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Interpretation of vertical and lateral seismic profiles: some case histories

by

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ABSTRACT

Interpretation of vertical and lateral seismic profiles: some case histories

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The integrated processing and interpretation of VSP data are developed to work together in order to enhance the final VSP interpretation. Furthermore, the interpretive processing of the VSP data within the case histories are reviewed along with the incorporation of the final VSP results (both near and far offset data) into the integrated geological/geophysical interpretations presented in the case studies. This thesis has attempted to personify the term "interpreter/processor" as first highlighted in Hardage (1985).

The case histories pertain to oil and gas exploration in carbonate reef and sandstones in the Western Canadian Sedimentary Basin (WCSB). The Lanaway case history (Hinds et al., 1994a) pertains to the exploration of the Lanaway/Garrington oil field located in central Alberta, Canada. The surface seismic interpretation over the reef crest differed dramatically from the isopach of the reef-encasing shales derived from the geological logs of a borehole drilled into the reef crest. To understand the discrepancy, a VSP survey was performed and the data were interpretatively processed. The results were integrated with the known geology of the field area to uncover possible reasons for the surface seismic anomaly.

The Ricinus case history (Hinds et al., 1993c) is a study in reef hunting within the Ricinus

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field in central Alberta, Canada, using the far offset VSP survey. Existing surface seismic was used to infer that a well drilled into the interpreted North-east corner of the Ricinus reef would be successful in penetrating oil bearing carbonate reef. The well was drilled; however, the well missed the reef and a near and far offset VSP survey was used to seismically image possible reef buildups in an area around the well.

The Fort St. John Graben case history (Hinds et al., 1991a; Hinds et al., 1993a) highlights exploration of a gas-filled channel sandstone using near and far offset (lateral) VSP surveys. An exploration well was drilled within the study area which intersected the target zone sandstone (the basal Kiskatinaw of the Upper Carboniferous). The target sandstone had a high shale content and was not reservoir quality. A near offset and two far offset VSP surveys were run in the exploration well to image out to a distance of 350 m to the North-west and to the East of the well. The VSP, surface seismic and geology results (from the geological logs of the exploration and surrounding wells) are integrated to infer a clearer picture of the sand/shale relationships of the basal Kiskatinaw and detailed faulting of the Carboniferous strata around the well and within the surface seismic line area.

The Simonette field case history (Hinds et al., 1991b; Hinds et al., 1993b) involves using VSP results to image the slope of a low-relief carbonate reef. The low-relief reef examined using the VSP data is located at the extreme end of a North-east reef spur of the Simonette Reef located in North-west Alberta, Canada. An exploration well drilled in the low-relief reef penetrated the edge of the reef. The VSP surveys were run in order to infer details of the reef slope. The interpretation of the VSP data was integrated with all other exploration data to infer the location of the crest of the low-relief reef and to assist in determining whether to whipstock the exploration well or not.

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Samevatting

Interpretasie van vertikale en laterale seismiese profiele: enkele gevallestudies

Deur: Ronald C. Hinds

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Die geintegreerde verwerking en interpretasie van vertikale seismiese profileringsdata (VSP) word ontwikkel om saam te werk ten einde die finale VSP - interpretasie te verbeter. Verder word 'n oorsig gegee van die interpretatiewe prosessering van VSP - gegewens aan die hand van gevalle - studies waarin die finale VSP - resultate (naby - en verafstande) as 'n geintegreerde geologiese\ geofisiese interpretasie gegee word. Die proefskrif poog ook om die term "interpreteerder\ prosesseerder" soos deur Hardage (1985) uitgelig, te verpersoonlik.

Die gevallestudies het betrekking op olie- en gaseksplorasie in karbonaatrif en sandsteen in die Wes - Kanadese Sedimentere Kom (WCSB). Die Lanaway - geval (Hinds et al.,1994a) verwys na die eksplorasie van die Lanaway\Garrington olieveld in Sentraal - Alberta , Kanada. Die oppervlak - seismiese interpretasie oor die rifkruin het dramaties verskil van die isopag van die skalies wat die rif omsluit, soos verkry van die geologiese staat van 'n boorgat in die rifkruin. Om die verskil te verstaan is 'n VSP - opname gemaak en die gegewens is interpretatief verwerk. Die resultate is geintegreer met die bekende geologie van die gebied

om moontlike verklarings te vind vir die oppervlak - seismiese anomalie.

Die Ricinus - geval (Hinds et al.,1993c) is 'n studie in rifopsporing in die Ricinus - veld in Sentraal - Alberta, Kanada, waarin 'n verafstand VSP - opname gebruik is. Bestaande oppervlak - seismiese gegewens is gebruik om af te lei dat 'n boorgat in die noordoostelike hoek van die Ricinus - rif oliedraende karbonaatrif sou tref. Die boorgat het egter die rif gemis en naby - en verafstand VSP - opnames is gebruik om moontlike rif - opbou naby die boorgat seismies af te beeld.

Die Fort St. John Graben - gevallestudie (Hinds et al.,1991a; Hinds et al.,1993a) belig die eksplorasie van 'n gasgevulde kanaalsandsteen deur middel van naby - en verafstand VSP opnames. 'n Eksplorasieboorgat in die studiegebied het die teiken sandsteensone (die onderste Kiskatinaw van die Bo - Karboon) getref, maar die sandsteensone het 'n hoë skalie - inhoud en was nie van reservoir gehalte nie. 'n Naby - en twee verafstand VSP - opnames is in die eksplorasie - boorgat gemaak om die geologie tot op 'n afstand van 350m noordwes en oos van die boorgat vas te stel. Die resultate van VSP -, oppervlak - seismiese en geologiese gegewens (van geologiese state van die eksplorasie - en omliggende boorgate) is geintegreer om 'n duidelike beeld af te lei van die sandsteen\skalie - verhouding van die onderste Kiskatinaw en van detail verskuiwings van die Karboon - strata rondom die boorgat en naby die oppervlak - seismiese lyn.

Die Simonetteveld - gevallestudie (Hinds et al., 1991b; Hinds et al., 1993b) behels die gebruik van VSP - resultate om die helling van 'n lae - reliëf karbonaat vas te stel. Die lae - reliëf rif wat deur middel van VSP - opnames ondersoek is, is geleë aan die einde van 'n noordoostelike rif - uitloper van die Simonette - rif in Noorwes -Alberta, Kanada 'n

Eksplorasieboorgat in die lae - reliëf rif het die rand van die rif getref. Die VSP - opname is gedoen om die besonderhede van die rifhelling af te lei. Die interpretasie van die VSP - data is geintegreer met al die ander eksplorasiegegewens om die kruin van die lae - reliëf rif vas te stel en om te help in die besluit of die eksplorasieboorgat gedeflekteer moet word of nie.

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