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THE SIIPYY GRANITE — A NEW RAPAKIVI OCCURRENCE IN FINLAND

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Introduction

The Siipyy (or Sideby in Swedish) granite is located on the western coast of Finland (Fig. 1) about 40 kilometres NNW of the newly discovered Reposaari rapakivi body which may represent a northern extension of the Laitila Rapakivi batholith (Vaasjoki et al. 1988). The Siipyy granite was first indicated as a separate rock unit on the general geological map of Finland 1:400 000, sheet B2, Tampere, published by Sederholm in 1903. Sederholm also shortly described the granite in his explanation to the map sheet (Sederholm 1911).

Sederholm, however, did not include the Siipyy granite into the anorogenic rapakivi granite group, which varies in age from 1570 to 1640 Ma. Instead, he regarded it as a »Post-Bothnian» granite, which are abundant in his map sheet area and correspond to the Svecofennian granites (ca. 1800—1900 Ma) in the present-day classification.

Little geological attention has been paid to this rather small granite body since Sederholm's days. However, in the summer of 1989, the granite was briefly studied for dimension stone purposes. It was in this context that the question of the age of the granite arose and consequently, a sample was taken for radiometric age determination.

The following mineralogical description is based on the field examination, the petrographic analyses of one thin section and the study of the heavy mineral fractions of the sample taken for age determination (sample A373, Lötskatan, map sheet 1231 05, coordinates in the national grid x = 6874630, y = 1517400).

Petrography

The granite is well exposed on the coast of the Gulf of Bothnia (see Fig. 1). Occupying a land area of about 6×3 km^2 its areal extent was reasonably well defined by Sederholm (1903), but its offshore continuation is unknown.

The Siipyy granite lacks the typical rapakivi texture, i.e. alkali feldspar ovoids mantled with plagioclase (for textural definitions, see e.g. Vorma 1976), but contains abundant euhedral (»drop») quartz diagnostic of rapakivi granites.

