

NOTES – NOTISER

A Rb-Sr isochron age of meta-andesites from Skorpehei, Suldal, south Norway

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The Precambrian basement in the Suldal area is overlain by a succession of mainly metamorphic pelitic rocks (the Schist Unit) and gneisses (the Gneiss Unit). The rocks in the Schist Unit were generally considered to be autochthonous or parautochthonous and of Cambro-Ordovician age, while the gneisses were thought to be allochthonous and of Precambrian age.

A new Rb-Sr whole-rock isochron date of 1145 million years of meta-andesites from the Schist Unit indicates that the Schist Unit is allochthonous and of Precambrian age.

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The Precambrian basement in the Suldal area (Fig. 1) is overlain by an essentially flat-lying series of phyllites and mica-schists intercalated with thin layers of meta-andesite, metatuffite, metasandstone, and kyanite-chloritoid schist (the Schist Unit) (Sigmond Kildal 1973). The Schist Unit is overlain by gneisses locally containing thin zones of quartzite, mica-schist and lenses of charnockitic rocks (the Gneiss Unit). Using as a basis general geological evidence – particularly the occurrence of meta-andesites in both units – Sigmond Kildal (1967, 1973) concluded that the main parts of the two units are one tectonostratigraphic unit, either of Cambro-Ordovician or Precambrian age.

Traditionally the Schist Unit has been considered as parautochthonous Cambro-Ordovician rocks (based on fossil determinations by Brøgger (1893) and Henningsmoen (1952)) while the Gneiss Unit has been regarded as allochthonous Precambrian rocks based earlier on general geological evidence, recently confirmed by radiometric age determinations (Priem et al. 1968, Heier et al. 1972, Andresen et al. 1974, Andresen & Heier 1975). The interpretation of the Schist Unit and the Gneiss Unit as a single tectonostratigraphic unit was thus in conflict with the traditional view.

In an attempt to solve this problem meta-andesites from the Schist Unit at Skorpehei, Suldal, have been dated by the Rb/Sr whole-rock method. In this area meta-andesites occur from just above the sub-Cambrian peneplain

