8. AGE AND GEOLOGICAL SIGNIFICANCE OF A TONALITE PEGMATITE FROM EAST-CENTRAL BAFFIN ISLAND

J. R. Henderson and W. D. Loveridge

Henderson, J.R. and Loveridge, W.D., Age and geological significance of a tonalite pegmatite from east-central Baffin Island; in Rb-Sr and U-Pb Isotopic Age Studies, Report 4, in Current Research, Part C, Geological Survey of Canada, Paper 81-1C, p. 135-137, 1981.

Abstract

The age of the most recent penetrative deformation in the Home Bay region of east-central Baffin Island was found to be 1806 +15/-8 Ma, by the U-Pb method on zircon from a synkinematic tonalite pegmatite. This age is younger than two K-Ar cooling ages on hornblende obtained from the host amphibolite (1927 ± 47 Ma and 1876 ± 45 Ma).

Introduction

In order to establish the age of the most recent penetrative deformation in east-central Baffin Island (F_4, Henderson and Tippett, 1980) we obtained a U-Pb age on zircon from a synkinematic tonalite pegmatite that had crystallized in an extension fracture within an amphibolite layer. Figure 1 shows the sample locality and the regional geology. Figure 2 shows the relationship of the pegmatites to the enclosing rocks. In the Home Bay region (Fig. 1) the F_4 folding is characterized by upright, open to tight folds with northwest striking axial surfaces and gently inclined axes. The F_4 folds are developed north of a line extending east from Cape Hooper. The folds may have resulted from dextral rotation of east-northeast striking F_3 folds in a wide transcurrent shear zone. The pegmatite, composed of plagioclase (An_{22}), quartz and biotite, is little deformed compared with the foliated and lineated granodiorite gneiss composing the bulk of the country rock.

Analytical Proceedures and Results

Techniques for the concentration of zircon and the extraction and analysis of lead and uranium are described in Sullivan and Loveridge (1980). Analytical results are listed in Table 1 and displayed on a concordia diagram (Fig. 3). A description of the zircon morphology of the fractions as analyzed is presented in the Appendix. The three fractions analyzed yielded data points, collinear within analytical uncertainty, defining a chord which cuts the concordia curve at 1806^{+15}_{-8} and 47^{+509}_{-47} Ma. K-Ar ages on hornblende concentrates from the host amphibolite (1927 ± 47 Ma) and from an amphibolite inclusion in the pegmatite (1876 ± 45 Ma) are documented in Table 2.

Table 1

Analytical data, zircon fractions from tonalite pegmatite, east-central Baffin Island

Fraction number		1	2	3
Fraction size		+149	-149+105	-149+105
Magnetic or non magnetic		-	n.m.	mag.
Weight, mg		4.68	3.61	2.44
Total Pb, ng		147.2	113.8	98.89
Pb Blank, %		1.0	1.3	1.5
Observed	$^{206}Pb/^{204}Pb$	5123	3535	1718
*Abundances (^{206}Pb=100)	^{204}Pb	0.00213	0.00559	0.03190
	^{207}Pb	11.066	11.096	11.468
	^{208}Pb	12.855	13.782	14.796
Radiogenic Pb, ppm		103.8	102.6	109.3
%		99.88	99.70	98.30
Uranium, ppm		309.2	307.2	330.4
Atomic ratios	$^{206}Pb/^{238}U$	0.31520	0.31159	0.30828
	$^{207}Pb/^{235}U$	4.7969	4.7348	4.6910
	$^{207}Pb/^{206}Pb$	0.11037	0.11020	0.11035
Ages, Ma	$^{206}Pb/^{238}U$	1766	1749	1732
	$^{207}Pb/^{235}U$	1784	1773	1766
	$^{207}Pb/^{206}Pb$	1805	1803	1805

*Corrected for Pb blank

Table 2

K-Ar age determinations

Hornblende concentrate from host amphibolite:
Age = 1927 ± 47 Ma

K = 1.19%, $^{40}Ar/^{40}K$ = 0.2001, radiogenic ^{40}Ar = 97.5%

Concentrate: Clean, fresh, unaltered, pleochroic light brown to dark green hornblende with no contamination.

Hornblende concentrate from amphibolite inclusion in pegmatite: Age = 1876 ± 45 Ma

K = 1.22%, $^{40}Ar/^{40}K$ = 0.1918, radiogenic ^{40}Ar = 94.9%

Concentrate: Clean, fresh, unaltered, pleochroic brown to dark green hornblende with no contamination.

Interpretation

We interpret the upper concordia intercept age of the zircon, 1806^{+15}_{-8} Ma, as the time of crystallization of the pegmatite in an extending crack in the amphibolite during F_4. We suggest the older K-Ar hornblende ages from the host amphibolite may indicate that the rocks had cooled below 500°C at least 10 Ma before the pegmatite crystallized. We also suggest that if biotite tonalite magmas crystallize above 650°C as indicated by the experimental studies of Winkler (1979), it would appear that the pegmatite dated in this study crystallized from an aqueous solution rather than a silicate magma.

