

Fault Recognition While Drilling

Haryanty Hashim¹, Raidi Hashim¹, and Anifadora Mustapha¹

¹Petronas

Abstract

In a structurally complex tectonic regime, formation of faults are inevitable. For a geoscientist, generally speaking, formation of faults indicate not only the tectonic history of the structure, but plays a huge role in hydrocarbon entrapments and also act as a conduits for hydrocarbon migration. For a drilling engineer, on the other hand, the presence of faults is challenging as it acts as channels for loss of drilling mud during circulation.

A fault is not typically created as a single, clean fracture fault plane, but generally formed in a zone of complex deformation associated with the fault plane, referred as the fault zone. Seismically, these fault zones are often time difficult to image as they are beyond resolution, further so with the sparse 2D seismic data of 1980 and 1990 vintages.

A case study to identify a fault while drilling has been carried out at the H-1 well at Central Luconia Province, Sarawak Basin, Malaysia. Hypothetically, during drilling, fault existence can be detected from drilling break event and from cuttings that have slickenside features. However, these indications cannot be seen in the H-1 well.

Based on observation, during drilling at 2100m MDDF,

- Sonic interval transit time retrieved from recorded mode exhibits an interval zone with 200 micro seconds per foot.
- The unprocessed check shot data shown a sudden big change between 2 intervals.
- Pore pressure data give high pressure values

Based on interpretation of the observed data at 2100m MDDF,

- The processed sonic gives a slowness reading at certain interval that show it is related with formation features.
- The processed checkshot gives a challenge in picking first arrival and gives slow velocity reading in the time depth model.
- The pressure model shows the ramp occurred is related with geological features based on petrophysical parameters and drilling event like pump out gas.

The integration of all data input have confirmed the existence of small throw fault which is hard to be seen in the seismic.