Comparison of Seismic Migration Strategies: the Ceduna Sub-basin of the Great Australian Bight, South Australia

Frances A. Cooke, BSc. (Hons), MSc.

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Australian School of Petroleum,

The University of Adelaide

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ABSTRACT

Migration is an important process applied to seismic reflection data to improve the quality of the sub-surface image. There are a variety of migration techniques available, with the choice of imaging greatly influenced by the complexity of the sub-surface.

3D seismic data acquisition was carried out in the Great Australian Bight in 2006 by Woodside. An area of 400km^2 – the 'Trim 3D', within the area of prime coverage in the Ceduna Sub-basin was selected for processing by PGS on behalf of BP in January 2011.

Two integral pre-stack migration methods were applied to the Trim 3D volume datasets. The migration datasets employ Controlled Beam migration (CBM) and Kirchhoff summation migration (KSM) techniques. The advanced technique of PGS proprietary CBM includes more dips in the algorithm and has the ability to run at higher frequencies. This advanced technique is designed to target the shallow section of the Beam volume. The output amplitudes from the CBM are known to be poor; therefore, KSM is used as a comparison to ensure that all appropriate events are present. The inconsistencies observed between the two processed products forms the basis of the investigation.

Seismic interpretation of faults and horizons were carried out on the two datasets. The fault image was observed to be clearer on the Beam coherency slices with a more coherent fault shadow zone. A greater number of fault plane reflections were also present on the Beam volume. The KSM displayed greater structural detail with improved imaging of the minor faults. It is hypothesised that structurally the Beam and Kirchhoff products are very similar. This is true for the positioning of faults in one volume relative to the other, though products were dissimilar in the structural imaging of the smaller faults.

The improvement to signal to noise ratio in the CBM results in greater lateral smoothing of the seismic reflections. This not only affects the detail of the minor faults but the stratigraphic detail of channels and other features such as potential patch reefs. The coherency volume attribute was found to be the most useful attribute for the stratal and stratigraphic imagery. The complex trace attribute 'slope of reflection strength' also gave potential insight into the use of attributes for facies analysis.

Limited well penetration in the Ceduna Sub-basin has resulted in a dependence on detailed seismic facies. The image quality of the KSM is optimal for geological interpretation and is more likely to influence future processing in the Ceduna Sub-basin.

LIST OF CONTENTS