Neotectonism in the Jæren area, southwest Norway

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Glaciomarine clays of Weichselian age lie at about 200 m above sea level in the Jæren area. The high-lying sediments are located east of the Gannsfjord lineament, which seems to be developed as a fault in the area. The clays appear to be uplifted by recent tectonic movements caused by reactivation of this fault.

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The Jæren area (Fig. 1) has been an area of interest for generations of geologists. Many of the geologic localities were well known as early as at the beginning of this century. Bio- and lithostratigraphic investigations show glaciomarine sediments and tills mainly of Weichselian age, 130,000–13,000 years BP (Fig. 2). The glaciomarine sediments, mainly clays, lie at about 200 m above sea level at Opstad and Høgemork (Milthers 1911, 1913; Feyling-Hanssen 1964, 1971; Andersen et al. 1987). Similar sediments have been described from Gjesdal (approximately 160 m a.s.l.) (Østmo 1971). The high-lying location of the sediments is difficult to explain by glacial isostasy, and our presentation is a contribution to this discussion.

The Gannsfjord lineament, described by several authors as the 'Gannsfjord-fault', follows a north–south trend (Fig. 1). The lineament extends southwards as an approximate boundary between the Caledonian gneiss/phyllite to the west and Precambrian gneiss to the east. The lineament represents a morphological boundary. Along the coast we observe flat-lying areas (Låg–Jæren). The mountains and higher areas rise to the east and are called Høg–Jæren. Both Opstad and Høgemork lie in the Høg–Jæren area. The trend of the Gannsfjord lineament seems to be parallel to the trend of the Paleozoic basins (Carboniferous–Permian) in the North Sea which were probably reactivated in Jurassic time (Fig. 1).

How can the high-lying sediments east of the lineament be explained? If the lineament is a fault, it could have been reactivated during periods with ice-melting because of pressure-release when the ice-cap disappeared. This fault has if not its continuation at least its analogy in the Vindafjord–Yrkjefjord fault system (Fig. 1). In this area Karl Anundsen has measured recent movements (Anundsen pers. comm.).

Using field observations and topographic maps, we have tried to map a pre- to Early Weichselian surface in Høg–Jæren. This surface is defined by the break in slope at the foot of several high areas (hills, etc.). The altitude of the surface rises from 60 m in the west to 300 m in the east. In Fig. 3, the shaded areas indicate ground above the mapped surface, and the approximate altitude of the break in slope is contoured. Further to the north of Jæren we observe the same phenomena, but for the time being we concentrate on south Rogaland. Here, the contour lines lie very close together at the fault line. This most likely reflects a young faulting. A rather steep rise to the east of the southern section of the surface possibly indicates a monoclinical structure. Off the coast a similar monoclinical structure is indicated by seismic reflection profiles where Quaternary layers dip from the coast in an offshore direction (Fig. 4b).

