SCOTLAND—FINLAND PRECAMBRIAN CORRELATIONS

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Isotopic age determinations indicate the generally co-eval nature of major episodes of earth history shown by the Precambrian rocks of Scotland and Finland, *viz.* (1) the *c.* 2 800—2 600 m.y. Scourian and Presvecokarelidic episodes, (2) the *c.* 2 200 m.y. Inverian episode and the *c.* 2 300 m.y. episode in Finland, (3) the *c.* 2.1 b.y. deposition of the Loch Maree Group in Scotland and the Jatulian quartzite, Karelian schists and related geosynclinal deposits in Finland, and (4) the *c.* 1 975—1 700 m.y. Laxfordian and Svecokarelian episodes. The existence of spatially connected belts in Precambrian times is suggested by the correspondence in both the sequence of development and the orientations of structural elements resulting from polyphase deformation in the successively formed Precambrian orogenic belts. This matching of complex structural frameworks implies that, before the initiation of the British-Scandinavian Caledonides, the Baltic Shield extended westward to include northwestern Britain and the continental shelf of the eastern North Atlantic Ocean. The Caledonian belt would then have developed on a plate of continental crust, or between the separated parts of a rifted continental crustal segment.

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Introduction

The early Precambrian crystalline complex exposed in the Outer and Inner Hebrides and Northwest Highlands of Scotland forms the stable foreland of the Caledonian orogenic belt to the west of the Moine Thrust (Fig. 1). While now occurring as tectonic blocks and in parts overlain by upper Proterozoic and Phanerozoic sediments, both its essential structural unity (Hopgood & Bowes 1972 a, b) and its extension northeastwards to near Shetland as part of the continental shelf under the eastern North Atlantic Ocean (Watts 1971) have been demonstrated. From near Shetland, for 1 200 km northeastwards, are gravity and magnetic anomalies which indicate a continuity of the Precambrian basement of Scotland with the Precambrian basement of northwestern Norway (Fig. 6), two regions which show marked similarities in Precambrian chronology (Talwani & Eldholm 1972; Bowes in press). This extensive mass of Precambrian crystalline basement is separated from the Baltic Shield of Sweden, Finland and northwestern U.S.S.R. by the Caledonian orogenic belt. However, in Eire, Scotland and Norway,

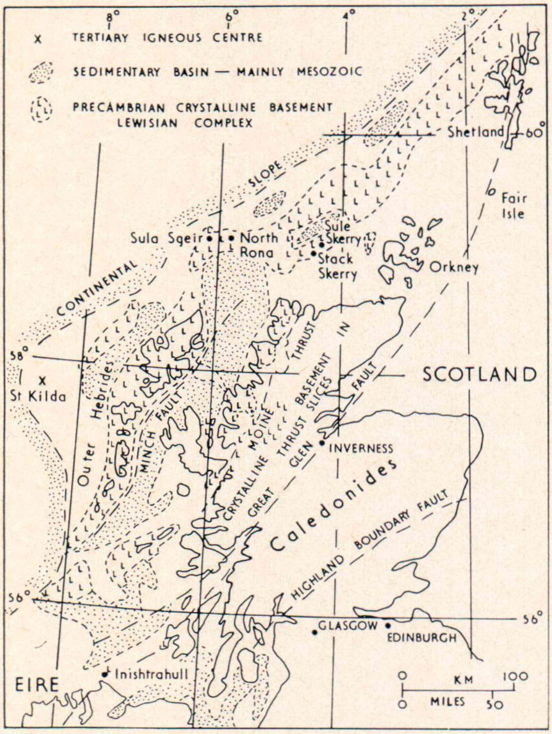

Fig. 1. Map of northern and northwestern Scotland showing distribution of Precambrian crystalline basement and sedimentary basins on the continental shelf and adjacent regions (mainly based on 1: 2 500 000 map — The Sub-Pleistocene Geology of the British Isles and adjacent Continental Shelf; Institute of Geological Sciences, 1972).

Precambrian crystalline basement crops out within this belt (Figs 1, 6). The isotopic ages determined for these basement rocks (*e.g.* Wilson & Nicholson 1973), some of which occur in tectonically emplaced slices, correspond with those of parts of the unmoved shield in Scotland and Fennoscandia. In addition these two crustal regions show correspondence in both the sequence of development and the orientations of structural elements resulting from polyphase deformation in successively formed Precambrian orogenic belts. This suggests that prior to the initiation of the Caledonian orogenic belt, the Baltic Shield extended westwards to include northwestern Britain, together with that part of the eastern North Atlantic region having a continental crust composed of Precambrian rocks.

