RUBIDIUM-STRONTIUM WHOLE ROCK ISOCHRON AGE DETERMINATION FROM THE BANGS HAVN INTRUSION, SOUTH GREENLAND

JOHN ENGELL AND SVEND PEDERSEN

ENGELL, J. & PEDERSEN, S.: Rubidium-strontium whole rock isochron age determination from the Bangs Havn intrusion, South Greenland. *Bull. geol. Soc. Denmark,* vol. 23, pp. 130–133. Copenhagen, August 22th 1974.

A RB/Sr isochron age determination on the Bangs Havn intrusion gives an age of 1211 ± 11 m.y. The initial Sr^{87}/Sr^{86} ratio is 0.7034 ± 0.0001.

John Engell, Mineralogisk Institut, Danmarks tekniske Højskole, bygning 204, Lyngby. Svend Pedersen, Institut for almen Geologi, Østervoldgade 5, 1350 København K, Denmark. December 21st, 1973.

The Bangs Havn complex (Harry & Pulvertaft, 1963, Bridgwater & Harry, 1968) forms part of the zone of intense Gardar igneous activity extending from Nunarssuit to the Inland Ice. It cuts a set of earlier anastomosing ENE Gardar dolerites and is itself cut by a later Gardar dolerite and the Helene granite of the Nunarssuit intrusion.

The complex is interesting because it is one of the relatively few Gardar intrusions in which the full range of rocks from gabbro to quartz syenite is seen. A detailed account of the geochemistry of these rocks is in preparation by one of the authors (JE).

The Bangs Havn complex is made up of two connected, elongated intrusive bodies placed in an en échelon fashion with a general strike ENE parallel to the earlier dolerites. The western part of the complex can be followed for about 4 km from Nunarssuit in to the mainland. The eastern part (fig. 1) is lenticular in form, about 2 km long and with a maximum width of about 0.8 km. All samples used in this study come from the eastern intrusion.

A nearly complete marginal zone rich in anorthosite xenoliths surrounds the eastern intrusion. In places the marginal zone grades from a microsyenite chill zone into dolerite towards the centre of the intrusion. The marginal zone thus resembles the composite microsyenite-trachydolerite Gardar dykes described by Bridgwater & Harry (1968). These dykes are thought to be the result of the intrusion of stratified magmas. Inside the marginal zone a differentiated sequence occurs grading from syenogabbro into quartz syenite.

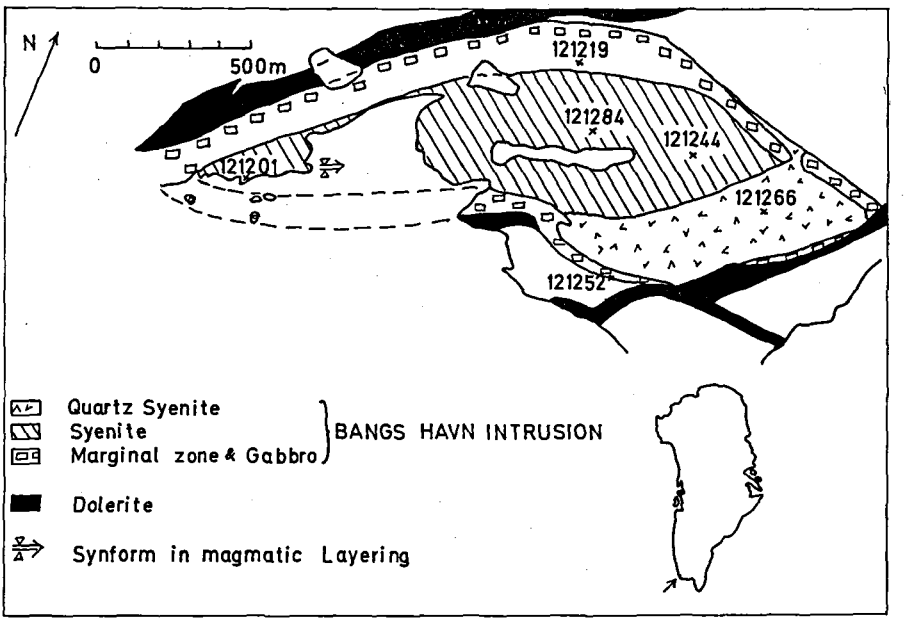

Fig. 1. Sketch map of the eastern Bangs Havn intrusion showing sample locations.

