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ANALYSIS OF GEODIP PROCESSED HTD

MT. WINTER NO. 1

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Compiled by: J.D. Gorter

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INTRODUCTION

Mt. Winter No. 1 was drilled to assess the hydrocarbon potential of the Cambrian section, and to investigate the stratigraphic succession below the basal Cambrian unconformity. The well was designed particularly to investigate the stratigraphy, reservoir and source rock potential, and maturation history of these sub-Cambrian sediments. The Cambrian stratigraphic succession at Mt. Winter No. 1 was anticipated to be similar to that penetrated by Ochre Hill No. 1 and as mapped in the Mt. Forbes area, 30 kilometres to the northwest in the Cleland Hills (Wells et al., 1965). This proved to be the case (Gorter et al., 1982).

Mt. Winter No. 1 also penetrated more than 1165 metres of Late Proterozoic sandstone, siltstone, shale, dolomite and evaporites. The well failed to intersect commercial deposits of hydrocarbons in these sub-Cambrian sediments although a significant oil show was encountered in sandy siltstone and silty sandstone near the top of the Bitter Springs Formation. These sediments have recently been included in the Johnny's Creek Beds (Gorter, 1982).

A conventional suite of logs was run by Schlumberger through the Precambrian sequence at Mt. Winter No. 1. The logging suite included the Four-arm High Resolution Continuous Dipmeter tool, which was later processed using Schlumberger's Cluster computer programme. The results of this programme coupled with the recognition of the importance of this newly defined, hydrocarbon bearing sequence, lead to the further computer processing of the 1675 - 1775 metre interval using the Geodip programme.

A print of the Geodip computation was sent to O. Serra of Schlumberger's Singapore office who was asked to comment on the depositional environment of the section covered. A copy of this report follows.

ANALYSIS OF GEODIP PROCESSED ON HDT

ON

WELL:MOUNT WINTER NO.1, AUSTRALIA

DATA AVAILABLE

O.H. LOGS : DLL-MSFL-GR-SP-CAL.
GR-FDC-CNL-CAL.
GR-BHC.
HDT.

PROCESSING : GEODIP on 1675-1775 m interval

Short Geological description of the formation.

PROBLEMS TO SOLVE

Definition of the depositional environment.

PROCEDURE

- Realisation of a composite log on the GEODIP interval in such a way to have an idea of the mineralogical composition of the events observed on the HDT resistivity curves. This was done by using cross-plot techniques and geological description.

  NB : The reproduction of the GEODIP at 1/200 scale would help the depth-matching of HDT with other O.H. logs. This was achieved using the raw HDT resistivity curves.

- Analyse zone by zone and step by step of :

  . the HDT resistivity curve evolution both in thickness and resistivity;

  . the type of contact between events;

  . the validity of the dips;

. the dip evolution with depths, both in magnitude and azimuth.

1775-1761m - Dolomite to dolomitic limestone with nodules or thin beds of anhydrite. Very low porosity, high resistivity, few spikes on the curves, no correlatable.

. All these remarks suggest a very cemented, compact formation, deposited in a supratidal to upper intertidal zone of an arid shoreline. Few fractures are present especially between 1768-1762.

1761-1760m - Radioactive compact level shaly-silt very cemented with glauconite(?). Can correspond to a transgressive period.

1760-1739m - Radioactivity varies from 50 to 140 API; lower resistivity; from ρ_b $-\varnothing_N$ cross-plots - this interval corresponds to a sandstone (max porosity 10%) with dolomitic cement, intercalated with siltstone. Both are micaceous (radioactivity), very cemented (dolomitic or quartz cement). GEODIP shows at the bottom of the interval (1757-1756m) dips in all azimuths, magnitude between 2 and 20^o which suggest wavy beddings. Curves evolution suggests finning and coarsening upward sequences. When the silt percentage increase (resistivity increases) the dips becomes more consistent (1753.5-1752m) suggesting no longer current influence so a lower energy environment with a deeper water deposit. The regional dip can probably be defined from this interval (9^o-N 10-20^{o}E). The direction of flow, defined after dip removal, seems to be towards NW.

The interval is composed of several sequences of similar patterns suggesting succession of shallow and deeper water detrital deposits.

1739-1736m - The sandstone is very cemented (no porosity).

1736-1727m - Very high resistivity with high radioactivity. From ρ_b - $\varnothing_N$ cross-plot this interval corresponds to a siltstone very cemented (dolomite cement) probably micaceous. In this interval the GEODIP processing did not find good correlations in spite of noisy resistivity curve in some places. This noise can suggest sand strings or fractures.

1727-1723m - High density, low radioactivity (10-20API), no neutron porosity. From pb-$Ø_N$ cross-plot this interval is composed of dolomite with nodules or thin beds of anhydrite without porosity at the base, the top of the interval showing more porosity. No dip.

1723-1718m Small increase of radioactivity, lower resistivity, lower density . pb-$Ø_N$ cross-plot indicates a sandy dolomite (Ø = 5%) evoluting to a dolomitic sand with very low porosity (1-2%).

1718-1707m - In this interval the density increases from the bottom to the top, the neutron porosity is always low, the radioactivity is low with some thin levels showing a higher radioactivity with higher neutron response and lower resistivity. At the same level the HDT curves show some low resistive (fractures?) and progressive evolution to lower resistivity with abrupt changes at the top (increase in shale percentage?). Few dips corresponding to these abrupt changes.

This interval could correspond to a succession of sequences starting with supratidal deposit (dolomite with nodules or thin layers of anhydrite) evoluting to a more microcristalline dolomite, calcareous with precipitation of clay, formed during tidal flooding.

1707-1683m - Very radioactive interval with higher neutron response, density between 2.6 and 2.75, lower resistivity. This corresponds to a shale. Some levels (between 1701-1700m; 1694.5-1693m; 1691.7-1692.2m) with lower HDT resistivity and abrupt changes could correspond to shaly sandstones or siltstones. The GEODIP shows some good correlations indicating composed bedding with sometimes current influence (wavy bedding, cross-bedding).

The top of the interval is characterized by an abrupt change in resistivity and a non planar boundary (4 dip computation). This can correspond to an unconformity.

1683-1675m - Low radioactive interval with alternance of high resistive, high dense, low neutron porosity levels (anhydrite) and low resistive, lower dense and higher neutron porosity levels (calcareous dolomite or dolomitic limestone). This corresponds to supratidal to intertidal deposits. The dips in that interval show some consistent azimuth (N 260° in average) and a dip magnitude from 10° to 20°.

CONCLUSIONS

The studied interval looks like an arid shoreline environment with variations from supratidal to intertidal and sometimes lagoonal deposits with three periods of detrital contribution which can correspond to change in the water level in relation with change in climate conditions : more humid with rivers discharging detrital material in the sea.

O. Serra

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