PANEL 5: THE BEST OF THEM ALL – SO FAR...

- In 1984 the Kufpec discovered the Fossil Downs Embayment northwest of the Gogo Block and the first seismic lines revealed 'geophysically-exquisite' reef anomalies, of which two examples are shown on Figures 5.1 and 5.2
- The location of the Fossil Downs Embayment is shown on Figure 5.3 and 5.4.
- These were the best reef anomalies seen by the Kufpec/Whitestone/Amax JV across their extensive permits in 8 years of exploration and caused great excitement.

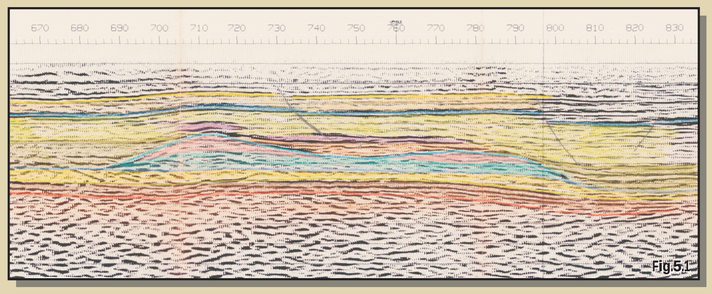
Fig.5.1

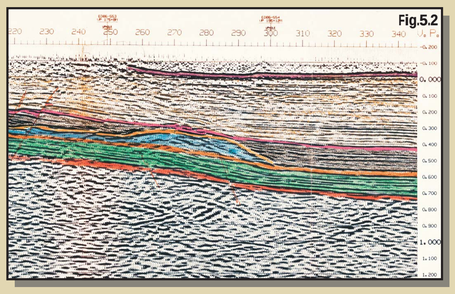
Fig.5.2

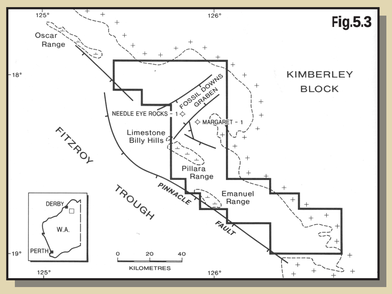

Fig.5.3

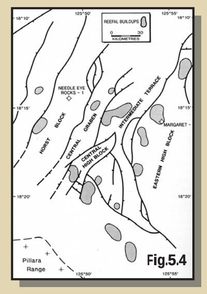

Fig.5.4

- This geophysical discovery co-incided with publication in PESA'a 1984 Canning Basin volume of a detailed model for the Pillara Reef Complex, developed by BHPP geologists, based on the nearby Limestone Billy Hills.
- Mike Hall's (1984) schematic cross-section of the Limestone Billy Hills 'atoll', shown on Figure 5.5, with two views of the outcrop on Figures 5.6 and 5.7, provided an excellent analogue for the seismic features.
- BHPP had recorded seismic across the down-faulted extension of the Limestone Billy Hills complex but, as shown on Figure 5.8, this had none of the elegance of the Kufpec reef discoveries.