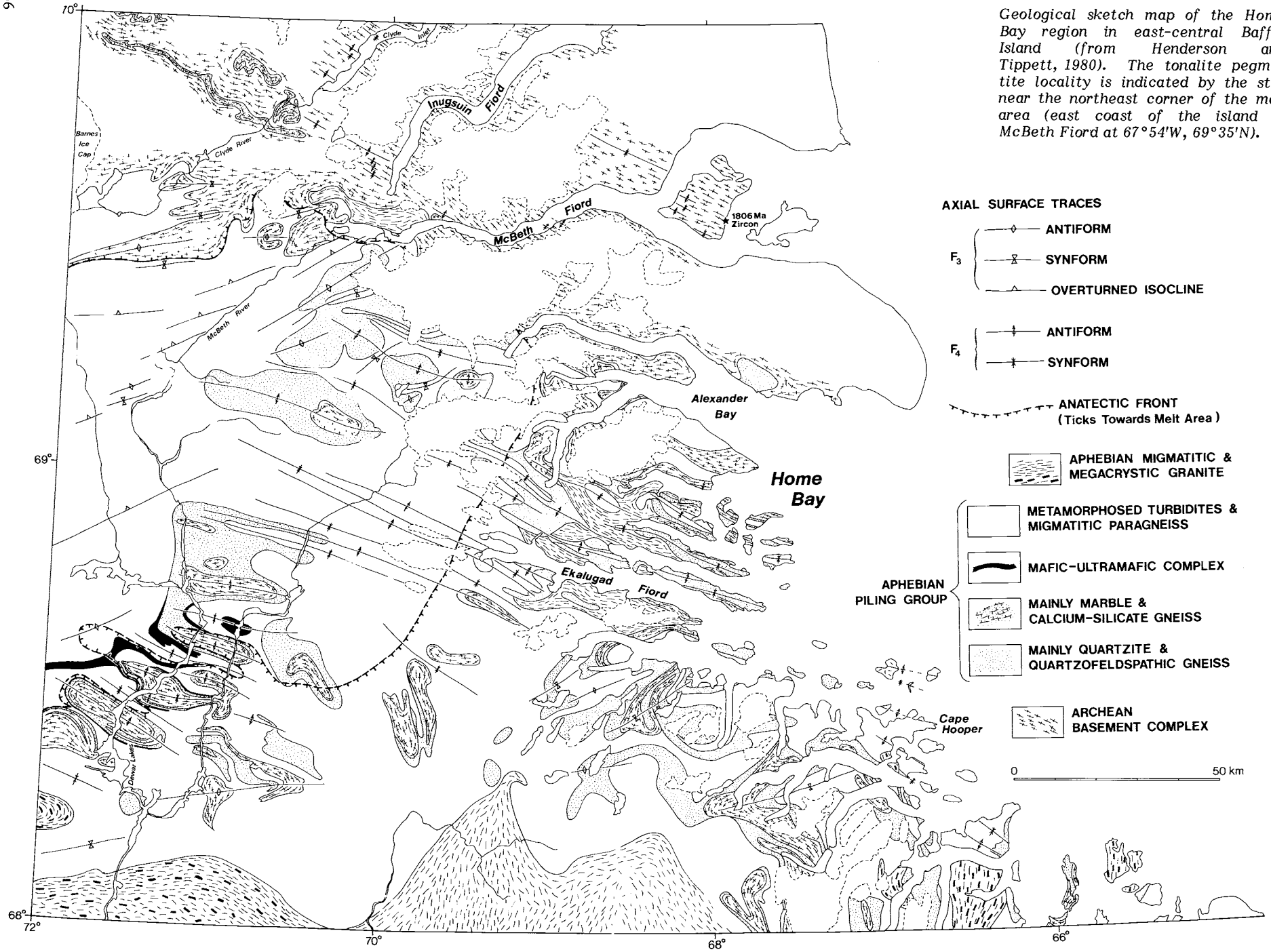

Figure 1.

Geological sketch map of the Home Bay region in east-central Baffin Island (from Henderson and Tippett, 1980). The tonalite pegmatite locality is indicated by the star near the northeast corner of the map area (east coast of the island in McBeth Fiord at 67°54'W, 69°35'N).

