

**K/Ar AND Rb/Sr AGE DETERMINATIONS
ON PRECAMBRIAN CRYSTALLINE ROCKS IN THE
INGLEFIELD LAND-INGLEFIELD
BREDNING REGION, THULE DISTRICT,
WESTERN NORTH GREENLAND**

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Following field investigations in North Greenland in 1971 by one of us (P.R.D.) a selection of rocks was made available for age dating work. The first results – K/Ar whole-rock ages on dolerites – suggest that the basal part of the unmetamorphosed Thule Group is at least 1200 m.y. old (Dawes *et al.*, 1973). This note reports the first results of a dating programme carried out by O. L. at the Institute for Petrology, University of Copenhagen and is concerned with the age of the underlying and older crystalline basement complex. Further work is continuing particularly on a Rb/Sr whole-rock isochron. Supplementary sample collecting is scheduled to take place in the summer of 1974.

Geological setting

The crystalline basement contains five major rock units (fig. 1):

Inglefield Bredning

(1) An old, mainly amphibolite-facies gneiss and granite unit containing amphibolites, pelitic rocks and intrusions, overlain by 2.

(2) A supracrustal succession containing metasedimentary schists, psammites and amphibolites.

(3) Qaqujârssuaq anorthosite associated with pelitic gneisses which are cut by metabasic dykes – relations to units 1 and 2 unknown.

Inglefield Land

- (4) Etah Group of mainly calcareous and pelitic rocks intruded by 5.
- (5) Etah meta-igneous complex composed of a basic to acid suite of intrusives which have suffered severe deformation.

Geological correlations of the units between Inglefield Land and Inglefield Bredning are uncertain (Dawes, 1972).

Aim of the study

The aim of the preliminary age dating programme was, (1) to establish the age of intrusion of the Etah meta-igneous complex, and (2) to date the latest metamorphism affecting the region as a whole.

Rb/Sr results

A suite of samples for Rb/Sr analysis was selected from the Etah meta-igneous complex in south-west Inglefield Land and northern Prudhoe Land (fig. 1). At the present time seven whole-rock samples have been analysed. These rocks range in composition from norite and diorite to granodiorite and granite.

When the isotopic composition of strontium is plotted against the $^{87}\text{Rb}/^{86}\text{Sr}$ ratio four of the samples may define an isochron corresponding to an age of 1960 m.y. and giving an initial ratio of 0.703. The remaining three samples plot above this isochron. If we accept variations in the initial isotopic ratio of strontium up to 0.706 all but one sample could be fitted to lines with 1960 m.y. slopes. In the case of sample GGU 140891 this interpretation does not apply; on the contrary it suggests that older rocks might be involved in the sampled suite. We therefore hesitate at present to suggest any interpretation at all for the points spreading above the 1960 m.y. 'isochron'. We do believe, however, that this line defined by four well-separated points is significant and suggest that the age obtained corresponds to the time of metamorphism of the Etah meta-igneous complex.

K/Ar results

Hornblende concentrates from three pyribole samples collected in south-west Inglefield Land give fairly concordant ages in the range 1750–1800 m.y. Hornblendes separated from samples of pyribole and amphibolite collected in the eastern part of Inglefield Bredning proved slightly older, 1850–1880 m.y. (table 1).

The K/Ar hornblende ages agree well with an age of metamorphism of 1900–2000 m.y. as indicated by the Rb/Sr work, the difference in age results probably

Table 1. Location, analytical detail and K/Ar mineral ages of rocks from North Greenland