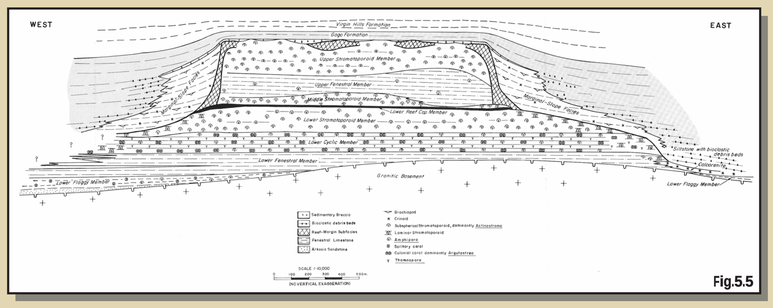

Fig.5.5

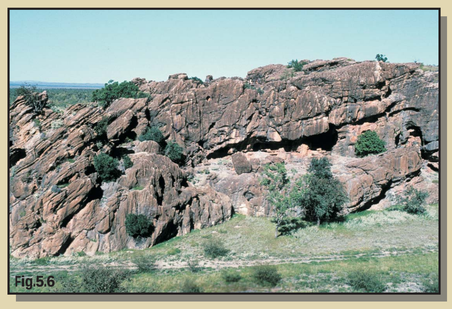
Fig.5.6


Fig.5.7

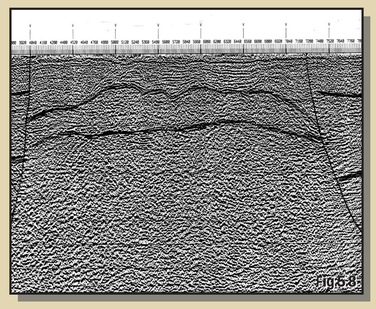
Fig.5.8

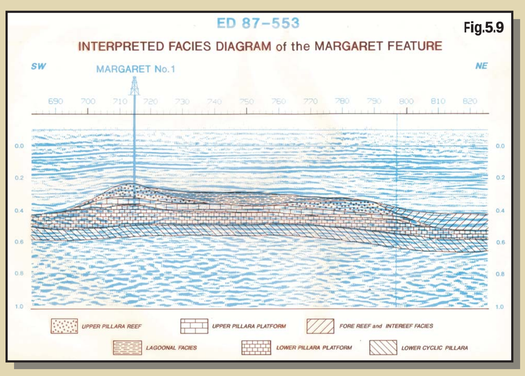

Fig.5.9

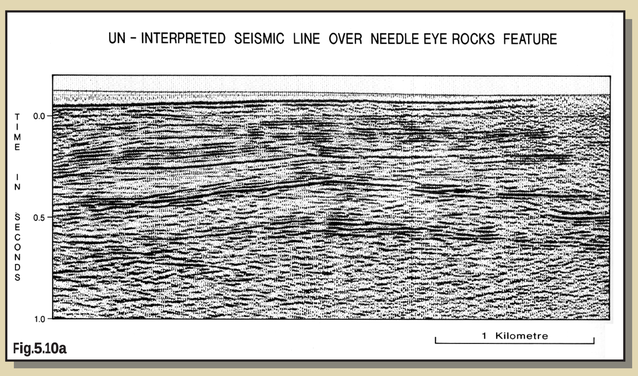

Fig.5.10a

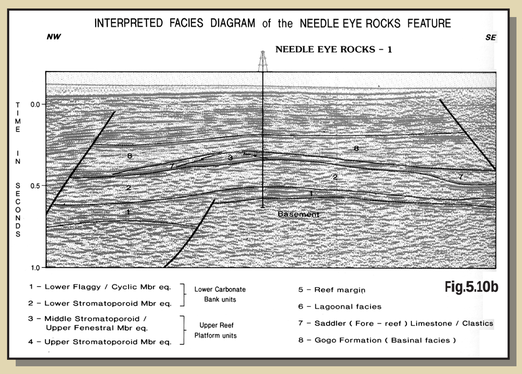

Fig.5.10b

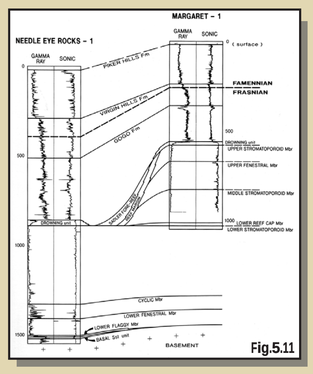

Fig.5.11

- Kufpec's interpretation of the Margaret-1 reef test is shown on Figure 5.9. The close correlation with the outcrop model is clear.
- The well encountered a thin porous zone (to 23%) within the Pillara limestonebut it was associated with only a trace gas show.
- However, the overlying and sealing Gogo Formation has good oil source potential in this area, but is immature.
- Needle Eye Rocks-1 tested another reef feature in the Fossil Downs Embayment. Un-interpreted and interpreted sections across the reef are shown on Figure 5.10.
- This well encountered the lower platform facies overlain by fore-reef and basinal sediments and is shown in relation to Margaret-1 on Figure 4.11. There were no significant shows and only minor indications of porosity within the Pillara sequence, and the overlying Gogo Formation at this location was neither a reliable seal nor an oil prone source rock.
- Taken together, these two wells showed that the reefs, though spectacular on seismic records, had only minor porosity and did not have access to mature oil-prone source rocks.