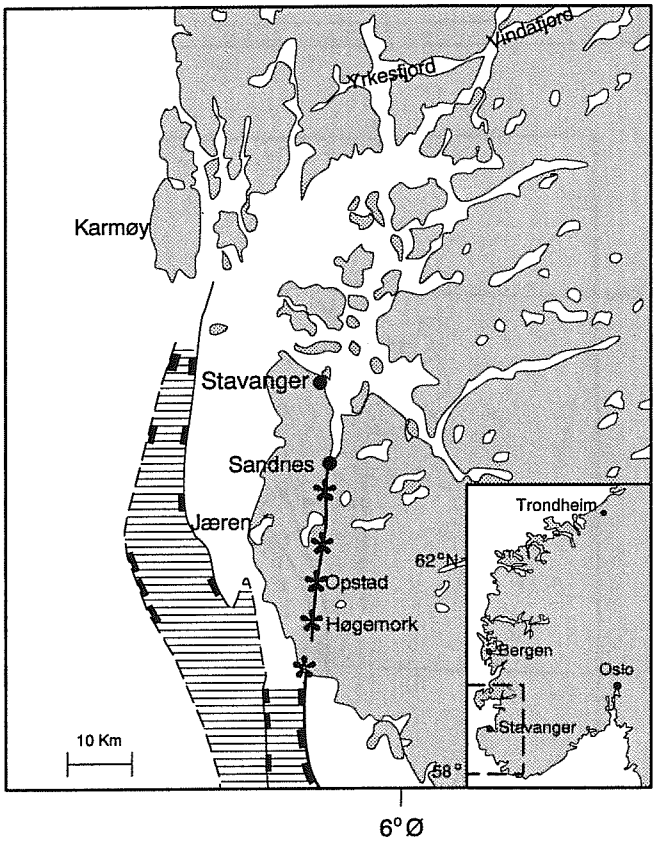


Fig. 1. Jæren with the investigated localities. The Paleozoic basin is marked with horizontal lines. The Gannsfjord lineament is marked with stars.

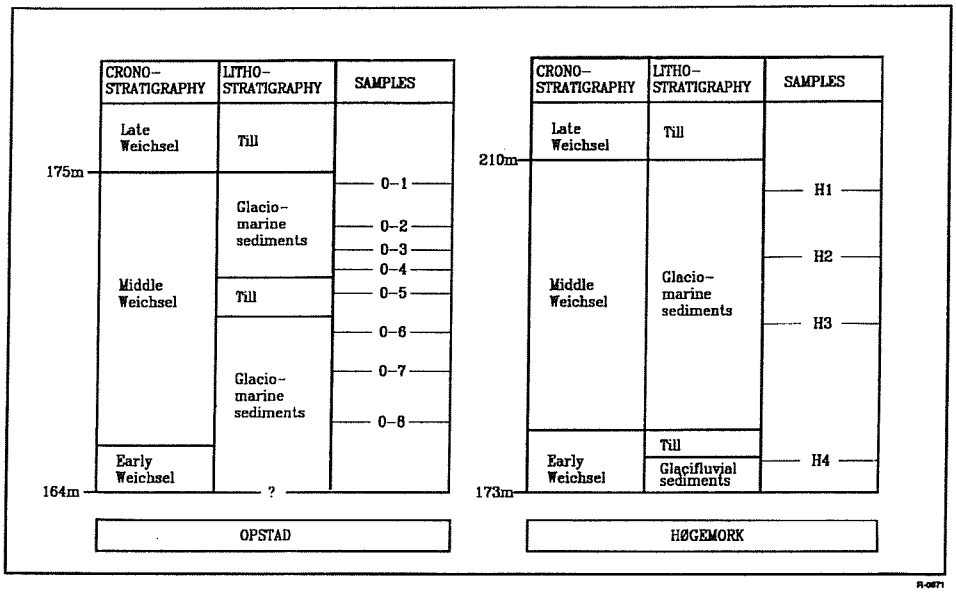


Fig. 2. Litho- and chronostratigraphic columns of the two described sections on Jæren.

