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Pre-Carboniferous Tectonostratigraphic Subdivisions of Cape Breton Island, Nova Scotia

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Cape Breton Island can be divided into four zones on the basis of contrasting stratigraphy, metamorphism, and plutonism. A Southeastern zone is characterized by late Precambrian volcanism and plutonism, followed by Cambro-Ordovician rift-basin sedimentation and minor volcanism. The Bras d'Or zone to the northwest is underlain by gneissic basement and overlying platformal (carbonate and clastic) sedimentary rocks, intruded by mainly late Precambrian and Ordovician(?) granitoid rocks. The Highlands zone has a gneissic core flanked by typically lower grade sedimentary and volcanic rocks of probable Precambrian age intruded by diverse and abundant dioritic to granitic plutons ranging in age from Precambrian to Carboniferous. The Northwestern Highlands zone has gneissic basement intruded by varied plutonic rocks including anorthosite and syenite, the latter of Grenvillian age. The nature and significance of the boundaries between these zones are as yet uncertain, but only the Southeastern and Bras d'Or zones are considered to be part of the Avalon Terrane.

Des contrastes de stratigraphie, métamorphisme et plutonisme permettent de diviser l'île du Cap-Breton en quatre zones. Un zone sud-est se distinque par un volcanisme et un plutonisme tardi-précambriens auxquels succèdent, au Cambro-Ordovicien, une sédimentation bassinale de type rift et un faible volcanisme. Au Nord-Ouest, la zone de Bras d'Or comporte un socle gneissique sur lequel s'est effectuée une sédimentation néritique (terrigène et à carbonates), le tout injecté de granitoides principalement tardi-précambriens et ordoviciens(?). La zone de Highlands englobe un noyau gneissique ceinturé de roches sédimentaires et volcaniques auxquels s'est typiquement imprimé un métamorphisme de faible intensité et qui sont probablement d'âge précambrien. Ceux-ci sont tous recoupés par d'abondants plutons dioritiques et granitiques divers dont l'âge s'échelonne du Précambrien au Caronifère. La zone de Northwestern Highlands renferme un socle de gneiss recoupé par diverses roches plutoniques dont l'anorthosite et la syénite, cette dernière étant d'âge grenvillien. Le doute subsiste encore en ce qui regarde la nature et la signification des frontières entre ces zones; cependant seules la zone sud-est et la zone de Bras d'Or sont considérées comme appartenant à la lanière d'Avalon.

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INTRODUCTION

All of Cape Breton Island has generally been included in the Avalon Zone or Terrane of the Appalachian Orogen (e.g. Williams 1978, 1979, O'Brien *et al.* 1983, Rast and Skehan 1983, Williams and Hatcher 1983). However, these interpretations have been based on data from older geological mapping (e.g. as compiled by Keppie 1979), much of which was on a reconnaissance scale. More recent mapping and petrological studies in northern Cape Breton Island (Raeside *et al.* 1986, Barr *et al.* 1985a, b, Raeside and Barr this issue, Jamieson and Craw 1983) have demonstrated that its geology is distinct from that of southeastern, and probably central, Cape Breton Island.

The purpose of this paper is to propose a subdivision of Cape Breton Island into four zones (Fig. 1), which contrast in pre-Carboniferous stratigraphy, metamorphism and plutonism. It

