Arctic Magmatism: Distribution, Age and Implications for Basin Development and Petroleum Systems in the Barents Sea

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The sedimentary basin development of the Barents Sea has been influenced by the formation of three Large Igneous Provinces (LIPS): The end-Permian (ca. 250 Ma) Siberian Traps, the Early Cretaceous (ca. 125 Ma) High Arctic LIP, and the Paleogene (ca. 55 Ma) North Atlantic Volcanic Province. Siberian Traps volcanics are present in an extensive area in Siberia, including the Tunguska Basin, the West Siberian Basin, and likely in the southern Kara Sea. There is no evidence of Siberian Traps volcanics in the Barents Sea. However, the latest Permian-earliest Triassic (Induan) is a time of changing environment and rapid basin subsidence with sediment infill from the southeast in the eastern Barents Sea. The High Artic LIP is more diffuse. Extrusive and intrusive volcanics rocks are outcropping on Svalbard and Franz Josef Land, and are wide-spread offshore in the north. We have done detailed seismic and magnetic mapping of a >150,000 km^2 large sill complex in the eastern Barents Sea, intruding mostly Triassic sediments. The intruded basin contains gigantic hydrocarbon accumulations such as the Shtockman field. The sills are identified as high-amplitude reflections, commonly displaying classical saucer shapes and transgressive segments. The intrusive magmatism caused local heating of the host rock, and formed new fluid migration pathways in the basin. The magmatism was further associated with regional uplift and erosion, documented by southward prograding clinoforms down-lapping on the Near Base Cretaceous reflection. These sequences are correlated with the Helvetiafjellet Formation on Svalbard. Finally, the more recent North Atlantic Volcanic Province had a impact on the western and northern margins of the Barents Sea, in particular in terms of localized uplift and erosion along the shear margin segments and local volcanism in the Vestbakken Volcanic Province.