

Notes on the Geology of an Area West of Støren (the Trondheim Region).

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(With 1 Geological Map)

Abstract.

In the paper a brief survey of the stratigraphy and structure of the Ordovician-Silurian sedimentary complexes in the western surroundings of Støren (the Trondheim region) is presented and some results of Prof. Th. Vogt's work are discussed.

Introduction.

The Gausdal valley area in an area west of Støren, south of Trondheim, is one of the tracts of land in the Trondheim region which are most suitable for the study of Early Paleozoic rock complexes of the Norwegian Caledonides. The Early Paleozoic rocks are preserved here in a broad syncline, so-called Horg-Syncline, bordered by thick complexes of greenstone. In contrast to other parts of the Trondheim region they are slightly metamorphosed or quite non-metamorphic. In them many determinable fossils have been found. On the basis of these fossils and comparison with other areas it was possible to prove the Ordovician and Silurian age of several stratigraphic horizons. The relatively multiform development of these rocks contributed considerably to the correct determination of the stratigraphic sequence of the rocks.

One of the remarkable works, on which our knowledge of the stratigraphy and structure of the Cambro-Silurian complexes of the Trondheim region is based, is the paper by Th. Vogt (1945). In it the geological conditions of the Horg syncline in the Hølonde-Horg area are described in detail and a complete lithostratigraphic scheme is presented. The task

of the author of the present report was to link up with the detailed Th. Vogt's mapping, to continue towards south-west and to investigate in greater detail the south-eastern limb of the above-mentioned syncline in an area west of Støren. The work was carried out in August 1962 for the Norges Geologiske Undersøkelse in Trondheim to which as well as to the gentlemen Dr. H. Bjørlykke, Ing. T. Brekke, Prof. Dr. Chr. Oftedahl and Dr. F. Wolff the author owes a special debt of gratitude for their kind help and very valuable instruction.

The Stratigraphy and Structure of the Area Mapped.

Due to his short stay in Norway the author could study only a restricted cycle of questions. The main attention was directed to the study of the stratigraphic sequence, the structure of the Ordovician-Silurian sedimentary complexes and to the detailed mapping (drawn into air-photographs of an area of about 45 km²). The results of the Th. Vogt's work have mostly been confirmed; in some cases, however, still other possibilities of interpretation of the structure and stratigraphy have been established. They are described in the subsequent paragraphs. First a comparison of the Th. Vogt's lithostratigraphic scheme for the Hølonde-Horg area with the scheme established in the newly studied area west of Støren is presented (table 1).

From the comparison of the Th. Vogt's geological map with the map appended to this paper as well as from the synoptic stratigraphic table it follows that the changes in the stratigraphic assignment of the rocks concern above all the younger members of the sedimentary complex under consideration.

The earlier members, the so-called Krokstad Beds, can be roughly placed into the Vogt's stratigraphic scheme. They are, however, differentiated in greater detail on the map. As to rock types, they consist of silty-sandy shale to siltstone, medium grained greywacke sandstone up to greywacke in the upper horizons with layers of gravelite; horizons of greenstone conglomerate also occur here. The characteristic feature of all these bedded rocks is the greenish grey colour due to a greater or smaller amount of green fragments of rocks or minerals. As rock constituents are represented: fragments of greenstone, keratophyre, chloritic-sericitic quartzitic shales, jaspers, further chlorite, epidote, needle-like amphibole, titanite and ores in addition to grains of quartz, lamellae-shaped acid plagioclase, chess-board albite, feldspars with pegmatitic

Stratigraphic Table 1.

	Groups	Hølonða-Horg area /Th. Vogt, 1945/	The area mapped W of Støren
Llandoverian	Horg group	Sandá shale and sandstone Lyngestein quartzite conglomerate	Dark shale with intercalations of sandstone; greywacke containing volcanic, mostly keratophyr-clastic material Lyngestein quartzite conglomerate
Ashgillian	Upper Hovin group	Hovin sandstone Grimsas rhyolite Volla polygenous conglomerate	Hovin sandstone with intercalations of dark shale Rhyolite tuff Volla polygenous conglomerate
Caradocian	Lower Hovin group	Dicranograptus black shale, Tømme black shale with Cryptolitus and rhyolite tuff Espshaug bedded rhyolite tuff Hareklett massive rhyolite tuff Sandstone, grit and shale	Dicranograptus black shale Greyish green medium grained greywacke sandstone to greywacke, locally with layers of gravelite
Llan-deilian		Krokstad beds	Greyish green silty-sandy shale to siltstone; greenstone conglomerate
Llanvirnian			
Skid-davian	Støren group	Greenstone	Greenstone

quartz and muscovite. If the metamorphism of rocks is slight it is difficult to decide whether the coloured constituents represent a supply of a real pyroclastic material or whether a redeposited earlier pyroclastic or even effusive material is concerned here. It was impossible to prove with certainty the occurrence of material derived from the contemporary

volcanic products. The largest fragments are those of greenstone conglomerate which attain dimensions of up to several centimeters. They are subangular to oval in form and consist mostly of fragments of various types of greenstone, keratophyre, red jasper, more rarely also limestone. The lowest horizon of these conglomerates (or breccias) lies directly at the boundary of the underlying greenstone.