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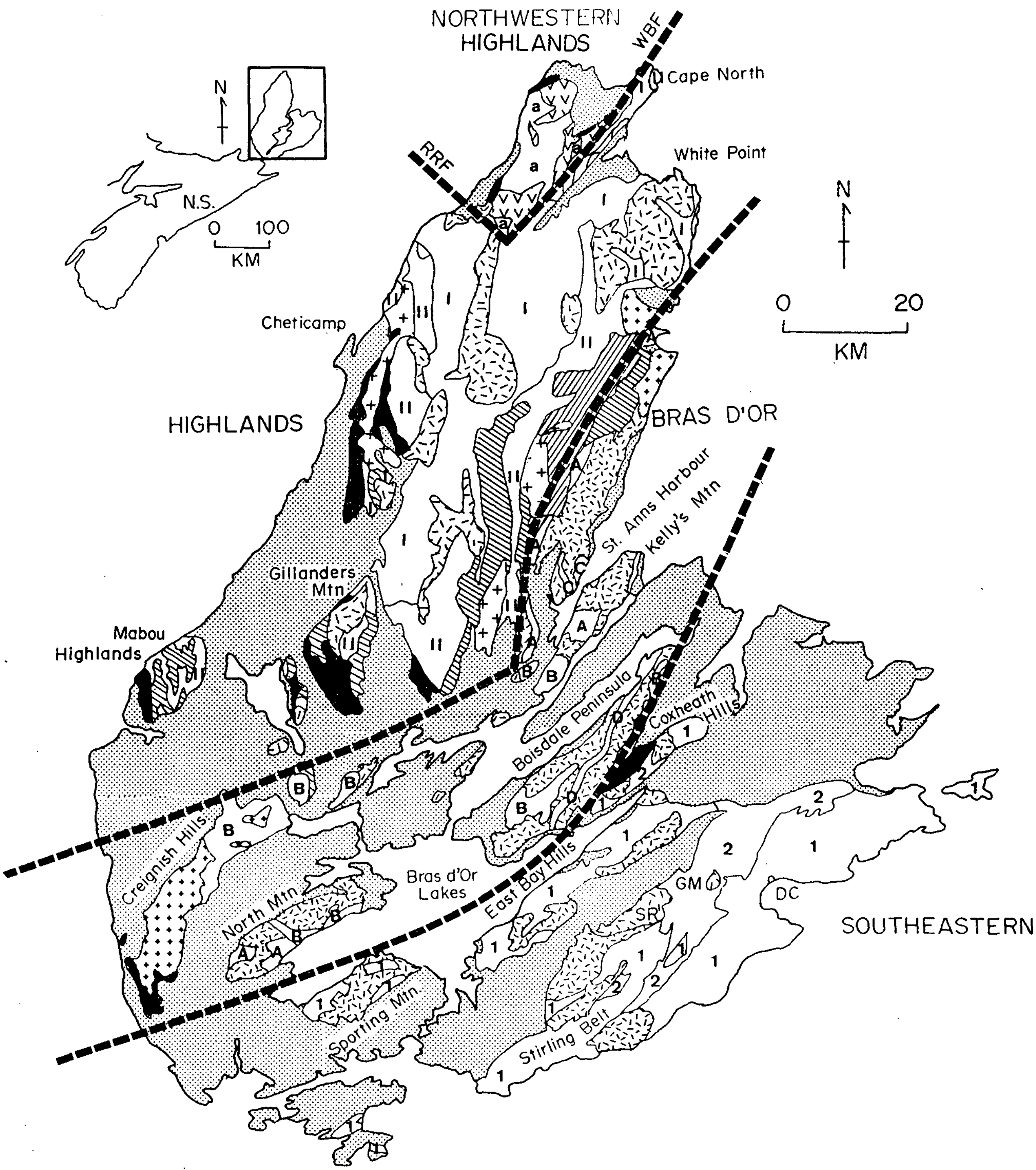

Fig. 1. Simplified geological map of Cape Breton Island showing the proposed tectonostratigraphic subdivisions. Map is compiled from various sources referenced in the text. SR, Salmon River; GM, Gillis Mountain; DC, Deep Cove; WBF, Wilkie Brook Fault; RRF, Red River Fault. Carboniferous sedimentary rocks include Horton Group and overlying units.

