Submarine Channels Characterization using Seismic Attribute Analysis: A Case Study from Browse Basin, Offshore Australia

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1. Introduction

Submarine channels are erosional features present on the world's continental margins including sea-floor, continental slopes and basin plains. Younger channels are characterized by a V-shape structure. However, mature channels are more incised. The present study aims to identify submarine channel features from the Poseidon 3D prospect in the Browse Basin from 3D reflection seismic data acquired across an area of 4070 km^2 with an orientation of 310° north. Submarine channels have been mapped from the Woolaston formation belonging to the Late Cretaceous period. These channels are thin and subtle, so manual horizon interpretation to map the channels was difficult. Hence, Generalized Spectral Decomposition Attribute was used to characterize these thin, subtle channel features. Finally, these channels were extracted as 3D objects called Geobodies.

2. Area of Interest

- Figures 1 and 2 show the area of interest which lies on the north western offshore part of Australia, lying in the Indian Ocean
- The survey area lies in the Browse Basin which has been described in the next section

Fig.1 World Map showing the location of Australia

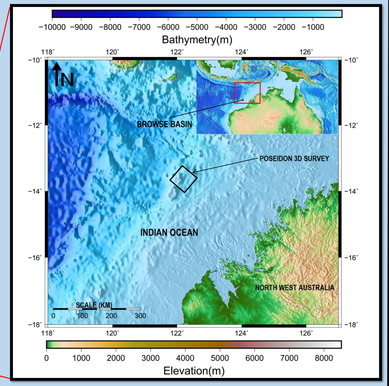

Fig. 2 A zoomed in view of Browse Basin, offshore Australia

3. Stratigraphy of Browse Basin

- The tectonostratigraphic framework study was undertaken by Geoscience Australia during 1996-97 which includes 22 sequences ranging from Carboniferous to late Tertiary
- The target zone for this study is the Woolaston Formation in Late Cretaceous
- They have been documented as potential areas of subsurface hydrocarbon exploration and production

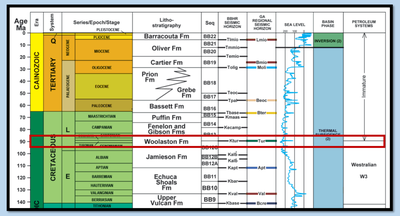

Fig. 3 Chart showing the Cretaceous and Tertiary Stratigraphy of the Browse Basin (after Struckmeyer *et al.,* 1998; Blevin *et al.,* 1998a)

4. What are Submarine Channels and challenges in interpretation

- Submarine Channels are prominent topographical features on sea-floor, continental slopes, basin plains, formed by sediment-laden turbidity currents and other sediment-rich gravity currents
- Submarine channels are important since they play a major role in the deposition of sediments from shallow to deep marine environment
- The submarine channels in the zone of interest for the given dataset consist of subtle channels features as shown in Fig 4 (a),(b)
- The channels shown in the figure are thin and subtle to the extent that it becomes error prone to establish their continuity in 3D space when mapped manually. Moreover, manual interpretation of these channels is a time intensive job. Hence attribute analysis has been used to extract the channels as 'Geobodies'

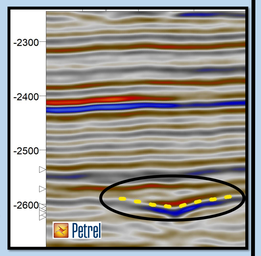

Fig 4 (a)

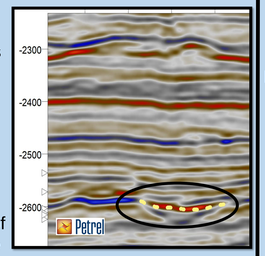

Fig 4 (b)

Fig 4 (a) Submarine Channel on Cross Line 1193 with a vertical scale of 20ms ; (b) Submarine Channel on Cross Line 1546 with a vertical scale of 20ms

5. Methodology

- The methodology used in this case study to characterize the subtle channel features was the use of **Generalized Spectral Decomposition** Attribute (GSD)
- GSD is used to separate the seismic signal into its constituent frequencies
- This allows the interpreter to delineate subtle geologic features tuned at a specific frequency

