GEOPHYSICS PAPER 8

THE KARAP MUD VOLCANO IMAGED ON NEW 2D SEISMIC – IMPLICATIONS FOR BASIN ANALYSIS

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Mud volcanoes can be seen in sedimentary basins, where clay and sand are accumulating within a "geological" short period of time. Several of them were mapped in the NW Borneo Basin, both Sarawak and Sabah (Liechti et al, 1960). In young clastic basins, following rapid burial, clay is liquefied. It moves upwards, intrudes sediment layers, and at times, reaches the surface. The plastic clay extrusions produce volcano-shaped cones than can reach a height of 20 m above area level in Sarawak (Kessler, 2008). The Karap mud volcano (Figure 1) is currently the largest active mud volcano in Northern Sarawak, and located in a hinge area of the "Baram Line". This complex lineament system separates the "Baram Delta", an area of poorly consolidated Mid-Miocene-to-Recent clastic deposits (Kessler 2010), from the more consolidated "Central Luconia" (Figure 2).

Mud volcanoes are complex features. Recent 2D seismic data acquired by JX NOEX, give for the first time insight into the structure of the volcano (Figures 3). The volcano's caldera is asymmetrical, and has formed as a collapse graben array on the tip of a major regional strike-slip fault zone (Figure 4). In the proposed model, the mud-volcanic activity stems from an interaction of surface waters with underlying overpressurized rock. In the funnel-shaped caldera, large quantities of meteoric water are collected, leading to a rise of hydrostatic pressure to a level in the order of 1200 psi. With increasing pressure, water penetrates deeper semi-permeable levels, and interacts with semi-mobile overpressurized pore-space gas.

As the water mud rises, and de-gasses on the way up, gas bubbles are forming that later detonate on the volcano's surface. Arguably, the presence of mud volcanoes points towards compressive tectonism in the sub-surface, strike-slip combined with reverse faulting in the Karap case. Since mud volcanoes depend on overpressured rock, they point towards basin areas

Figure 1: Surface view of the Karap mud volcano, central caldera with center of eruptions.

that are under-compacted. However, a direct link to charge and gas-bearing reservoir can currently not be made. Mud volcanoes also constitute an area of increased drilling risk.

The Karap volcano (triangle, 91; enlarged section) is right in the center of the map. Faults are in red, anticline axis (pink); dip of Baram Delta clastics, yellow arrows. The fault zone responsible for the Karap volcano is covered by alluvials. Insert is the unscaled aerial photo of the volcano.

Figure 2: Tectonic (surface) summary map of the Enkabang area (Northern Sarawak, SK 333).

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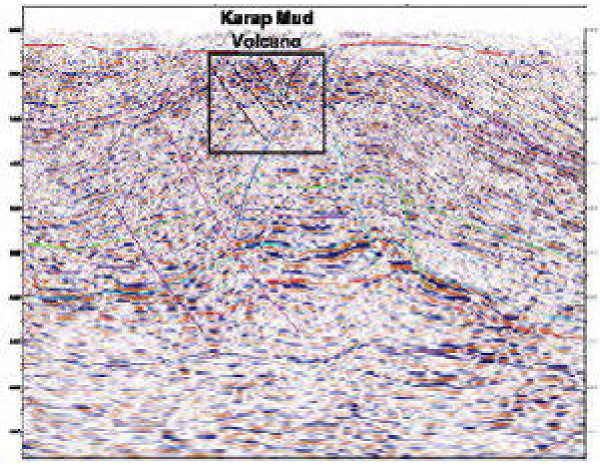

Figure 3: Subsurface image of the Karap mud volcano.

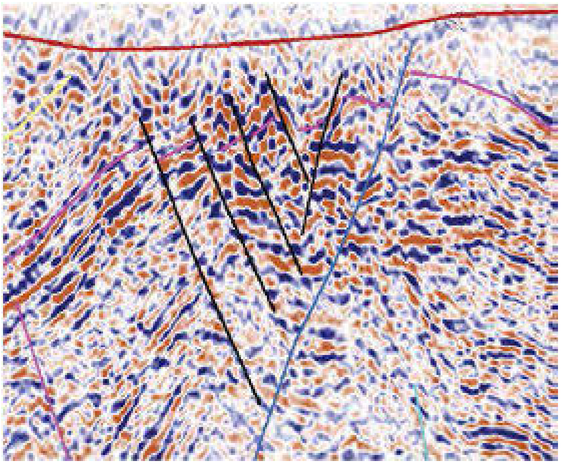

Figure 4: Detailed internal structural overview of the Karap mud volcano.