

SVERIGES GEOLOGISKA UNDERSÖKNING

SER C NR 627

AVHANDLINGAR OCH UPPSATSER

ÅRSBOK 61 NR 12

NILS SUNDIUS

THE SUPRACRUSTAL ROCKS
IN THE ARCHIPELAGO
SOUTHEAST OF STOCKHOLM



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Abstract: The three series of supracrustal rocks in the archipelago southeast of Stockholm and their mutual relations are described. Of the series that of femic leptonite has been discussed in greater detail. It is concluded that it most probably is formed from volcanic material delivered by early volcanic outbursts of lava and tuff from the magma of the urgranites. Rocks of this kind are widespread in central and southernmost Sweden.

In his interesting paper about the Precambrian quartzite in the Norberg district P. Geijer (1967) gives a detailed description of two occurrences of quartzite and iron-banded quartzite from the Norberg district and makes a more general survey about geological events during the time when the so called Larsbo-Mälars series was formed and also about the series of the hällflintas-leptonites and the limestones contained in them. To the opinions expressed by Geijer I have very little to add as I have also only slight personal experience of the district treated by him. Only one small remark may be made. On p. 23 he says about the formation of the limestones in the leptonites: "Whether these surface waters were inland lakes or part of the sea cannot be determined. For the sake of simplicity they will here be spoken of as the sea." If the latter is correct the leptonites should not have formed the massive complexes they do for the most part but rather an intimately bedded series similar to that in the archipelago of Stockholm to which I return in the following pages.

The zone of demarcation, shown in Fig. 1, p. 6 in the paper of Geijer is of great interest. If I have understood him right there was a culmination east of which the sea rose at intervals to the zone during the time of the deposition of the Larsbo-Mälars series. To the west of this zone the great Grythyttre-Älvestorp-Saxå synclinal had begun to form and was filled with clay sediments. I have always been of the opinion that the Grythyttre slate corresponds in time to the Larsbo-Mälars series.

In his paper Geijer has not treated the relations in the archipelago southeast of Stockholm. This district is rich in exposures of rocks that allow in more cases observations of the contact relations and also statements about the sequence and tectonics in the leptonite series to be made. When compared with Bergslagen the district exhibits rather different relations regarding the make up of the leptonites and the layers corresponding to the Larsbo-Mälars series because the rock surface lay continually under the sea during this whole epoch.

The supracrustal rocks in the archipelago cover a considerable area in a wide zone extending from Runmarö in the north to Utö, Älö, Nottarö in the south. In this zone the metamorphism diminishes from south to north. The best preserved rocks are found on Runmarö and the islands immediately south of it. Here, and in the whole supracrustal zone, I could divide the rocks into three distinct units: an albite-rich leptonite that forms the bottom series and a quartz-porphyr younger than the sodic leptonite. Both are salic rocks chemically similar to the leptonites and

hällflintas in central Sweden. The sequence of a potash-rich leptite over an albite-rich one is also the same. Only 1.5 km south of Runmarö begins another sedimentary rock. It is a dark, more femic and An-rich rock that was designated by me as "femic leptite" and is the time equivalent of the Larsbo-Mälars series. It had been distinguished by me before Hjelmqvist's publication of the Larsbo series (1937).

The albite-rich leptite that forms the bottom member in the district is a well banded rock, rich in limestone layers. The banding is only partly caused by some variation of biotite — it depends also on different quantities of quartz that is dark coloured, and locally also on the enrichment of microcline in thin layers where this feldspar is present. Furthermore, thin layers and broader zones of limestone are very general. The leptite is gray white on weathered surfaces with darker gray white varieties. It is rich in quartz, the dominant feldspar being albite and albite oligoclase (An 8—9 %, seldom up to 20 %). Microcline can occur but irregularly and in inconsiderable amounts. Small flakes of biotite are often present in an amount up to 5 or 7 %. This leptite is very persistent. It forms a syncline along the whole western coast of Runmarö-Storö-Munkö and continues over Nämndö to Ornö. From here it bends to the west in the sea but reappears on the small islands at Mälsten southeast of Nynäs, a distance of about 65 km. To the west the leptite is covered by the sea but probably continues under it and under the garnet gneiss and passes over to the albite leptite in central Sweden. Indeed I found some small occurrences of it on the mainland on the northern side of the bay Tvären southwest of Nynäs and southwest of Trosa. On Runmarö the leptite is again visible east of the syncline named above and forms an anticline that occupies the eastern part of the island.