1958

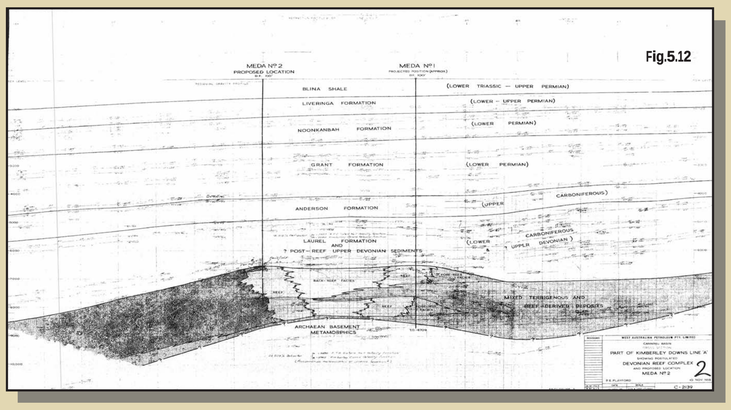

Fig.5.12

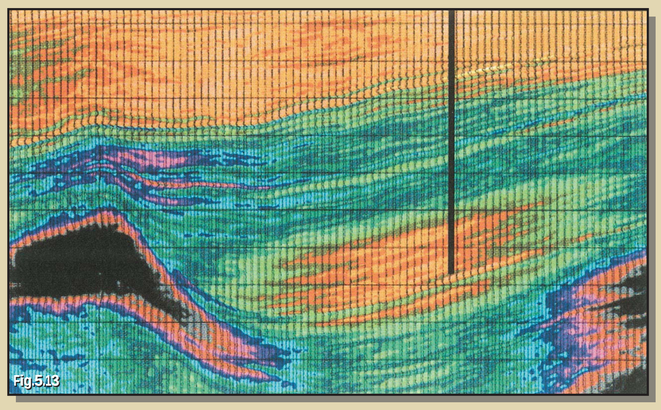
Fig.5.13

2006

Summary and Conclusions

- It is nearly 50 years since the first well was drilled to test a seismically-defined Devonian reef prospect in the Canning Basin.
- The seismic imaging of the reef in the subsurface has advanced considerably over that time, as illustrated by the hand-plotted picks from single-fold data at Meda and the 2006 acoustic impedance section across Blina by Oil Basins, as shown on Figures 4.12 and 4.13 respectively. (Oil Basins are reportedly planning a stratigraphic test in the back-reef section (Oil and Gas Gazette, 2006).
- The geophyicists' imagining of the reef in the subsurface has also changed considerably over that period, influenced by both the model of the reef in outcrop and the seismic images of producing reefs in other basins.
- My historical review of seismic exploration for Devonian reefs in the Canning Basin is still in the data-gathering stage, and this poster is both selective in issues and well covered and preliminary in any analysis or conclusion. That said, a number of points do emerge from this first reading of the available historical files:
  - The most 'creative' period for seismic reef interpretation in the Canning Basin was the 1976-1990 round of exploration when numerous companies pursued the Devonian reef play, with over thirty reef prospects drilled, albeit without much success.
  - Some of the 'reef' interpretations proved to be geophysical folly; others were elegant and insightful, with data quality a major determinant – but not exclusively so.
    - Many unsuccessful wells were based on identifying the Devonian section on the basis of seismic anomalies considered analogous of the Canning reefs in outcrop or seismic reefs in other basins.
    - With hindsight – and, in a few cases, with better foresight – it becomes clear that many reefs were interpreted in areas and sequences that were not the correct palaeogeographic and basin setting.
    - This was unavoidable in the past when wells control was minimal and seismic data poor, but would not be prudent practice in future.
- A new round of exploration in the Canning is overdue and will have the benefit of the considerable work done by previous explorers. It is hoped this historical work will also benefit new explorers by helping them see the errors of the past.
- The chances of successfully defining reefs in the subsurface will improve where good regional understanding and best-practice seismic acquisition and processing techniques are combined with a careful integration of the reef models from outcrop and analogous seismic anomalies.
- The ultimate lesson that emerges clearly from even this preliminary history is that even when the geophysicists get it dead right, the Canning presents the explorer with serious challenges regarding porosity and sourcing. Successful exploration will need models to address these geological risks co-incidentally with the seismic mapping of the reef prospects.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).

Acknowledgements

I worked for Whitestone Australia Petroleum from 1977 to 1985 when they were operating in the Canning basin, both as Operator and in Joint Ventures with Amax, IEDC (later Kufpec), Ampolex and others. My interest in the changing reef interpretations began during those years but is an extension of an historical interest in the Canning exploration going back to Wapet days in the late 1960s.

Bud Stilley and Harold Dubuisson gave me the files when they disbanded Whitestone in 1985. Both are dead now, and missed. Bud played a leading role in the revival of exploration in the Canning with Whitestone's 1976 application for EP 97 and soon after for EPs 101, 102 and 103. All who worked with him will remember his hand written memos and creative drawings, only a few of which I have used here.

Several other people, companies and organizations helped me with research and material, either in general or specifically for this poster:

- *Bill Tinapple, Jeffrey Haworth at DOIR assisted greatly by arranging declassification of the old Application to Drill reports, the ultimate source documents for showing the pre-drill reef interpretations. Felicia Orimies, Roger Hocking and Mike Middleton helped with viewing and copying of the well reports.*
- *Chevron generously granted access to the old Wapet files and allowed me to copy and use material from them;*
- *Finally, numerous colleagues from past Joint Ventures or neighbouring permits wracked their brains in trying to answer my assorted questions about the old prospects and wells.*

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