Ophiolitic ultramafites in the Folldal-Røros tract, and their Cr-(PGE) mineralisation

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Tectonostratigraphic setting

Remapping of the Vågå-Røros tract has shown the existence of a major dismembered ophiolite (Fig.1) - the Vågåmo Ophiolite. This was thrust in above rocks of the Heidal Group, uplifted and deeply eroded prior to the deposition of the sedimentary/ volcanic Sel Group. A number of other massifs, mainly ultramafic, are known in the region between Folldal and Feragen (Fig.1), though no clear collective origin has previously been proposed. These massifs are mainly concentrated at the Sel-Heidal boundary (Fig.1). The massifs along the Sel-Heidal boundary are floored by a thrust plane, above the Heidal unit, and overlain by rocks of the Sel Group. Such relationships are seen at Fåsteen, Stenkletten, Raudhammeren and Feragen. The unconformity is also exposed at a number of other locations (Sturt et al. 1995, also this volume). Serpentinite conglomerate, derived from the ultramafics, occurs in the lower part of the Sel Group. Many of the conglomerates were originally identified as ultramafic bodies. We consider that the ultramafic/mafic massifs occurring along the boundary of the Sel and Heidal Groups have a common origin and represent the lower part of a once continuous ophiolite sheet.

In a belt from Middagshaugen (2.5 km south of Røros) to Feragen in the east, the tectonostratigraphic relations of the massifs are complicated by Scandian deformation. Collectively, they have a fairly complete, though dismembered, ophiolite pseudostratigraphy. In addition to upper mantle ultramafics, layered and vari-textured gabbros, gabbros with dykes and even dykes-in-dykes have all been identified and mapped. The inset map (Fig.1) shows that the ophiolitic rocks occur in two E-W belts. The southern belt of mafic/ultramafic rocks is underlain by a thrust and overlain by rocks of the Sel Group. The northern ophiolitic belt, however, is both underlain and overlain by rocks of the Sel Group. Where exposed, e.g. at Raudhammeren, the base of the ultramafite is marked by a zone of ultramafic mylonites directly above phyllites of the Sel Group. This we consider is the result of Scandian thrusting, thus duplicating tectonostratigraphic relationships.

The Cr-(PGE) mineralisation

The northeastern part of the Folldal - Røros tract has been by far the most important Cr-mining district in Norway, accounting for more than 90 % of the country's total production 40, 000 tons of chromium ore during the period 1820-1940.

The largest of the massifs is at **Feragen** (15 km^2), with major Cr-mineralisation. The main rock types are variably serpentinised dunite and peridotite (varying from cpx-bearing harzburgite to cpx-poor lherzolite) and dunite. Modal layering and mantle tectonite fabrics strike NW-SE to E-W with steep dips. The body has a pseudostratigraphic thickness of approximately 4-5 km. Dunite is abundant in the north (>50%), where the peridotites are seen as detached rafts in dunite, whereas peridotite dominates in the south. Cr-ores are exclusively hosted in the dunite. Typical podiform ores predominate, though semi-stratiform ore bodies are also present. These are common features in the upper mantle sections of ophiolites. Ore-types include fine-grained impregnations and banded, schlieren/vein, nodular (grape, pique, leopard) and massive (usually>55% Cr_2O_3) types. The Cr/Cr+Al ratios in chromitite vary from 0.74 (in the northeast) to 0.86 (in the southwest) which may indicate way-up to the northeast. Generally, the chromitites are PPGE depleted (especially Pt, average c.1 ppb) and have low PGE grades (100-200 ppb). The highest grades are in the southwest with PGE values up to 1.6 ppm (Geitsjøgruva).

The massifs of **Raudhammeren** (5 km^2), **Klettene, Stenkletten, Fåsteen** and **Raudkletten** have very similar Cr-ore types to those at Feragen, though their degree of serpentinisation is higher. They again have low PGE values, though Fåsteen is slightly anomalous with values up to 1.1 ppm.

The **Osthammeren** serpentinite body (0.05 km^2) is distinctly anomalous in terms of its PGE content and very high Cr/Cr+Al ratios (0.90). These features can be taken to indicate a lower position in the upper mantle section than is the case for the bodies described above. The Cr-ores are mainly of a rich schlieren/vein type. The chromitites are Os, Ir, Ru, (Rh) and Pt enriched, whereas Pd and Au values are low. The PGE fractionation pattern has an uncommon shape with a marked Pt high (up to 9 ppm). The average Pt enrichment is 200-300 times higher than for the chromitites of Feragen and Raudhammeren. PGE grades in the Osthammeren chromitites vary from 1 to 11 ppm with an average of 1.5 ppm (n=12). The host serpentinite shows an average grade of 40 ppb (n=10). The platinum group mineralogy is very complex .

