U-Pb and Rb-Sr age determinations on Caledonian plutonic rocks in the central part of the Scoresby Sund region, East Greenland

B. T. Hansen, R. H. Steiger, N. Henriksen
and B. Borchardt

Abstract

Five new U-Pb age determinations on zircons and three new or reanalysed Rb-Sr age determinations of some of the late orogenic plutonic bodies from the Gåseland – Stauning Alper migmatite and granite zone in the Scoresby Sund region, give Caledonian ages between 428 Ma and 352 Ma. Together with previously published age determinations they suggest a main intrusive epoch around 420 Ma with the last intrusive events as late as 390 – 350 Ma. In addition analytical data for six previously published Rb-Sr ages from the region are reassessed and presented in full.

B. T. H. & B. B., Institut für Mineralogie, Westfälische Wilhelms-Universität, Corrensstrasse 24, D – 4400 Münster, Western Germany.
R. H. S., Institut für Kristallographie, Eidg. Techn. Hochschule, Sonneggstrasse 5, CH – 8006 Zürich, Switzerland.
N. H., Grønlands Geologiske Undersøgelse, Øster Voldgade 10, DK – 1350, Copenhagen K, Denmark.

The study of the geology and the geochronology of the southern part of the Caledonian fold belt in East Greenland has revealed that large parts of the fold belt comprise complexes of Archaean and Proterozoic rock units variously reworked during the Caledonian orogeny. The pre-Caledonian rock units include both infracrustal and supracrustal rock sequences reflecting orogenic events dated at 3000 – 2300 Ma, 2000 – 1800 Ma and 1200 – 1000 Ma (Steiger *et al.*, 1979; Hansen *et al.*, 1978, 1981; Rex & Gledhill, 1981). A thick sequence of upper Proterozoic to Ordovician sediments deposited on this older basement was subsequently involved, together with the basement in the Caledonian orogeny. The whole region was subjected to Caledonian regional metamorphism and parts of the basement were mobilised and variously deformed. Caledonian migmatisation and plutonism were widespread and a variety of late orogenic plutonic rocks were emplaced. Some of these plutons were intruded into the pre-Caledonian basement complexes, but many occur in the border zone between the infracrustal basement complexes and belts of upper Proterozoic – Ordovician sediments (Higgins & Phillips, 1979; Henriksen, 1984).

In the inner parts of the Scoresby Sund region between 70° and 72°N there are no upper Proterozoic – Ordovician sediments and the whole region here is formed by a complex of Archaean and Proterozoic gneisses, migmatites and granites, which in the eastern part have