The lower part of this sequence is layered, forming a synform plunging 10° ENE. The quartz syenite is transgressive relative to the marginal zone.

The six samples analysed include one sample of the microsyenite chill zone and five samples covering the differentiated sequence.

Rb, Sr and Rb/Sr ratios were determined by X-ray fluorescence spectrometry (XRF by JE during a stay at the Grant Institute of Geology University of Edinburgh). The Rb and Sr contents are derived from the XRF data by

Table 1 – Analytical data for whole rock samples from the Bangs Havn Intrusion

G.G.U.		X R F			I D				
Sample no.	Rock type	Rb ppm	Sr ppm	Rb/Sr	Rb ppm	Sr ppm	Rb/Sr	Rb^{87}/Sr^{86}	Sr^{87}/Sr^{86}
121219	Gabbro	8	521	0.012	–	–	–	0.035	0.7039
121201	Mafic syenite	15	304	0.055	–	–	–	0.159	0.7061
121284	Syenite	23	144	0.160	–	–	–	0.463	0.7116
121244	Syenite	51	155	0.329	51.9	157.8	0.3289	0.952	0.7174
121266	Quartz syenite	72	128	0.598	73.1	122.1	0.5986	1.734	0.7328
121252	*Microsyenite from chill zone*	119	579	0.215	–	–	–	0.622	0.7138

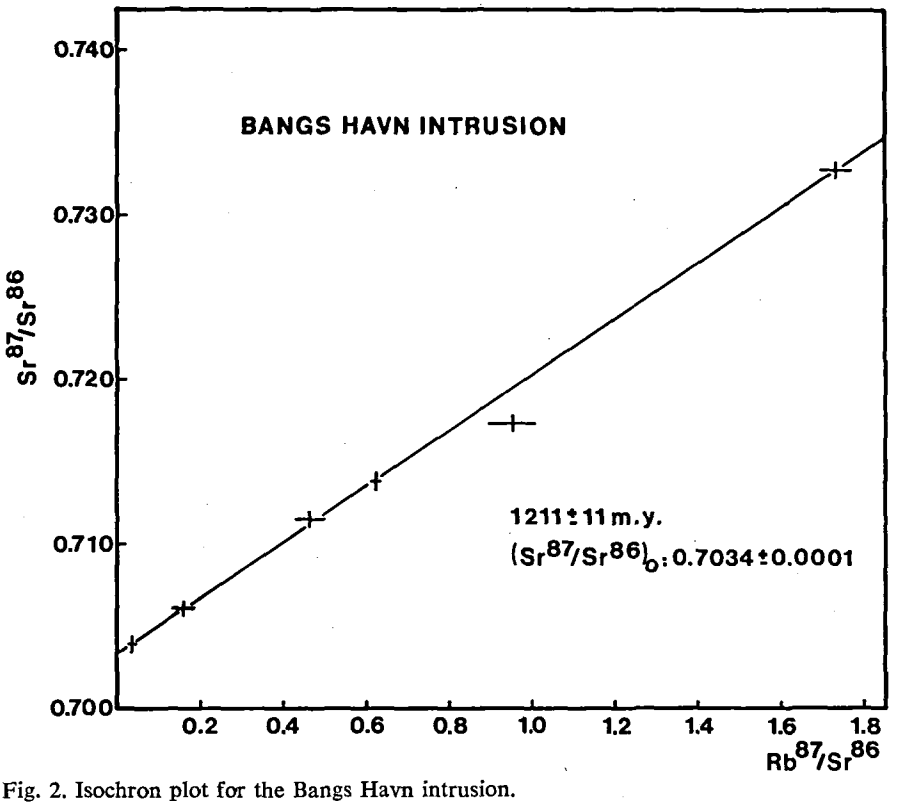

Fig. 2. Isochron plot for the Bangs Havn intrusion.

a peak to background method independently of the Rb/Sr ratios, and are only accurate to about 5–10 %. GSP-1 and G-2 were used as standards, the Rb/Sr ratios assigned to these being 1.093 and 0.355 respectively as recommended by Pankhurst & O'Nions (1973).

