



## **Gas migration pathways in a complex faulted hangingwall in the western part of the Norwegian Danish Basin**

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The studied fault is positioned in the westernmost Danish part of the Norwegian Danish Basin at the southern margin of the Northern Permian Basin. The dominating fault is the so called D-1 fault, which is part of a fault trend which follows the southern pinch-out line of the Zechstein salt and detach along the top Zechstein evaporites. Just north of the D-1 fault is the only Danish commercial HC producing area outside the Mesozoic Central Graben -the Siri Canyon- located

The presence of gas within the Neogene sediments at the hanging-wall of the D-1 fault was reported in the D-1 well and the D-1 fault was analyzed in detail using 2-D seismic data in the early 90-ies. Due to the open seismic grid used then it was not possible to link the presence of possible gas occurrences and the faults as well as linking the small faults associated to the hanging-wall deformation. The area was subject to renewed interest due to the HC discoveries in the Siri Valley and industrial 3-D seismic data was acquired covering the D-1 fault. The 3D seismic data has enabled a very detailed mapping of the entire D-1 fault complex as well as seismic attribute analysis (courtesy OpendTect).

The D-1 fault is in map-view characterized by segments approximately 10 km long striking E-W and NE-SW respectively. In the Cretaceous and Cenozoic part is the main fault coherent whereas the antithetic and secondary synthetic faults in the hanging-wall are smaller (both with respect to offset and length). The character of the internal hanging-wall faults varies along strike of the main fault. In areas adjacent to NE-SW striking segments is the number of faults much higher and they strike both parallel to the main fault and at an angle to it; whereas the faults are longer, less numerous and dominantly parallel to the main fault in the E-W striking central parts. Gas occurrences are observed as bright-spots associated to small faults in the hanging-wall next to the NE-SW striking segments, whereas significant fewer flags are observed along the E-W striking central part of the main fault.

Seismic attribute analysis indicate the presence of diffuse gas trapped in the Paleogene sediments above the footwall along the entire D-1 fault. In the hanging-wall we observe that the deeper rooted antithetic faults terminating at the Chalk Group interval at the D-1 main fault serve as chargers for the bright spots and chimneys observed in the intensely faulted Miocene succession. The number of both bright spots and chimneys is higher along the NE-SW striking segments which indicate that the distribution is also controlled by the dynamic evolution of the D-1 fault.