SOUTHEASTERN

CARBONIFEROUS
- Sedimentary rocks

DEVONO-CARBONIFEROUS
- Granitoid rocks

CAMBRO-ORDOVICIAN
- 2 Sedimentary and volcanic rocks (mainly Kelvin Glen Group)

LATE HADRYNIAN-CAMBRIAN
- Diorite to granite

LATE PRECAMBRIAN
- 1 Fourchu Group (and Giant Lake Complex)

BRAS D'OR

CARBONIFEROUS
- Sedimentary rocks

DEVONO-CARBONIFEROUS
- Sedimentary rocks, minor tuff (McAdam Lake Fm)
- Granitoid rocks

ORDOVICIAN?
- Granitoid rocks

CAMBRO-ORDOVICIAN
- D Sedimentary and volcanic rocks (mainly Bourinot Group)

LATE HADRYNIAN-CAMBRIAN
- Diorite to granite

LATE PRECAMBRIAN
- C Volcanic rocks (Price Point unit)
- B George River Group
- A Gneiss (includes Kellys Mtn, Barachois River, Lime Hill)

HIGHLANDS

CARBONIFEROUS
- Sedimentary rocks

DEVONO-CARBONIFEROUS
- Sedimentary & bimodal volcanic rocks (Fisset Brook Fm)
- Granitoid rocks

ORDOVICIAN-DEVONIAN?
- Granitoid rocks
- Diorite, tonalite

LATE HADRYNIAN-CAMBRIAN
- Granitic rocks (includes Cheticamp pluton)
- Diorite, tonalite, leucotonalite (in part may be younger)

LATE PRECAMBRIAN-EARLY PALEOZOIC?
- II Volcanic and sedimentary rocks (Money Point Group, Crowdis Mtn volcanics, Western Highlands complex, McMillian Flowage Fm)
- I Paragneiss and orthogneiss (Cheticamp Lake, Cape North Group, undifferentiated gneisses)

NORTHWESTERN HIGHLANDS

CARBONIFEROUS
- Sedimentary rocks

DEVONO-CARBONIFEROUS
- Sedimentary & bimodal volcanic rocks (Fisset Brook Fm)
- Granitoid rocks

PRECAMBRIAN
- Syenite, anorthosite, monzodiorite
- a Quartzofeldspathic and syenitic gneiss (Polletts Cove Brook Group)

Legend for Fig. 1.

is further suggested that only two of these zones can be correlated with the Avalon Terrane, as defined in eastern Newfoundland and southern New Brunswick. The proposal has important implications for lateral correlations of terranes in the northern Appalachians.

SOUTHEASTERN ZONE

Southeastern Cape Breton Island is characterized by the Fourchu Group (Weeks 1954) which consists mainly of volcanic rocks, now generally metamorphosed to lower greenschist facies. These rocks occur in five belts (Fig. 1). The southernmost *coastal belt* serves at present as the "type area" of the Fourchu Group because of its excellent coastal exposures which have been relatively well studied (Murphy 1977, Keppie *et al.* 1979, Macdonald 1983). It consists mainly of subaerial pyroclastic rocks and minor mafic to felsic flows. Geochemical studies of mafic flows, and of mafic intrusions interpreted to be cogenetic with the volcanic rocks, indicate calc-alkalic transitional to tholeiitic affinity (Keppie *et al.* 1979, Macdonald 1983).

The *Stirling belt* to the northwest is apparently more restricted in composition and dominated by bimodal flows and varied subaqueous pyroclastic and epiclastic rocks containing chert and carbonate layers, as well as syngenetic Fe-Zn-Pb-Cu occurrences (Macdonald 1983). This belt contains much more sedimentary material than the coastal belt and appears less pervasively deformed and metamorphosed. It was originally mapped as Cambrian (Weeks 1954) but more recent work has indicated a Precambrian age (Smith 1978, Macdonald 1983, McMullin 1984). Smith (1978) referred to part of this belt as the Giant Lake Complex.