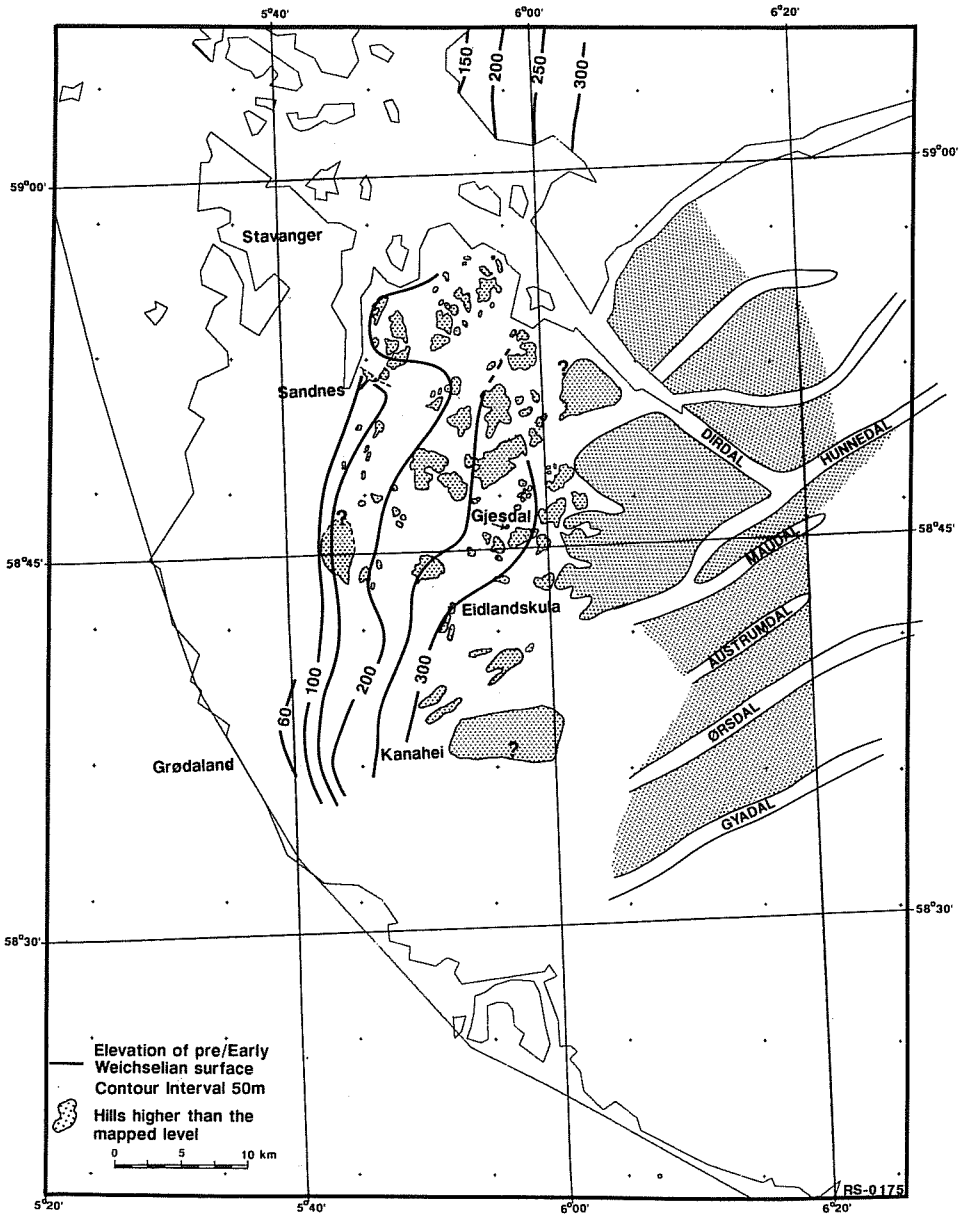
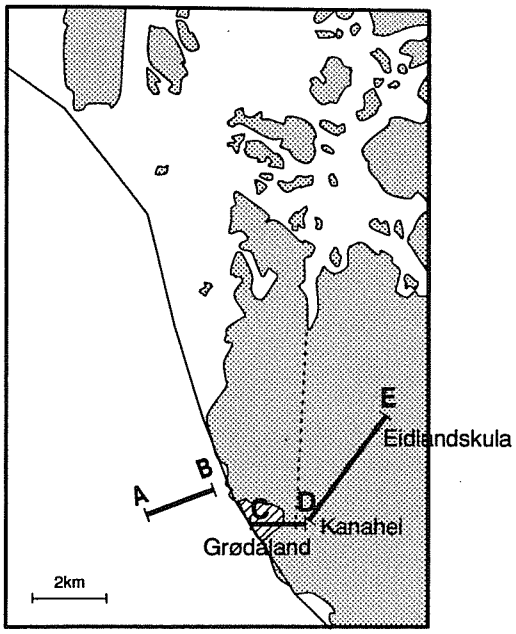
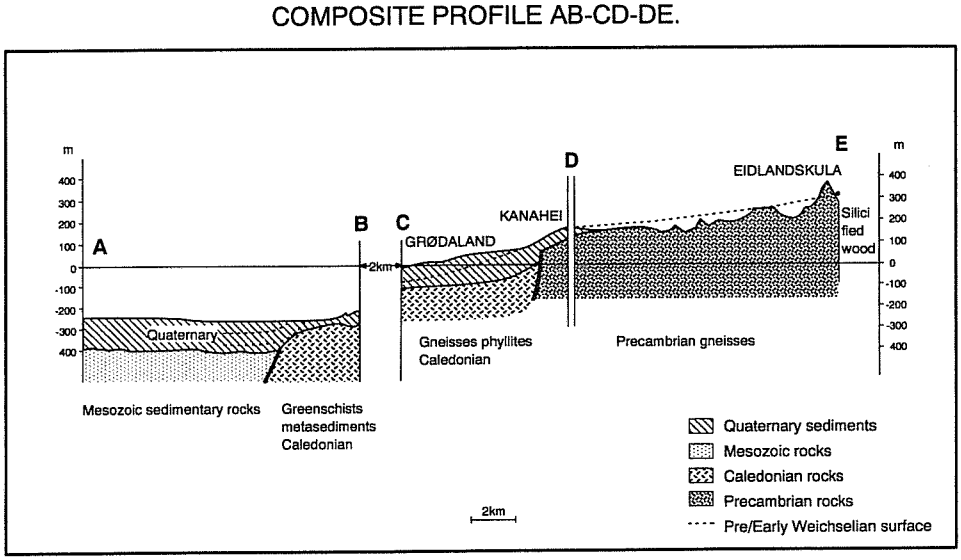