The Rb and Sr content of the two most differentiated rocks has also been determined by isotope dilution (ID by SP at Université Libre de Bruxelles).

The determinations of the Sr isotope ratios were carried out on a Varian MAT TH-5 mass spectrometer at the Institute of Petrology, University of Copenhagen. A mean of 0.7105 ± 0.0002 was calculated for 12 Sr^{87}/Sr^{86} ratio measurements on the NBS 987 Sr standard, all normalized to $Sr^{86}/Sr^{88} = 0.1194$. The average obtained here is 0.6 ‰ higher than the certified value of 0.7101 (March 1972); the difference is thought to be due to an attenuator error. For this reason 0.6 ‰ was subtracted from all measured Sr^{87}/Sr^{86} ratios.

The values obtained (table 1) are given in fig. 2. All errors are at the 1 δ level. The age and the initial ratio were calculated by the 'least-squares

cubic' method (York, 1966). The decay constant used is $\lambda = 1.39 \times 10^{-11}$ yr^{-1} (Aldrich et al. 1956).

One sample 121244, a reddish syenite, falls of the isochron as defined by the five other samples. A possible explanation is that this sample is slightly weathered. This sample has not been used in the calculation of the isochron.

The isochron age of 1211 ± 11 m.y. obtained on the Bangs Havn intrusion is comparable with isochron ages from other Gardar igneous complexes published by van Breemen & Upton (1972) i.e. 1245 ± 16 m.y. (Kûngnât), 1187 ± 9 m.y. (Hviddal dyke), and 1180 ± 37 m.y. (Central Complex Tugtutôq).

Moorbarth (in Harry & Pulvertaft, 1963) reports a Rb/Sr age on biotite of 1216 m.y. (recalculated using $\lambda = 1.39 \times 10^{-11} yr^{-1}$) from the biotite granite of the Nunarssuit complex. A K/Ar age determination on biotite from the Nunarssuit syenite gave 1128 ± 30 m.y. (Bridgwater, 1965).

The Bangs Havn complex is clearly older than the Helene granite of the Nunarssuit intrusion. Field evidence indicates that this granite is younger or contemporaneous with the biotite granite and older than the Nunarssuit syenite (Harry & Pulvertaft, 1963).

The low initial ratio and the concordance of the isochron are compatible with a development of the Bangs Havn intrusion from a single mantle-derived magma.

Acknowledgement. The authors wish to thank Greenland Geological Survey for financial and logistic support and permission to publish this paper.

Dansk sammendrag

En Rb/Sr isochron aldersbestemmelse af Bangs Havn intrusionen har givet en alder på 1211 ± 11m. år. Det oprindelige Sr^{87}/Sr^{86} isotopforhold er 0.7034 ± 0.0001

References

Aldrich, L. T., Wetherill, G. W., Davis, G. L. & Tilton, G. R. 1956: Half life of Rb^{87}. *Phys. Rev.* **103**, 1045–1047.

Breemen, O. van & Upton, B. G. J. 1972: Age of some Gardar intrusive complexes, South Greenland. *Bull. geol. Soc. Amer.* **83**, 3381–3390.

Bridgwater, D. 1965: Isotopic age determinations from South Greenland and their geological setting. *Meddr Grønland* **179** (4), 56 pp.

Bridgwater, D. & Harry, W. T. 1968: Anorthosite xenoliths and plagioclase megacrysts in Precambrian intrusions of South Greenland. *Meddr Grønland* **185** (2), 243 pp.

Harry, W. T. & Pulvertaft, T. C. R. 1963: The Nunarssuit intrusive complex, South Greenland. *Meddr Grønland* **169** (1), 136 pp.

Pankhurst, R. J. & O'Nions, R. K. 1973: Dertermination of Rb/Sr and $^{87}Sr/^{86}Sr$ ratios of some standard rocks and evaluation of X-ray fluorescence spectrometry in Rb–Sr geochemistry. *Chem. Geol.* **12**, 127–136.

York, D. 1966: Least-squares fitting of a straight line. *Can. Jour. Phys.* **44**, 1079–1086.