Fourchu Group rocks to the northwest in the *East Bay Hills*, *Sporting Mountain*, and *Coxheath Hills belts* are generally less well known, but contain varied pyroclastic rocks and flows apparently of calc-alkalic affinity and formed in association with subduction at a continental margin (Helmstaedt and Tella 1973, Rowan 1985, Sexton 1985).

Details of stratigraphic relations within and between these five belts are lacking, making it difficult to compare the rocks directly with those of the Avalon Terrane of eastern Newfoundland or elsewhere. Most workers have implied correlation with much of the Late Hadrynian sequence in Newfoundland, from the Love Cove/Harbour Main groups to the Bull Arm/Signal Hill/ Marystown groups (inferred to range from about 680 Ma to less than 600 Ma) and with the Coldbrook Group of southern New Brunswick (Rast and Skehan 1983, O'Brien *et al.* 1983).

The metavolcanic rocks of the Fourchu Group are intruded by granitoid plutons which have given Rb-Sr isochron ages ranging from 544 $\pm$ 21 Ma to 577 $\pm$ 21 Ma (Cormier 1972, 1979; Barr *et al.* 1984a, Sexton 1985). These are generally in agreement with K-Ar ages for amphiboles from the same units (Sexton 1985, McMullin 1984), except an older K-Ar age has been obtained from the Coxheath Hills pluton (Stevens *et al.* 1982). These plutons are nowhere observed to intrude Cambrian to Ordovician strata and hence are considered to be late Precambrian rather than Cambrian, like apparently similar granitoid rocks elsewhere in the Avalon Terrane (e.g. O'Brien *et al.* 1983).

The granitoid rocks are compositionally expanded (dioritic to granitic), calc-alkalic suites with I-type features as defined by Chappell and White (1974, 1983). They may be cogenetic with the associated volcanic rocks of the Fourchu Group, which are also mainly calc-alkalic (Sexton 1985, Helmstaedt and Tella 1973, Keppie *et al.* 1979). However, this interpretation presents some problems as the Fourchu Group has experienced low-grade regional metamorphism and deformation (Avalonian Orogeny?) whereas the granitoid rocks are generally post-tectonic, although locally strongly sheared. Hence it is more probable that the granitoid magmas are younger than the volcanic rocks and represent late-orogenic plutonism whereas the volcanic rocks were erupted early in the orogenic cycle.

These granitoid and metavolcanic units are overlain unconformably by various early Cambrian to Ordovician sedimentary units (Hutchinson 1952, Weeks 1954, Smith 1978, McMullin 1984). Although stratigraphic relations are not entirely resolved, Smith (1978) assigned most of these units to the Kelvin Glen Group. The units include conglomerate, siltstone, shale, minor limestone and possibly some volcanic rocks (Smith 1978). They contain trilobites and brachiopods generally characteristic of the Atlantic faunal realm (Hutchinson 1952), a fact widely used in reconstructions of now dispersed Avalonian terranes (e.g. O'Brien *et al.* 1983).

A group of Devonian granites has intruded these rocks and the Fourchu Group, forming an arcuate belt from Salmon River through Gillis Mountain to Deep Cove (Barr and Macdonald 1985).

The northern boundary of the Southeastern zone is inferred to be a fault or series of faults through the southern Bras d'Or Lakes and Boisdale Peninsula (Fig. 1). In the Lakes the presence of the fault is suggested from the shape of the channels and intense shearing and cataclastic deformation in metavolcanic and granitoid rocks of the Sporting Mountain area (Sexton 1985) and East Bay Hills (McMullin 1984). Through the Boisdale Peninsula the boundary follows a previously identified major fault that cuts lower Carboniferous units (Giles 1982). This fault is one of many major faults crossing southeastern Cape Breton Island (Keppie 1979), all of which are probably splays from the Minas Geofracture system (Keppie 1982).