Fig. 3. Contour map of pre/early Weichselian surface, southern Rogaland.



(a)



(b)

Fig. 4. (a) The three profiles mentioned in the text. The Gannsfjord lineament is marked with stippled lines. The area of coal findings (Jørstad 1964) is marked with diagonal lines. (b) Combination of the three profiles shown in Fig. 4a.

In Fig. 4, section AB represents a marine seismic line, section CD and DE was constructed using information from Grødaland (Bjørlykke 1908), Kanahei (Opstad) (Fugelli 1987), Eidlandskula (Låg & Skadsheim 1955) and the map presented in Fig. 3 (cf. Grimes 1909, 1910). We have also used a seismic refraction line shot by NGU (Norwegian Geological Survey) in the early 1960s (Andersen et al. 1987).

A borehole at Grødaland, which was drilled in the 1870s, reached basement at 93 m (Fig. 4a). Pre-Weichselian sediments occurred at approximately 45 m (Andersen et al. 1987). In the deeper parts, pieces of brown coal similar to Lias coals in England and Bornholm, Denmark, commonly occurred (Horn & Isachsen 1944).

A large piece of well-preserved, silicified wood, assumed to be of *Fraxinus*, was found near Eidlandskula at 300 m a.s.l. in 1920 (Låg & Skadsheim 1955). The nearest occurrence of fossil wood is in Denmark in layers of Miocene age. We suggest that this fragment of wood was transported into a pre-Weichselian coast by icebergs (cf. Feyling-Hanssen 1964). The dashed line on Fig. 4b illustrates a possible pre-Weichselian surface, perhaps a coastal plain.

The profile A–E suggests that the pre- to Early Weichselian surface has been disturbed by flexuring and/or faulting. In the seismic profile AB, the resolution is not good enough to determine whether the basement fault penetrates the Quaternary layers. The steep rise in topography from B to C could indicate another basement fault. In profile CD, the interpretation of the NGU seismic profile suggests that the Gannsfjord lineament is developed as a fault in this area. Observations of coal in

the Quaternary sediments of Jæren seem to be restricted to areas of the west side of the 'Gannsfjord fault' (Jørstad 1964, Fig. 4a). The high-lying sediments at Høg–Jæren thus appear to be uplifted by recent tectonic movements, resulting in monoclinal structures associated with basement faults (cf. Feyling-Hanssen 1966).

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