

"Sharing to be better"

Offshore Platform Shallow gas Incident

”Sharing to be better”

- **Under the direction of Norwegian Oil and Gas, a joint industry task force of Operator and Drilling Contractor personnel has been formed to recommend ways to reduce the number and potential severity of well control events on the NCS.**
- **One team recommendation was communicating actual well control incidents that have recently occurred on the NCS so lessons are shared and understood.**
- **This is the ninth in a series of case histories. The incident highlights the importance of shallow gas preparations and uncertainties in Site survey.**
- **Please take some time to review this case history with the drilling crew and discuss the questions raised during the presentation. Please invite and encourage related drilling service personnel to participate.**
- **It is hoped that sharing of incidents is helpful and any feedback is welcome.**

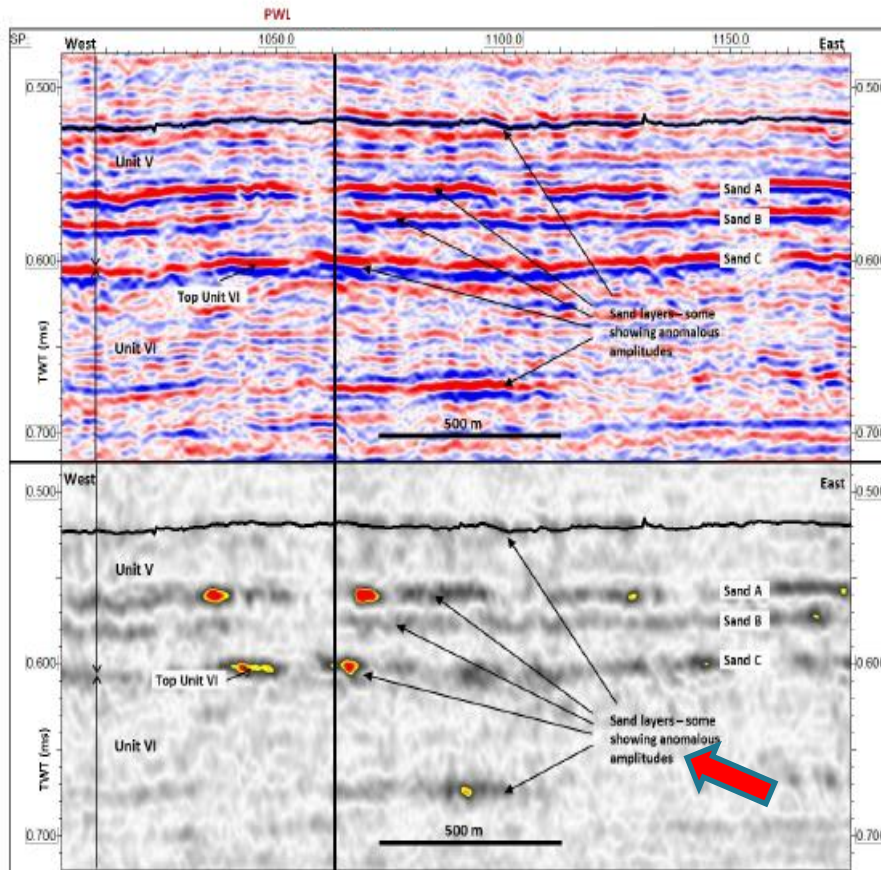


Figure 3.6: 2D seismic line DN1203-0113 showing sand layers near the top of Unit VI and associated amplitude anomalies (amplitude display top and envelope display bottom).

