Formation as barrier during P&A

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Formation as barrier – an introduction

- During bond logging operations (USIT-CBL) in casing above predicted top cement it is common to observe intervals of log response similar to the response of good cement bonding.

- Such a response can only occur if solid material is present and hard packed onto the outside surface of the casing.

- From cutting descriptions and MWD logs there is a good correlation between clay rich zones and the zones on the log which show good bonding.

- The solid material packing onto the outside of the casing is therefore assumed to be the formation.

- If sufficient formation is packed onto the outside of the casing it can be inferred that an annular barrier exists.
General procedure

1) Define the interval up to where the Sh is still larger than the reservoir pressure the formation can be exposed to.

2) Log with CBL / USIT and evaluate.

3) Pressure test for every new formation in every geological field.

4) For later usage you need only to log to verify bonding.
Usage in Hydro & Statoil

• Has successfully, since 2006, been used to resolve critical barrier issues or as a cheaper and safer way to establish barriers in 100+ wells. Average cost reduction / well is estimated to 15mill NOK.

• It replaces often section milling and other costly & failure-prone mitigating actions during P&A.
Some general info...

• All wells tested to date have passed pressure testing were logs has indicated the presence of good bonding.

• Annular barriers have been regularly qualified in the Tertiary and Cretaceous shale in all parts of the NCS.

• Good quality barriers are often observed within a timeframe of 2 days to 2 weeks after setting the casing.
Oseberg C8

- Green clay at 2705m – 2100m

Increased impedance at green clay boundary

- Good ”bond” apparently all the way up through the green clay

- Line at 270 degrees is due to casing wear groove

- Perforations made later in casing below green clay. They were pressure tested to prove creeping green clay qualified as a barrier
Example of qualified barrier using bond logs in Shetland.

Non-swelling chalk layers clearly seen in log proving barrier occurs only in the shale sections.

Important evidence for Creep as mechanism.
There’s never been a better time for good ideas

Questions?