Relationship between salt and crustal tectonics in the Sørvestsnaget Basin, SW Barents Sea

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The geology of the Barents Sea has been widely studied because of the interest for hydrocarbon exploration. Our study focuses on the SW Barents Sea, on the western side of the Senja Ridge in the Sørvestsnagets Basin, which is still a less deciphered area. Located at the limit of the continental shelf, this deep Cretaceous basin is characterized by a several-kilometer-thick sequence of Cenozoic sediments locally influenced by salt structures. Because of the peculiar rheological characteristics of salt, the deposition of evaporites during Permo-Carboniferous times still represents a key aspect to deeply understand the geological setting because salt tectonics considerably affects the brittle sedimentary cover.

5,500 km² of high-quality 3D seismic data, integrated with potential field data and existing wells, led to the interpretation of the main horizons and unconformities in the sedimentary sequence, with focus on the salt structures.

The top of the salt is characterized by a strong positive-amplitude reflection in the seismic data, and has been interpreted with a line spacing of 100 m. Subsequent gridding of the interpreted horizon to a bin size of 12.5 m highlights that the geomorphology for the top of the three salt structures is particularly complex, with presence of salt horns and development of minibasins above the salt. Integration of potential field data shows a strong correlation between salt structures and low values in Bouguer-Gravity anomalies. Different families of faults related to salt and to crustal tectonics have been mapped, and strong seismic anomalies related to faults above the salt structures are identified at multiple stratigraphic levels. Part of these faults have been active until 20 000 years ago, and are rarely active at present day.

The three salt structures interpreted on the western side of the Senja Ridge have a total extent of around 800 km² and are mainly the consequence of different pulses of reactive diapirism, due to several diachronous rifting events during the opening of the Barents Sea. After the opening of the Sørvestsnagets Basin, salt tectonics continued and was influenced by crustal movements and glacial sedimentation and erosion in this pull-apart basin setting.
The presence of the strong seismic anomalies above the salt structures is interpreted as gas accumulations, which makes this topic of particular interest for the future development of the oil and gas industry of the SW Barents Sea.