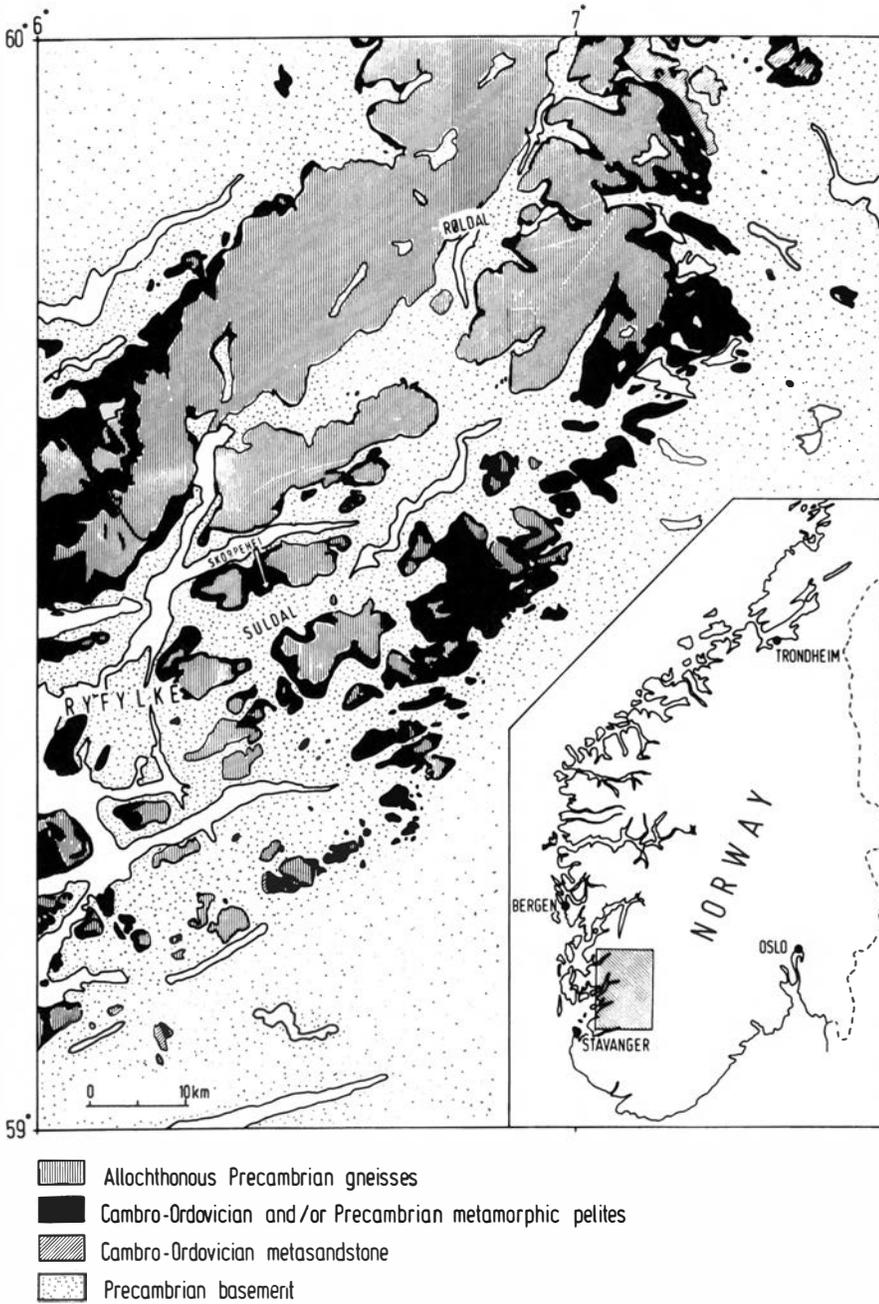


Fig. 1. Simplified map showing the main tectonic units, and the location of the Skorphehei area.

to the top of Skorphehei. In the lower part, the meta-andesites are inter-layered with black and grey phyllite, in the higher part with quartz-mica schists. The competent meta-andesites have retained their porphyritic tex-

Table 1. Sample locality and analytical data.

| Sample | Locality* | Rb/Sr** | $^{87}\text{Rb}/^{86}\text{Sr}$ | $^{87}\text{Sr}/^{86}\text{Sr}$ | Calculated age |
|--------|-----------------------------|---------|---------------------------------|---------------------------------|--------------------|
| 72.160 | Meta-andesite | 542 994 | 0.326 | 0.9438 | 1145 \pm 98 m.y. |
| 72.162 | Meta-andesite | 542 994 | 0.359 | 1.0390 | $R_i = 0.7060$ |
| 72.163 | Meta-hornblende andesite | 541 993 | 0.230 | 0.6669 | ± 0.00109 |
| 72.166 | Meta-hornblende andesite | 523 003 | 0.176 | 0.5109 | 0.7139 |

* Grid references. Given as UTM coordinates on mapsheet 1314 III.

** Mean of duplicate analyses.

ture and are only locally transected by the cleavage affecting the incompetent pelites in the Schist Unit.

Analytical techniques

The Rb/Sr ratios were determined by a Philips Manual X-ray spectrograph, PW 1410 with a 2.7 kw tube. The isotopic analyses of Sr were performed on a Micromass MS 30 solid-source mass spectrometer employing magnetic scanning of the spectra.

Age calculations were made by using ^{87}Rb decay constant of $1.39 \cdot 10^{-11} \text{ Yr}^{-1}$. All Rb-Sr dates referred to in this paper have been recalculated to this decay constant. Regression was fitted using the method of York (1969). The errors are given as two sigma. All analytical work was done in the laboratories of Mineralogisk-geologisk museum in Oslo.

Results and discussion

The Rb-Sr analytical data are listed in Table 1 and Fig. 2. The regression analyses give an age of 1145 ± 98 m.y.

The metamorphic pelites interbedded with the meta-andesites display upper greenschist facies mineralogy (kyanite + chloritoid + quartz); the age could therefore date this metamorphic event.

However, the age implies that the meta-andesites have been thrust above the sub-Cambrian peneplain to their present position during the Caledonian orogeny. They must accordingly have been subjected to Caledonian metamorphism, apparently without a reset of the isotope whole-rock relations. Further, the rocks contain up to 30 percent zoned plagioclase phenocrysts (An_{25-52}). The anorthite content reflects the composition of the volcanic plagioclases and are not in equilibrium with the greenschist facies mineralogy of the matrix.

The mineralogy of the groundmass is dynamically controlled. There is a clear connection between the foliation and the mineralogy. With increasing foliation the rocks contain only chlorite, chlorite and biotite, and only biotite respectively.

