

Traces of an Eocambrian orogeny in Southern Norway.

BY

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During a trip to the Mjøsa District, Southern Norway, together with Prof. F. Geukens (Louvain, Belgium), studies were made on the boulder content of the Moelv Conglomerate (tillite) in the railway sections south of Moelv.

Prof. Geukens suggested that some of the boulders of Biri Limestone, which are locally abundant in the conglomerate, were metamorphosed before the formation of the Moelv Conglomerate. Later the present author made some detailed studies which confirm Prof. Geukens' suggestion.

The geology of the district, the stratigraphy of the Sparagmite series and a description of the locality are given in HOLTEDAHL (1953), where references to earlier papers are given.

The boulders and stones of Biri Limestone are locally very common in the Moelv tillite. Generally limestone boulders in conglomerates have well preserved structures due to the protection by the matrix, but in this case the limestone boulders show exactly the same signs of pressure as does the limestone exposed near by. Thin bands (1—12 mm) of coarse, recrystallized calcite with "pressure twinning" are common (see fig. 1). The bands generally follow the schistosity of the limestone. In the boulders the recrystallized bands showed no orientation; contrary to what would be expected if they had been formed by deformation in the conglomerate. The distribution of band directions was studied in about 40 boulders. It was random, and showed no relation to the direction of pressure in the conglomerate. Studies on polished surfaces and in thin sections also showed that the recrystallized bands are cut discordantly by the outline of the boulders, thus indicating that they were formed before the sedimentation of the conglomerate. The whole conglomerate has been compressed by later (Caledonian) movements, and the compression cracks found in many boulders are thin, without any signs of recrystallisation, and they cut the bands at varying angles (fig. 2).

This probably indicates that the Biri Limestone was folded before the deposition of the Moelv Conglomerate, and thus that the deposition of the Sparagmites in Southern Norway was interrupted by an orogeny, probably between the Biri Limestone and the Moelv Sparagmite. This is also indicated by the fact that the Sparagmite Series in this region consists of two sedimentary cycles. The older one starts with the Brøttum Sparagmite, a dark graywacke with conglomerate and shale beds. Then follows the Biri Conglomerate, a fluvial conglomerate with typical "lag bedding" and imbricate boulders. The Biri Limestone,

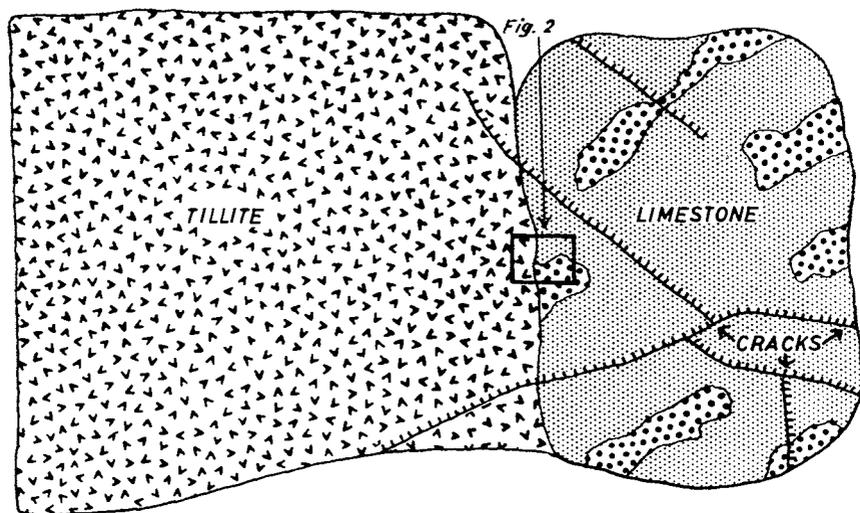


Fig. 1. Drawing of a polished section of a limestone boulder in tillite, showing recrystallized bands (larger dots), and pressure cracks (indented lines), belonging to two different phases of deformation of the limestone. The small square indicates the spot from which fig. 2. is taken. About natural size.

which completes this cycle, consists mainly of gray and black shales, with locally abundant and thick limestones, which have given name to the formation. The younger cycle starts with the Moelv Sparagmite, a typical red arkose consisting of coarse, angular granitic debris. It is followed by the Moelv Conglomerate, a tillite forming in many localities the base of the younger cycle, which has a much wider geographic distribution than the older one. The Moelv Conglomerate is followed by the Ekre Shales, green and red, partly varved shales. They are followed by the Vardal Sparagmite, which is a sandstone with numerous kaolinized feldspars. It grades into the "Quartz Sandstone" (Kvartssandsteinen), which is a typical orthoquartzite. According to the author's observations, no considerable lithological break is found between this formation and the fossiliferous Lower Cambrian.

