DARK BLUISH BOULDER-CLAY: A POSSIBLE DEPOSIT FROM THE FIRST WÜRM GLACIATION

Jan Lundqvist
Geological Survey of Sweden, Fack, S—104 05 Stockholm 50

Abstract. A very dark, bluish-grey till with a clay content of 5—25 per cent has been found in scattered places in Sweden. Mostly it occurs as a lower bed under the ordinary till. It can probably be correlated with the oldest set of striae, which derive from the first Würm glaciation, that is, before the Mid-Würm (Jämtland) interstadial.

The aim of this paper is to present a problem which it is important to investigate more thoroughly, rather than a solution of the problem. The boulder-clay in question is a very characteristic, dark, bluish-grey till, which seems to be widespread in central and northern Sweden. It was first described by J. Lundqvist (1958) from northern Värmland. There it occurred in several places in Finnskoga-Dalby, both in the Klarälven valley and west of it. Later, a similar till was described from Gävleborg County by G. Lundqvist (1963) and from the Stockholm region by Möller (in Möller and Stålhös, 1964 and 1969). During reconnaissance mapping in Västernorrland County, the present author observed it in numerous places, especially in the eastern part of the district. A similar, although slightly different type of till occurs at the Långsele mine, Västerbotten. Probably also the lower till upon the Eemian deposit at Leveäniemi, SE. of Kiruna (J. Lundqvist, 1971), can be referred to the same type, although it differs still more from the type deposit. Possibly the same till also occurs in Jämtland County, but the conditions there are not so clear. The Cambrian-Silurian shales and limestones in central Jämtland generally yield a similar till, irrespective of its stratigraphic position. The till below the sediments of the Jämtland Interstadial is of similar type, unlike the till resting upon the sediments (J. Lundqvist, 1967 and 1969). This lower till, as well as a later observed blue boulder-clay from Ammer, eastern Jämtland, should probably be correlated with the boulder-clay to be discussed here.

The till in question is very compact and hard to work and is therefore very wellknown among road-workers etc. The bluish colour is characteristic. With natural moisture, that is, below the water-table, the colour is very dark, in Värmland almost bluish-black. When dry, and where the ground is not always moist, the till has a lighter colour, but the bluish shade is still characteristic. This ligher colour also characterizes the northernmost occurrences. Only close to the surface, where oxidation has been strongest, does the bluish shade disappear and is replaced by a grey or brownish colour.

A certain content of clay is also typical. Generally the clay content is high enough to cause the till to be designated clayey till by definition (5—15 per cent clay) or boulder-clay (more than 15 per cent of the material finer than 20 mm). As high a content as 25 per cent has been observed. Sometimes the content may be less than 5 per cent, but even then it is higher than in adjacent ordinary till and is clearly noticeable.

The lithology of the boulder-clay has been determined in some instances. It differs from one region to another but is always slightly different from that of the ordinary till. Very often a certain percentage of a fine-grained, dark grey gneiss of unknown origin is characteristic, which is not the case in the ordinary till.

The reason for the colour is not clear. It is possible that the lithology has some effect. Probably the reason to some extent is the non-oxidizing conditions, but this explanation is insufficient. Ordinary till in similar positions does not show the same colour. In Värmland the reason may have been an admixture of a dark ice-lake clay which occurred below adjacent ordinary till (J. Lundqvist, 1958). Now that we know that the boulder-clay is much more widespread, it is clear that this explanation can be of local importance only. Anyway, this explanation only shifts the problem from the till to the clay. It is clear that the colour cannot be caused by iron sulphide, as in the case of many sedimentary clays. This has been proved by analyses of the boulder-clay from Värmland.

It has not yet been investigated whether interglacial material occurs in the boulder-clay. Weathering residual has not been identified. X-ray and DTA analysis of the Värmland deposits showed that the clay minerals were the same as in the ordinary till. The only older material that has been identified is the microfossils in the till upon the interglacial deposit at Leveäniemi (Ek, in J. Lundqvist, 1971).

The stratigraphic position of the boulder-clay is somewhat better known. The deposit is often clearly overlain by the ordinary till. At Leveäniemi it could be referred to the oldest ice movement of the area, which probably represented the oldest phase of the last glaciation (Würm I). Also in the Stockholm region the boulder-clay could be correlated with the oldest ice movement, which, according to Möller (in Möller and Stålhös, 1964 and 1969), was separate from all younger ice movements. In Västernorrland the stratigraphic position has not yet been clarified, but the boulder-clay often occurs where there are striae belonging to very old ice movements from the west and east. Therefore it seems reasonable to refer the deposit to an old phase of the glaciation. It may be appropriate also to point out that in the Kola Peninsula in the USSR the till that is referred to the first phase of the last glaciation (Valdai I = Würm I) seems to be of similar type (Armand *et al.,* 1969). Thus there are indications that the deposit under consideration should be referred to the first phase of the Würm glaciation, that is, the glacial phase between the Eem Interglacial and the Jämtland Interstadial.

The deposit in question is still incompletely known. Especially the following information must be obtained: (1) a more complete picture of the regional distribution, (2) the reason for the dark bluish colour, (3) a possible content of microfossils and weathering residual, (4) the direction of transport, and (5) a conclusive age determination.

REFERENCES

Armand, A.D., Armand, N.N., Grave, M.K., Evzerov, V.Ja., Lebedeva, R.M. 1969. СВОДНАЯ СТРАТИГРАФИЧЕСКАЯ СХЕМА ЧЕТВЕРТИЧНЫХ (АНТРОПОГЕНОВЫХ) ОТЛОЖЕНИЙ КОЛЬСКОГО ПОЛУОСТРОВА В СВЕТЕ НОВЕЙШИХ ДАННЫХ. [Generalized scheme of the Quaternary (Anthropogen) Deposits of the Kola Peninsula in the light of the new data]. Akad. Nauk. USSR, Main Problems of Geomorphology and Anthropogen Stratigraphy of the Kola Peninsula. Leningrad.

Lundqvist, G. 1963. Beskrivning till jordartskarta över Gävleborgs län. *SGU,* Ca 42.

Lundqvist, J. 1958. Beskrivning till jordartskarta över Värmlands län. *SGU,* Ca 38.

– 1967. Submoräna sediment i Jämtlands län. *SGU,* C 618.

– 1969. Beskrivning till jordartskarta över Jämtlands län. *SGU,* Ca 45.

– 1971. The interglacial deposit at the Leveäniemi mine, Svappavaara, Swedish Lapland. *SGU,* C 658.

Möller, H. and Stålhös, G. 1964. Beskrivning till geologiska kartbladet Stockholm NO. *SGU,* Ae 1.

– 1969. Beskrivning till geologiska kartbladet Stockholm SV. *SGU,* Ae 4.