Radiometric ages of Tertiary salic intrusions near Kong Oscars Fjord, East Greenland

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As part of current geochronological studies of the Tertiary igneous province of East Greenland, samples from three subvolcanic complexes around Kong Oscars Fjord: Werner Bjerge, Kap Simpson, and Kap Parry (fig. 39) have been dated using Rb-Sr and K-Ar methods.

Geology

The Werner Bjerge complex (Bearth, 1959) is located immediately to the east of a major N–S fault system separating the crystalline rocks of the East Greenland Caledonian fold belt

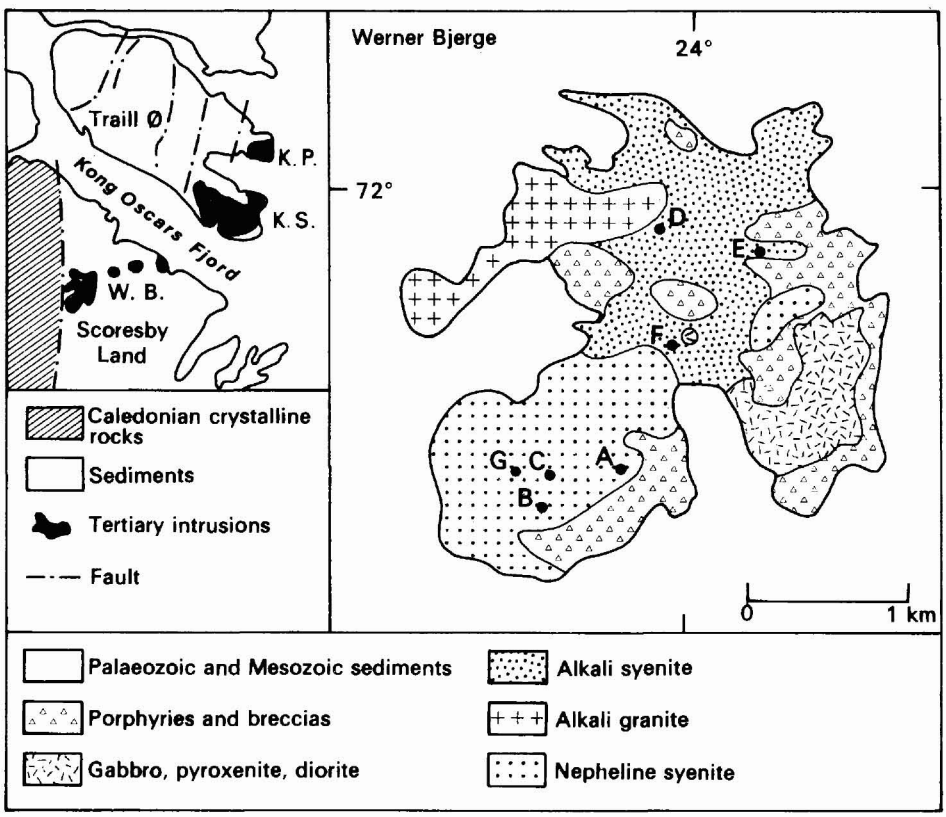

Fig. 39. Simplified geological map of Werner Bjerge subvolcanic complex central East Greenland (after P. Bearth, 1959). Letters A-G indicate locations of samples for Rb-Sr age determinations. W.B.: Werner Bjerge; K.S.: Kap Simpson; K.P.: Kap Parry.

from younger sedimentary deposits. The intrusions (fig. 39) are emplaced in a sandstone sequence of Carboniferous to Triassic age. A volcanic cover consisting of acid, intermediate and basic porphyries, and volcanic breccias is preserved at several places. Intrusive bodies were emplaced in at least two phases, an older basic to intermediate suite which has not been included in this study, followed by a suite of alkaline granites, syenites and nepheline syenites. Numerous dykes of various compositions intruded the complex during and after the emplacement of the main igneous bodies.

The Kap Simpson complex (Schaub, 1942) and the Kap Parry complex (Schaub, 1942; Engell, 1975) both situated on Traill Ø (fig. 39), are composed of syenitic and granitic, ring shaped intrusions enclosing downfaulted volcanics and sediments of the roof.

