Aspects of the lithology and structure of the Leksdalsvann Group, Tømmerås window, central Norwegian Caledonides

PER-GUNNAR ANDREASSON

Andreasson, P. G.: Aspects of the lithology and structure of the Leksdalsvann Group, Tømmerås window, central Norwegian Caledonides. *Norsk Geologisk Tidsskrift*, Vol. 58, pp. 109–112. Oslo 1978. ISSN 0029-196X.

Studies of six traverses across the Leksdalsvann Group of metasediments provide no evidence of a tectonic break within the group as indicated in a recent publication (Gee 1977). The major part of the previously suggested lower unit is recrystallized due to tectonic movements along the contact with basement rocks of the Tømmerås window. Objections may also be raised against a subdivision on a lithological basis as proposed by Springer Peacey (1964).

P. G. Andreasson, Dept. of Mineralogy and Petrology, University of Lund, Sölvegatan 13, S-223 62 Lund, Sweden.

Basement rocks of the Tømmerås window in the northern Trondheim Region of the central Norwegian Caledonides are overlain by metasediments of the Leksdalsvann Group which was named and described in a reconnaissance study by Springer Peacey (1964). She identified an upper unit of arkoses and feldspathic sandstones grading into a lower unit of siltstones and subordinate calcareous sandstones. Gee (1977) recently reinterpreted this subdivision of the Leksdalsvann Group, identifying in the area to the west of the Tømmerås window a 'mega-lens' composed of the Offerdal, Särv, and Seve units of the Swedish Jämtland Caledonides. He correlated the Lower Leksdalsvann unit with the Offerdal and the Upper Leksdalsvann unit with the Särv lithologies, respectively, and suggested a tectonic discontinuity between these two units. In doing so he employed, without modification, the reconnaissance map of Springer Peacey (Fig. 1). Gee's work also suggests a piece of evidence of great qualitative significance for a correlation of the Upper Leksdalsvann unit with the Särv lithology, namely the existence in that unit of porphyritic dolerite dykes (Strömberg 1961). Gee states that, in contrast, no basic dykes have been found to cut the lower unit.

In connection with present studies of Caledonian metamorphism, structures and mineral associations were surveyed along six traverses across the Leksdalsvann metasediments and their contact with basement rocks of the Tømmerås window. These six traverses were run in the valley of Malsåa at Kjesbuvatnet, along Lundselva, at Henningvatnet, in Ogndalen, and at Hatlingvatnet (Fig. 1). (In order to provide as full a documentation as possible, the statements in this paper are referred to observations on specimens in the Caledonian Research Project (CRP) collection of the Dept. of Mineralogy and Petrology, Lund University.) With increasing stratigraphic depth there is, in each case, a parallel variation in mineralogy and texture. This includes progressive recrystallization of the arkoses and feldspathic sandstones, which is first apparent as a phyllitic development of primary laminae. Such laminae are usually less than a centimetre thick and are densely spaced, being 5 to 10 centimetres apart. Garnet appears as minute knots on cleavage surfaces. As recrystallization proceeds, schistosity develops also in the arenaceous and feldspathic layers and eventually the entire sequence turns into a coarse-grained garnetiferous, quartz-muscovite schist with characteristic quartz segregations. Thin horizons of comparatively little affected, micaceous sediments are, nevertheless, encountered even very close to the basement contact. Under the microscope the undeformed sediments of the upper level occasionally show sparse xenoblastic garnets which pre-date the pervasive schistosity defined by minute mica flakes (Spec. CRP-A75-102, -167, -BL74-174, -178). Garnets of the quartz phyllite have idioblastic outlines but exhibit signs of discontinuous growth and the rotation of inclusion trails. Coarse muscovite