References

Sturt, B.A., Bøe, R., Ramsay, D. M. & Bjerkgård, T. 1995: Stratigraphy of the Otta-Vågå tract and regional stratigraphic implications. (Extended abstract). *Norges geologiske undersøkelse Bulletin 427*, 25-28.

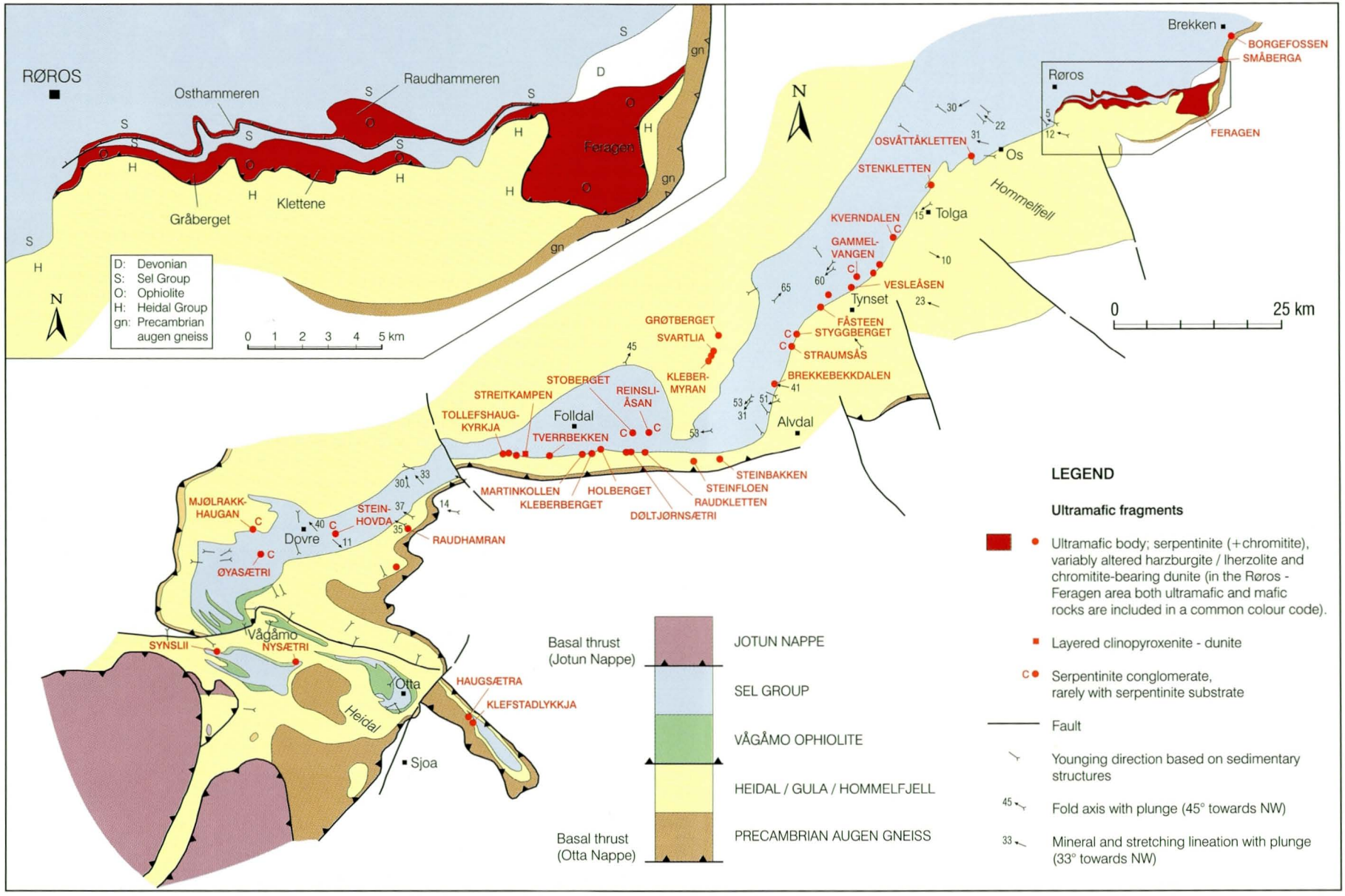

Fig. 1. Geological sketch map of the Vågå - Røros tract showing the locations of the ultramafite bodies.