Results

The analyses of samples listed in Table 1 were carried out using standard techniques (Van Breemen & Dodson, 1972). The whole rock Rb-Sr isochron (fig. 40) for the Werner Bjerge samples located in fig. 39 yields an age of 31±2 m.y. when all data points of Table 11 are included. This age agrees well with the biotite-feldspar Rb-Sr age of 27.1±2 m.y. and is interpreted as the time of intrusion. However, the biotite K-Ar age of 28±1 m.y. may be fractionally younger, although this is not adequately demonstrated by the data.

Beckinsale *et al.* (1970) tentatively interpreted a biotite K-Ar age of 28.7±2 m.y. as a cooling age, but in the light of the present work can no longer be accepted. Gleadow & Brooks (in prep.) obtained fission track ages on titanite (30.3±1.3 m.y.) in agreement with the results reported here.

It is necessary to express a word of caution on the interpretation of the isochron, fig. 40. The scatter of points is well outside the analytical error, indicating that all least one of the assumptions inherent in the Rb-Sr method is not fulfilled. In view of results from other East Greenland syenites (Pankhurst *et al.*, 1976) it is tentatively suggested that there has been a variation in the initial $^{87}Sr/^{86}Sr$ ratio. Alternatively two ages may be represented as indicated in fig. 40. The broken line corresponds to an age of 33 m.y., but the lower scatter on the solid line giving the age of 30±2 m.y. and initial $^{87}Sr/^{86}Sr$ of 0.7040±1, leads us to consider it as a best estimate for the age of the intrusion.

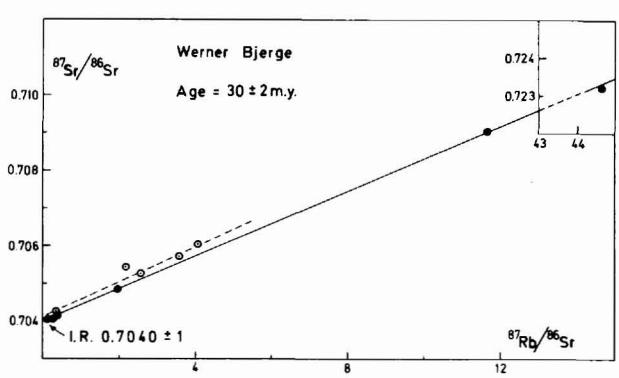

Fig. 40. Whole rock Rb-Sr isochrons for syenites of the Werner Bjerge subvolcanic complex, central East Greenland. The age and I.R. (initial $^{87}Sr/^{86}Sr$ ratio) indicated are based on the filled circles only.

Table 11. Rb-Sr age determination from Werner Bjerge and Kap Simpson

GGU sample no.	Rock type/mineral	Locality	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$
Werner Bjerge				
240981	Nepheline-sodalite syenite	A	1.9609	0.70484±4
240985	Nepheline-sodalite aplite	A	2.1899	0.70544±5
240996	Nepheline syenite	B	0.2040	0.70407±6
241006	Nepheline-sodalite syenite	C	0.3331	0.70425±5
241016	Nepheline-sodalite aplite	C	4.0524	0.70603±5
241025	Nepheline-sodalite aplite	C	2.5637	0.70526±4
241027*	Syenite	D	3.5945	0.70571±6
241038	Nepheline syenite	E	44.643	0.72321±46
241041	Syenite	F	11.646	0.70906±10
241170*	Syenite	G	0.3416	0.70414±6
241171*	Syenite	G	0.1351	0.70406±5
Apparent age 31±2 m.y. I.R. 0.7041±1				
241027*	Feldspar	D	3.365	0.70571±8
241027	Biotite	D	263.3	0.80452±18
241027	Biotite (repeat)	D	269.8	0.80882±8
Apparent age 27.1±2 m.y. I.R. 0.7044±6				
Kap Simpson				
241142	Mafic syenite		0.163	0.70478±9
241142	Hornblende		0.046	0.70469±16
241142	Biotite		22.68	0.7169±2
241142	Biotite (repeat)		24.23	0.7173±4
Apparent age 37.5±2 m.y. I.R. 0.70468±17				