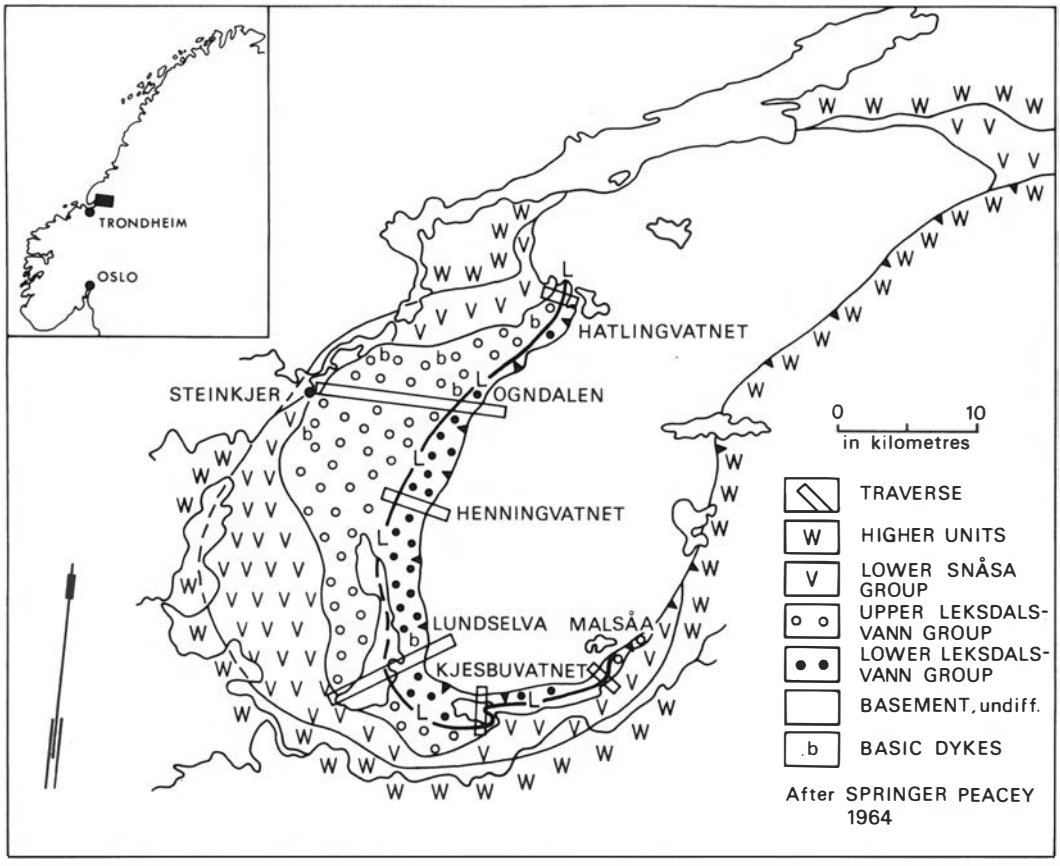

Fig. 1. Geology of the Tømmerås Antiform. The heavy line L–L divides the Leksdalsvann Group into an upper and a lower subgroup (Springer Peacey 1964). According to Gee (1977) the same line is the thrust contact between the Särv and Offerdal Nappes.

flakes are deflected around these garnets (Spec. CRP-A75-87, -89a, -91, -99, -163, -165, -158, -159), and also around lenticular crystals of biotite and hornblende (Spec. CRP-A75-160). Garnets of the coarse quartz-muscovite schist, finally, appear as minute, idioblastic, non-poikilitic grains perforating and post-dating the crenulated muscovite schistosity (Spec. CRP-A75-128, -163). Additional evidence of recrystallization with increasing deformation is the increase in grain-size as well as in the polygonal character of grain boundary patterns when the basement contact is approached.

Near the contact the basal units are usually raised to steep angles by mesofolding. An instructive continuous section through the basal parts of the Leksdalsvann Group is provided by the canyon across the hill Finnstadkammen, 1.9 kilometres northeast of Stöa bridge in Ogndalen. A strong axial-plane schistosity and a crenulation are developed. Quartz segregations display isoclinal folding. Close to the contact the mesofolds become recumbent and the schistosity as well as the axial-plane of the crenulation become parallel to the low-angle, dense foliation of basement porphyries, and the quartz veins are sheared out. The thickness of the basal coarse-grained schists varies between an estimated maximum of two hundred metres on the western slope of Tømmerås to less than twenty metres on its eastern slope in the Malsåa valley. In the Malsåa area the schist borders on a thick unit of a strongly tectonized granite (Hærvola granite, Wolff 1960).

The zone of schistosity obediently follows the basement topography except in Ogndalen, where

there is a minor, but interesting, deviation. At Støa bridge, well-preserved sediments appear below the zone of schistosity. Their calculated thickness is less than fifty metres. This area may thus give the impression of a tectonic discontinuity which separates an upper Leksdalsvann unit from a lower one. However, two kilometres northeast of the bridge, at the farm Finnstad, the schist is again found in direct contact with a basement porphyry, the uppermost part of which is an augen gneiss (Spec. CRP-A76-174). We have concluded (Andreasson 1976) that the zone of schistosity at Støa is the basal schistosity zone which is here proceeding some tens of metres above the actual basement contact, thus creating a local, possibly fault-bounded, pocket of undeformed sediments. A correct interpretation of the Støa situation has bearing on the attempts at a quantitative evaluation of the tectonization along the Tømmerås basement. Preliminary results indicate that the sediments found below the Støa zone of schistosity (Spec. CRP-A75-124-127, BL74-180) have important textural and mineralogical similarities with the undeformed sediments above the zone (Spec. CRP-A75-91A,-67, -158, -167).