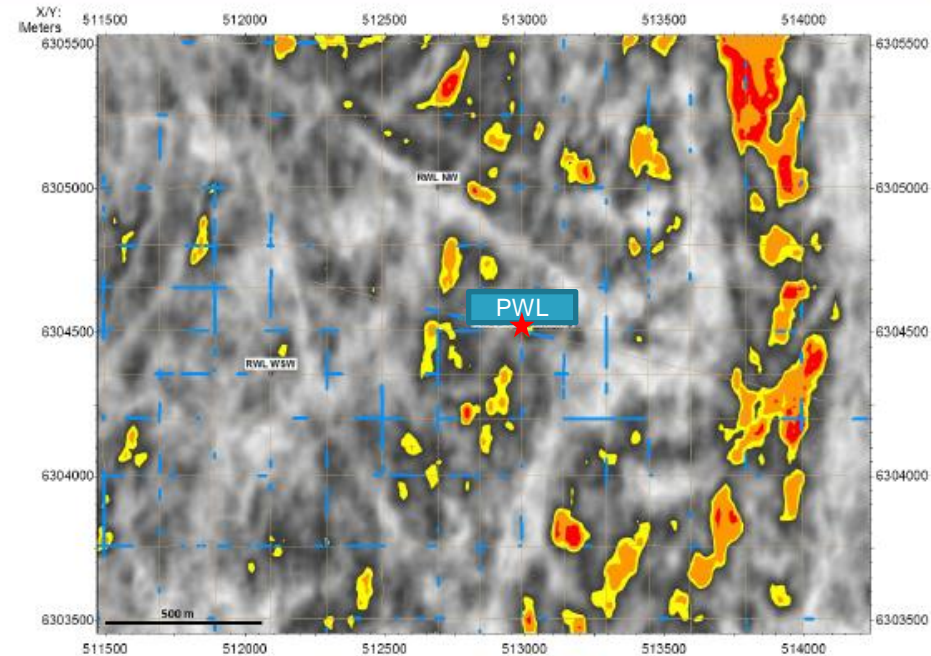


Figure 3.7: Anomaly map showing the distribution of 2D anomalies (blue) and 3D anomalies (yellow to red) at the Lower Unit V level.

Intra Unit VI

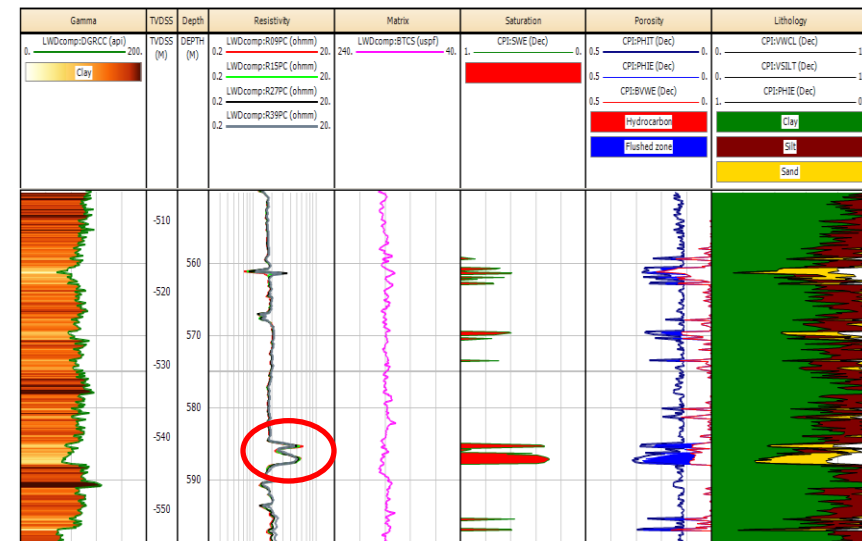
Anomalies at the Intra Unit VI level occur mainly in the southeast part of the survey area and are associated with an internal reflector in the upper part of this unit (614 m \pm 22 m below MSL, 673 ms TWT). The Intra Unit VI anomalies are likely to result from lithology contrasts or constructive seismic interference. However, they may also be due to a possible gas-charged sand layer. The nearest amplitude anomaly at the Intra Unit VI level is located 305 m ESE of PWL

No shallow gas is expected at the Intra Unit VI level at PWL

Results: Gas zone # 1 at 585 mRKB

Operational sequence:

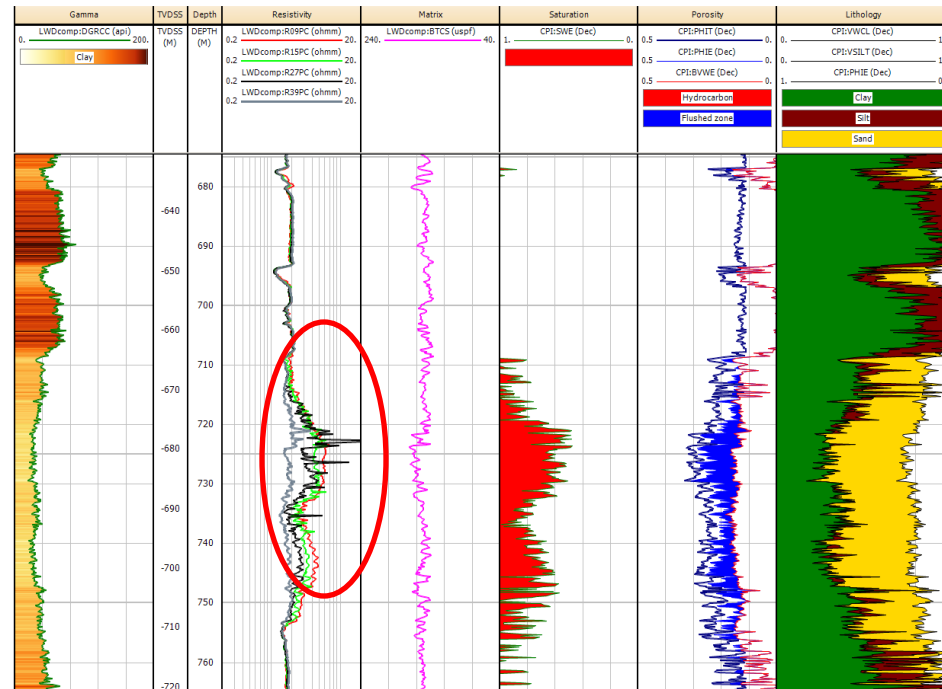
- Drilled 9 7/8" pilot hole to 603 mRKB with seawater and pills, planned TD 900 mRKB.
- Observed high resistivity at 585 mRKB on MWD. Flowchecked, stable well first 10 min, then started to flow.
- Closed the diverter and killed the well with 1.35 sg killmud, circulated 2 x hole volume. Lost returns during last part of circulation.
- Opened diverter and verified well killed.
- String stuck, unable to activate jar, most likely diff. stuck in sands below 30" shoe.
- Worked string free (6 hrs). Performed wipertrip. Displaced to 1.10 sg mud.
- Porepressure based on PWD 1.08 sg.
- Pulled out of hole, ran back with 5" pipe and set cement plug to 485 m.
- Opened up to 26" down to 540 m, ran and cemented 20" casing.



Results: Gas zone # 2 at 715-755 mRKB

Operational sequence:

