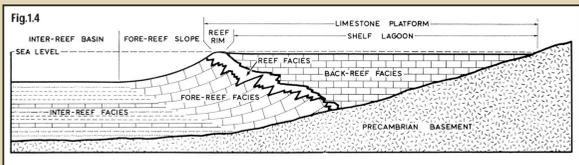
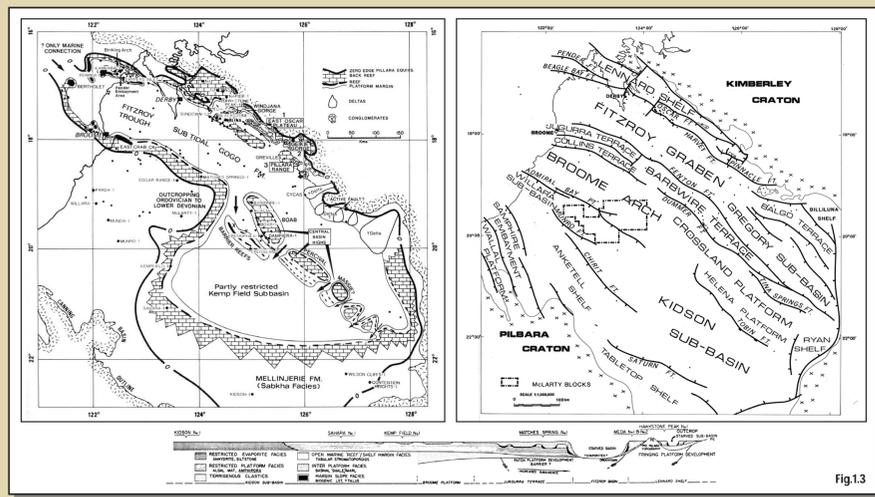
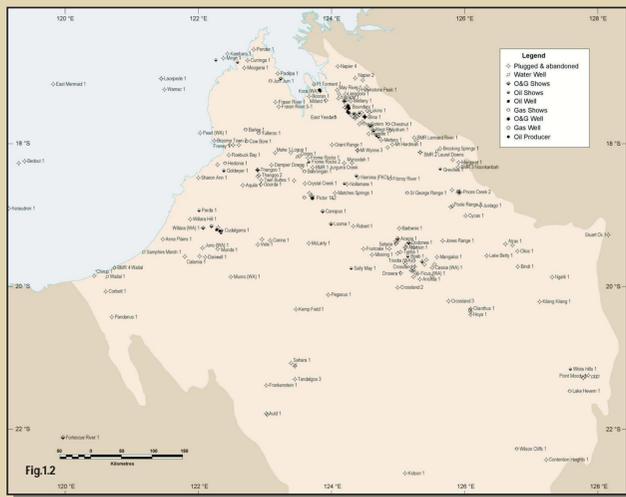


PANEL 1: REEF OUTCROPS AND SEISMIC MODELS

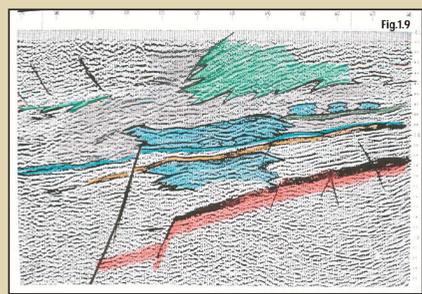
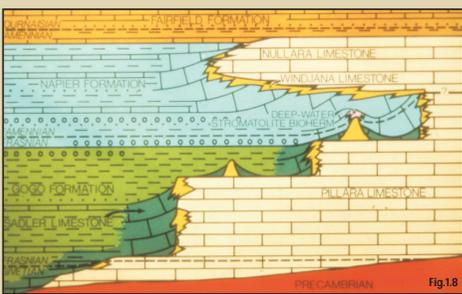
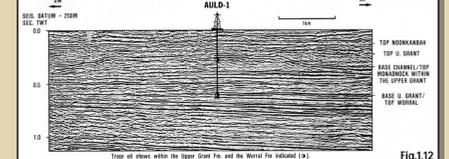
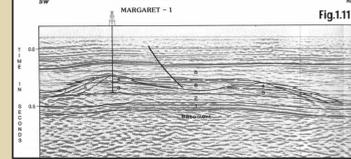
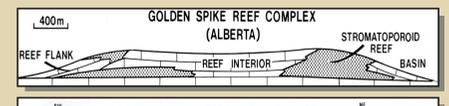
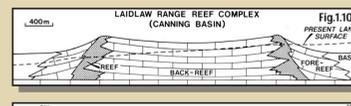
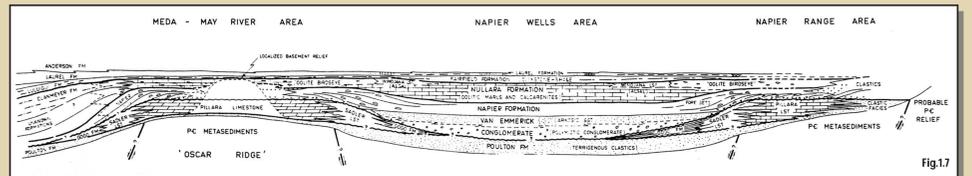
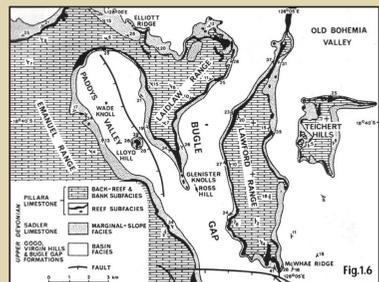