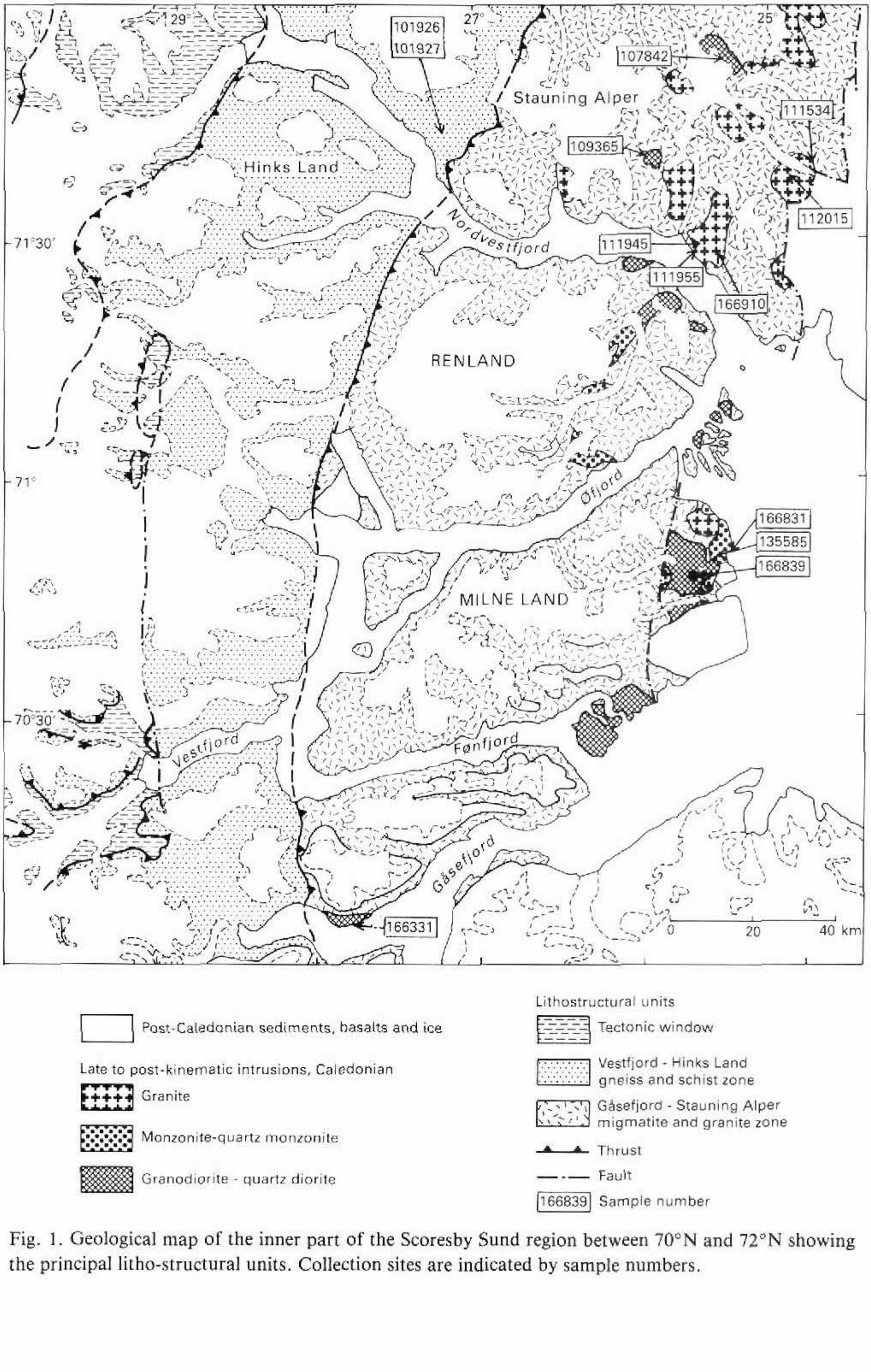

Fig. 1. Geological map of the inner part of the Scoresby Sund region between 70°N and 72°N showing the principal litho-structural units. Collection sites are indicated by sample numbers.

been influenced by Caledonian migmatisation and plutonism. Three major lithostructural units may be distinguished: (1) Caledonian foreland rocks exposed in three tectonic windows below Caledonian thrusts along the rim of the Inland Ice. (2) The Vestfjord – Hinks Land gneiss and schist zone made up of interfolded Archaean gneisses and Middle Proterozoic schists; this 40 – 60 km wide zone trends *c.* N – S and occupies the innermost fjord zone. (3) The Gåsefjord – Stauning Alper migmatite and granite zone, made up of Middle Proterozoic and Caledonian migmatites and granites; it forms the eastern complexes and is an 80 km wide N – S trending zone.

The Gåseland – Stauning Alper migmatite and granite zone is dominated by gneissic migmatites and various synkinematic to post-kinematic plutonic rocks. Palaeosome bands, lenses and schlieren in the migmatites are mainly relics of the Middle Proterozoic Krummedal supracrustal sequence (Henriksen *et al.*, 1980). Generally there is an increasing degree of migmatisation from west to east. The migmatite and granite zone has a complex genesis, migmatisation, deformation and plutonism taking place during both middle Proterozoic and Caledonian orogenesis. The middle Proterozoic event has been dated by Rb-Sr whole rock isochron and zircon analyses on augen granites which gave ages of 987 Ma and 1053 Ma respectively.

The earliest Caledonian event recorded is intrusion of a thick hypersthene monzonite sheet dated at *c.* 475 Ma (Steiger *et al.*, 1979). Late to post-kinematic plutonic intrusions are widespread in the eastern part of the migmatite and granite zone. They normally cut through the adjacent migmatite rocks with sharp boundaries, but some have gradational boundaries. It is sometimes possible to trace links between the intrusive bodies and the neosome veins and sheets in the migmatites. Isotopic analyses on a variety of the late to post-kinematic plutonic intrusions have given ages mainly in the range 430 – 410 Ma, but with some both older and younger ages (Hansen *et al.*, 1972, 1973; Hansen & Steiger, 1971, 1976; Hansen & Tembusch, 1979; Steiger *et al.*, 1979).

This paper deals in part with new U-Pb and Rb-Sr age determinations of some of the late orogenic plutonic bodies from the Gåseland – Stauning Alper migmatite and granite zone which all give Caledonian ages. Furthermore this paper reassesses and presents analytical data for some isotopic studies on intrusive bodies and a few other rock types published in preliminary form in earlier progress reports (Hansen & Steiger, 1971, 1976; Hansen *et al.*, 1972, 1973).

Sampling and analytical procedures

The location of the analysed samples is indicated in fig. 1 and Table 1. The material for zircon separation was obtained by the authors by drilling and blasting from sites exhibiting fresh and homogenous rock, about 100 kg being collected at each locality. The 1 – 5 kg specimens used for Rb-Sr mineral analyses were mainly supplied by other GGU field geologists.