The significance of this boundary depends on the relation between southeastern Cape Breton Island and the Bras d'Or zone to the north. In Newfoundland, the northern boundary of the Avalon terrane is the Dover-Hermitage Bay fault, apparently a major crustal suture (Keen *et al.* 1986) separating the Avalon and Gander terranes. However, it is not likely that the Bras d'Or zone of Cape Breton Island is Gander-equivalent (see below).

BRAS D'OR ZONE

The Bras d'Or zone is the least well understood region in Cape Breton Island at the present time. The characteristic rock unit is the George River Group but its stratigraphy and geographic distribution are not well known. Milligan (1970) described quartzite, greywacke, slate, marble, and minor mafic volcanic rocks from widely separated outcrop areas in what is here termed the Bras d'Or zone, but was not able to directly correlate among the areas. Most of these rocks are of low metamorphic grade (except locally adjacent to intrusions), but areas of higher grade schist and gneiss also occur in the Bras d'Or zone. The best studied gneiss in the Bras d'Or zone is the Kellys Mountain gneiss (Barr *et al.* 1982, Jamieson 1984). It has yielded Rb-Sr metamorphic ages of about 700 Ma and is intruded by diorites which have given a Rb-Sr isochron age of 636 $\pm$ 69 Ma (Olszewski *et al.* 1981, Gaudette *et al.* 1985). Heterogeneous gneiss (Lime Hill unit) and intimately associated dioritic rocks have also recently been mapped as a unit separate from lower grade metasedimentary rocks of the George River Group in the North Mountain area west of the Bras d'Or Lakes (Justino 1985), and gneissic units and amphibolites are also present locally in the Boisdale Peninsula (Barr and Setter 1984, and unpublished data). The relationship of these higher grade rocks to the George River Group is as yet unclear. The gneisses may represent "basement" to the lower grade rocks, analogous to the inferred relationship between the Brookville Gneiss and associated Greenhead Group (carbonate and clastic rocks) in southern New Brunswick (e.g. Olszewski and Gaudette 1982, O'Brien *et al.* 1983).

Compositionally expanded I-type granitoid suites of similar age and lithology to those of southeastern Cape Breton Island have intruded the George River Group and associated higher grade rocks (Barr and Setter 1984, Justino 1985, Barr *et al.* 1982, 1985b). However, younger granitoid rocks also occur locally, including large plutons of apparent Ordovician or Silurian age (Campbell 1980, R.F. Cormier, written communication, 1980, Barr *et al.* 1982, 1985b), and a small Devonian pluton similar to one of the small Devonian plutons in southeastern Cape Breton Island (Barr *et al.* 1984b).

A significant succession in the Bras d'Or zone is the Middle Cambrian to Ordovician Bourinot Group and overlying formations which form a linear belt in the Boisdale Peninsula. These rocks are north of the postulated boundary with the Southeastern zone, but contain an "Atlantic-type faunal assemblage" (Hutchinson 1952) and are generally considered "Avalonian", like sequences of similar age already described in the Southeastern zone. This implies that the Southeastern and Bras d'Or zones were probably juxtaposed and undergoing similar tectonic activity in the Cambrian, if not previously. The Bourinot Group and overlying formations are in faulted contact with the George River Group but unconformably overlie late Hadrynian-Cambrian granitoid suites (Barr and Setter 1984, Helmstaedt and Tella 1973). Although in part sedimentary, the Bourinot Group includes bimodal volcanic rocks, and the succession has been interpreted to have formed in a "within-plate" rift environment (Keppie *et al.* 1980). Following this volcanism and sedimentation, the latter extending into the lower Ordovician, a gap in the stratigraphic record occurs until the mid-Devonian McAdam Lake Formation (arkoses, conglomerates and minor volcanic components) (Helmstaedt and Tella 1973, Bell and Goranson 1938). A second sedimentary-volcanic succession also occurs in the Bras d'Or zone, in the western Creignish Hills. This is considered to be Devono-Carboniferous and part of the Fisset Brook Formation of the Cape Breton Highlands (Kelley and McKasey 1965, Blanchard *et al.* 1984). A volcanic succession (Price Point unit) in the St. Ann's area, formerly considered also to be Devono-Carboniferous (Kelley and McKasey 1965) is now known to be intruded by the late Hadrynian-Cambrian Indian Brook granodiorite (Macdonald and Barr 1985). The relationship of this isolated calc-alkalic volcanic unit to the George River Group, or to the Fourchu Group of southeastern Cape Breton Island, is not known.