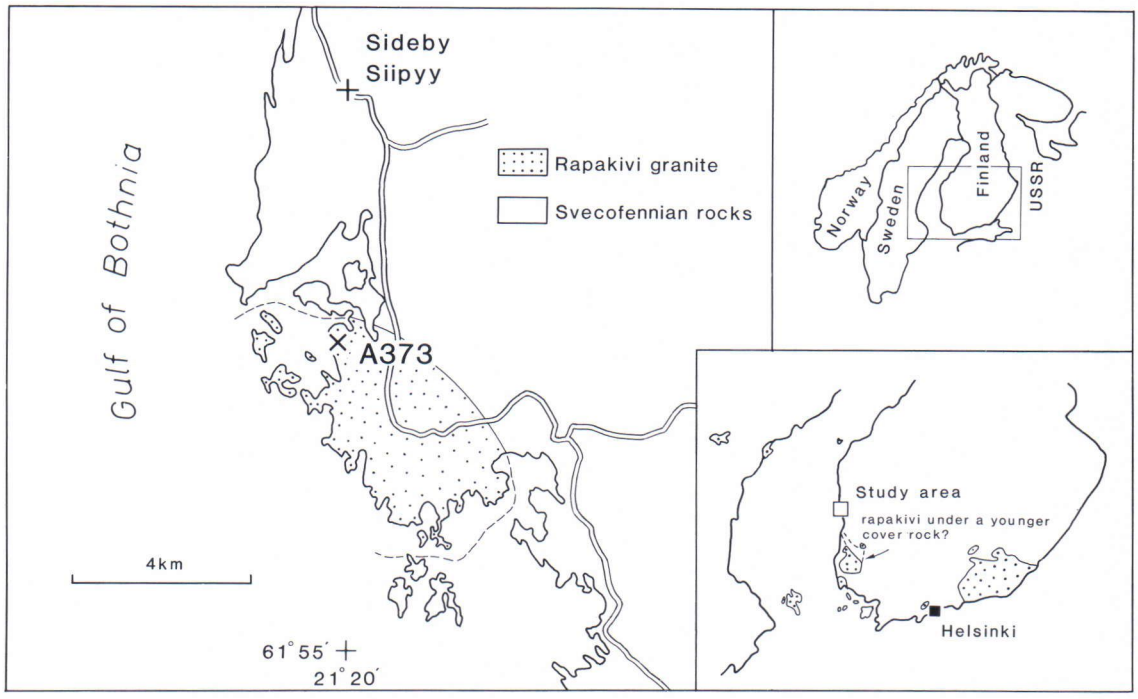

Fig. 1. Sketch map of the Siipyy granite (based on Sederholm 1903), showing the sampling site. The lower inset shows the location of the study area and the known rapakivi granites in Finland and Central Sweden (based on Vorma 1976 and Vaasjoki 1988).

Texturally it is a porphyritic variety with subangular phenocrysts of potassium feldspar imparting a reddish tint to the rock. The feldspar phenocrysts reach up to 6 cm in length but average 2—3 cm and are embedded in a medium-grained groundmass. Rare rounded phenocrysts of potassium feldspar are also seen, but no transitions to a pyterlitic rapakivi type were observed. As a whole, the granite seems to be texturally uniform throughout the body, however, both the grain size and mode of the dominant minerals vary to some extent.

Mineralogically the rock is a biotite-granite (Table 1) with accessory minerals such as fluorite, zircon, apatite and monazite typical of rapakivi granites (see Vorma, op.cit. and Haapala 1977). No sphene is present. Some chlorite (replacing biotite) and sericite + carbonate (replacing plagioclase) have formed as a result of secondary alteration.

Table 1. Modal composition of the porphyritic Siipyy granite. (x = present).

Quartz	49.3
Potassium feldspar	24.2
Plagioclase	16.3
Biotite	3.8
Sericite	2.8
Fluorite	1.6
Chlorite	1.5
Zircon	x
Apatite	x
Carbonate	x
Opaques	x
Monazite	x

The potassium feldspar is dominantly microcline (tartan twinning with string and vein or replacement? perthite intergrowths). Typical of rapakivi granites, quartz occurs in two generations, most of it being drop quartz and the other occurring as anhedral grains. The modal quartz

content of the sample is, however, unusually high (c.f. Vorma 1971 and Haapala, op.cit.), but this must due to the small number of analyses acquired because field observations suggest generally somewhat lower quartz content. Fluorite also occurs in two generations, the first as subhedral grains 1—2 mm in size and the other as small irregular grains included in altered plagioclase.

Zircon U-Pb results

The zircons are colourless (clear and turbid) typical of rapakivi granites. The crystals have well-developed prisms and pyramids with length/breadth ratios generally 2—3 but in smaller crystals up to 8—10. The crystals are perfectly euhedral with sharply terminated crystal faces. They are simple tetragonal prisms in heavier fractions but some platy examples occur. A number of crystals show concentric euhedral internal zones which are accentuated through red pigmentation common in some of the zircon crystals. Qualitative analyses of the pigmented crystals using electron microprobe revealed the presence of various materials (e.g., xenotime, monazite, an unidentified Nd-Ce phosphate, iron, gold, electrum, galena, an unidentified metamiet U-Th mineral) as inclusions but it was not directly obvious which of these were responsible for the pigmentation. In the heaviest fraction zircon is clear and rich in unidentified, sometimes needle-shaped inclusions. In the low—density fractions crystal terminations are blunted and the zircons lose their faceted appearance; also additional crystal faces can be found. A few grains have cores of metamict zircon.

Analytical results of zircon density fractions are given in Table 2 and displayed on a concordia plot in Fig. 2. The analyses were performed in the laboratories of the Geologcal Survey of Finland and the analytical methods are described e.g. by Vaasjoki et al. (1988).

Uranium concentrations in the zircons vary from 134 to 684 µg/g. The zircon fractions exhibit a wide range in density and amount of radiation damage which provides an opportunity to compare variations in these properties to the degree of lead loss in the isotopic systems. A striking feature of the results is that the common lead content decreases with increasing content of uranium. This is due to the numerous inclusions, especially in the heaviest fractions. On the basis of the high ^{208}Pb contents in the heaviest frac-

Table 2. U-Pb analytical data for zircons from the Siipyy granite.