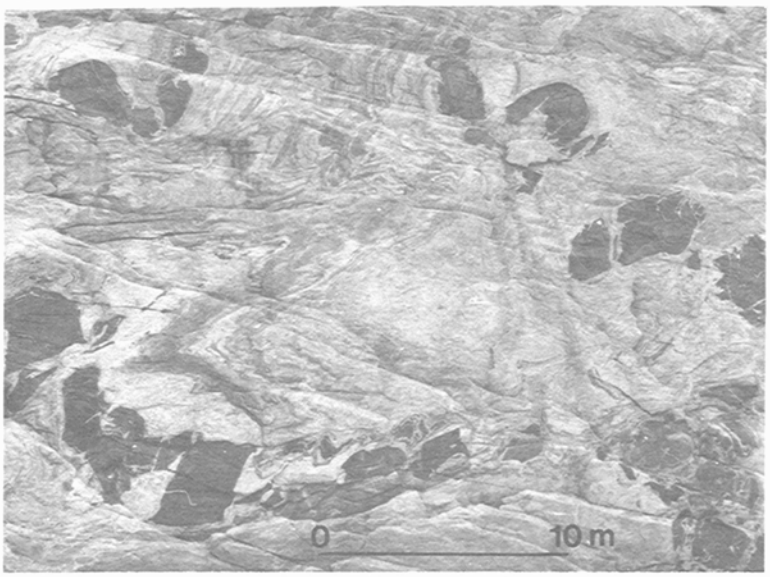

Figure 2. *Vertical cliff exposure of boudinaged amphibolite (black) with white pegmatite in extension fractures. Granodiorite gneiss composes the bulk of the country rock. The tonalite pegmatite dated in this study was collected from an analogous setting nearby.*

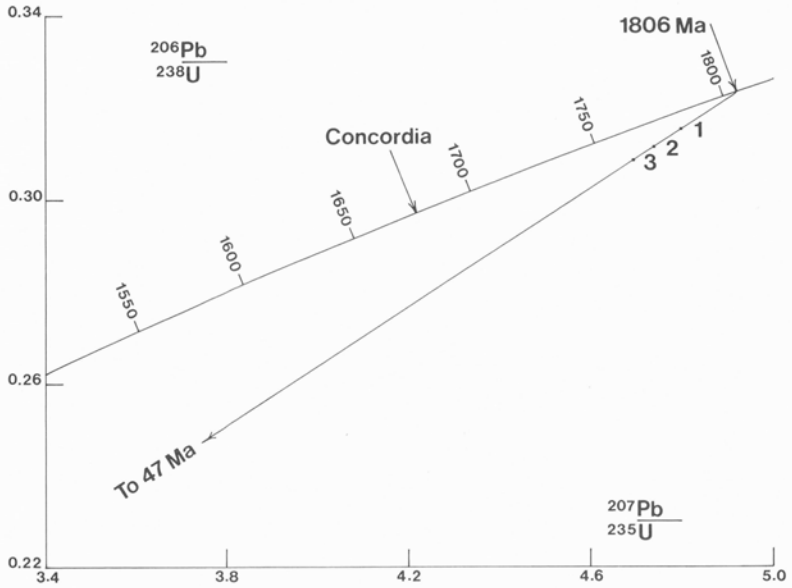

Figure 3. *Concordia diagram showing the results of analyses of zircon concentrates from tonalite pegmatite, east-central Baffin Island.*

Conversely, the older K-Ar hornblende ages may be the result of excess argon in the hornblende. Further geochronological work is planned to discriminate between these two possibilities.

References

Henderson, J.R. and Tippett, C.R.
1980: Foxe Fold Belt in eastern Baffin Island, District of Franklin; in Current Research, Part A, Geological Survey of Canada, Paper 80-1A, p. 147-152.

Sullivan, R.W. and Loveridge, W.D.
1980: Uranium-lead age determinations on zircon at the Geological Survey of Canada: current procedures in concentrate preparation and analysis; in Loveridge, W.D., Rubidium-strontium and uranium-lead isotopic age studies, Report 3; in Current Research, Part C, Geological Survey of Canada, Paper 80-1C, p. 161-246.

Winkler, H.G.F.
1979: Petrogenesis of metamorphic rocks (Fifth Edition), Springer-Verlag, 324 p.

APPENDIX

Description of zircon concentrates as analyzed, tonalite pegmatite from east-central Baffin Island.

Fraction 1, +149 µm: The original, somewhat impure concentrate was sieved to separate the +149 µm fraction which was then hand picked to approximately 100 per cent pure, clear, very pale purple zircon grains. Most of the crystals were euhedral, equidimensional to only moderately elongated (2.3:1), and of generally rounded appearance. All grains were very pure and free of inclusions. No zoning was observed.

Fractions 2 and 3, -149 +105 µm: The -149 +105 µm fraction was separated into relatively magnetic and nonmagnetic subfractions by repeated passes through a Frantz Isodynamic separator. Both subfractions were hand picked to yield approximately 100 per cent pure zircon samples. The nonmagnetic split, Fraction 2, consisted of very clear essentially colourless equidimensional to moderately elongated crystals some of which contained one or more fine crystalline inclusions and very small "dusty" central spots.

This description applies equally to Fraction 3, the more magnetic split, except for the presence of a tinge of very pale purple.

We thank R.D. Stevens for supplying the zircon descriptions.

AUTHOR INDEX