- The Devonian reefs of the Canning Basin have been a source of inspiration and frustration for petroleum explorers for half a century.
- The analogy to the Devonian reefs of Alberta, Canada, and reefs trends elsewhere, have stimulated interest in the Canning reef 'play', but results have been disappointing.
- Over 40 wells have been drilled for Devonian reef complex objectives, but few have encountered the predicted section, showing the difficulty of defining the reef complex in the subsurface (figure 1.2).
- The seismic image of the Devonian reefs in the Canning Basin has been based mainly on geological models of the reefs in outcrop, along the basin's northern margin.
- These outcrops stretch over 200 km along the basin margin and are world famous, especially the so-called 'classic face' at Windjana Gorge, shown above.
- The reef system occurs in the subsurface along the basin's northern shelf and also on the mid-basin Broome Arch and its flanking terraces. A deep starved basin separated these reef systems in Devonian time, while a large evaporitic basin covered most of the southern basin area (Figure 1.3).

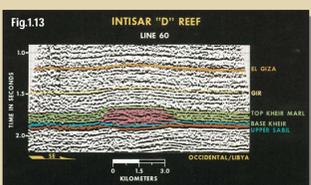
This poster is not a chronological review of the geophysical interpretation of Canning Basin Devonian reefs, nor the wells drilled to test them. The source material for that larger historical review is still being collected and this poster is a selective viewing of some of the themes that emerge from a first reading of that history.



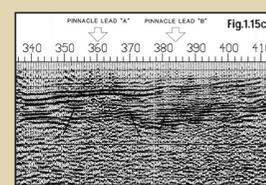
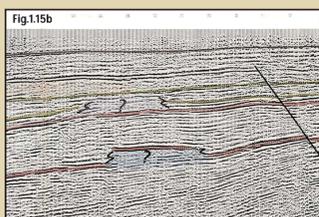
- In the 1960s company and Government geologists interpreted the Devonian outcrops as an extensive, relatively simple single cycle reef system, 'uninterrupted from Givetian to Late Upper Devonian' (Playford and Lowry, 1966), as shown on Figure 1.4
- Drilling quickly revealed a more complex structural and stratigraphic Devonian basin system but this outcrop model continued to influence this early exploration.
 - Devonian carbonates were seen as an exploration objective basin-wide, especially after the discovery of thick porous limestone/dolomite Devonian platform sequence in the Matches Springs-1 well on the Broome Arch (Fig. 1.2).
 - Wells such as Yulleroo-1 and St Georges Range-1 in the 1960s even targeted the Devonian sequence within the Fitzroy Trough. These wells encountered only thick Permo-Carboniferous sediments, but the concept of a Devonian reef play on high basement blocks in the Fitzroy Trough has remained a recurring theme in the exploration history, as discussed further on Panel 4.
- Mapping in the later 1960s and early 1970s, combined with the drilling results, led to a more detailed model of the Devonian reef system. This work recognized the significance of outcrops such as the Laidlaw and Lawford range (Figures 1.5 & 1.6) as Givetian-Frasnian reef complexes, with features such as Lloyd Hill being smaller pinnacle reefs. A new model for the reef system by Wapet geologists, emphasizing this earlier rift cycle, is shown on Fig. 1.7.
- A new model for the reef system, involving separate Givetian-Frasnian and Fammenian cycles, separated by an unconformity, was developed by Playford (1980) and, with minor modifications, mainly by Dr Playford himself, remains the accepted model today (Figure 1.8).



- A new round of exploration had commenced in the basin in the late 1970s, and this new model immediately influenced the geophysicists' image(s) of the reef in the subsurface. Figure 1.9 shows an interpretation by the author from 1979.
- The Givetian/Frasnian atolls and pinnacles were seen to be larger than their counterparts in the producing Alberta Basin, Canada, (Figure 1.10) leading to expectations that 100-200+ MMbbl field were soon to be discovered.
- Through the late 1970s and 1980s, many wells were drilled based on seismic anomalies interpreted as reef and platform systems. Some were very successful, as at Margaret-1 (Figure 1.11) in the southern Canning Basin, where a very nice 'reef' shape proved to be an erosional remnant carved in Permian sediments during the Upper Permian glaciation.



- The geophysicists' image of the Canning 'reefs' was also influenced by the seismic expression of producing reefs in other basins.
 - The Intisar Oilfield (Figure 1.13 in Libya) was a popular model, widely known because of the AAPG paper by Conrad Maher, who was in Perth then with Occidental.
- Other seismic images stimulated the geophysicists' imagination because they showed how small anomalies could be the key to giant deposits. The North African reef in Figure 1.14 contained over 1.5 billion barrels.
- 'Reef-like' anomalies were interpreted far and wide by the geophysicists in many different companies. Several examples are shown on 1.15.
- With little well control and poor seismic quality limiting regional correlations, the recognition of these seismic 'reefs' became the basis for identifying the Devonian section and the exploration targets. This was not to prove an easy task, as the following panels will show.



- It bears noting that exploration in the 1980s did not ignore the regional platform concept, which was seen by some companies as having enormous potential. This image is from a Whitestone presentation to investors in 1979.