Samples marked with one asterisk in Tables 2 and 3 were analysed in Zürich according to the methods described by Steiger *et al.* (1979). Samples marked with two asterisks were analysed in Münster according to the methods of Persson *et al.* (1983) for the U-Pb analyses and Persson & Hansen (1982) for the Rb-Sr analyses. All ages quoted in this paper have been recalculated using the constants recommended by the IUGS Subcommission (Steiger & Jäger, 1977). Errors based on replicate analyses are 0.7% for $^{207}Pb/^{235}U$, 0.4% for $^{206}Pb/^{238}U$ and $^{207}Pb/^{206}Pb$; for the $^{87}Sr/^{86}Sr$ and $^{87}Rb/^{86}Sr$ errors of 0.05 and 1.5%, respectively, were assigned. Regression lines were calculated according to the least squares method of York (1969). Errors quoted in this paper are 2σ of the means.

Plutonic rocks and migmatites from the Stauning Alper

Henriksen *et al.* (1980) made a distinction in the Stauning Alper between heterogeneous medium-grained migmatites with schlieren and enclaves of palaeosome material and a series of more homogeneous plutonic intrusions. The intrusive bodies are mainly granitic, forming sheets and stocks varying in size from thin veins to bodies more than 10 km across. In larger bodies a range of rock types may be found, varying in lithology and texture. Some bodies are conformable, slightly foliated sheets with streaks and inclusions, while others are clearly cross-cutting homogeneous rocks. Four groups have been distinguished: leucocratic granites, dioritic to granodioritic bodies, granodioritic to quartz-monzonite bodies, and granites with associated syenites. Samples from the two last mentioned groups and from granitic migmatites are dealt with here.

Table 1. Zircon and Rb-Sr mineral ages from Caledonian rocks in the Scoresby Sund region

	GGU sample no	Age Ma	Locality	Coordinates
Granodiorite-quartz-monzonite	107842	Zr 420±2	Roslin Borg, Stauning Alper	71°53′N, 25°17′W
	107842	Rb-Sr 428±8		
	109365	Rb-Sr 406±7	Borgbjerg Gletscher	71°41′N, 25°45′W
Granites and associated syenites	166910	Zr 393±9	Oxford Gletscher	71°33′N, 25°21′W
	111955	Rb-Sr 440±7	" "	71°29′N, 25°30′W
	111945	Rb-Sr 415±7	" "	71°30′N, 25°34′W
	112015	Rb-Sr 464±8	Bjørnebo Gletscher	71°37′N, 24°57′W
Mafic quartz monzonite	166831	Zr 418^{+5}_{-13}	East Milne Land	70°52′N, 25°30′W
	135585	Rb-Sr 395±7	" " "	70°51′N, 25°31′W
Pink granite	166839	Zr 352^{+30}_{-15}	" " "	70°48′N, 25°33′W
Quartz diorite	166331	Zr 416^{+19}_{-21}	South Gåseland	70°07′N, 27°42′W
Migmatite	111534	Rb-Sr 410±7	Bjørnebo Gletscher	71°39′N, 24°44′W
Metadolerite	101927	Rb-Sr 481±13	Inner Nordvestfjord	71°43′N, 27°13′W
Pegmatite	101926	Rb-Sr 385±5	" "	71°43′N, 27°13′W

Zr: U-Pb zircon age
Rb-Sr: Rb-Sr mineral ages

Granodiorites

Sample 107842 (fig. 1) is from a large 25 km^2 intrusion centered on Roslin Borg in the northern part of the Stauning Alper. The rocks are dark, grey homogeneous and contain biotite, hornblende and clinopyroxene; the composition varies from quartz monzonite to quartz monzodiorite and granodiorite to tonalite. Locally the bodies contain rounded inclusions of more melanocratic rock types.

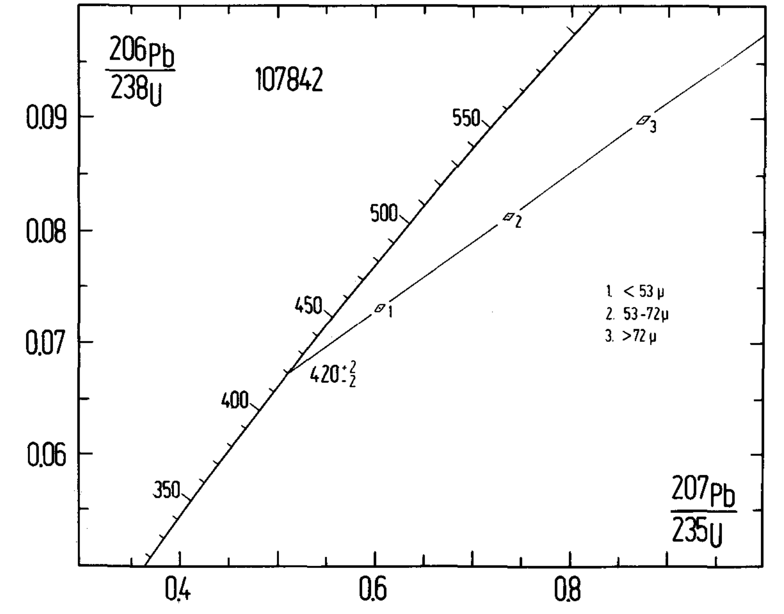

Fig. 2. Concordia plot of the analysed zircon fractions from sample 107842.