In Finnmark, FÖYN (1937) reports an angular disconformity between the Porsanger Dolomite and the tillites. The angle is low, and the disconformity might be due to tilting rather than to folding of the beds. The boulders of Porsanger Dolomite in the tillites are apparently not metamorphic, but the fact that they consist of dolomite indicates that the dolomitisation took place before the formation of the tillites.

In Normandy tillites are found also (WEGMANN, DANGEARD & GRAINDOR, 1950) as the "poudingue de Granville". This conglomerate

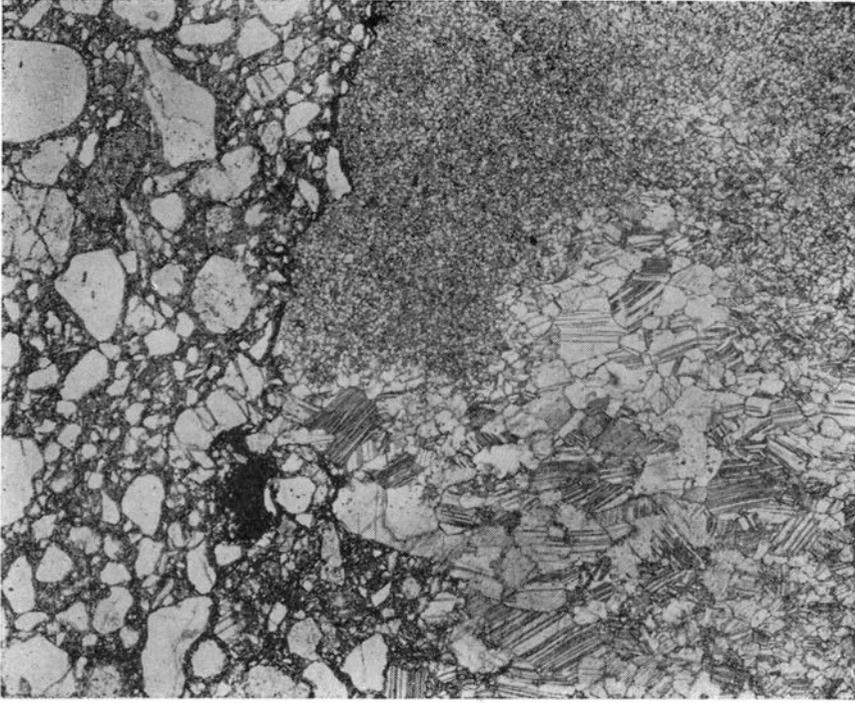


Fig. 2. Photomicrograph of a thin section through the border between tillite and limestone (cf. fig. 1), showing the discordant cutting of the recrystallized band (lower part of fig.), and the "pressure twinning" in the calcite. 50x.

has been regarded as a part of the Brioverien, that is as the basal conglomerate of the upper part of the Brioverien, or as the basal conglomerate of the Cambrian. According to the studies of MATHIEU (1943) the boulders in the conglomerate include metamorphic sediments and a granite which is younger than the lower part of the Brioverien. This indicates that the older rocks were folded and intruded by a granite before the formation of the tillite. This orogeny has been called the "Phase Candomienne" in this region, and has also been referred to the doubtful "Assyntic Orogeny".

Thick lavas (rhyolites) are found between the tillite and the fossiliferous Cambrian.

The observation referred to indicates that the widespread tillites at the base of the Cambrian are also in many areas accompanied by evidence of an orogeny. It has been suggested, that the tillites will be a convenient lower border for the Cambrian, and the presence of an orogeny adds to the value of this suggestion.

The glacial period indicated by the tillites might have been of long duration, and the orogeny might not be strictly contemporaneous in all regions, but, in the absence of fossils, this will be the best available stratigraphical border.

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Manuscript received October 21, 1958.

Printed April 1959.