Scotland

The Precambrian crystalline complex of northwestern Britain (Lewisian Complex — *cf.* Bowes 1969) extends westwards to the Rockall Bank (Fig. 6), with intervening oceanic crust, and southwards to Eire (Macintyre *et al.*, 1975). It consists largely of a thick crust building pile of basalts, andesites and acidic volcanic rocks, with derived sediments (Bowes & Hopgood 1973), that was affected by a major metamorphic event during the Scourian orogenic episode *c.* 2 800—2 700 m.y. ago (Fig. 2). Over large parts of the complex neither the gross crustal disposition of lithological units nor the dominant rock fabric established by 2 700 m.y. ago has been greatly modified by subsequent events. There was only a short time interval between the separation of the crust-building material from the mantle *c.* 2 900—2 800 m.y. ago and the onset of the tectonics and metamorphism of the Scourian episode (Moorbath *et al.*, 1969) and no isotopic or structural evidence for the existence of pre-2 900 m.y. old crystalline supracrustal type rocks in this crustal segment (Bowes & Hopgood 1973). Apart from metamorphic grade, the volcanogenic pile is similar to the upper part of the volcanogenic crust-building piles of corresponding age known from other shield areas (*cf.* Douglas 1970, p. 55). It may have formed, flanking a nucleus of early Archaean supracrustal rocks, on an anorthositic crust similar to the lower crustal layer interpreted as being present under at least parts of northwestern Britain (Bowes & Hopgood 1975), or on such an early Archaean assemblage itself on the lower crustal layer.

The lowest levels of the *c.* 2 900—2 800 m.y. old volcanogenic pile are not seen, their presence being inferred from geophysical data (*cf.* Powell 1971, Fig. 1). Pyroxene granulite and associated rocks, dominantly of andesitic composition make up the Kylesku group (Khoury 1968; Bowes *et al.* 1971) and represent an intermediate part of the crust-building pile (Fig. 2). The existence of

Crustal disposition of major lithological units c 2·8 b.y. ago	Rocks formed during main metamorphic phase of Scourian episode c 2·7 b.y. ago	Crustal disposition of major lithological units at start of Laxfordian episode c 2·0 b.y. ago	Crustal disposition of major lithological units during Laxfordian episode
		SEDIMENTS	METASEDIMENTARY SCHISTS AND GNEISSES
? SEDIMENTARY PILE	? PART OF QUARTZOFELDSPATHIC GNEISS	? PART OF QUARTZOFELDSPATHIC GNEISS ? TECTONIC OVERPRINTING	? PART OF QUARTZOFELDSPATHIC GNEISS TECTONIC OVERPRINTING
ACIDIC LAVAS, PYROCLASTIC ROCKS AND DERIVED SEDIMENTS	QUARTZOFELDSPATHIC GNEISS AND METASEDIMENTS	QUARTZOFELDSPATHIC GNEISS AND METASEDIMENTS — ? TECTONIC OVERPRINTING IN INVERIAN EPISODE	QUARTZOFELDSPATHIC GNEISS AND METASEDIMENTS — TECTONIC OVERPRINTING IN LAXFORDIAN EPISODE
ANDESITIC LAVAS, PYROCLASTIC ROCKS AND DERIVED SEDIMENTS	PYROXENE-GRANULITE	PYROXENE-GRANULITE BASEMENT DEFORMATION IN BELTS IN INVERIAN EPISODE	PYROXENE-GRANULITE BASEMENT DEFORMATION IN BELTS IN LAXFORDIAN EPISODE
BASALTIC LAVAS	PYROXENE-GRANULITE (NOT SEEN)	PYROXENE-GRANULITE (NOT SEEN)	PYROXENE-GRANULITE (NOT SEEN)
? EARLY ARCHAEAN ROCKS	? EARLY ARCHAEAN ROCKS	? EARLY ARCHAEAN ROCKS	? EARLY ARCHAEAN ROCKS
? ANORTHOSITIC EARLY CRUST	LOWER CRUSTAL LAYER	LOWER CRUSTAL LAYER	LOWER CRUSTAL LAYER

Fig. 2. Stages in the development of the Precambrian of Scotland.

gross lithological layering in rocks with much smaller scale metamorphic/tectonic layering but overall igneous composition suggests that lava flows predominated. The upper part is mainly quartzofeldspathic gneiss, with widely distributed but not extensive sedimentary relics of distinctive composition (Chowdhary *et al.* 1971), and amphibolite. This rock assemblage makes up the Rhiconich group (Dash 1969) in which the relative proportions of acidic flows, pyroclastic rocks or derived sediments with compositions similar to those of volcanic rocks have not been determined.