The U-Pb measurements on zircons from sample 107842 (Table 2, fig. 2) suggest that emplacement took place during Caledonian time. Although the three data points lie on a discordia with a lower intercept of 420 ± 2 Ma, such high discordancy of uranium-poor zircons (~ 400 ppm) is difficult to explain either by episodic or continuous lead loss. The age of 420 Ma is regarded therefore as an intrusion age, and is in agreement with a new Rb-Sr biotite age of 428 ± 8 Ma from the same sample (Table 3). The latter was obtained on a re-purified concentrate of the same sample from which Hansen & Steiger (1971) reported a preliminary Rb-Sr biotite age of 1130 Ma. The zircons analysed are well developed, euhedral, elongate and clear crystals, some of which show zonal growth around older cores which suggest magmatic growth. It is difficult to judge whether the age of 1688 Ma implied by the upper intersection has any geochronological meaning, but the high $^{207}Pb/^{206}Pb$ ratios clearly show that components of at least 950 Ma in age are present.

Another body belonging to this group is represented by sample 109365, from a body on the east side of Borgbjerg Gletscher (fig. 1). It is a dark grey biotite-hornblende granodiorite occupying an area of several km^2. Hansen *et al.* (1972) presented a preliminary Rb-Sr K-feldspar-biotite age of 619 Ma from this rock. As this age is controlled mainly by the biotite, a new concentrate was analysed using the double spike technique (Table 3), and the slope of the reference line for K-feldspar and biotite now corresponds to an age of 406 ± 7

Ma, which confirms that the group of granodioritic to quartz-monzonitic bodies within the Stauning Alper are of Caledonian age.

The three results obtained from this group all indicate intrusion approximately 420 – 406 Ma ago.

Granites

In the southern and eastern parts of the Stauning Alper composite bodies of granitic and syenitic rocks occur. The granites are biotite and biotite-hornblende bearing types which grade into clinopyroxene and biotite-bearing hornblende quartz syenites and syenites. Parts of the granites may be porphyritic. In a few intrusions andalusite and cordierite have been recorded, possibly indicating some metamorphism after their intrusion, but in general the age relations to the adjacent migmatites indicate that the granites were emplaced after the main phases of migmatisation.

Four samples representing this group of rocks have been analysed. Three of these (samples 166910, 111955 and 111945) come from localities within a 5 by 15 km complex west of Oxford Gletscher (fig. 1). The fourth sample (112015) stems from a 6 by 10 km complex in the lower part of Bjørnbo Gletscher.

The body at Oxford Gletscher has a core of clinopyroxene-biotite-hornblende syenite with the main part of the body formed by a porphyritic biotite granite and hornblende-biotite granite. Parts of the body have a granodioritic composition.

Three sieve fractions of zircons from sample 166910 were analysed (Table 2). The data points show an extreme spread and point to an intrusion age of 393 ± 9 Ma (fig. 3). As the zircons have uranium contents of some 400 ppm, it seems unlikely that this is a metamorphic

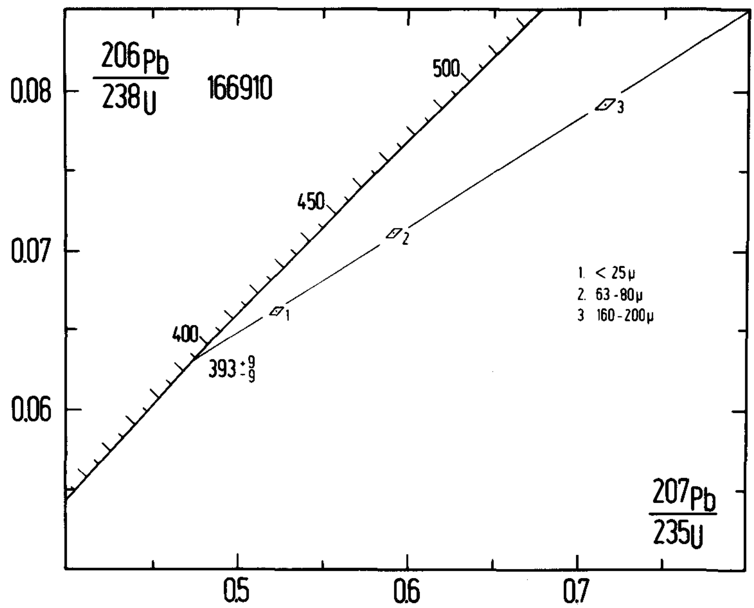

Fig. 3. Concordia plot of the analysed zircon fractions from sample 166910.

age caused by episodic lead loss. The fraction < 25 μ plots rather close to the concordia pointing to a magmatic formation; however, the coarse fraction clearly shows the presence of a component at least 795 Ma old. A similar granite to the north has given a conventional zircon age of 329 ± 2 Ma, but this age is considered as too low due to recent lead loss. Leach experiments indicate true intrusion age at 439 ± 12 Ma (Hansen & Friderichsen, unpublished). The granite (166910) may also have suffered a small recent lead loss, giving rise to the slightly young age.