The Kråkstad Beds – a formation about 3000 m thick – is overlain by a complex of black shale of 200 m thickness. The latter has been named *Dicranograptus* shale according to the graptolites found in the adjacent north-eastern area. Vogt parallels stratigraphically this shale with the so-called Tømme black shale occurring at the opposite side of the syncline at the north-western slope of the Grimsåsen ridge. This shale appears in the area mapped in a stripe running from the north-western border of the Grimsåsen Lake and the hill Vedløset closely at the north-western boundary with rhyolite tuff. In this place the black shale has not been assigned to the *Dicranograptus* shale but to the youngest formation of the Horg group.

This new assignment has not been proved paleontologically, but it is supported by the study of the stratigraphic conditions and lithological comparison: In the north-east, in the adjacent area mapped by Vogt the youngest formations of the Horg group consist of shale, siltstone and fine-grained sandstone, dark grey or black in colour; only sporadically a horizon of rhyolite tuff has been established. A similar development of this complex may be observed in the stripe continuing into the studied area along the river Sandåcn. The difference consists only in that in the above-mentioned formation abundant dark grey fine-grained compact rocks also occur. They are composed predominantly of microscopically distinguishable fragments consisting of a very fine-grained mixture of quartz, feldspar, sericite, chlorite and minerals of a zoisite-epidote group (probably fragments of keratophyres) and fragments of strongly altered plagioclase, subordinately also grains of quartz, amphibole, albite, titanite, scales of muscovite etc. These rocks have preliminarily been designated as greywackes (but a tuffitic character is also not excluded; in many features they resemble the greywackes described below, but these seem to be more basic and darker in colour). In the whole rock content of the uppermost formation they represent 50 %. This whole complex of dark shale and greywacke does not differ in its whole lithological development from the formation designated by Th. Vogt as Tømme black shale and Esphaug bedded rhyolite tuff; towards the west they even link up with each other,

forming an anticlinal closure in the mantle of light rhyolite tuff and Lyngestein quartzite conglomerate.

In future it will be necessary to verify again the origin of free blocks of tuffitic sandstone near the farm Esphaugen which contain fossils of Caradocian age. According to Th. Vogt they derived very probably from the Tømme black shale; this may be the main reason why Th. Vogt compared these shales and the Esphaug bedded rhyolite tuff with the Dicranograptus black shale on the south-western slope of the Horg syncline.

The Dicranograptus black shale is overlain, and the youngest formation of dark grey shale with horizons of greywacke described here is underlain by a complex of conglomerate and sandstone which in the lower portion is formed by the so-called Volla polygenous conglomerate, in the upper portions by Hovin sandstone with intercalations of dark shales, and in the uppermost part by the Lyngestein quartzite conglomerate. Such succession of beds is developed at the south-eastern side of the Horg syncline, in the south-east of the river Sandåen, while on the opposite side the complex of Hovin sandstone is represented according to Th. Vogt by the so-called Grimsås rhyolite. It is noticeable that in the continuation of the Grimsås rhyolite in the area studied it was possible to prove in many places a fragmentary character of these rocks. It would be, therefore, suitable to designate some of these rocks as rhyolite tuffs. They occur in an anticlinal stripe rimmed on both sides by Lyngestein quartzite conglomerate (not by Volla conglomerates on the north-western side). They are petrographically quite similar to the rhyolite tuff occurring at the close contact of the Krokstad Beds in the north-western part of the area mapped and as to position they correspond to the Vogt's Hareklett massive rhyolite tuff.

The scheme of the succession of beds having been somewhat changed, the concept of the structure has also been somewhat adapted. While Th. Vogt in the south-eastern part of the area mapped by him assumes a simple synclinal structure, it appears necessary to reckon with a more complicated fold structure in the area under consideration (compare the geological section). The question remains open whether the more intensive folding is restricted to the younger sedimentary complex of the Horg- and the upper Hovin-group or whether a similar folding also shows itself in the earlier members of the so-called Krokstad Beds. The single horizons of greenish grey shales, greywacke sandstone and greywacke as well as of greenstone conglomerate could be regarded as tectonically repeated

horizons. But the varying lithological development of the complex trending from the underlying greenstone towards the overlying Dicranograptus black shale furnishes evidence against this. In the lower portions of the Krokstad Beds greenish grey shale and greenstone conglomerate prevail, in the upper portions greywacke sandstone to greywacke, in some places with intercalations of gravelite, predominate; on the average the rocks here are lighter in colour. This evident change of lithological development would speak rather for a normal stratigraphic succession of beds without any tectonic repetition.

In some places a fine wrinkling of rocks is developed whose direction agrees with the course of the large fold structures. The cleavage is mostly conformable with the bedding; here and there unconformable cleavage may also be observed.

Presented January 1st, 1963.

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GEOLOGICAL MAP OF AN AREA WEST OF STOREN

Compiled by J. Chaloupský 1962