The high grade metamorphic rocks formed during the Scourian episode were affected by later earth movements and igneous emplacement in both the *c.* 2 200 m.y. Inverian episode and the 1 975—1 700 m.y. Laxfordian episode. During the latter, the lithologically contrasted intermediate (Kylesku group) and upper (Rhiconich group) parts of the deformed and metamorphosed volcanogenic pile acted as different tectonic regimes of basement below younger supracrustal rocks, including the Loch Maree Group (Bikerman *et al.*, 1975) which show cover-type deformation. The sequences of events in the Scourian and Inverian episodes are best seen in parts of the granulite-facies regime, particularly south of Scourie (II in Fig. 3, Table 1; Khoury 1968). The effects of a polyphase deformational sequence in the Laxfordian episode (Hopgood & Bowes 1972 a) are prominently expressed in quartzofeldspathic gneisses of dominantly amphibolite-facies. In parts of the Northwest Highlands, (I, IV in Fig. 3), the Outer Hebrides (V—VII) and Inishtrahull, Eire (VIII), the Laxfordian earth movements exercised a major control on the disposition of *c.* 800 m.y. older lithological layering and gneissose foliation. The generally very nearly identical orientation, style and intensity of development of structures formed during each of the deformational phases (Table 2) permits a correlation from region to region and the demonstration of the existence of a single tectonic domain (Hopgood & Bowes 1972 b). In the parts of the Northwest Highlands in which there were metasediments deposited *c.* 2.2—2.0 b.y. ago and quartzofeldspathic gneisses were formed during the Laxfordian episode at the expense of these supracrustal cover rocks (III in Fig. 3; Bikerman *et al.* 1975), the orientation and expression of successively formed structures (Table 3) show marked similarity with those formed at the corresponding time by deformation of the much older Rhiconich group quartzofeldspathic gneisses.

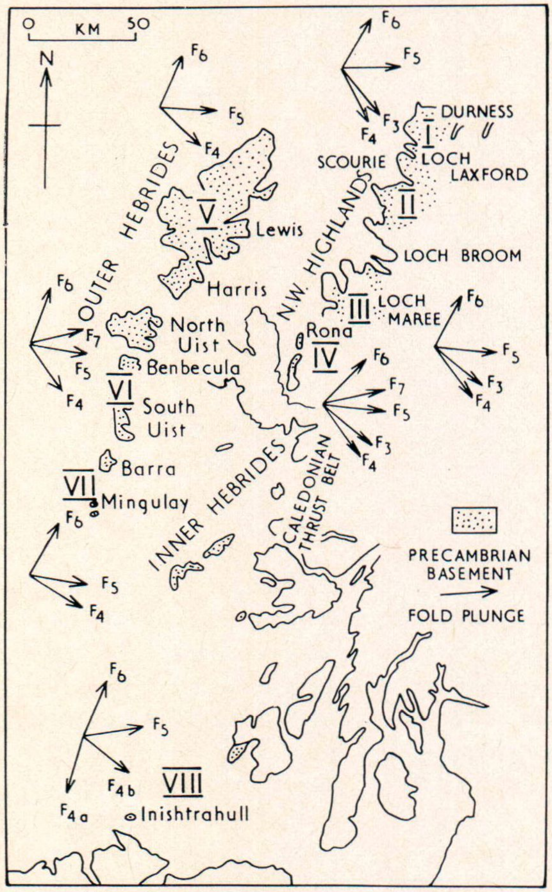

Fig. 3. Map of northwestern Britain showing correspondence of trend of folds formed in successive deformational phases in the Laxfordian orogenic episode by the tectonic overprinting of *c.* 2 700 m.y. old gneisses (I, IV—VIII) and by the folding of supracrustal younger metasediments (III). The *c.* 2 700 m.y. old granulite-facies regime (II) represents deeper crustal levels (*cf.* Fig. 2) brought into tectonic juxtaposition with the gneisses during the Laxfordian earth movements.

Emplaced into the crust-building pile during the *c.* 2 800—1 700 m.y. period were layered ultrabasic — basic masses, an anorthosite — tonalite complex, sets of basic minor intrusions and sets of granitic and pegmatitic bodies including an extensive injection complex in Harris—Lewis (Fig. 3). Times of emplacement relative to the structural sequences (Tables 1, 2) show the layered ultrabasic — basic masses to be older than the *c.* 2 700 m.y. major metamorphic event with the anorthosite complex younger but emplaced before *c.* 1720 m.y., the age of the injection complex (van Bremen *et al.* 1971). The anorthosite — tonalite complex appears to represent an early expression of the unique anorthosite intrusion period during Proterozoic times (Herz 1969).