The northern boundary of the Bras d'Or zone is inferred to lie north of the Bras d'Or Lakes and St. Anns Harbour (Fig. 1). The main reasons for this proposed position of the boundary are: (i) distinctive late Precambrian-Cambrian leucogranites occur both north and south of St. Anns Harbour (Barr *et al.* 1985b, Macdonald and Barr 1985), and hence any boundary must lie to the north of these leucogranites. (ii) plutonic units can be traced from St. Anns Harbour north along the eastern Highlands, east of the inferred boundary (Barr *et al.* 1985b). (iii) occurrences of a distinctive gneiss (Barachois River gneiss) trend north-northeast in the eastern Highlands. The Barachois River gneiss is intruded by granitoid suites on the east but may have faulted contacts with Highland zone units to the west (see next section). (iv) no definite George River Group rocks occur north of this boundary (Barr *et al.* 1985b, Raeside and Barr this issue).

The relationship of the Bras d'Or zone to the Southeastern and Highlands zones cannot yet be resolved. Do the gneisses and George River Group of the Bras d'Or zone stratigraphically underlie the Fourchu Group, thus completing the traditional Avalonian stratigraphy (e.g. Rast and Skehan 1983, O'Brien *et al.* 1983)? Similarity of late Hadrynian-Cambrian granitoid suites in the Bras d'Or zone and southeastern Cape Breton Island imply similar tectonic setting and similar deep crustal or upper mantle source rocks at that time in these two zones, suggesting that the boundary between them is not of the same fundamental nature as the Dover-Hermitage Bay Fault. Are the George River Group and associated gneisses correlative with some of the metasedimentary units and gneisses of the Cape Breton Highlands? Or is the northern boundary of the Bras d'Or zone a major boundary, perhaps equivalent to the Dover-Hermitage Bay Fault? The latter explanation is preferred at the present time, but more detailed studies of the inferred boundary are needed.

HIGHLANDS ZONE

Although the nature and location of the boundary are not yet resolved, it is clear that the geology of the Cape Breton Highlands contrasts markedly with that of the Bras d'Or and Southeastern zones just described. The Highlands consist of a core of ortho- and paragneissic rocks flanked by lower grade metasedimentary and metavolcanic units (Barr *et al.* 1985a, b, Raeside and Barr, this issue). They are intruded by a variety of granitoid rocks which are so similar to those of the Gander Terrane of Newfoundland (e.g. Wilton 1985, Chorlton and Dallmeyer 1986) that similar crustal and/or subcrustal source rocks seem implied. However, they are also similar to rocks in the Fleur de Lys belt (Hibbard 1983) and the recently defined Piedmont terrane of western Newfoundland (Williams and Hatcher 1983).

The oldest units in the Highlands are inferred to be varied gneissic units. Best known are the Cape North Group (Macdonald and Smith 1980) and the Cheticamp Lake gneiss (Raeside *et al.* 1984, Raeside and Barr this issue). The Cape North Group consists of semi-pelitic and pelitic gneiss, amphibolite, marble and calc-silicate gneiss. The Cheticamp Lake gneiss consists mainly of biotite-K-feldspar orthogneiss with lenses of migmatized mica schists and pelitic gneiss. In the western Highlands, gneissic and granitoid rocks form a major unit which has not yet been subdivided by detailed mapping (Barr *et al.* 1985a). Zircons from orthogneiss in this unit have yielded an U-Pb age of 440 Ma (Jamieson *et al.* 1986). Gneissic rocks also occur in the Gillanders Mountain area (French 1985) and in the Mabou Highlands; in the latter area they occur in an aureole around dioritic intrusions (Barr and Macdonald 1983).