Two other samples from this Oxford Gletscher complex have previously been analysed, and Rb-Sr mineral ages were published by Hansen *et al.* (1972, 1973). The analytical results on which these ages are based are here published in full for the first time. The samples have GGU nos 111955 and 111945.

Sample 111955 is a garnet cordierite biotite granite collected as a block below exposures of the southern part of the Oxford Gletscher granite body. The sample indicates that the mineral paragenesis is similar to that found in the migmatites adjacent to the granite. It is therefore uncertain which of the two rock units the sample represent. The Rb-Sr biotite age of 440 ± 7 Ma was published by Hansen *et al.* (1972), and the analytical data is presented in Table 3. The date indicates either a synkinematic metamorphism or partial or complete updating of an older rock.

Sample 111945 was collected at the base of a sub-horizontal sheet-formed homogeneous granodioritic body emplaced into migmatites. Hansen *et al.* (1973) presented a Rb-Sr age of 415 ± 7 Ma for the two-mineral isochron of K-feldspar and biotite. The previously unpublished analytical data are given in Table 3.

The complex at Bjørnbo Gletscher is represented by sample 112015 from a porphyritic biotite granite. A biotite – K-feldspar mineral isochron of 464 ± 8 Ma was published by Hansen *et al.* (1972) and the analytical data are now presented for the first time in Table 3.

The large spread in ages from 464 to 393 Ma obtained from the four samples suggests a heterogeneous and composite origin for the group of granites and associated syenites. The zircon U/Pb diagram from the zircon determinations of sample 166910 from the Oxford Gletscher body supports this assumption, as it indicates the presence of a pre-Caledonian component.

Migmatites

The migmatite and granite zone is dominated by migmatitic rocks, divided into gneissic migmatites and granitic migmatites (Henriksen *et al.*, 1980). Gneissic migmatites are typically heterogeneous, banded varieties, while granitic migmatites appear homogeneous at a distance but show considerable variation at close quarters. The neosome component forms 30 – 80% of the migmatites, with the largest proportion in the granitic migmatites.

One sample from this group of rocks (111534) has previously been dated giving a biotite – K-feldspar age of 410 ± 7 Ma (Hansen *et al.*, 1972) and the analytical data for this age is here presented for the first time in Table 3. The dated rock is a migmatitic neosome with a quartz-bearing hornblende syenitic composition. Feldspar forms coarse-grained leucocratic layers, and the biotite originates from dark layers. The biotite – K-feldspar mineral isochron points to a high initial $^{87}Sr/^{86}Sr$ ratio (0.7487) confirming the multistage history of the rock. The age dates either the formation of the migmatite or the last significant metamorphic overprint.

Table 2. U-Pb analytical data from plutonic rocks in the Scoresby Sund region

GGU sample No & sieve fraction[a] in μm	mg sample analysed	Observed atomic ratios $^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{204}Pb$	U ppm	Pb_{rad} ppm	$^{206}Pb_{rad}$ n mol/g	Atomic ratios corrected for blank[b] and common Pb $^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$
GGU 107842 *										
< 53 T	5.8	0.1757	O.07728	840	400	30.0	122	0.07308	0.6057	0.06018
53 – 72 T	8.3	0.1538	0.07616	1391	398	33.3	134	0.08134	0.7384	0.06592
> 72 T	5.7	0.2262	0.11055	292	380	34.6	142	0.08973	0.8758	0.07088
GGU 166331 *										
< 40 T	3.75	0.11430	0.06326	2596	455	32	134.3	0.07073	0.56195	0.05762
40 – 80 I	7.6	0.10218	0.05988	8590	462	32	135.9	0.07058	0.56596	0.05816
80 – 100 T	7.4	0.11902	0.06683	3019	384	29	121.2	0.07574	0.64790	0.06204
> 100 I	5.05	0.13483	0.07886	1871	305	30	122.8	0.09644	0.94660	0.07119
GGU 166831 *										
< 25 M	7.2	0.27820	0.06940	1060	280	22	79.1	0.06783	0.52030	0.05563
< 25 NM	10.0	0.27736	0.07184	900	283	22.3	80.3	0.06793	0.52103	0.05563
80 – 100 NM	14.2	0.27125	0.07855	648	479	38.6	134.7	0.06745	0.52124	0.05605
50 – 63 M	11.0	0.28914	0.08339	552	230	19.1	65.8	0.06850	0.53842	0.05700
125 – 160 NM	10.7	0.27815	0.07879	666	244	20.1	70.3	0.06909	0.54219	0.05692
GGU 166839 * *										
< 100 NM	3.0	0.76876	0.31585	55.9	5547	604	947	0.04095	0.30770	0.05450
100 – 160 T	6.2	1.16335	0.45555	36.4	5035	1315	1218	0.05799	0.42783	0.05351
> 160 T	5.6	0.78647	0.29606	60.7	5472	626	1019	0.04461	0.33688	0.05476
GGU 166910 * *										
< 25 T	6.0	0.20455	0.06796	1369	459	33.7	126.7	0.06615	0.52288	0.05733
63 – 80 T	7.5	0.18470	0.07427	1041	452	35.3	134.2	0.07115	0.59187	0.06034
160 – 200 T	10.0	0.14689	0.07298	1956	371	30.9	122.4	0.07919	0.71640	0.06561

