THE AGE OF THE ILIVERTALIK GRANITE IN THE FISKENÆSSET AREA

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Introduction

The Ilivertalik granite has been briefly described by Kalsbeek & Myers (1973). It forms the mountain of Ilivertalik north–west of Midgård and consists mainly of a very homogeneous, relatively coarse grained brownish-weathering, hypersthene-bearing augen gneiss of granitic composition.

The object of this paper is to present the results of a zircon U-Pb geochronological study of the granite and to discuss the significance of the results in terms of the regional geology and previous geochronology.

Geological relationships of the granite

The emplacement of the Ilivertalik granite represents an important time point in the history of the Archaean in this region. As described by Kalsbeek & Myers (1973) the granite intrudes foliated and migmatized amphibolite and streaky gneiss which themselves locally contain inclusions of rocks of the anorthosite complex. Following emplacement the granite has been strongly deformed during the second and third phases of folding recognised in this part of the area. It possesses steeply plunging linear fabrics (F_2 or F_3) and near the bordering gneisses it may be strongly foliated. The Ilivertalik granite of Ilivertalik mountain has a hornblende granulite facies mineralogy. Comparable rocks farther to the north and north–east are in amphibolite facies. Locally the Ilivertalik granite is migmatized and cut by sheets of younger granite.

The zircon sample

The investigated sample was supplied as a zircon concentrate by F. Kalsbeek. The sample was further purified at the S.U.R.R.C. to greater than 98 percent zircon. It was then subdivided into a number of size and magnetic fractions and selected fractions were boiled for approximately ten minutes in 1:1 nitric acid and then in distilled water and were then isotopically analysed. Analytical methods followed those of Krogh (1973). Isotopic analyses were made on the AEIGEC MS 12 mass-spectrometer at the S.U.R.R.C.

The zircons are subhedral with irregular rounded and embayed facets. Many grains contain transparent and opaque rod shaped inclusions. Faint euhedral zones have been observed in many crystals suggesting that the zircons grew as euhedral crystals and that late chemical corrosion produced the present irregular forms. A few oval shaped grains, up to a maximum of five percent, resemble zircons described from the gneiss and tonalite of the Frederikshåb area (Jocelyn & Pidgeon, 1974) and might be xenocrysts. A few examples of 'parallel growth' described by these authors for zircons from the gneisses and tonalites were found in the Ilivertalik granite zircon population.

Table 2. U-Pb isotopic analyses of zircon fractions from Ilivertalik granite sample GGU 131124

Zircon fraction	Pb (rad.) μg/g	U μg/g	$\frac{Pb^{206}}{Pb^{204}}$	Atom percent radiogenic lead			$\frac{Pb^{207}}{Pb^{206}}$	Atomic ratios	
				206	207	208		$\frac{Pb^{207}}{U^{235}}$	$\frac{Pb^{206}}{U^{238}}$
1 +142 μ NM	160.9	256.6	18.260	73.89	14.49	11.62	0.1961	14.54	0.5379
2 -84+61 NM	150.6	238.2	16.810	73.55	14.41	12.03	0.1959	14.59	0.5399
3 -45 NM	198.4	329.8	5.300	74.34	14.43	11.23	0.1941	13.91	0.5195
4 -106+84 M1°	165.5	283.3	6.000	74.48	14.50	11.01	0,1947	13.57	0.5055
5 +142 M8°	235.5	389.8	10.250	74.94	14.68	10.38	0.1958	14.20	0.5260

Calculated with the following constants $U^{235}/U^{238} - 1/137.8$, $\lambda U^{238} = 1.53 \times 10^{-10}y^{-1}$, $\lambda U^{235} = 9.72 \times 10^{-10}y^{-1}$.

