

Mesozoic rifting of the North Sea region and the formation of joints on the west coast of Norway

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In my 1973 paper on the relation of joint patterns to the formation of the fjords in the Solund area of western Norway, I suggested that the prominent north-south-trending extensional joint set that controls the location and orientation of the north-south-trending 'fissure' fjords in this area was of Tertiary age. I considered these joints to have been formed extensionally during the early Tertiary opening of the Norwegian-Greenland Sea. I suggested that, in contrast, the east-west-trending 'strike' fjords were eroded along older east-west-trending Caledonian and Svalbardian structures.

Roberts (1974), from an examination of a larger area of western Norway, challenged some of these conclusions and suggested that the structural trends controlling joint orientations were in part Precambrian in age; he inferred that these old stress fields had remained in the crust residually through Paleozoic, Mesozoic, and Cenozoic time. I replied to Roberts' discussion (Nilsen 1974) by emphasizing the fact that in the Solund area, the north-south joint set clearly truncates Caledonian and Svalbardian structural trends, retaining its north-south orientation despite changes in orientation of the older structures; this relation suggests that the joints are younger and responded to younger tectonic stresses.

The purpose of this note is to reject my earlier suggestion that the north-south joints formed as a result of Tertiary opening of the Norwegian-Greenland Sea in favor of Mesozoic rifting in the North Sea area. Recently published stratigraphic, structural, and paleogeographic data from the North Sea area clearly show that the North Sea rift system was initiated during the Triassic and subsequently dominated the paleogeographic setting of the area during the Jurassic and Cretaceous (Ziegler 1975). This rifting took place offshore from the present west coast of Norway along north-south-trending axes, resulting in formation of the prominent Viking graben along the central axis of the North Sea. Beneath the eastern North Sea adjacent to the Norwegian coast, numerous down-to-basin (west) normal faults related to the rifting phase can be seen in seismic profiles (Watson & Swanson 1975).

Rifting later shifted progressively westward to the active spreading ridges of the Norwegian-Greenland Sea in the early Tertiary (Naylor et al. 1974, Pegrum et al. 1975, Whiteman et al. 1975). However, this second phase of

rifting took place along northeast-southwest-trending axes, rather than north-south-trending axes, and thus does not easily explain the origin of the major north-south-trending extensional joint set in the Solund and adjacent areas. It appears far more reasonable to ascribe its formation to the Mesozoic phase of North Sea rifting. The east-west-trending strike fjords, however, appear to be related to Paleozoic structural elements such as folds and faults rather than joint sets, inasmuch as there is not a well-defined east-west joint set in the area (Nilsen 1973, Fig. 5).

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