The sequence of events in the *granulite-facies regime* (Table 1) shows the successive effects of the Scourian, Inverian and Laxfordian episodes, the latter two being expressed as discrete belts associated with successive sets of basement block movement and retrogression of the granulite-facies mineral assemblages formed during an early phase of the Scourian episode (Bowes 1969, Figs 2, 3; Pidgeon & Bowes 1972). The later phases of this *c.* 2 800—2 600 m.y. episode are mainly expressed as open to very open folds, often only localty developed, with mineral growth restricted to narrow hinge zones (as in F_2 folds).

The sequence of events in the dominantly amphibolite-facies *gneissose regime* (Table 2) shows mainly the effects of polyphase deformation during the Laxfordian episode superimposed on the 2 770—2 710 m.y. old gneissose foliation (Pidgeon & Aftalion 1972; Lyon *et al.* 1973). Many of the effects of the later phases of the Scourian episode and the effects of the Inverian episode distinguished in the granulite-facies regime have not been recognised, possibly because the superimposed structures of the Laxfordian episode mask or tighten the earlier-formed open folds. Conversely the number of phases of deformation during the Laxfordian episode expressed in the gneisses is greater than in the granulites (*cf.* Tables 1 and 2).

The sequence of events in the *metasedimentary schist regime* (Table 3) shows the effects of polyphase deformation during the Laxfordian episode on sediments deposited *c.* 2.1 b.y. ago (Bhattacharjee 1963, 1968; Keppie 1969; Bikerman *et al.* 1975). The dominant fold-forming phase (F_3) corresponds with the dominant fold-forming phase in the gneisses with which *c.* 1740 m.y.

Table 1

Sequence in Precambrian granulite-facies terrain, northwestern British Isles

Episode		Geological Features	Age in m.y.
LAXFORDIAN		Faults	
	F_{10}	Open folds in belts; mylonite-pseudotachylite	
		Pegmatites; reheating	c. 1 750—1 700
	F_9	Asymmetrical folds in belts	
		Basic minor intrusions	
	F_8	Isoclinal and associated folds in SE- to E-trending belts; greenschist- to amphibolite-facies retrogressive mineral assemblages	
		Deposition of Loch Maree Group at higher crustal level	c. 2 100
INVERIAN	F_7	Open folds in belts	
		Basic minor intrusions ('Scourie dykes')	c. 2 190
	F_6	Refolded folds transverse to monoclinal — asymmetrical folds in NW-trending belts: amphibolite-facies retrogressive mineral assemblages	c. 2 200
	?	Deposition at higher crustal level	
SCOURIAN		Pegmatites	
	F_5	Open, upright NNE-trending folds; localised	
	F_4	Open, upright E-trending folds; localised	
	F_3	Open, upright NW-trending folds	
	F_2	Monoclinal-asymmetrical NNE- to NE-trending folds; long gently-dipping limbs predominate; amphibolite-facies retrogressive mineral assemblages and pegmatites in hinge zones	c. 2 600
	F_1	Dissected tight to isoclinal NW- to WNW-trending folds; granulite-facies mineral assemblages — dominant metamorphic fabric	2 700
		Foliation, metamorphic segregation banding, mineral lineation formed at amphibolite-facies	
		Layered ultrabasic — basic masses	
		Crust-building volcanogenic pile; dominantly andesites with minor sedimentary intercalations below acidic volcanic rocks and derived sediments	c. 2 900—2 800

old pegmatites are related. It also correlates with the dominant fold-forming phase in the fold-crush belts cutting the granulties (Table 1). The new axial planar foliation apparently continues from one crustal level to another.

The existence of hypabyssal and effusive post-orogenic igneous activity *c.* 1 620 m.y., and possibly *c.* 1 450 and c. 1 350 m.y. ago, is indicated by the dating of minerals and pebbles in the overlying Torridonian sediments (Moorbath *et al.* 1967). K/Ar mineral ages of *c.* 1 500 and c. 1 400 m.y. (Moorbath & Park 1972) and a Rb—Sr whole rock isochron age of 1500 m.y. (Bikerman *et al.* 1975) are related to crustal uplift. Cataclasis and reheating *c.* 1 150 m.y. ago, as well as movement on the Hebridean Thrust (Hopgood & Bowes 1972 b) may related to the Grenville orogenic episode.