a T = Total fraction, no magnetic separation, NM = Low relative magnetic susceptibility, M = High relative magnetic suceptibility, I = Fraction of idiomorphic grains.

b Composition of lead used for blank correction $^{206}Pb/^{204}Pb$ = 18.7, $^{207}Pb/^{204}Pb$ = 15.63, $^{208}Pb/^{204}Pb$ = 38.63
The composition of common lead used for correction accords to the model of Stacey & Kramers (1975).

* Sample analysed in Zürich * * Sample analysed in Münster

Plutonic rocks from east Milne Land

Late to post-kinematic plutonic intrusions of Caledonian age form the major part of extreme east Milne Land, which is separated from the migmatite zone, making up the rest of Milne Land, to the west by a prominent NNE – SSW trending fault (Henriksen & Higgins, 1971). The plutonic rocks cut discordantly through folded metasedimentary rocks, and are overlain unconformably by Mesozoic sediments which cross the fault line without displacement. The oldest intrusions are granodioritic and the youngest are granitic (Henriksen & Higgins, in press). Preliminary Rb-Sr mineral and whole rock ages were published by Hansen *et al.* (1972) and Hansen & Steiger (1976). A more extensive study dealing with Rb-Sr whole rock analyses on two post-kinematic intrusions and the metasediments was presented by Hansen & Tembusch (1979).

The oldest and most extensive of the plutonic bodies is of granodiorite to quartz diorite composition, and may have been emplaced as a thick sheet. It contains numerous mafic inclusions of igneous origin. The granodiorite has yielded a Rb-Sr whole rock isochron age of 453 ± 23 m.y. (Hansen & Tembusch, 1979). Another major pluton comprises a coarse-grained mafic quartz monzonite, and is clearly younger than the adjacent granodiorite-quartz diorite and a body of leucocratic granite. A series of small pink, granitic bodies form the youngest intrusions in the area. They are sub-circular to irregular shaped bodies punching up through the surrounding older plutons.

Mafic quartz monzonite

Sample 166831 comes from the south-west part of a large intrusion, of which only the western part outcrops on Milne Land; the main part is covered by the sea to the east. Along a part of the northern margin the quartz monzonite is chilled against the adjacent leucocratic granite. In the internal parts the rock is very coarse-grained, in parts pegmatitic.

U-Pb analyses on five zircon fractions are presented in Table 2. The data obtained for the magnetic and non-magnetic fractions of the same grain size are coincidental within limits of error. All five fractions plot close to the concordia (fig. 4) indicating that only very little inherited older material is present in the zircons. The age of 418 $^{+5}_{-13}$ Ma is interpreted as representing the age of intrusion.

A preliminary Rb-Sr biotite age of 1315 ± 20 Ma from another locality in the mafic quartz monzonite was published by Hansen *et al.* (1972). This sample (135585) has now been reanalysed using the double-spike technique, and gives an age of 395 ± 7 Ma (Table 3). This age is considered to be a cooling age.

Pink granite

One of the stocks of pink granite intruding the granodiorite on Milne Land was dated by Hansen & Tembusch (1979); it yielded a Rb-Sr whole rock isochron of 373 ± 9 m.y. This stock, about 1500 m in diameter, has a characteristic development of the feldspars and contains a little hornblende in addition to biotite. Petrological and chemical studies (A. K. Higgins, personal communication) indicate that it is a quartz-poor granite, and differs slightly from the other pink granites. -

In order to test the young age, one of the samples (166839) used for the Rb-Sr whole rock dating was analysed by means of the U-Pb method on zircons. The three size fractions analysed (Table 2) yielded an age of 352 $^{+30}_{-15}$ Ma which is in agreement with the Rb-Sr whole rock age within limits of error. One of the data points (fraction 100 – 160 μ) plots slightly above the concordia (fig. 5). This is probably due to the fact that these zircons are extremely uranium-rich (> 5000 ppm) and that precision may be overestimated by measuring extreme underspiked samples rather than taking the effect of uranium gain into account. However, this pluton shows a rather high content of uranium with a sample gamma count rate of 38 cpm.

