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Summary

The Eucla Basin adjoins the Great Australian Bight. One-third of the basin lies in South Australia, and two-thirds in Western Australia, where it covers some 65,000 square miles of land and 23,000 square miles of continental shelf. Most of the basin is occupied by an arid limestone plateau that slopes gently seawards from an altitude of about 800 feet in the north to 200 to 390 feet in the south. The plateau grades northwards into the Great Victoria Desert, and to the south it terminates abruptly in wave-cut limestone cliffs. In places the cliffs drop vertically into the sea and in other places they are separated from the sea by a low-lying coastal plain. The plateau has numerous small caves, and several large ones that reach down to the water table some 250 to 350 feet below, but on the whole, karst development has been retarded by the aridity and low initial relief.

The basement of the Eucla Basin is formed in most areas of Precambrian granite, gneiss and quartzite. In the north there are also folded beds of Proterozoic sandstone and stromatolitic limestone here named the Ilma Beds, Permian tillite and possible fluvioglacial deposits of the Wilkinson Range Beds occur in the extreme north of the basin, but the tectonic development of the basin did not begin until the Lower Cretaceous. The oldest Cretaceous formation, the Loongana Sandstone is a lenticular, conglomeratic, feldspathic sandstone, and was deposited on an irregular basement surface. The sandstone is overlain conformably by glauconitic, carbonaceous, pyritic sandstone, siltstone, claystone and shale of the Madura Formation. This formation contains Neocomian--Aptian, Albian-Cenomanian and Senonian palynomorph assemblages that indicate marine deposition for all but the base of the sequence. Deposition recommenced in the Middle Eocene in the centre of the basin with the accumulation of the lenticular Hampton Sandstone, followed by marl that forms the base of the Wilson Bluff Limestone. In the Upper Eocene the sea spread throughout the basin, with the deposition of chalky bryozoan limestone of the Wilson Bluff Limestone in most areas and current-bedded bryozoan calcarenite of the Toolinna Limestone in the southwestern part of the basin. A period of emergence in the Oligocene was followed by marine deposition in the Lower Miocene of the Abrakurrie Limestone, a porous current-bedded bryozoan calcarenite. After a brief period of erosion, deposition of the Nullarbor Limestone commenced with the formation of a biostrome of calcareous algal nodules (the Mullamullang Limestone Member) in the centre of the basin and continued as the sea spread further; with deposition of foraminiferal calcarenite. At the same time, sandstone, claystone, and minor limestone of the Colville Sandstone accumulated in the northern part of the basin.

At the end of the Lower Miocene the sea bed emerged to form a plateau which

has persisted with minor erosional modification, to the present. In the Pleistocene the sea reached about 120 feet above its present level, eroding the Roe Plains and depositing a veneer of shelly limestone (the Roe Calcarenite). A similar coastal plain (the Israelite Plain) was eroded in the southwest of the basin. Both plains were partly covered by coastal dunes in the late. Quaternary, while on the plateau there accumulated colluvium, alluvium, playa deposits with associated dunes and longitudinal desert dunes. Much of the plateau is covered by clay soil having a hard calcareous kankar developed at or near the surface, but in the centre, deflation of the soil created the stony Nullarbor Plain.

Diagenetic changes in the sedimentary rocks include silicification of Wilson Bluff Limestone to form chert nodules and minor dolomitization in the Madura Formation, Wilson Bluff Limestone, Abrakurrie Limestone and Colville Sandstone. Prolonged weathering at the surface of the plateau has caused recrystallization of parts of the Nullabor Limestone to microcrystalline limestone lacking any recognizable clastic textures.

Tectonic deformation has been very mild. Gentle downwarping was centred south of the present site of Madura in the Cretaceous, Eocene and Lower Miocene and was followed by uplift, slight tilting and minor faulting. The basement surface now slopes southwards at about 0.2 degrees and the base of the Nullarbor Limestone at about 0.03 degrees. A thickness of about 1,000 feet of Cretaceous beds was deposited in the Madura area, followed by 600 feet of Eocene and 550 feet of Lower Miocene beds. About 200 to 400 feet of Miocene strata has since been eroded. Tertiary limestone is exposed on the surface of the plateau, on coastal cliffs and in caves, but Cretaceous strata are known only from bores.

Confined groundwater occurs in basal Cretaceous beds and in the Hampton Sandstone, but in most areas it is too saline for stock. Unconfined groundwater occurs in Tertiary limestone in many areas, but is too saline for stock beneath the Roe Plains and on the western side of the basin. However the water is commonly suitable for stock beneath the centre of the plateau, while near Rawlinna, limestone beneath solution dolines (" dongas ") contains shallow bodies of water with salinities that are always suitable for stock and occasionally suitable for domestic use. There are vast reserves of limestone containing about 97 per cent calcium carbonate and 1 or 2 per cent magnesium carbonate. The petroleum prospects are poor. There are possible source beds and potential reservoirs with impermeable caps, but the section is thin, no hydrocarbons have been reported, and it is doubtful whether any closed structural traps exist.