TABLE 2

Sequence in Precambrian gneissose terrain, northwestern British Isles

Episode			Geological Features	Age in m.y.
? Grenville			Cataclasis; ? thrusts; reheating	*c.* 1 150
			? Acidic igneous activity — hypabyssal/effusive masses at higher levels	*c.* 1 350—1 450
↑	?	—	Closure of isotopic systems — uplift	*c.* 1 500—1 400
?			Acidic igneous activity — hypabyssal intrusions at higher levels ...	*c.* 1 620
|	?			
			Faults	
L		F_7	Kink-bands or very open, upright ENE-trending folds; localised	
		F_6	Symmetrical, very open, upright folds; NNE axial trend	
A			Basic minor intrusions	
X			Granitic and pegmatitic veins; injection complex; reheating; ? higher level effusive and hypabyssal igneous activity	1 750—1 680
F		F_5	Symmetrical to asymmetrical, open, upright-folds; E axial trend, weak S_5	
O		F_4	Asymmetrical to symmetrical, open folds on steeply-dipping axial planes; dominantly SE axial trend but SE- and SW-trending ? conjugate pair in parts; weak S_4	
R			Basic minor intrusions; few intermediate and acidic intrusions	
D			Granite and pegmatite veins; abundant in parts	1 740
I		F_3	Strongly asymmetrical folds; some large; SE axial plunge in NW Highlands — more variable elsewhere; some S_3 particularly in tight synforms	
A			Basic minor intrusions	*c.* 1 750
N		F_2	Tight to isoclinal folds; ? tectonic slices; metamorphism in parts ..	1 975
			Anorthosite-tonalite complex	
			Deposition of Loch Maree Group at higher crustal level	*c.* 2 100
Effects of Inverian episode and later phases of Scourian episode not recognised				
S				
C			Sets of basic minor intrusions; agmatite; pegmatite	2 640
O		F_1	Dissected intrafolial folds; NW axial trend; dominant foliation (S_1)	
U			formed mainly at amphibolite-facies; migmatites	2 770—2 710
R			Foliation, metamorphic segregation banding, mineral lineation formed	
I			at amphibolite facies	
A				
N				
			Layered ultrabasic — basic masses	
			Crust-building volcanogenic pile; acidic flows (? including ash flows) and derived sediments above andesites and minor sedimentary intercalations	*c.* 2 900—2 800

Finland

The oldest known rocks in Finland, dated at *c.* 2 800 m.y. ago occur in the Presvecokarelidic basement (Fig. 4), the age representing the age of metamorphism and gneiss formation during an early phase of a 2 800—2 700 m.y. episode of earth movements. However part of this basement may show the effects of a *c.* 2 500—2 000 m.y. old episode (Simonen 1971) with evidence of plutonic activity c. 2 300 m.y. ago given by the isotopic systems of some detrital zircons from the overlying supracrustal rocks (Kouvo & Tilton 1966). The 1 950—1 750 m.y. old Svecokarelidic orogeny affected the isotopic systems of some minerals but had little general effect on the basement rocks away from localised tectonic zones. However the overlying supracrustal sedi-

TABLE 3

Sequence in Precambrian metasedimentary schist terrain, northwestern British Isles

Episode		Geological Features	Age in m.y.
		Closure of isotopic systems — uplift	1 500
LAXFORDIAN	F_6	Open to tight upright folds; NNE axial trend; crush zones and pseudotachylite formation	
	F_5	Open to tight upright folds; E axial trend; retrogression; some S_5	
	F_4	Appressed folds; SE axial trend; shear planes; some new mineral growth (S_4)	
	F_3	Asymmetrical folds, some large; SE axial plunge; dominant regional structure	
	F_2	Tight to isoclinal folds; prominent penetrative schistosity (S_2) and mineral lineation (L_2); amphibolite-facies metamorphism	1 975
	F_1	Folds rare; tectonic banding, metamorphic mineral growth (S_1)	
		Sedimentary sequence (including Loch Maree Group and Gairloch metasediments) overlying crystalline basement composed of products of Scourian and Inverian episodes	*c.* 2 100

TABLE 4

Sequence in gneisses of Presvecokarelidic basement, Kuopio district, Central Finland

Episode			Geological Features
PRESVECO	KARELIDIC		Granites
		F_5	Open, upright, N-trending folds
		F_4	Open, upright, E-trending folds; localised
		F_3	Open, upright NW-trending folds
			Basic minor intrusions
		F_2	Asymmetrical to symmetrical folds; fan of axial planes with NNW, NNE and NE trends prominent; localised weak cleavage; agmatisation of amphibolites; patchy granite in hinge zones
		F_1	Dissected tight to isoclinal NW-trending folds; dominant foliation; amphibolite-facies mineral assemblages; boudins
			Foliation; metamorphic segregation banding; augen formation
			Supracrustal pile — igneous and sedimentary

mentary sequence shows the effects of polyphase deformation, metamorphism and igneous activity. In the Karelian (eastern) part of the Svecokarelidic belt, micaceous schists predominate. Further westward and across into Sweden, in the Svecofennian part of the belt, gneisses and migmatites formed from the sedimentary sequence together with abundant syn-orogenic and post-orogenic granites predominate. Emplacement of rapakivi granites (1 700—1 650 m.y.) and of hypabyssal masses during an episode of cratonisation followed the Svecokarelidic orogeny.

