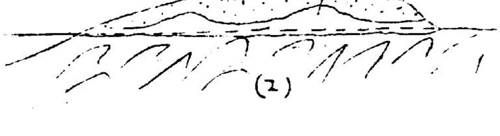
The aeolian character of the coastal limestone has long been recognised by field workers. During the period of maximum glaciation, extensive patches of calcareous sands were blown inland by onshore winds. An emerging coastline resulted in a succession of dune ridges each in turn being the foredune. Conditions need not have been particularly arid as it is the absence of vegetation rather than aridity which induces new dunes. Given the right geomorphological, geological and climatic conditions, we can interpret a cycle of dune formation. Starting with the formation of calcareous dunes, we progress through fixation, soil formation, destruction of vegetation and renewed growth of sand.

Ultimately, a gradual consolidation into coastal limestone occurs. The inland edge of the consolidated limestone is often marked by a scarp edge.

The solidification of the dunes was caused by rainwater seeping through and dissolving out small amounts of calcium carbonate which were then reprecipitated at lower levels to impart coherence to the

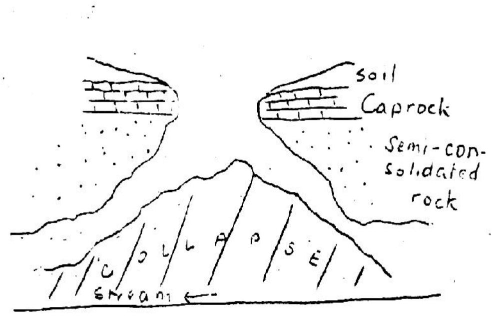


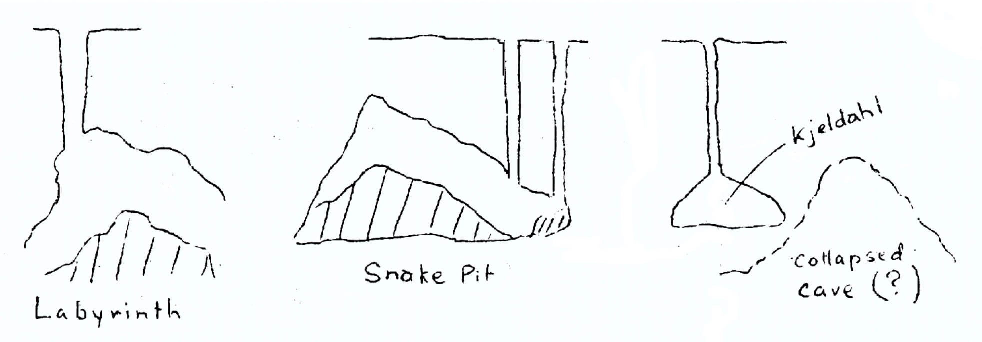
EMBRYO CAVES along Water Table



Linear Cave Structure enlarged through collapse rock. Water moving along the water table would carve out cavities in this slowly consolidating rock. Collapses would be frequent until stability occurred. This would account for the inordinately large amounts of sand in some of our caves. It would also account for the comparatively large caverns in young caves and for the phreatic nature of many channels coupled with strong vadose stream characteristics.

Where collapses reach the surface we get the typical sections seen so often in many of our caves. The collapses have vertical sides with high rubble cones along the periphery of which are to be found the extensions leading to stream level. Most of our caves show this characteristic in one form or. the other. Harder to account for are the occasional shafts encountered. These .shafts are generally narrow and deep and often end in small chambers without any leads. These 'kjeldahls' are spread over the entire areas. It would appear that these caves are not formed by water table stream activity but by surface water. However, in the absence of joints (our limestone has not been exposed to diastrophic action), the pore spaces of the loosely-knit rock must have been the avenues along which the shafts developed. Against this must be balanced the fact that the caprock is the earliest to form, through capilliary action, and soon presents an impervious front to water. Alternatively, it can be hypothesised that large tree roots could have been the basis of the shaft. Occasionally such a shaft links up with an uncollapsed cave. The large caves of the Augusta Limestone Patch - Jewel, Easter and Labyrinth - all exhibit this feature. The Snake Pit of Yallingup is another example.





The drainage of the limestone is, as expected, rather complicated. It would appear that the drainage patterns are controlled largely by the topography of the underlying basement rock. The dunes have overridden much of the surface drainage. Many streams drain eastwards towards the rift valley formed by the Dunsborough - Augusta Scarp and the Darling Fault Scarp. Several caves exhibit a combined drainage. One of the best examples is the Connolly Cave System which appears to concentrate the drainage of Calgardup Cave, Mammoth Cave and Rudduck's Cave - an area of about 6 square miles.

One interesting feature which has not been investigated is the relationship of rainfall and surface run-off to stages of cave development and the profusion of cave decoration. The Augusta Limestone Patch with its heaviest rainfall seems to have a preponderance of cave decoration. Anyone care to work out a theory?

-Terence D. Bain -