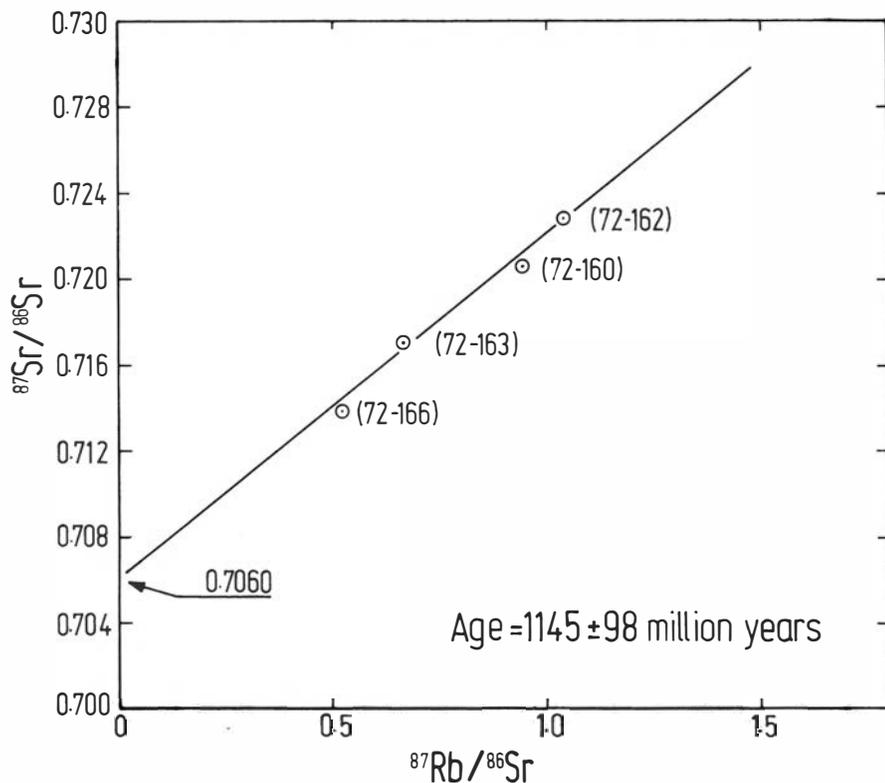


Fig. 2. Rb-Sr isochron plot of whole rock analyses of meta-andesites from Skorpehei, Ryfylke, south Norway.

Thus the meta-andesites are incompletely equilibrated to any metamorphic facies – Caledonian or Precambrian. This fact, combined with the low initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio and the rather good fit of the regression line, suggests that the 1145 m.y. age represents the extrusive age of the andesites.

This age is consistent with a group of Sveco-Norwegian Rb/Sr whole rock ages of rocks from the Stavanger area (Heier et al. 1972, Andresen & Heier 1975) and the Røldal area (Andresen et al. 1974). These rocks are in a tectonic position equal to that of the gneisses in Suldal.

Age determinations thus seem to confirm that main parts of the Schist Unit and parts of the Gneiss Unit are one allochthonous unit of Precambrian age.

The present age determination raises the problem how to distinguish between parautochthonous Cambro-Ordovician metapelites and allochthonous Precambrian metapelites.

In a few areas, characteristic rock types interlayered with the metapelites could reveal the presence of one or both age groups. However, from large scale mapping in Ryfylke (Sigmond 1975) it is evident that the localization of the boundary and the identification of the two groups generally must be based on differences between the pelitic rocks themselves. At

present no criteria based on observations in the field, in hand specimen or in the microscope, is known to the authors.

It is possible that the chemistry could show some distinct differences between the two age groups. The chemistry of the meta-andesites are consistent with both island-arc and continental-margin andesites, pointing to a different depositional environment for the Precambrian metapelites than for the pelitic Cambro–Ordovician foreland deposits.

The Precambrian age for the meta-andesites leads to the following conclusions concerning the Suldal area:

The rocks of the Schist Unit conventionally thought to be of Cambro–Ordovician age are allochthonous Precambrian rocks.

The main thrust plane is situated at or near the Sub-Cambrian peneplain.

Only remnants of autochthonous Cambro–Ordovician rocks occur in this area.

At present no petrographic or field-criteria exist to distinguish between metapelites of Cambro–Ordovician age and those of Precambrian age.

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