



Deep buried valleys in the North Sea indicate large-scale channelized subglacial drainage

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High-resolution 3D seismic data volumes from the Danish sector of the North Sea reveal abundant valleys of Quaternary age buried below the seabed. In two areas studied in detail, the valleys occur at various depths throughout the Quaternary succession. In the Sirinor-96 area, 15 valleys were mapped with lengths of up to 31 km, maximum depth of 350 m, maximum flank angle of 32° and longitudinal profile gradient of up to 13°. In the Agip area, 22 valleys were mapped with a maximum length of 34 km and depth up to 240 m. Valleys in both areas are characterised by highly undulating bottom profiles with frequent overdeepenings and thresholds, they either have one principal channel of bifurcate, and they often begin and end abruptly without obvious spatial continuation. No catchment areas of the valleys can be delineated and no clear directional trend was noticed although the biggest valleys seem to follow the NE-SW direction. The valleys often intersect at different levels and they are filled primarily with clinofolds of loose, granular sediments. Cross-cutting relationships suggest at least 7 valley-forming episodes in the Sirinor-96 area and 11 in the Agip area. Due to the lack of firm stratigraphic control, the age of the valleys cannot be better constrained at present.

Based on the morphological, geometrical and partly geological characteristics it is suggested that the valleys are relict subglacial meltwater channels (tunnel valleys) very likely formed during multiple Pleistocene glaciations. This study, in accord with numerous investigations from on-shore central and northern Europe, stresses the importance of erosion by pressurised meltwater under past ice sheets as a geomorphic agent. In terms of palaeoglaciological conditions, such incisions indicate a surplus of

meltwater at the ice-bed interface in relation to the drainage capacity of the substratum and thus suggest temporarily unstable behaviour of the ice sheets.