The sequence of events in the *Presvecokarelidic basement* in the Kuopio district of central Finland (Table 4), where polyphase deformed gneisses underlie sedimentary rocks affected by the Svecokarelidic orogeny, is similar to that in *c.* 2 800 m.y. old gneisses further east in northern Karelia. Gneiss formation was followed by the successive formation of sets of generally open folds with mineral growth restricted to narrow hinge zones, or not seen. Emplacement of granitic material was controlled by upright structures formed during late deformational phases. Biotite ages of *c.* 1 800—1 700 m.y. indicate opening of

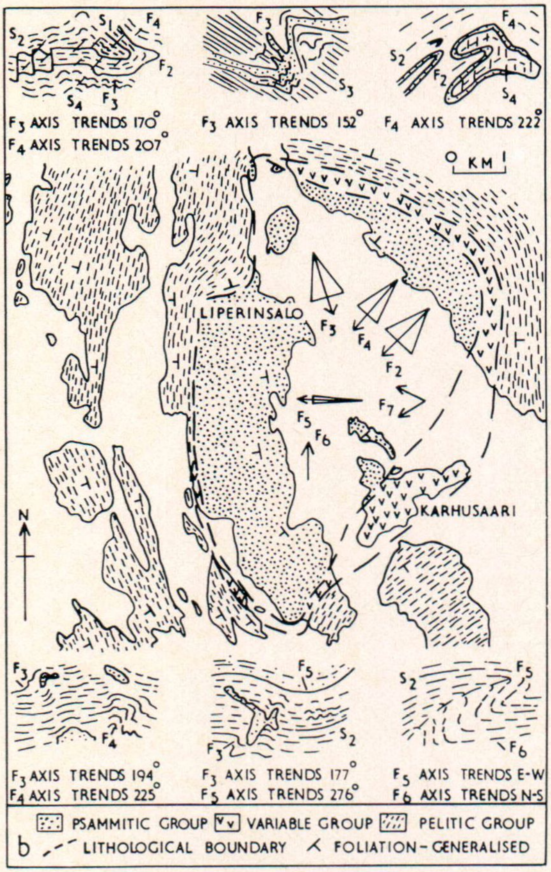

Fig. 4. Successively formed structures and their orientations resulting from the Svecokarelidic orogeny; in supracrustal schists, Liperinsalo district, northern Karelia, Finland (partly after Gillen and Macdonald 1971).

isotopic systems associated with the Svecokarelidic orogeny.

The sequence of events in the *supracrustal schists* of northern Karelia (Fig. 5; Table 5) generally corresponds with that in the *supracrustal gneisses* of southwestern Finland and eastern Sweden. All show the effects of polyphase deformation and metamorphism in the Svecokarelidic orogeny, with the effects of seven phases of deformation identified in the schists of Karelia (Fig. 4). In both orientation and presence or absence of metamorphic mineral growths, the structural elements of the first six phases in these schists successively generally correspond with those of the structural elements in the six phases recognised in gneisses in eastern Sweden (Fig. 5). However the deformational phase associated with the structural elements imparting the dominant trend, or associated with the major folds, varies from region to region.

Comparison

Isotopic age determinations have shown the generally co-eval nature of (1) the Scourian and Presvecokarelidic episodes, (2) the Inverian episode and the *c.* 2 300 m.y. old episode in Finland, (3) the deposition of the Loch Maree Group in Scotland and the Jatulian quartzite, Karelian schists and related geosynclinal deposits in Finland (Eskola 1963) and (4) the Laxfordian and Svecokarelidic episodes. That the successive episodes of earth movements not only took place at about the same time in Scotland and Finland, but also in spatially connected belts is indicated by comparability in both the determined structural sequences and the orientations of successively formed structural elements. Matching of the complex structural frameworks shown by both the *c.* 2 800—2 700, and 1 975—1 900 m.y. old metamorphic rocks on either side of the Caledonian orogenic belt (Fig. 6) is supported by the occurrence within the belt of basement rocks dated at *c.* 2800 and 1800 m.y. as well as the westerly continuation of the Svecokarelidic belt from Finland into Sweden.

