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IS THERE A CONNECTION BETWEEN PALEOGENE VOLCANISM AND OOZE DEPOSITION OFFSHORE MID-NORWAY?

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Observations in a large number of wells offshore Mid-Norway indicate ooze-rich zones at a stratigraphic level which coincides with the Paleogene volcanic rift episode. Late Paleocene to Early Eocene represents a peak in regional tuff deposition, but ash layers are also found in older and younger sections.

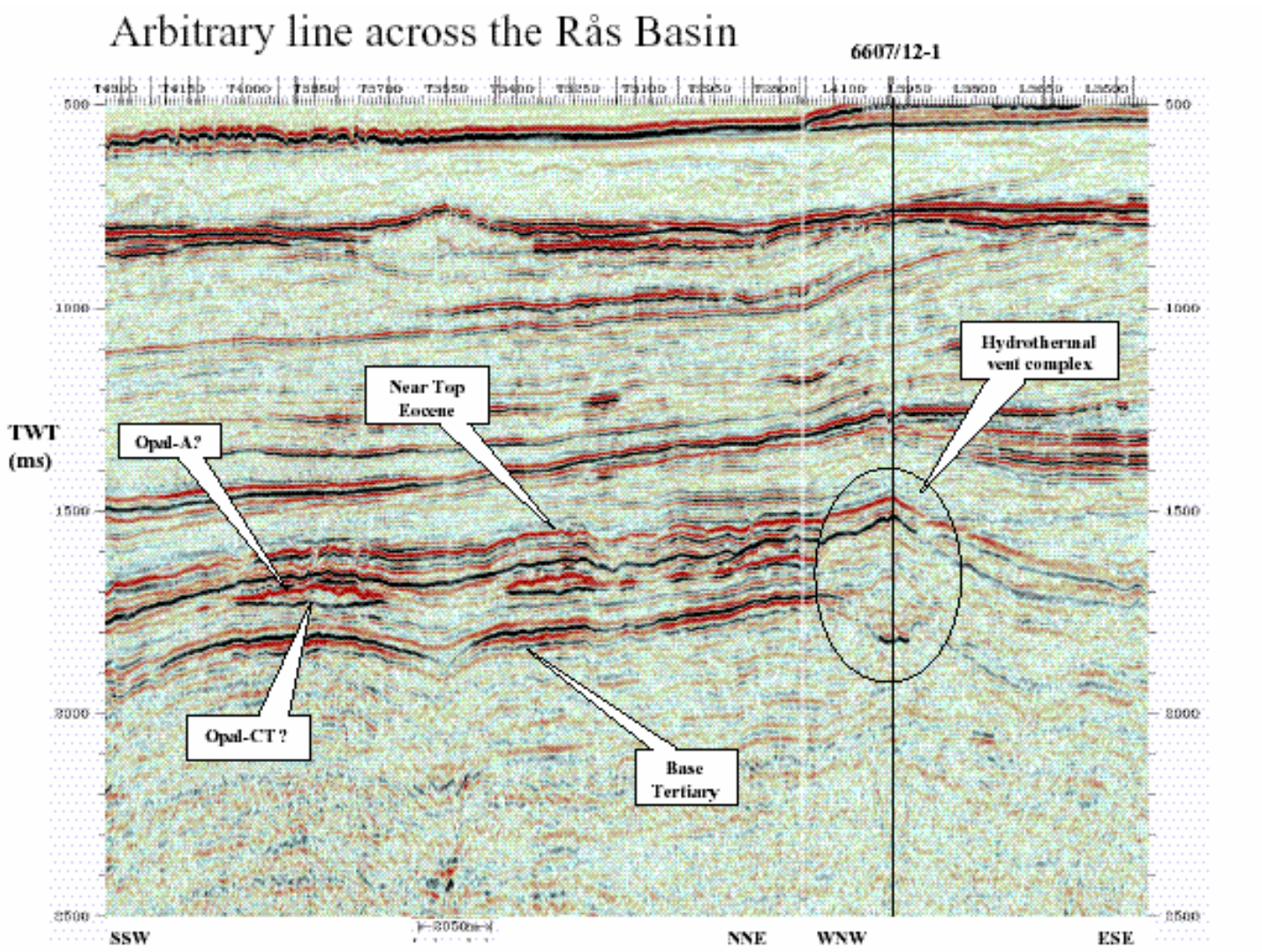
Well 6607/12-1 has penetrated a hydrothermal vent complex filled with ooze rich Paleogene sediments, and the vent formed as a result of underlying sill intrusions of Paleocene – Eocene age. On a local and regional scale the ooze deposition has implications for seismic interpretation and prospect evaluation (Fig.). There is an ongoing debate about a possible connection between deposition of volcanic tuffs and preservation of siliceous oozes.

Over large areas offshore Mid-Norway the Paleogene packages are characterised by siliceous oozes. When these oozes are buried, opal-A is transformed to opal-CT and subsequently to microcrystalline quartz. Seismic reflectors caused by these opal transformations can be mapped as seismically hard reflectors that often crosscut stratigraphy. Occasionally, it is difficult to distinguish such a crosscutting reflector from a hydrocarbon related flat-spot.

Ooze-rich zones are best identified on density logs as intervals with density below 1.9-2.0 g/cc, but sonic logs (Vp and Vs) may also be used to identify ooze-rich zones and opal transformations. In particular the Vp/Vs ratio of ooze rich zones may be diagnostic.

To calibrate the seismic tie, ooze was sampled in a number of wells, and the opal phase analysed by XRD methods. Seismically, opal-A is softer than opal-CT, which in turn is softer than quartz. The AVO behaviour of a trap with an opal transformation is in practice indistinguishable from that of a hydrocarbon- filled trap.

To discriminate between a fluid contact in a shallow sandstone reservoir and the lithology effect of an opal transformation in an ooze-rich zone, more sophisticated geophysical analyses are needed. When 3-D seismic is available, analyses of fluid and lithology volumes can be used to discriminate. Alternatively when 4C data are available, the opal transformation reflector will not disappear on the shear data, in contrast to a fluid contact. In addition Vp/Vs ratios above the crosscutting reflector will tell the difference between fluid and lithology.


Arbitrary line across the Rås Basin
6607/12-1
TWT (ms)
500
1000
1500
2000
2500
Hydrothermal vent complex
Near Top Eocene
Opal-A?
Opal-CT ?
Base Tertiary
SSW
NNE
WNW
ESE