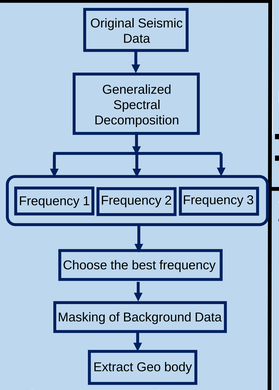

Fig. 5 Flowchart showing the process used to obtain the final results

6. Results

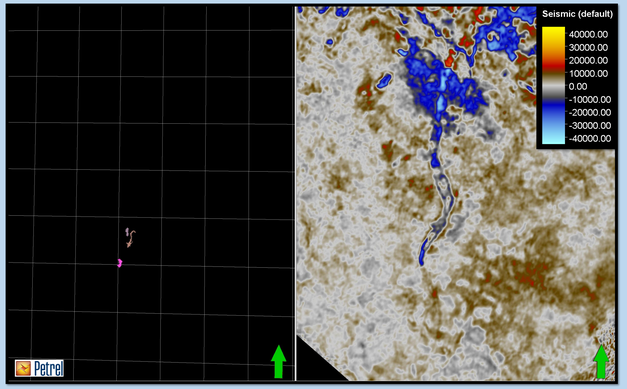

Fig 5(a) Geobody extracted from Original Seismic Data at a time slice of 2614ms

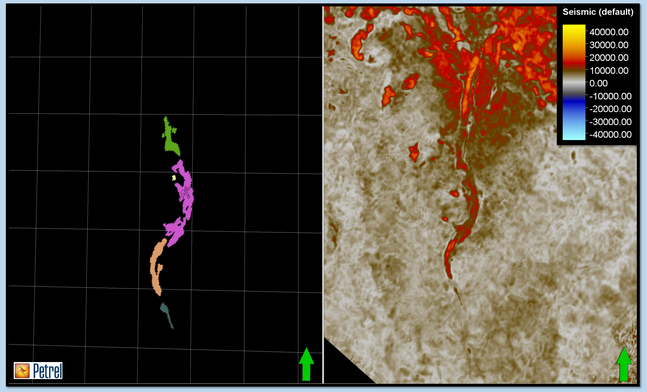

Fig 5(b) Geobody extracted from GSD Attribute at a time slice of 2614ms

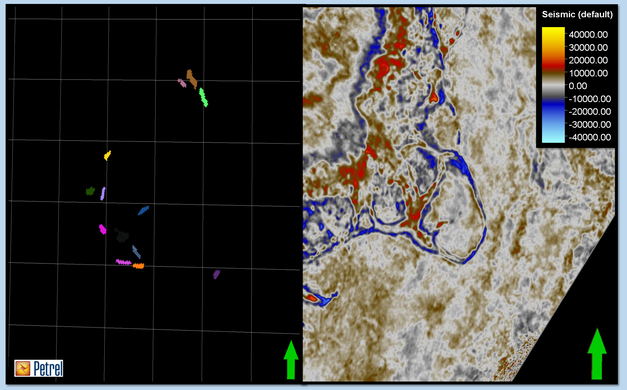

Fig 6(a) Geobody extracted from Original Seismic Data at a time slice of 2616ms

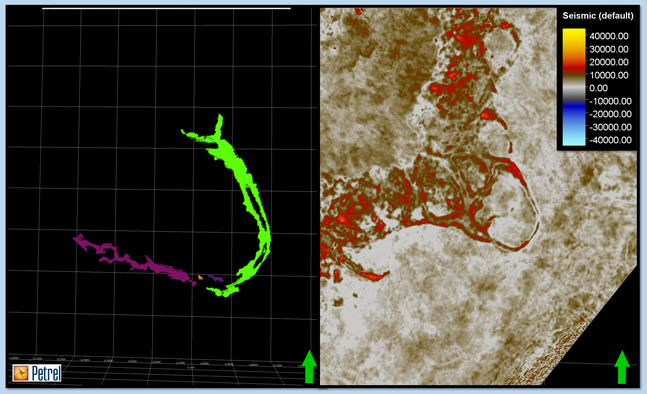

Fig 6(b) Geobody extracted from GSD Attribute at a time slice of 2616ms

- Thin subtle channels are better recognizable in GSD attribute volume [fig 5,6 (b)] than those observed in the original seismic volume [fig 5,6(a)]
- The extraction of the channels as geobodies is more continuous by using GSD attribute volume [fig 5,6(b)] as compared to the original seismic volume [fig 5,6 (a)]

7. Conclusion

- Attribute analysis can improve subtle channel features which is difficult if done by manual horizon interpretation
- This case study provides such an example where Generalized Spectral Decomposition Attribute has been used to enhance the submarine channels over manual horizon mapping
- Geobody extraction of the channels from the attribute analysis provides much better results as compared to the original seismic

8. Acknowledgement

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- Generic Mapping Tools to provide the software for constructing study maps of the region of interest