The structural sequences in the Scourian episode in Scotland (Table 1) and the Presvecokarelidic episode in Finland (Table 4) show marked correspondence, although the evidence is limited in regional distribution. As in both crustal segments the rocks being deformed were a mixed igneous and sedimentary assemblage, representing the first recognised supracrustal piles, the Scottish model of diachronous development, metamorphism and deformation of greenstone-type belts flanking an earlier-formed nucleus (or nuclei) is likely to be applicable to

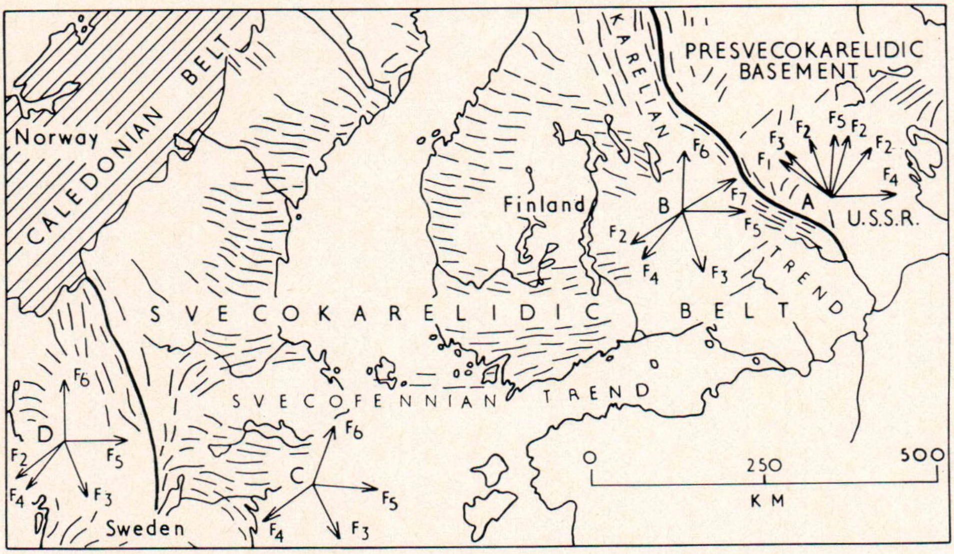

Fig. 5. Major tectonic regimes of Fennoscandia and trends of successively formed folds in (A) gneisses of Presvecokarelidic basement (Table 4), (B) supracrustal schists of Svecokarelidic belt, northern Karelia, Finland (Table 5), (C) supracrustal gneisses of Svecokarelidic belt, eastern Sweden and (D) gneisses of Sveconorwegian unit, southwestern Sweden.

the whole crustal region. Subsequent effects on these rocks in the *c.* 2 300—2 200 and *c.* 1 900—1 800 m.y. old episodes have been minimal in both crustal segments.

The structural sequences in both the Karelian schistose and Svecofennian gneissose parts of the Svecokarelidic belt of Finland and Sweden (Fig. 5; Table 5) are very similar to those determined in the metasedimentary schist cover rocks of the Laxfordian belt of Scotland (Table 3). They are also very similar to those determined for the *c.* 2 700 m.y. old gneisses tectonically overprinted during the Laxfordian episode in Scotland (Table 2). With the Karelian schists and Svecofennian

Table 5

Sequence in schists of Svecokarelidic belt, Northern Karelia, Finland

Episode		Geological Features
S V	F_7	Very open, upright ENE- and ESE-trending folds; ? conjugate set; localised
E	F_6	Symmetrical very open, upright folds; N axial trend
C	F_5	Open, upright folds; E axial trend; weak S_5
O K	F_4	Open to tight folds on steeply dipping axial planes; SW axial trend; weak S_4; quartz rodding
A		Basic minor intrusions
R		Quartz veins
E L	F_3	Asymmetrical folds; some large; SSE axial trend; S_3 strongly expressed in some hinge zones
I D	F_2	Tight to isoclinal folds; SW to WSW axial trend; prominent foliation (S_2) and mineral lineation (L_2)
I C	F_1	Isoclinal folds; strong metamorphic mineral growth (S_1)
		Thick sedimentary sequence unconformably overlying Presvecokarelidic basement (*cf.* Table 4)