The upper leptite is a dense quartz porphyry, brown in colour on fresh surfaces. Small phenocrysts of plagioclase, microcline and quartz are sometimes partly preserved. Chemically the rock is alkali-intermediate. It has a restricted extension being chiefly confined to the syncline on the western part of Runmarö to Munkö. The porphyry forms a compact mass with only local and irregular bedding and seldom contains limestone. The boundary against the lower albite-rich leptite is exposed at more localities along its eastern boundary between Söderby and Lerkila. Along the southern part of the boundary this is distinct, concordant and uncomplicated but to the north the boundary is marked by a limestone-leptite breccia that may have been produced by some movement along limestone layers at the contact.

The uppermost member of the supracrustal rocks, called by me femic leptite, is not represented on Runmarö. The northernmost exposures are found on small skerries and islands about 1 km to the south from its southernmost corner. From here the rock occupies a number of islands east and west of Nämndö and on the islands east and southeast of Ornö to Långviksskär, Utö and Älö-Nottarö. To the west the rock here grades into garnet gneiss and is also rather coarsely schistose on the two last-named islands.

The femic leptite occupies also the greater part of the eastern shore of Nämndö

and comes here into contact with the albite leptite. No sign of unconformity has been seen. As the femic leptite contains light layers, poor in biotite, the drawing of a contact line can be somewhat arbitrary. The dip of the layers is about 50—60° east.

The femic leptite is a dark grey rock. It is generally not banded but a coarse banding with lighter reddish or white bands and zones can occur. Also concordant amphibolitic zones have been seen. The rock is, in the northernmost exposures, very fine-grained and massive and the material once deposited may have been rather fine. To the south the femic leptite becomes coarser due to recrystallization and on Utö it is about medium-grained. The femic leptite contains not infrequently limestone or thin layers of Ca-silicates. Some carbonate is usually present in the slides studied. The dominant minerals are quartz, plagioclase and 10—30 vol.-% biotite. Amphibole is only seldom present. Microcline may occur but in most cases in small amounts. The composition of the plagioclase varies from An_{10} to An_{60} . An andesine with about An_{20} to An_{30} seems to be most common. The quartz content is generally high (15 to 60 %). It is noteworthy that the content of microcline and quartz is not proportional to the content of albite but can also be high in An-rich varieties of the rock. Muscovite is developed on Utö and on the islands immediately to the north. Probably this is due to a local schistosity of later date and to a contemporary leaching out of some alkalis (Holmquist 1910, p. 1489). An accessory mineral often found in the femic leptite is graphite as thin flakes coating biotite shales.

In general the femic leptite has the composition of a quartz-diorite not far from that of the grey plagioclasic urgranites that have invaded the supracrustal rocks (Sundius 1947). Like the latter the femic leptite contains a considerable amount of K_2O but due to a high Al_2O_3 content this is chiefly bound in biotite in both rocks.

No conglomerates designating an interval in the sedimentation of the femic leptite have been found. On Fjällångsön, Norrön and the neighbouring skerries (Måskläpparna) inclusions in the femic leptite were observed by Törnebohm (1882), but he thought they had been developed by denudation during the time of the sedimentation of the leptite because the inclusions consist of the same rock. The same assumption can be made regarding inclusions named by Holmquist from the northern shore of Utö (1910) to the extent that it is not the result here of a mechanical breaking up. Most likely the inclusions were formed by wave erosion, e. g. storm waves from the sea.

In the northern part of the archipelago the bed-rock is chiefly made up of urgranites. But on the island Svartlöga and the surrounding skerries as on Östra Lagnö about 60 km to the east north east of Stockholm there is an area of supracrustal rocks described by Th. Lundqvist (1962). Here reappear rocks belonging to the femic leptite series: a large elliptical area of metadacite and accompanying tuffs, agglomerates and conglomerates of dacitic composition.

The material of the femic leptites must have come from the north and west and have been brought to its present place in a finely divided state by wind, streams

and waves. The composition of the femic leptite is similar to that of the plagioclase urgranites. Probably the leptite is in some way genetically connected with the urgranite. It can have been produced by early effusive eruptions of the urgranite magma before its intrusion. The supracrustal rocks at Svartlöga are of this kind. Unfortunately the vast areas of urgranite in the northern archipelago have removed any dacites and tuffs, and this is the case also on the neighbouring mainland.

Rocks of the same kind as the femic leptite and the metadacite in the archipelago of Stockholm are widespread in central Sweden. They may also have formed the bulk of the original rock from which the garnet gneiss developed. The hälleflint-gneiss and gneiss identified already in 1897 as a recrystallized quartz porphyritic tuff by H. Bäckström (1897, p. 52) in Blekinge and the neighbouring part of Skåne belong also here. The epoch between the leptites and the intrusion of the urgranites was therefore a time of widespread and strong volcanic activity in central and southernmost Sweden.

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