Rock unit	Origin	GGU sample No.	Approx. coordinate position	Rock type	Location and geological setting	Mineral	% K ₂ O	⁴⁰ Ar radiogenic µgat/g	Age m. y.
3	Igneous	141016	77°37'N 66°14'W (G.I.)	Garnet-biotite pyrobitite	Core of an approx. 40 m thick metadolerite dyke, now conformable, within the Qaqujårssuaq anorthosite. East Inglefield Bredning.	Hbl.	1.48±0.05	6.89±0.16×10 ⁻³	1852±48
						Bio.	8.4±0.3	3.15±0.07×10 ⁻²	1610±46
		141029	77°35'N 67°15'W (G.I.)	Garnet-rich amphibolite	10 m layer in supracrustal succession overlying basement gneisses. East Inglefield Bredning.	Hbl.	1.09±0.07	5.20±0.15×10 ⁻³	1881±84
2	Sedimentary	141026	77°36'N 66°47'W (G.I.)	Garnet-biotite-sillimanite schist	Yellow-brown weathering schists from supracrustal succession overlying gneissic basement. East Inglefield Bredning.	Bio.	8.6±0.3	3.47±0.08×10 ⁻²	1694±47
						Musc.	9.2±0.3	3.86±0.08×10 ⁻²	1727±48
		141034	77°36'B 66°47'W (G.I.)	Biotite-muscovite-sillimanite schist		Bio.	8.6±0.3	2.95±0.07×10 ⁻²	1519±44
5	Igneous	140808	78°16'N 72°44'W (A.M.S.)	Pyrobitite	Thin, discrete, folded, mafic layer in severely deformed melanocratic gneiss. Hartstene Bugt, SW Inglefield Land.	Hbl.	0.87±0.03	3.74±0.11×10 ⁻³	1758±52
		140827	78°22'N 72°46'W (A.M.S.)	Pyrobitite	20 m mafic layer in garnet granitic gneiss. North of 'Life Boat Cove', SW Inglefield Land.	Hbl.	1.10±0.05	4.88±0.13×10 ⁻³	1795±61
		140901	78°19'N 72°41'W (A.M.S.)	Pyrobitite	Thick, northerly dipping mafic layer in foliated granite and granitic gneiss. NW of Etah, SW Inglefield Land.	Hbl.	0.73±0.01	3.13±0.09×10 ⁻³	1756±38

Decay constants: $\lambda_{ec} = 5.85 \times 10^{-11} \text{ y}^{-1}$, $\lambda_B = 4.72 \times 10^{-10} \text{ y}^{-1}$ using $^{40}\text{K}/\text{K} = 1.19 \times 10^{-4}$

Abbreviations G.I. and A.M.S. qualifying coordinate positions refer to the 1:250 000 topographic maps issued by the Geodetic Institute, Copenhagen and the Army Map Service, Washington D.C.

reflects the time elapsed between the end of strontium equilibration on a whole rock scale and the closure of hornblende to Ar diffusion.

The ages of mica separated from rocks from Inglefield Bredning are at least 200 m.y. lower than the hornblende ages.

All K/Ar ages are interpreted as 'cooling ages'. The considerable discordance between the ages of hornblendes and micas suggests that the sampled rocks cooled very slowly. This implies that the uplift of the basement rocks of Inglefield Bredning was very slow. The hornblende ages from Inglefield Land suggest an even slower uplift of the basement of this area, at least during the initial stages of cooling.

Regional correlation

The critical age relationship between the supracrustal successions in Inglefield Land (unit 4 – Etah Group) and in the Inglefield Bredning (unit 2) remains unknown. The Etah Group is pre-1960 m.y. old and from the K/Ar dates, unit 2 appears to be pre-1880 m.y. Either of these successions could be of early Proterozoic age but the chance that either or both are of Archaean age must also be considered. In this connection the age of unit 2 is critical since a cycle of older sedimentation, intrusion, deformation and migmatization (now seen within unit 1 – so far not dated) pre-dates its deposition.

The Rb/Sr ratios were kindly determined by Dr. J. Bailey of the Institute of Petrology. The strontium isotopic ratios were measured on unspiked samples using a Varian MAT Th-5 solid source mass spectrometer. Further work is in progress in order to check the Rb/Sr ratios by isotope dilution. The indicated isochron age was estimated by manually fitting a line through the four lowest points on the diagram and calculated using a decay constant for Rb⁸⁷ of $1.39 \times 10^{-11} \text{y}^{-1}$.

References

- Dawes, P. R. 1972: Precambrian crystalline rocks and younger sediments of the Thule district, North Greenland. *Rapp. Grønlands geol. Unders.* **45**, 10–15.
- Dawes, P. R., Rex, D. C. & Jepsen, H. F. 1973: K/Ar whole rock ages of dolerites from the Thule district, western North Greenland. *Rapp. Grønlands geol. Unders.* **55**, 61–66.

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