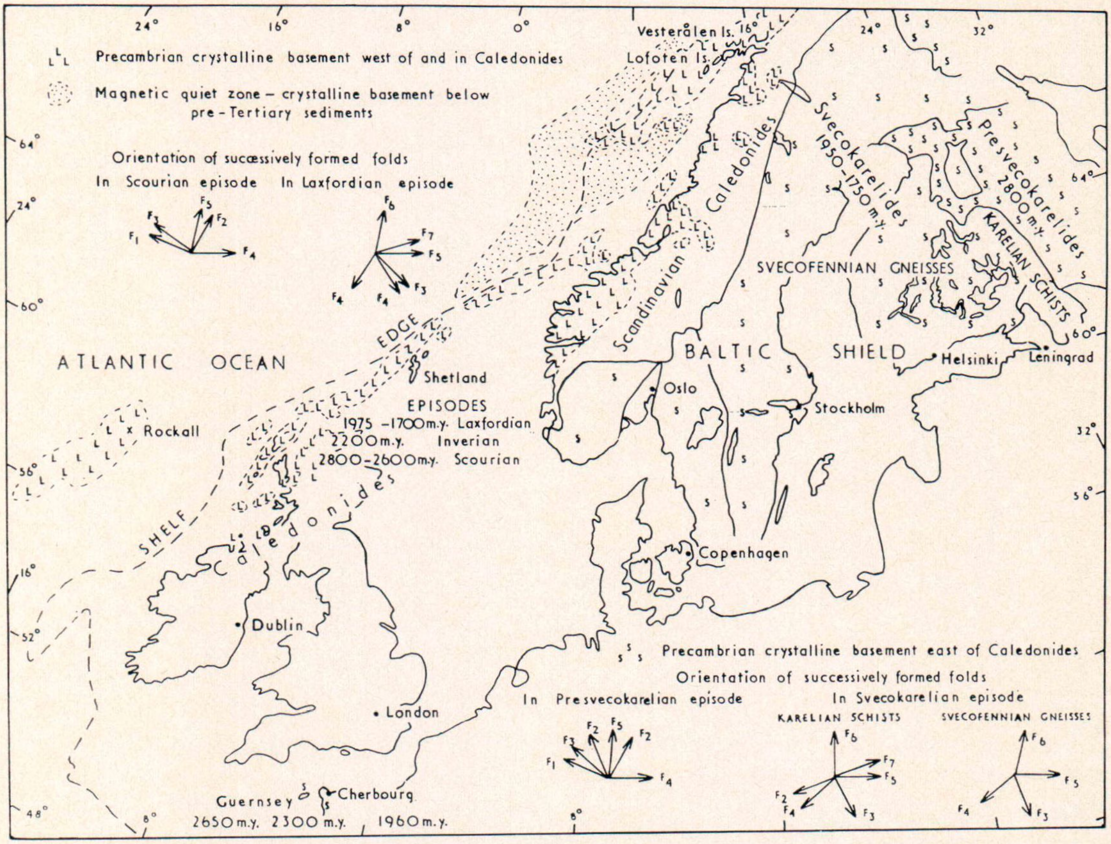

Fig. 6. Distribution, ages and orientations of fold structures of Precambrian crystalline basement in part of northwestern Europe and the eastern margin of the North Atlantic.

gneisses representing cover rocks and the Scottish gneisses representing foliated basement rocks, there are differences in development and expression of the early phases. However, where competence controls were comparable, the expressions of the middle and later deformational phases are similar in the two crustal segments, as are the orientations of the various sets of structures, allowing for the variation in dominance of the SE- and SW-trending elements of the F_{4a} and F_{4b} foldsets (*cf.* VIII in Fig. 3). The existence in northern Sweden of sediments and extrusive rocks (1 725—1 605 m.y.), which post-date the Svecokarelidic episode but in part overlap in time intrusive activity towards the end of the Laxfordian episode in Scotland, further indicates differences in crustal level as well as diachronous development. The 1 635—1 540 m.y. plutonic igneous activity in Sweden (Welin 1970) corresponds partly in time with the igneous activity in Scotland deduced from pebbles in the Torridonian sediments which overly the metamorphic complex.

The evidence suggests a westward continuation of the Baltic Shield to northwestern Britain. Such a continuation implies a Svecokarelidic—Laxfordian belt of comparable dimensions and of similar age to that formed during the Hudsonian orogeny in Canada. In addition preservation of corresponding structural orientations in the Presvecokarelidic and Scourian parts of the c. 2 800—2 600 m.y. old belt and in the Svecokarelidic and Laxfordian parts of the *c.* 1 975—1 700 m.y. old belt implies absence of major changes in continental configurations in this crustal segment, or of rotation of plates. It also implies that the Caledonian mobile belt which now separates the Precambrian rocks of Fennoscandia and northwestern Britain (Fig. 6) developed on a plate of continental crust or between the separated parts of a rifted continental crustal segment.

The Scotland—Finland Precambrian correlations as well as both the continuity of basement from Scotland to northwestern Norway and the apparent continuity of basement through the Caledonides suggest the possibility that the geological evolution of northwestern Europe has been dominated by one large Precambrian crustal segment. Such a possibility is given further support by the existence within the Variscides, in France and the Channel Islands, of rocks dated at 2 650 m.y., 2 300 m.y. and 1 960 m.y. (Fig. 6; Bishop *et al.* 1975) and by the similarity of structural sequences and orientations in the Sveconorwegian unit of the Baltic Shield in southwestern Sweden (Fig. 5), and those in the Svecokarelides.

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