

The Paleozoic sequence ranges in age from Cambrian to Carboniferous, and may exceed 25,000 feet in thickness on the southeast side of the Otway Basin. Four onshore wells, Frome-Broken Hill Ferguson's Hill-1, Pretty Hill-1, Alliance Kalangadoo-1 and Robertson-1 have encountered Paleozoic rocks without shows of hydrocarbons. The strata consist of complexly folded, faulted, metamorphosed sediments with extrusive and intrusive igneous rocks. The Paleozoic are considered to be "economic basement" for the Otway Basin.

The Tasman Geosyncline was terminated in late Carboniferous to early Permian time by the Hunter Bowen Orogeny which was followed by the development of the Otway Basin in Jurassic and Lower Cretaceous time.

Jurassic to early Lower Cretaceous clastic sediments were deposited in a poorly defined east-west trending trough which extended from offshore South Australia south of Cape Jaffa to western Victoria near Casterton. Only one well, Planet Oil Casterton-1, encountered Jurassic rocks, where 1282 feet of clastics and dolerite lay unconformably over Paleozoic slate. The section consists of a 490 foot thick sub-greywack underlain by dark grey, carbonaceous shale, siltstone and two dolerite sills.

The Lower Cretaceous may have a maximum thickness of 15,000 feet. This section is predominantly non-marine and consists of greywackes, sub-greywackes, carbonaceous siltstones and chloritic mudstones. The sandstones usually contain abundant matrix material, which results in low permeabilities. A clean quartzose sandstone of basal Lower Cretaceous age was encountered at Frome-Broken Hill Pretty Hill-1 which exhibited excellent reservoir characteristics. The sandstone was 1910 feet thick with measured porosities of 19% to 25% and high permeabilities that range from 198 to 2756 millidarcies. An equivalent age sandstone section was drilled at Esso Crayfish A-1 that was in excess of 5257 feet thick. The sand was more fine grained than at Pretty Hill-1, and suffered from clay choking. However, subsequent production tests proved the Crayfish sandstone capable of sustained fluid output. The top of this massive sandstone is an angular unconformity in the Crayfish area, where early Lower Cretaceous sediments were uplifted and truncated.

Similar aged porous and permeable Lower Cretaceous sands were also encountered by Planet Casterton-1, as well as at Interstate Woolsthorpe-1 and Garvoc-1.

Late Lower Cretaceous, Otway Group sediments were deposited unconformably over this older Lower Cretaceous unconformity, or over Jurassic and Paleozoic rocks of various types. The axis of Otway deposition is northwest-southeast, parallel to the present coast of Victoria and South Australia from Gippsland to Cape Jaffa. The section is non-marine greywackes, mudstones and coal that is up to 8976 feet thick in more basinal areas. The clastics were probably derived from uplifted Mesozoic and Paleozoic highlands to the north and south of the depositional trough. While the highland to the north of the Otway trough is easily outlined from geological evidence, the highland to the south is largely conjectural and is not documented in fact. Recent papers (Le Pichon, X., Heirtzler, J.R., 1968, Magnetic anomalies in the Indian Ocean and ocean floor spreading: Jour. Geophys. Res. 73 (6). Isacks B. et al, 1968, Seismology and the new global tectonics, Jour. Geophys. Res. 73 (28). Vine, F.J., 1966, Spreading of the ocean floor; new evidence, Science 1954) on the theory of continental drift suggest that the southern highland may have been the present day Antarctic continental landmass.

At the close of Lower Cretaceous (Otway) time, there were areas of uplift, faulting, truncation and erosion. The truncation and faulting is seen by seismic in the Victorian and Tasmanian portions of the Otway Basin.

However, to the west in the area of Esso Crayfish A-1, there is no obvious angular unconformity. In the Gambier Sunlands, deposition may have been continuous between Lower and Upper Cretaceous, with the subtle marine drowning of the Otway non-marine sediments representing the break between the two ages.