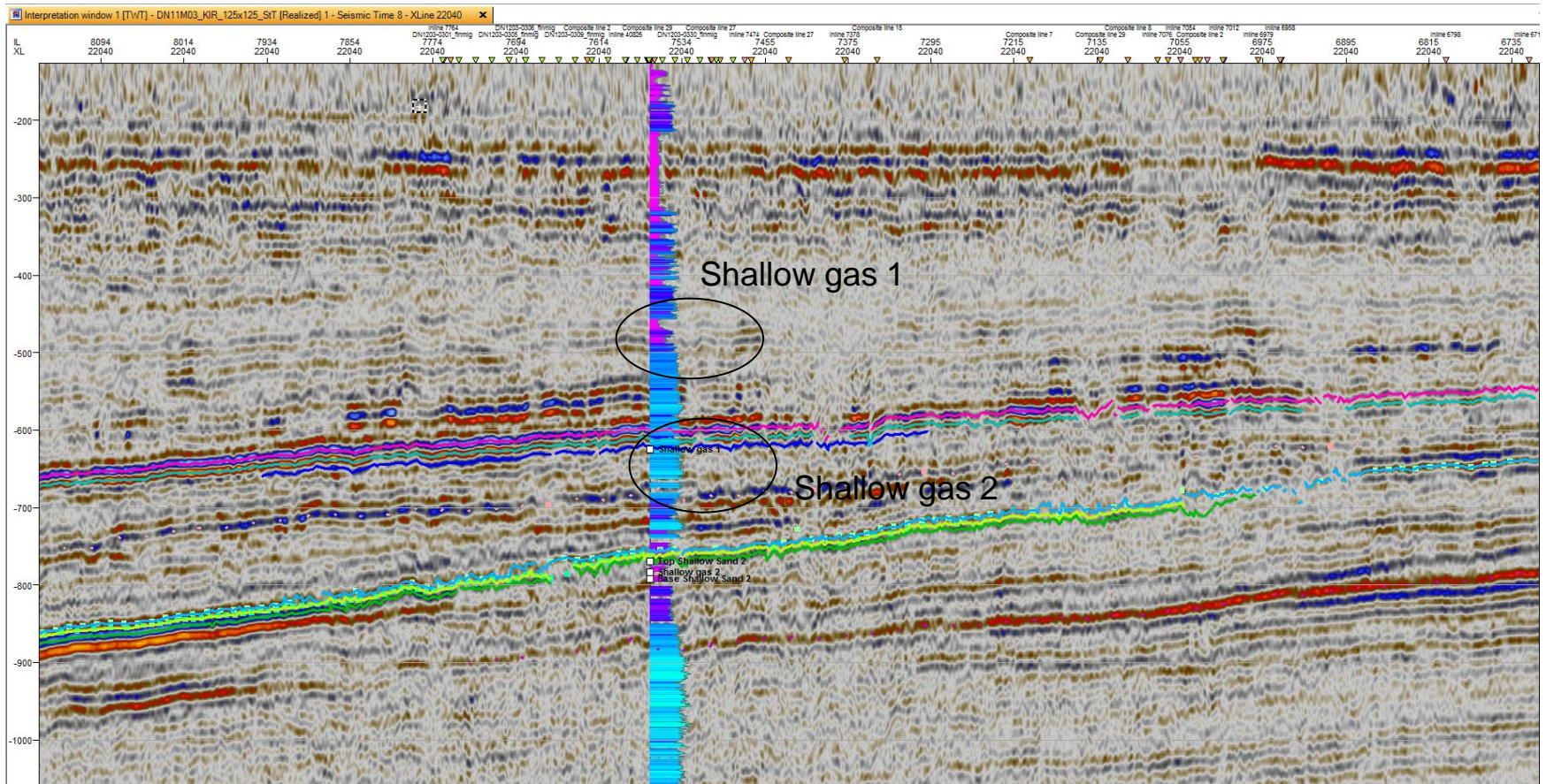
- Drilled 16" hole with 1.40 sg OBM.
- Increased gas readings (2-3%) through sand interval 715-755 mRKB and increased resistivity indicating gas charged sand.
- 16" section drilled and 13 3/8" casing set and cemented according plan.
- P&A program revised due to presence of gas bearing sand.
- Gas saturation estimated to 20-40%, i.e. "residual" saturation.
- High permeability and porosity in sand interval.



Post-well evaluation

- Routines for QC of Site survey followed
- Both site survey and 3D seismic has been evaluated, and there is no evidence/indications of gas bearing sands at Gas zone # 2 (even when knowing it is present).
- Gas saturation in Gas zone # 2 is too low for gas being the continuous phase in the pores, hence the seismic will show the response of water.

Checkshot (time-depth curve) for the XX-well were used. The Fm tops may be a bit effected by this, so the interpretation is done on several different horizons where the shallow gas was observed.



Shallow gas strategy, discussion

- The rig was well prepared, gas handled safely according procedures and all equipment worked as expected.
- Evaluate to perform a "FIT" with weighted mud at conductor shoe prior to drilling the pilot hole and base the selected weight of kill mud on this test. Too high weight of kill mud is no good.
- Be prepared for stuck pipe if hitting shallow gas.
- On jack-ups, evaluate to set 20" casing above shallow gas warnings in order to reduce risk exposure and potential lost time due to shallow gas handling.
- 9 7/8" pilot hole with SW is recommended, this enables proper detection of shallow gas and control of same. Evaluate dynamic kill with seawater as first response, than displace to kill mud.
- Standard for flowchecking in pilot holes should be minimum 30 min, this is based on the experience that it often takes some time before the gas enters the hole, 10 min is for sure too short.
- Evaluate to drill pilot hole from seabed prior to setting 30" conductor also on jack-ups.
- **No warning is not a guaranty for no gas, not all gas bearing sands are visible on seismic. Hence, drill pilot hole on all locations !**