Quartz diorite from Gåseland

Major sheet formed bodies of biotite-hornblende quartz diorite occur in the southern part of the migmatite and granite zone at the south coast of Gåseland and at the south-east corner of Milne Land (Henriksen & Higgins, 1973; Bucher-Nurminen, 1979). These sheets are in places more than 500 m thick; they are conformable with the structure in the adjacent

Table 3. Rb-Sr analytical data from plutonic rocks in the Scoresby Sund region

Sample GGU No.	Type of sample[a]	Rb ppm	Total Sr ppm	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$[b]	Age in Ma
101926*	Bi	848	5.09	652	4.300	385 ± 5
101926*	Kf	290	467	1.81	0.7400	
101927*	Bi	272	85.1	9.31	0.7695	481 ± 13
101927*	Hb	10.7	125	0.248	0.7074	
107842*	Bi	475	52.3	26.7	0.8706	428 ± 8[c]
109365*	Bi	626	19.7	97.4	1.273	406 ± 7
109365*	Kf	102	1997	0.148	0.7107	
111534*	Bi	929	14.0	217	2.016	410 ± 7
111534*	Kf	222	323	2.00	0.7603	
111945*	Bi	509	25.0	61.2	1.067	415 ± 7
111945*	Kf	58.3	2491	0.678	0.7096	
111955*	Bi	675	5.19	489	3.775	440 ± 7[c]
112015*	Bi	524	51.1	30.3	0.9112	464 ± 8
112015*	Kf	122	2055	0.172	0.7120	
135585*	Bi	548	20.4	81.3	1.165	395 ± 7[c]

* sample analysed in Zürich
* * sample analysed in Münster

a Bi = biotite
Kf = K-feldspar
Hb = hornblende
b $^{87}Sr/^{86}Sr$ normalised to $^{86}Sr/^{88}Sr$ of 0.1194
c Bi-ages calculated with an initial $^{87}Sr/^{86}Sr$ ratio of 0.708

migmatites and are sometimes foliated, especially in the marginal zone. The quartz diorites are dark grey, medium grained rocks which in addition to biotite and hornblende may contain clinopyroxene. Numerous small rounded inclusions of mafic diorite are characteristic in places, similar to those found in the granodiorite-quartz diorite of east Milne Land. The quartz diorites are apparently younger than the main regional migmatisation and deformation; however, they are slightly metamorphosed and slightly deformed and are cut by abundant, pale pink, biotite pegmatites.

Sample 166331 was taken from the south-eastern part of a 10 km long and 500 m thick quartz diorite body at the southern coast of Gåseland. From this sample four zircon fractions have been analysed for U and Pb (Table 2). The data points are plotted in fig. 6 and show a considerable spread indicating a high proportion of inherited material in the zircons. However, the fine fractions plot rather close to the concordia indicating an intrusion age of 416^{+19}_{-21} Ma. The data points do not define an ideal chord (MSWD: 3.08); however, the age obtained from the two fractions of idiomorphic zircons agrees with that of the two total fractions within limits of error. The age of 416 Ma concurs with the field evidence that the granite is younger than the main regional migmatisation.

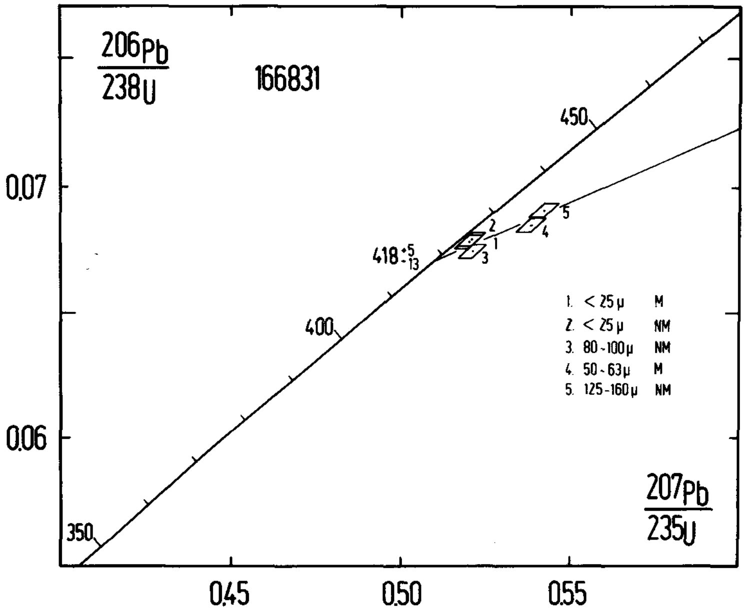

Fig. 4. Concordia plot of the analysed zircon fractions from sample 166831.

