Salt Tectonics of the Southeastern Norwegian Barents Sea

Mark Rowan[1], Tore Skar[2], and Laila Pedersen[2]

[1]Rowan Consulting, Inc.
[2]Suncor Energy Norge AS

Abstract

The salt-related geology of the Nordkapp Basin, in the SE Norwegian Barents Sea, has barely been addressed in the literature since the mid-1990s, and there are no publications on the salt tectonics of the former disputed area between Norway and Russia. Here we examine the Upper Carboniferous to Lower Permian salt, its relationship to underlying rift basins, and its Mesozoic-Cenozoic evolution. The salt comprises an interbedded mixture of halite, anhydrite, potentially other evaporites, carbonates, and possible siliciclastics. Its thickness and internal character vary markedly on seismic data. It forms small pockets of bright reflectivity between a polygonal pattern of carbonate buildups on the margins of the salt basin. Where it is somewhat thicker, it is a layered sequence of varying amplitude and minor internal deformation that comprises both folds and boudins of stronger lithologies and at least three intervals of more mobile material. The salt is thickest in large salt pillows and diapirs, where there is little internal character due to complete disruption of the layered evaporite sequence. The relationship of the salt to the rift geometry varies. In the east, grabens trend WNW-ESE, rifting was probably Devonian to Early Carboniferous, and the salt was post rift, thickening gradually from both flanks into relatively minor lows. In contrast, the salt fills large half-grabens that mostly trend NE-SW and switch polarity along the length of the Nordkapp Basin, suggesting that it was synrift to early post rift and that rifting was younger than to the east. The plan-view geometry of the Nordkapp Basin is a result of the interaction of the two rift events with different orientations. The salt-tectonic styles also vary considerably. In the Tiddlybanken Basin, movement was initiated by Lower-Mid Triassic contraction, erosional truncation, and diapir breakthrough. On the Signalhorn, Haapet, and Veslekari domes, there was little to no Triassic-Jurassic deformation and mostly/entirely Cenozoic folding and uplift due to basement inversion. In the Nordkapp Basin, the Upper Permian carbonate section is prekinematic and salt movement began in the earliest Triassic. Some diapirs were triggered by progradational loading of Triassic siliciclastics, some by minor thin-skinned extension, and others by loading-induced inflation, erosion, and diapir breakthrough. Most diapirs were buried during the Late Triassic to Jurassic, and almost all were rejuvenated during the Cretaceous and Cenozoic.