Decay constant $^{87}Rb = 1.42 \times 10^{-11}\ y^{-1}$

Rb/Sr ratios determined by XRF which gave GSP-1 = 1.08, AGV-1 = 0.102, BCR-1 = 0.144

$^{87}Rb/^{86}Sr$ ± 2%. Errors quoted at 2σ level

NBS 987 = 0.71030±3

*Samples are from a moraine

A mineral isochron (Table 11) and K-Ar mineral determinations (Table 12) from the Kap Simpson intrusion yield ages of 38.5±5 m.y. and 38±2 m.y. respectively, while a K-Ar amphibole age (Table 12) from Kap Parry gives 40.3±1.2 m.y. These results agree within analytical error.

Discussion

The results reported here show that contrary to expectation (Bearth, 1959) there is a significant age difference between the intrusive rocks of the Kong Oscars Fjord area. The syenites and granites of the Werner Bjerge complex were emplaced about 30 m.y. ago and are thus the youngest igneous activity yet documented in East Greenland.

The somewhat older Kap Simpson and Kap Parry complexes correspond within experimental error with ages from the area of the Kialineq complex much further to the south (Brown *et al.*, 1977). All these rocks are younger than the syenites of the Kangerdlugssuq district (*c.* 500 km south of Werner Bjerge) which were intruded 50±1.0 m.y. ago (Pankhurst *et al.*, 1976).

Table 12. K-Ar age determinations from Werner Bjerge, Kap Simpson and Kap Parry

GGU sample no.	Mineral	%K	$Vol^{40}Ar_s$ sec/yx10^{-5}	$\%^{40}Ar$ rad	Age m.y.
Werner Bjerge					
241027	biotite	7.56	0.8286	69.7	28±1
Kap Simpson					
241142	biotite	6.88	1.0254	75.2	38±2
241142	amphibole	0.636	0.09469	46.9	38±2
Kap Perry					
124918	amphibole	1.35	0.2120	45.7	40.0
	(repeat)		0.2151	48.1	40.6

The initial $^{87}Sr/^{86}Sr$ ratios obtained here (Tables 11 & 12) are similar to those reported by Pankhurst *et al.* (1976) for similar rock types in the Kangerdlugssuaq intrusion, suggesting that these syenitic to granitic magmas all originated in a similar manner.

Acknowledgement

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References

Beckinsale, R. D., Brooks, C. K. & Rex, D. C. 1970: K-Ar ages for the Tertiary of East Greenland. *Bull. geol. Soc. Denmark* **20,** 27–37.

Bearth, P. 1959: On the alkali massif of the Werner Bjerge in East Greenland. *Meddr Grønland* **153,** 4, 66 pp.

Brown, P. E., van Breemen, O., Noble R. H. & MacIntyre, R. M. 1977: Mid-Tertiary igneous activity in East Greenland – the Kialineq complex. *Contr. Miner. Petrol.* **64,** 109–122.

Engell, J. E. 1975: The Kap Parry complex, central East Greenland. *Rapp. Grønlands geol. Unders.* **75,** 103–106.

Gleadow, A. J. W. & Brooks, C. K. in prep: Fission track dating, thermal history and tectonics of igneous intrusions in East Greenland.

Pankhurst, R. J., Beckinsale, R. D. & Brooks, C. K. 1976: Strontium and oxygen isotope evidence relating to the petrogenesis of the Kangerdlugssuaq alkaline intrusion, East Greenland. *Contr. Miner. Petrol.* **54,** 17–42.

Schaub, H. P. 1942: Zur Geologie der Traill Insel (Nordost-Grönland). *Eclog. geol. Helv.* **35,** 1–54.

Van Breemen, O. & Dodson, M. H. 1972: Metamorphic geochronology of the Limpopo Belt, Southern Africa. *Bull. geol. Soc. Amer.* **83,** 2005–2018.

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