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ONSHORE

SEISMIC REINTERPRETATION OF THE ORANGE STRUCTURE

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INTRODUCTION

The OP 175 Joint Venture partners are currently accelerating their search for gas in the eastern area of this permit since a DST test in Dingo No. 1 of the Proterozoic aged Arumbera 1 Sandstones flowed up to 5 MMCF/D. A well to test the Arumbera sandstones in a larger structure called Orange, approximately 25 kilometres north-northeast of Dingo No. 1, has been proposed.

Orange No. 1 was drilled on the structure by Magellan in 1966. This well bottomed in the Arumbera 3 sandstones and did not penetrate the potentially productive Arumbera 1 sandstones. Although potential reserves of this structure are enormous, the present seismic data over the structure has problems which do not allow definitive mapping of the Orange Structure. Therefore, the chances of choosing an optimum location for Orange No. 2 are severely constrained. This report reviews the assumptions used to overcome these problems and the limitations of mapping based on these assumptions.

SEISMIC INTERPRETATION OF THE ORANGE STRUCTURE

1. Seismic Surveys to Date

Currently, about 230 kilometres of three vintages of seismic data with different sources and field parameters exist over the Orange Structure. A single fold survey acquired in 1965/66 used a dynamite source, and although the data are noisy and have poor horizontal resolution, vertical resolution of this survey is the best of the three vintages. These single fold data were reprocessed in 1983 by Digital Processing. There are about 147 kilometres of this dynamite sourced data over the Orange structure.

Just under 47 kilometres of twelve fold weight drop data, were acquired over the Orange Structure in 1973. Signal to noise ratio was improved, but due to a long group spacing and the narrow band width of the source, horizontal and vertical resoltuion are poor. Reprocessing of these data was done in 1983 by Hosking Geophysical.

Pancontinental Petroleum Limited operated a twelve fold vibroseis sourced survey in 1980, of which 36 kilometres of good quality data were acquired over the Orange Structure. Two lines of this survey pass through the Orange No. 1 well, but unfortunately, due to economic constraints, this survey was carried out only over the eastern flank of the structure.

The map on Enclosure 1 shows the approximate limits of the Orange Structure and the location of the different vintages of seismic data discussed above.

2. Interpretation and Discussion

Typically, when different vintages of seismic data, with different sources and processing are used in an area, interpretation and mapping are difficult. The Orange area is no exception. Two major problems arose which, in this interpretator's opinion, made reliable mapping over the Orange Structure impossible.

The first problem was an extreme mistie of about 77 milliseconds between line 3-A and lines P80-8, P80-9. Since line 3-A follows along the strike of the structure, it is a critical tie to all dip lines. Bulk shifting line 3-A to make it tie with P80-8 and P80-9 led to more severe misties elsewhere.

To map the Orange Structure, two time maps were constructed.

The first time map assumes that the P80 lines are correct and forces line 3-A to tie with these lines by bulk shifting 77 milliseconds. All dip lines were bulk shifted such that they tied with line 3-A. Since this resulted in extreme misties of the dip lines with line 3-2, values from this line had to be ignored. A two-way time map of the top Julie Formation (a reflector just below the Arumbera sands which tested gas pay in Dingo No. 1) using these adjustments is shown on Enclosure 2. This map shows two separate en-echelon structures instead of the one larger structure as previously mapped. The possibility of Orange having two separate culminations is enhanced by a gas detector survey (see Enclosure 3) which shows two separate moderate hydrocarbon seepages over the Orange structure.

The second two-way time map of the top Julie Formation was constructed by ignoring line 3-A and using all other time values. This map (Enclosure 4) shows Orange as one large structure, as originally mapped.

The second major interpretation problem is the extreme variations in the velocity control in the area and the subsequent alternative depth maps drawn from these velocities.

Seismic derived (RMS) velocities were used to produce velocity fields to the mapped time event (top Julie Formation). Velocities estimated from well shoots were used to calibrate the RMS velocities. As expected, due to differing offsets and processors, seismic velocities between the different vintages did not correspond. However, utilizing the RMS velocities available, a smoothed velocity field to the top Julie Formation was done. This map, shown on Enclosure 5, has lower velocities to the west and southeast of Orange No. 1 and higher velocities to the northeast of Orange No. 1. In general, the velocity field seems to be data dependant and does not appear to reflect the velocity field one would expect over a reasonably symmetrical structure like Orange. However, to illustrate the extremes in interpretation possible from these seismic data, a depth map was made utilizing this velocity field and the time map which showed two culminations on the Orange structure (Enclosure 2).

The resultant depth map (Enclosure 6) shows Orange as one large structure culminating approximately 9 kilometres west-southwest and about 400 metres updip from Orange No. 1. It also suggests that Orange No. 1 was drilled just outside of structural closure.

The 1980 twelve fold seismic data covers only the east flank of the structure. As expected, the RMS velocities for these data are much higher than RMS velocities from other vintages. This has the effect of making the mapped horizon in this area appear deeper. To overcome this problem, a second velocity field to the top Julie Formation, which ignores the 1980 twelve fold data, was drawn.

As the 1973 weight drop data has three dip lines across the Orange structure, the RMS velocities for these data were used as

a guide. A bulk shift of 600 metres per second had to be applied so that the velocity field would tie the predicted velocity at Orange No. 1. The smoothed velocity field is shown on Enclosure 7. This velocity field is more consistent with the velocity trend one may expect from a symmetrical structure like Orange.

To illustrate the other mapping extreme possible, a depth map using this velocity field and the time map which showed one culmination on the Orange structure (Enclosure 4) was made. Enclosure 8 shows the depth map produced. This map shows the Orange Structure as one large structure with its culmination about one kilometre west of Orange No. 1.

CONCLUSIONS

Several assumptions had to be made to produce the seismic maps presented in this report.

With the data available over the Orange Structure, there is no sure way of knowing which of the assumptions are correct. The different sets of maps show two mapping extremes that are possible. One depth map shows Orange No. 1 near the crest of the structure while the other depth map shows Orange No. 1 down flank of the structure and possibly not within structural closure.

It is clear that using the three vintages of seismic data with their different sources and different processors, there is little chance of definitively mapping the Orange Structure. Therefore, the ability to locate Orange No. 2 on the structure in an optimum location for a valid test is severely hindered. The only alternative is to run a new seismic survey over Orange.

RECOMMENDATION

Shoot, process and interpret a stand-alone/infill seismic survey over the Orange structure, before drilling Orange No. 2. A suggested survey is shown on Enclosure 9. The 150 kilometres shown represent the minimum amount of seismic data required to sufficiently delineate the Orange Structure and facilitate a valid test by Orange No. 2.

Furthermore, given a successful Orange No. 2 well, which would indicate that the third well of the present drilling cycle should be drilled at Orange in preference to Dingo, the Operator would have extreme difficulty in recommending an optimum western Orange No. 3 appraisal location on current seismic data.