Common lead correction $Pb^{206}/Pb^{204} = 18.1$, $Pb^{207}/Pb^{204} = 15.5$, $Pb^{208}/Pb^{204} = 36.5$
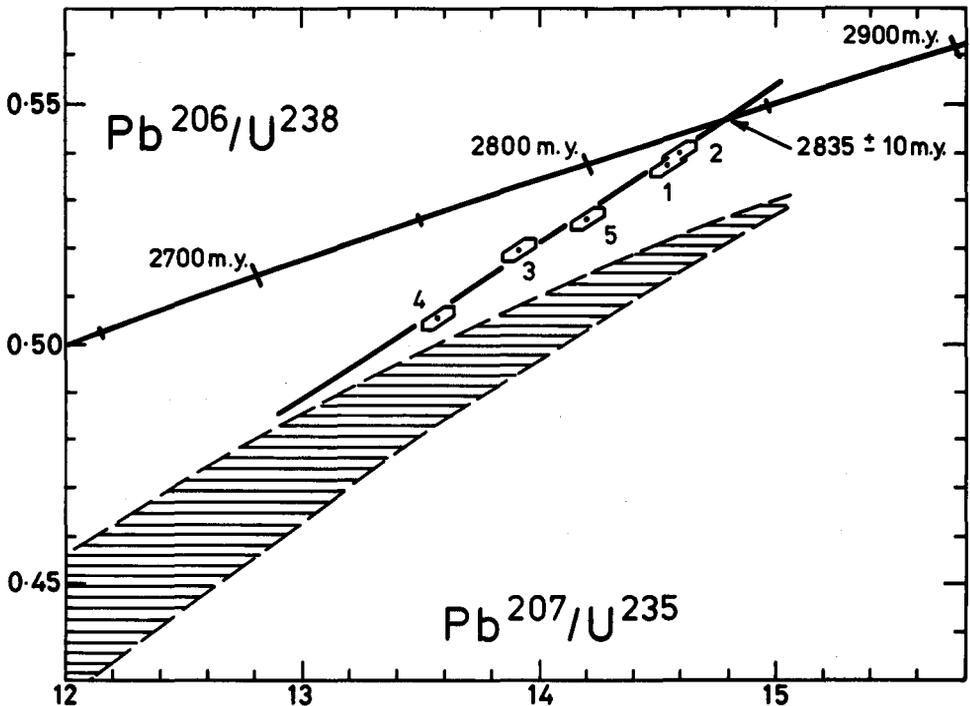

Fig. 16. Section of a concordia plot showing the linear distribution of the five data-points. Error polygons were calculated using an uncertainty of ± 0.2 percent in Pb[207]/Pb[206] and ± 0.5 percent in Pb/U. The shaded area contains zircon data-points from gneisses and tonalites from near the Frederikshåbs Isblink (reported by Pidgeon & Hopgood, 1975).

The isotopic age determination

U-Pb isotopic analyses of five fractions from a single zircon population (from sample number GGU 131124) are shown on Table 2 and plotted on figure 16.

It can be seen from the reported atomic ratios that the zircons are slightly discordant. It is shown on fig. 16 that the zircon points fall on a line slightly below the concordia curve. On extrapolation this line intersects the concordia at 2835 ± 10 m.y. (The error is a visual estimate of the maximum uncertainty of the intersection). This result is independent of whether a model of 'episodic lead loss' or 'lead loss by slow continuous diffusion' is used to explain the slight isotopic discordance.

Discussion and conclusions

The distribution of discordant zircon data-points from the gneiss and tonalite from near the Frederikshåbs Isblink (Pidgeon & Hopgood, 1975) is shown as a shaded area on fig. 16. The U-Pb systems of these zircons are complex. Pidgeon & Hopgood interpret them as indicating a minor component of pre-2900 m.y. old lead in the zircons, which was almost completely removed during a major isotopic disturbance approximately 2700 m.y. ago. These zircon isotopic relationships were further complicated by a recent isotopic disturbance which produced the present discordant pattern.

The linear distribution and close concordance of the Ilivertalik granite zircon points (fig. 16) indicates that the granite zircon U-Pb systems do not contain significant components of lead contributed by 'older' gneiss zircons.

We conclude therefore that 2835 ± 10 m.y. is the age of crystallization of zircon during emplacement of the Ilivertalik granite.

The zircon U-Pb age of the Ilivertalik granite of 2835 ± 10 m.y. is not significantly different from the Pb-Pb whole-rock age of 2850 ± 100 m.y. reported by Black *et al.* (1973) for gneisses and anorthosites from the Nordland – Sukkertoppen and Fiskenæsset areas. These authors interpret the Pb-Pb age as that of the regional granulite facies metamorphism. This is in accord with the geological evidence that emplacement of the Ilivertalik granite took place fairly late in the plutonic history of the area, and perhaps during the waning stages of the granulite facies metamorphism of the Fiskenæsset region. If this is so the time interval between F_2 (which deforms the granite) and the granulite facies metamorphism (which continued post-F_3) must have been short. The alternative possibility that the zircon age reflects the granulite facies metamorphism of the granite without retaining any memory of an older age is considered less likely.

References

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