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3D seismic imaging of voluminous earliest Eocene buried lava fields and coastal escarpments off mid-Norway

Sverre Planke (1,2), John M Millett (1), Dwarika Maharjan (1), Dougal A Jerram (2,3), and Mohamed Mansour Abdelmalak (2)

(1) Volcanic Basin Petroleum Research, Oslo, Norway (planke@vbpr.no), (2) CEED, University of Oslo, Norway, (3) DougalEarth, Solihull, UK

Continental breakup between Greenland and NW Europe in the Paleogene was associated with massive basaltic volcanism, forming kilometer-thick sequences of flood basalts along the conjugate rifted margins. This event was temporarily associated with a warm world, the early Eocene greenhouse, and the short-lived Paleocene-Eocene Thermal Maximum (PETM). A 2500 km2 large industry-standard 3D seismic cube has recently been acquired on the Vøring Marginal High offshore mid-Norway to image sub-basalt sedimentary rocks. This cube also provides a unique opportunity for imaging top- and intra-basalt structures. Detailed seismic geomorphological interpretation of the Top basalt horizon reveal new insight into the late-stage development of the lava flow fields and the kilometer high coastal Vøring Escarpment. Subaerial lava flows with compressional ridges and inflated lava lobes cover the marginal high, with comparable structure and size to modern subaerial lava fields. Pitted surfaces, likely formed by lava emplaced in a wet environment, are present in the western part of the study area near the continent-ocean boundary. The prominent Vøring Escarpment formed when eastward-flowing lava reached the coastline. The escarpment morphology is influenced by pre-existing structural highs, and locally these highs are by-passed by the lava flows which are clearly deflected around them. Volcanogenic debris flows are well-imaged on the escarpment horizon along with large-scale slump blocks. Similar features exist in active volcanic environments, e.g. on the south coast of Hawaii. Numerous post-volcanic extensional faults and incised channels cut both into the marginal high and the escarpment, and show that the area was geologically active after the volcanism ceased. In conclusion, igneous seismic geomorphology and seismic volcanostratigraphy are two very powerful methods to understand the volcanic deposits and development of rifted margins, and the association of major volcanic events and global warming.