NOTIS - *NOTE*

Rb-Sn AND K-An AGE MEASUREMENTS ON PHLOGOPITIC BIOTITE FROM THE ULTRABASIC LAMPROPHYRE DYKE ON THE ISLAND OF YTTERÖY, TRONDHEIMSFJORD, NORWAY

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In a recent paper, Storetvedt (1967) reported on the direction of natural remanent magnetization in the post-Caledonian lamprophyre dyke on the island of Ytteröy in the Trondheimsfjord, about 50 km NNE of Trondheim. He concluded that the palaeomagnetic data suggest a Late Caledonian age for the intrusion of the dyke.

The Ytteröy lamprophyre was first described by Carstens (1961). The dyke, which is exposed over a length of about 3 m in a limestone quarry, has a thickness of 80-90 cm, a N60° E strike and a 70°SE dip. It has intruded into limestones of presumably Lower Ordovician age. The rock consists of abundant large flakes of biotite (close to phlogopite in composition) and, subordinately, carbonate-chlorite phenocrysts (pseudomorphs after olivine), embedded in a dark, fine-grained groundmass composed mainly of biotite, clinopyroxene, calcite, analcite, and magnetite. Accessories are alkali-feldspar, pyrite, and apatite. The rock is strongly brecciated. According to Carstens, this lamprophyre is closely related with alnöitic-kimberlitic rocks and similar to the Early Cambrian damtjernite of the Fen area, Telemark. Post-Caledonian basic dykes are extremely scarce in the Norwegian Caledonides, the nearest known dyke being situated some 300 km to the south (near Hamar). Carstens suggested that intrusion of the Ytteröy lamprophyre dyke might have been connected with Permian rift faulting.

The present communication reports the results of isotopic age determinations according to the Rb-Sr and K-Ar methods on the phlogopitic biotite from the Ytteröy lamprophyre. The biotite was analyzed for rubidium and strontium by isotope dilution using a mass-spectrometer with thermal ionization and multiplier detection for the isotope measurements. Argon was determined by isotope dilution on a Reynolds type glass mass-spectrometer. Potassium was measured by flame-photometry using a lithium internal stan-

Table 1. Analytical data and computed ages

Rb-Sr age determinations[a]

	Rb ppm Wt.	Sr[b] ppm Wt.	$^{87}Sr/^{86}Sr$[c]	Radiogenic ^{87}Sr[d] ppm Wt.	Age[e] million years
biotite (1)	401	93.9	0.7498	0.410	246±10
	405	98.1	0.7496	0.418	
biotite (2)[f]	414	74.3	0.7641	0.427	249±10
			0.7645*		

K-Ar age determinations[a]

	K % Wt.	Radiogenic ^{40}Ar ppm Wt.	Atmospheric ^{40}Ar (% total ^{40}Ar)	Age[g] million years
biotite	7.93	0.220	15.3	363±15
	7.94	0.229	11.5	

a The duplicate determinations represent completely independent analyses, starting from different samples of biotite.

b Total strontium (initial Sr+radiogenic ^{87}Sr).

c All $^{87}Sr/^{86}Sr$ ratios normalized to $^{88}Sr/^{86}Sr=8.3751$. The ratio marked * was obtained by direct measurement on an unspiked sample.

d Initial $^{87}Sr/^{86}Sr$ ratio=0.705.

e Calculated with ^{87}Rb decay constant $\lambda=1.47\times10^{-11}yr^{-1}$.

f The differences in Rb and Sr contents and $^{87}Sr/^{86}Sr$ ratios between the biotite concentrates (1) and (2) are due to different amounts of included calcite.

g Calculated with the ^{40}K constants: abundance=0.0118 atom% total K; decay constants $\lambda_e=5.85\times10^{-11}\,yr^{-1}$, $\lambda_\beta=4.72\times10^{-10}/yr^{-1}$.

dard. Some calcite was present in all biotite concentrates analyzed. The relevant analytical data and computed Rb-Sr and K-Ar ages are given in Table 1.

The Rb-Sr and K-Ar ages of the biotite are strongly discordant. The K-Ar age is 363 ± 15 million years—Middle Devonian according to the Geological Society Phanerozoic Time-Scale (1964). However, the Rb-Sr age is 248 ± 10 million years — Middle Permian according to the same time-scale. In view of the Late Caledonian (Devonian) versus Permian age proposed for the Ytteröy dyke, these results may be somewhat embarrassing. There can be little doubt, however, that the K-Ar age sets a reliable date for the intrusion of the dyke. It is well-known that the Rb-Sr age of biotites is easily affected by processes of base exchange, radiogenic strontium in biotite being replaced by common strontium in circulating fluids. The K-Ar age of biotites, on the other hand, is not affected even by processes of extensive base exchange (Kulp & Engels 1963). Conditions for base exchange must have been extreme in the Ytteröy lamprophyre—a narrow, strongly brecciated dyke in a limestone environment. Therefore, the lower Rb-Sr age of the biotite may be ascribed to replacement of radiogenic strontium by common strontium, which is abundantly present in this environment. The question remains open whether the exchange has been a more or less continuous process, the apparent Permian age

being only accidental, or whether radiogenic strontium has been lost episodically some 250 million years ago, for instance as the result of hydrothermal activities in connection with Permian rift faulting.

It may thus be concluded that the Ytteröy lamprophyre is a Late Caledonian dyke, intruded 363 ± 15 million years ago (Middle Devonian). This confirms the results of Storetvedt's palaeomagnetic measurements.

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