Sample no.	Fraction d = g/cm³ abr = grains abraded	Concentration µg/g ^{238}U	Concentration µg/g ^{206}Pb	$^{206}Pb/^{204}Pb$ measured	Isotopic composition of lead $^{206}Pb = 100$ 204	207	208	Atom ratios and radiometric ages, Ma $^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$
A373A	d>4.6;abr	133.7	31.22	775.3	.12411	11.371	24.633	.2700 ±21 1540	3.592 ±28 1547	.09649 ±21 1557
B	4.3<d<4.5 abr	364.2	79.71	1181	.08228	10.805	19.120	.2530 ±16 1453	3.371 ±21 1497	.09664 ±11 1560
C	4.2<d<4.3 abr	683.6	140.10	1991	.04852	10.302	15.565	.2369 ±20 1370	3.145 ±26 1443	.09629 ±18 1553
D	4.2<d<4.5 pigmented, abr	630.7	130.62	1270	.07627	10.645	16.882	.2394 ±17 1383	3.164 ±24 1448	.09586 ±14 1545

Decay constants: Jaffey et al. (1971).

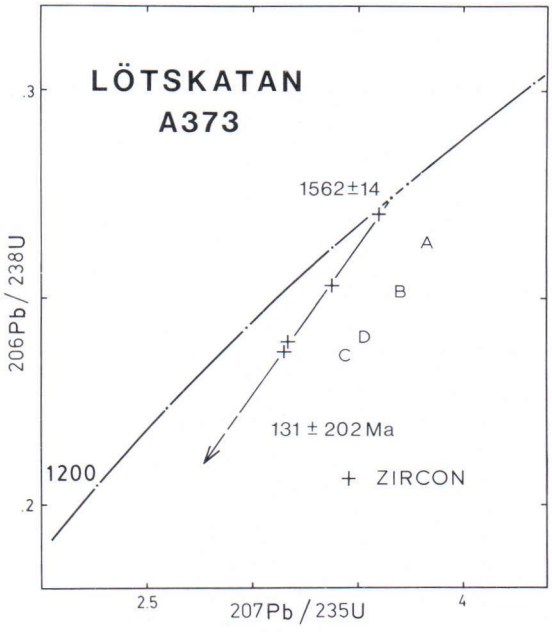

Fig. 2. Concordia plot of zircon fractions from the Siipyy granite.

tions, it is probable that the thorium content in the inclusions is high as well. The U-Pb data for four zircon fractions define a chord which gives an upper linear regression intercept with the concordia at 1560 ± 7 Ma (2 × sigma) and a lower intercept at 114 ± 181 Ma. Employing the regression procedure of York (1969) the four analyses of zircon give an upper intercept age of 1562 ± 14 Ma with a lower intercept of 131 ± 202 Ma. The upper intercept is controlled essentially by the nearly concordant zircon fraction A which has a Pb-Pb age of 1557 ± 4 Ma.

The age obtained is somewhat lower than those reported for the Reposaari granite (1584 ± 9 Ma) and for the Laitila Rapakivi complex (1573 ± 9 Ma) (Vaasjoki et al. 1988).

Conclusions

The porphyritic Siipyy biotite-granite, occupying a land area of about 6 × 3 km² on the western coast of Finland, has formerly been regarded (Sederholm 1903 and 1911) as Svecofennian. Though lacking the typical rapakivi texture, its zircon U-Pb age (1562 ± 14 Ma) together with mineralogical features typical of rapakivi granites (e.g. drop quartz, fluorite and monazite present, no sphene) leave little doubt that the Siipyy granite is a rapakivi granite.

This result not only increases the areal extent of the Finnish rapakivi granites but also raises the question as to whether more rapakivi granites are to be found among the well-preserved »Post-Bothnian» (Svecofennian) granites as defined by Sederholm.

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