Seisware Interpretation of Eromanga and Cooper Basin in Southern Australia

GOPH 559

Eneanwan Ekpo

Lawrence Lines

Safian Qureshi

ID 10086638

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Abstract

Seismic surveys are one of the most popular geophysical techniques in order to extract data about the local subsurface. Using Seisware, a 3D volume plus two 2D seismic lines from the Eromanga and Cooper Basin in southern Australia is interpreted. 3D to 2D seismic data was first tied and seismic-to-well ties were then performed using synthetic seismograms. On the seismic shot records, two horizons were then picked at a certain interval between lines (100) over the entire 3D volume, in line and crossline. This resulted in generating time structure, amplitude and isochron maps which can be finally be interpreted .

Introduction

The following figure 1 shows a brief overview of the local area in study. The area (or technically 3D volume) enclosed by the black diamond is referred to as the Moomba Big Lake while the two green lines are referred to as the 84-tpz crossline and 84-tqj inline, providing 2D seismic data. The diamond area is 45km corner to corner to provide the reader with a sense of scale. Two wells are indicated by the black spiked known as the Moomba 138 at the top and Moomba 132 on the bottom. Respective sonic, density and gamma ray logs were provided to assist us in the seisware interpretation as Ormsby filters were customized. The irregularly shaped red polygons outside and inside of the black diamond represent a 'culture layer' which outlines the known gas fields[1].

After tying 3D seismic data to 2D, two geological horizons known as the Cadna-owie and Toolachee were picked across the entire 3D volume, Cadna-owie being at higher elevation. Time structure, amplitude and isochron maps were finally generated as results to attempt to interpret the data in terms of inferring trapping mechanisms, relative timing of uplift and general depositional settings visible.

[1]Lines, L. (2017). GOPH 559 - Geophysical Interpretation. Retrieved from https://d2l.ucalgary.ca/d2l/le/content/169326/viewContent/2419130/View?ou=169326

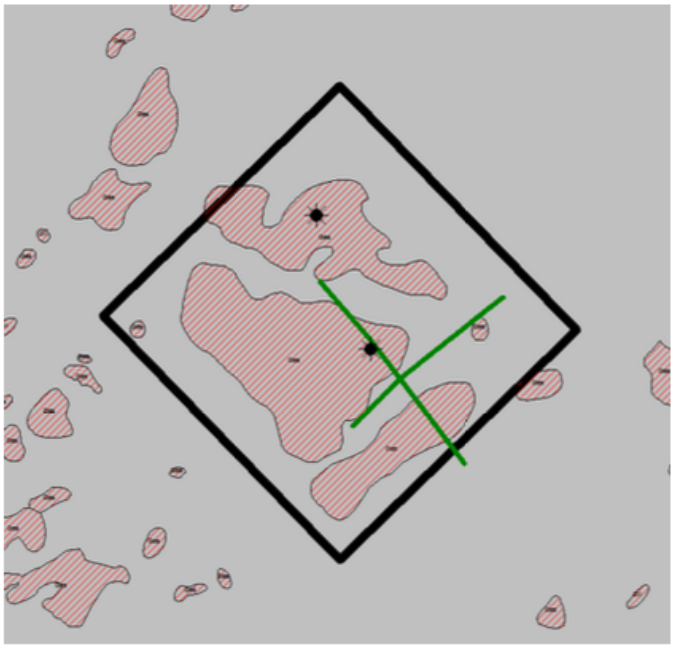

Figure 1: basemap of project study data, southern Australia

Interpretation and Results

Resulting figures of time structure and isochron maps hint that the gas fields may have been trapped structurally. After tying 3D seismic data to 2D and generating well synthetic seismograms which are then tied to the shot record, it is quite discernible that uplifting has occurred after deposition of the Cadna-owie and Toolachee formations. It can be inferred as such due to the fact that both horizons Cadna-owie and Toolachee were shifted an equal amount. The Cadna-owie formation is obviously younger as it lies on top of the Toolachee horizons.

Elevation changes that are very abrupt when moving along a position may be indicative of faulting. This pattern can be seen when looking at the Toolachee formation's time structure map which indicates there may be faulting present. The thought on faulting can further be made clear with the amplitude map of the horizon. Higher amplitude values in somewhat of a linear format, when compared to surroundings, is also indicative of a fault especially when combined with the time structure map.

The Toolachee horizon is of hydrocarbon source rock due to its depositional age in geologic history. These depositions form part of the Cooper Basin. Following some other formations whose horizons were not studied, the Cadna-owie formation was deposited on top

of other layers and the Toolachee at the bottom. The Cadna-owie formation is then part of the Eromanga Basin. Uplift then happened after deposition of Toolachee and Cadna-owie formations. Local seals which partially broke in reservoir are formed of shale.

There is also an anticline present from looking at the seismograms and shot records. Anticlines are a preferable geological structure for reservoirs and are easily traced due to arched shape.

Conclusions

Bringing it together, the software interpretation package Seisware allowed to look closely at a 3D volume in southern Australia. Resulting maps of time structure, amplitude and isochron, in conjunction with well ties to seismic data, can be used to infer the history of deposition in the subsurface. Trapping mechanisms can also be interpreted and in the case of this volume, clear faulting was seen. The faulting resulted in a partial break to the seals and the faulting led to migration from Toolachee to Cadna-owie formation. The Cadna-owie formation can most likely be assumed as a trap which encloses the gas field of interest. Thus, the gas fields indicated by the red polygons on basemap where the wells are located are essentially trapped between the Toolachee and Cadna-owie horizons. As such, emphasis in interpretation should be placed there which narrows down and focuses positions and locations within subsurface strata.

References

Apex Energy Consultants. 2011. Geological Report on Southern Australia. Retrieved from: http://www.brandenburgcorp.com/i/pdf/hcb-georeport2.pdf

Lines, L. (2017). GOPH 559 - Geophysical Interpretation. Retrieved from https://d2l.ucalgary.ca/d2l/le/content/169326/viewContent/2419130/View?ou=169326

W.M. Telford, L.P. Geldart and R.E. Sheriff. (1990). *Applied Geophysics, Second Edition*. Cambridge University Press.