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Petroleum Exploration on the Rifted Volcanic Margin of West Greenland

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Central West Greenland is a region dominated by widespread oil staining and seepage in a thick succession of Palaeogene basaltic hyaloclastites and lava flows. The volcanic succession outcrop at seabed in the nearshore area, from where they dip offshore and are covered by a wedge of Eocene and younger sediments.

The presence of continental crust in the volcanic area, where thick sedimentary successions are present below the volcanic section, has been tested by integrating gravity modelling with interpretation of seismic data. Bright spots and DHI's have been recognised above structural closures formed by large rotated fault blocks, which probably developed during rifting in the Cretaceous.

Onshore extensive seepage and oil staining are common in the lower part of the volcanic succession, and five different oil types have been recognised based on their geochemical characteristics. The results indicate the existence of two regionally important source rocks; a Paleocene deltaic source rock and a marine source rock of presumable Cenomanian-Turonian age.

Overcooking and cracking due to excess heatflow of both source rocks and petroleum accumulations and hydrothermal effects do not seem to be of great importance for the petroleum generation in central West Greenland. The overall increased heatflow, and rapid subsidence caused by the loading of the volcanic pile upon the existing topography, seem to be of greater importance in the area. Derived effects of such rapid subsidence include rapid maturation of petroleum source rocks in the sub-volcanic succession, and hence the time window for formation of a trapping system, allowing migrating petroleum to accumulate and be preserved may be very narrow.

The presence of Paleocene source rocks and the demonstration of the presence of thick sedimentary successions below the volcanic rocks, suggest the general presence of Palaeogene sediments under the volcanic cover, which upon subsidence and maturation may release petroleum to be trapped within the volcanic rocks. The identification of bright spots within the post-volcanic succession west of Disko indicate that in favourable settings, a viable trapping system has been in place before petroleum generation and migration.