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AVO CASE STUDY IN THE ILLIZI BASIN - ALGERIA

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1 - Introduction and objectives

The application of amplitude variation with offset (AVO) to prestack reflection data has proved to be very useful in identifying hydrocarbon accumulations in various other basins in the world.

The Illizi basin was selected for a first application of the AVO method. Within this basin, the region of Hassi Tabtab contains two geologically similar prospects that resulted in a gas discovery and a dry hole when drilled.

The object of this work is twofold: first, to enable us to test the AVO method in order to determine if this technique is likely to explain the dry hole; and second, to establish if AVO anomalies or amplitude variations could be used as direct hydrocarbon indicators in the Illizi basin.

2 - Pre-processing

A good quality seismic line tied to both wells 1 and 2 was selected. Prior to inputting the data to AVO analysis it was necessary to precondition the common mid-point (CMP) gathers in order to ensure that reliable amplitude with offset values would be obtained. The input gathers to the AVO preconditioning process had surface consistent deconvolution applied in the production processing of the line. In order to remove multiple contamination on the gathers a radar demultiple routine was applied to the normal move out (NMO) corrected common depth points (CDP's.) Residual noise contamination was then reduced by the application of a frequency domain random noise attenuation routine.

3 - AVO modelling

We have also examined the theoretical AVO response for wells 1 and 2 using synthetic well logs to test the effects of gas and water filled reservoirs. This allows us to determine under what conditions a gas-filled sandstone could be distinguished from a water one, given perfect data quality.

4 - AVO analysis

In relation with our case, the purpose of the AVO analysis was to help determine whether or not any amplitude with offset behaviour could be detected which was consistent with hydrocarbon saturation or fluid contacts. Analysis was done over two way times between 900 and 1350 ms, and the main level of interest was between the Frasnian unconformity and the top of the Ordovician.

5 - Conclusions

- Extremely well conditioned seismic data are required for AVO analysis to be worthwhile.
- Gas in Ordovician reservoirs is unlikely to be detectable by AVO analysis.
- Gas in Silurian and Devonian F6 reservoirs and in the Emsian reservoirs should give strong amplitude and AVO anomalies.