Whereas there is thus tectonization at the border between the Leksdalsvann sediments and the Tømmerås basement, we have not observed, either in the field or the laboratory, any evidence of a tectonic or metamorphic break between the Lower and the Upper Leksdalsvann units, i.e. along the line L-L in Fig. 1.

The lithologic subdivision into a lower, fine-grained unit and an upper, more coarse-grained and arkosic unit is not easily discerned. Dark, silty sediments are by no means rare in the upper parts of the Leksdalsvann Group. On the whole the outcrops often give the impression of a small-scale depositional variation between sand, silt, and sometimes lime. It must be remembered that Springer Peacey based her conclusions about grain-size variation within the Leksdalsvann Group on a study of only 34 specimens. She assumed furthermore that recrystallization in the lower unit did not affect the quartz and feldspar grains, and therefore stated: 'One notable difference from the upper unit is that potash feldspar does not occur as a detrital mineral' (1964: 45). In our opinion much of the variation is explained by the degree of recrystallization, and the possibility exists that potash feldspar was, to some extent, destroyed by retrogression due to tectonization. In fact, grains of cross-hatched microcline with detrital character are observed in thin sections of samples from the above-mentioned thin lenses of undeformed sediments encountered close to the contact, as well as in samples taken below the schistosity zone at Støa bridge (Spec. CRP-A75-91A, -167, -125-127). As recrystallization proceeds the arkose and feldspathic sandstones become darker and more dense in appearance and it is, perhaps, no mere coincidence that a line indicating the onset of recrystallization is roughly parallel to the dividing line L-L of Fig. 1.

It is very important in the light of Gee's statement (1977:109) that basic and calcareous rocks occur in both units. Basic rocks in the lower unit appear as concordant bands, usually less than half a metre in thickness. The isoclinal folding and shearing obscure their original character as either dykes or flows. Under the microscope the texture and mineralogy indicate well-recrystallized basic, in some cases originally plagioclase-porphyritic rocks (e.g. Spec. CRP-A75-230-231). Some of the bands are hornblenditic in composition, often rich in epidote and carrying sparse quartz aggregates (Spec. CRP-A75-89b-c). From the Upper Leksdalsvann unit, Gee (1977) reported concordant amphibolites and a discordant porphyritic dolerite. A swarm of seven narrow dykes of alkaline-ultramafic composition (Spec. CRP-A75-116) and another dyke swarm of a conspicuously green rock not yet studied chemically (Spec. CRP-A76-173) are observations made by us which may be quoted here in support of otherwise very meagre evidence of basic intrusive activity in the Leksdalsvann Group (Springer Peacey 1964: 57). In conclusion, our study has not manifestly brought out any tectonic or metamorphic features imperatively requiring a subdivision of the Leksdalsvann Group along the boundary lines indicated on recent maps. There is also new doubt concerning the lithological and tectonic nature of the differences between the two units of the Leksdalsvann Group. However this latter aspect requires additional detailed study. The only obvious change with increasing stratigraphical depth which has been observed by us so far is the progressive recrystallization of the basal parts due to tectonic movements along the contact with the Tømmerås basement rocks.

Acknowledgements. This work is part of the Caledonian Research Project of the International Geodynamics Project, which is financially supported by the Swedish Natural Sciences Research Council. The author is indebted to Dr. David

G. Gee for guidance in field and for comments on the manuscript. Professor Roland Gorbatschev contributed valuable suggestions and read the manuscript.

September 1976

References

Andreasson, P. G. 1976: Preliminär iakttagelse av ett överskjutningsplan i kontakten mellan täcke och prekambriskt underlag i Tömmeråsantiformen, norra Trondheimsfältet. Foredrag ved XII Nordiska Geologvintermötet i Göteborg 1976. *Chalmers Tekn. Högskola och Göteborgs Universitet*. Abstract.

Gee, D. G. 1975: A geotraverse through the Scandinavian Caledonides – Østersund to Trondheim. *Sveriges Geol. Unders. Ser. C No. 717*, 1–66.

Gee, D. G. 1977: Extension of the Offerdal and Särv Nappes and Seve Supergroup into northern Trøndelag. *Nor. Geol, Tidsskr. 57*, 163–170.

Springer Peacey, J. 1964: Reconnaissance of the Tømmeråsanticline. *In* Studies in the Trondheim Region; Central Norwegian Caledonides. *Nor. Geol. Unders. 227*, 13–84.

Strömberg, A. 1961: On the tectonics of the Caledonides in the south-western part of the county of Jämtland, Sweden. *Bull. Geol. Inst. Uppsala, 39*, 1–92.

Wolff, F. C. 1960: Foreløpige meddelelser fra kartbladet Verdal. *Nor. Geol. Unders. 211*, 212–228.