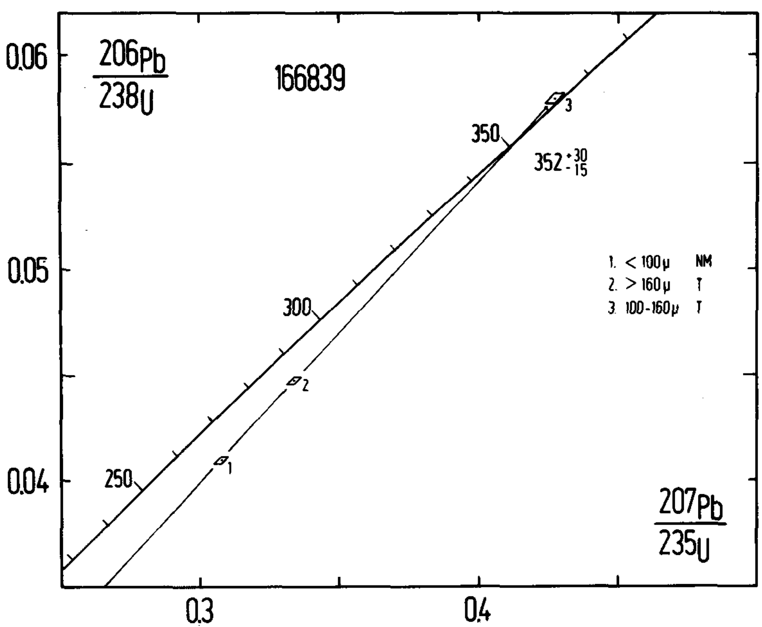

Fig. 5. Concordia plot of the analysed zircon fractions from sample 166839.

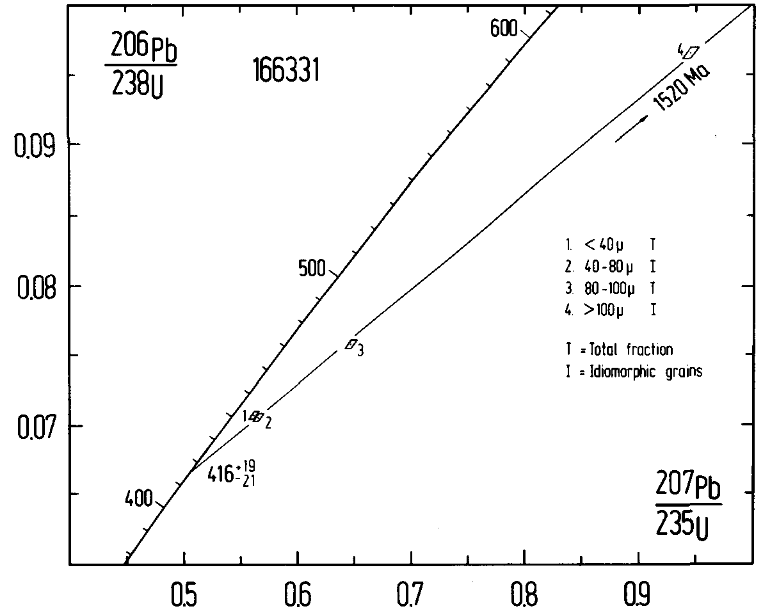

Fig. 6. Concordia plot of the analysed zircon fractions from sample 166331.

Rb-Sr data from a metadolerite and a pegmatite in the pre-Caledonian basement

The oldest unit recognised in the Vestfjord – Hink Land gneiss and schist zone in the innermost fjord zone is the Flyverfjord infracrustal complex which forms a gneissic basement to the overlying Middle Proterozoic cover sequence (Krummedal supracrustal sequence; Henriksen *et al.,* 1980; Higgins, 1974). Metadolerites are widespread as swarms of discordant amphibolites in the basement gneisses, and are themselves cut by younger pegmatites. Rb-Sr mineral ages from a metadolerite and a pegmatite have previously been published (Hansen & Steiger, 1971) but without the analytical data, which are here presented in Table 3.

Sample 101927 originates from a metadolerite which intrudes the surrounding banded gneiss with sharp contacts. The Rb-Sr age of 481 ± 13 Ma calculated from the determinations on biotite and hornblende may be interpreted as the age of metamorphism of the dolerite, or more likely a mixed age, the dolerite being of pre-Caledonian origin with partial updating during Caledonian time.

Sample 101926 represents an undeformed pegmatite which cuts the dated metadolerite. The biotite – K-feldspar tieline indicates an age of 385 ± 5 Ma. The age probably reflects the emplacement of the pegmatite or the late uplift of the area. Similar young ages have been recorded in other areas of the Caledonian fold belt to the north of the Scoresby Sund area (Rex & Gledhill, 1981).

Conclusions

The results presented in this paper show a considerable spread of ages and do not indicate a simple pattern. The main conclusion is without doubt that most of the dated plutonic rocks have yielded clear Caledonian ages, although some of them reflect a multistage history with inclusions of older components. The zircon ages generally confirm the Rb-Sr ages, and thus support the general interpretation. The first Caledonian plutonic rocks in the Scoresby Sund region were emplaced at approximately 475 Ma (Steiger *et al.,* 1979), but the main intrusive epoch took place around 420 m.y. ago according to present knowledge. The last intrusive events were as late as 390 – 350 Ma. Regional cooling to the Rb-Sr biotite blocking temperature of 350°C was reached about 410 – 395 m.y. ago.

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