Lower grade metamorphic units are also widespread in the Highlands, although the relations with the gneissic units are not yet resolved. The Western Highlands volcanic-sedimentary complex (Barr *et al.* 1985a) is a major unit in the western Highlands, and includes the Money Point Group (Macdonald and Smith 1980), the Jumping Brook Complex (Currie 1982), the Crowdis Mountain volcanics (Jamieson 1981, Jamieson and Doucet 1983), and unnamed units in the Gillanders Mountain area (French 1985) and Mabou Highlands (Barr and Macdonald 1983). Although stratigraphy is not well known, the typical sequence appears to be a lower mafic unit (metabasalts and mafic tuffs) overlain by interlayered felsic volcanic and pyroclastic rocks interfingered with clastic sedimentary rocks (pelitic and psammitic). The rocks are complexly folded, and metamorphic grade ranges into upper amphibolite facies, but greenschist facies rocks are most typical. In the Cape North area where the change from the Money Point to Cape North Groups has been examined in detail, there is no evidence of either a tectonic or stratigraphic break as in a typical basement-cover relationship, and metamorphic grade increases gradually from one group into the other (Macdonald and Smith 1980). The age of these rocks is not known, although late Precambrian is usually suggested (Barr *et al.* 1985a, Macdonald and Smith 1980).

In the eastern Highlands, stratified rocks are assigned to the McMillan Flowage Formation (Raeside and Barr this issue), consisting of pelitic to psammitic metasedimentary rocks, quartzite, minor marble and calc-silicate rocks, and thin amphibolite layers in a north-south belt over 60 km in length. Metamorphic grade increases from lower greenschist facies in the south to upper amphibolite facies adjacent to the Cheticamp Lake gneiss with which the unit is in faulted contact. On previous maps, many of the rocks now included in the McMillan Flowage Formation were assigned to the George River Group (Keppie 1979, Wiebe 1972, Milligan 1970). However, the lack of significant carbonates in the Formation makes this correlation tenuous.

A distinctive feature of the Cape Breton Highlands is the variety and abundance of plutonic rocks. Dioritic rocks are widely distributed, forming large, typically foliated bodies; also present are separate plutons of leucotonalite and tonalite. Radiometric ages of these units range from late Precambrian to Devonian, but it is not yet clear which are emplacement ages and which reflect superimposed younger thermal events (e.g. Jamieson *et al.* 1986, Barr *et al.* 1985a). Plutons ranging from granodiorite to granite are numerous in the western Highlands; the Cheticamp granodioritic pluton is apparently of early Cambrian age but others are as young as Devonian. Muscovite-biotite granodiorite to tonalite in the central Highlands may be of late Precambrian age. However, diverse Siluro-Devonian to early Carboniferous plutons are also present, associated with the central gneissic "core" of the Highlands, and these include muscovite-biotite granodiorite and granite, megacrystic granite, biotite granite and syenogranite (Barr *et al.* 1985a). The latter have yielded the youngest (early Carboniferous) ages, and have been interpreted to be comagmatic with felsic volcanic rocks of the Fisset Brook Formation (see below) (French and Barr 1984, French 1985). This petrologic range in Silurian(?) to early Carboniferous plutonic rocks suggests correlation with the Gander Zone of Newfoundland (e.g. Strong 1980), and distinguishes the Highlands from the Bras d'Or and Southeastern zones in Cape Breton Island.

The Fisset Brook Formation occurs locally on the southern and western periphery of the Highlands. It apparently ranges in age from late Devonian to early Carboniferous and consists of bimodal tholeiitic basalt-rhyolite with interbedded shales, siltstones, and minor pyroclastic rocks (Kelley and MacKasey 1965, Blanchard *et al.* 1984). These rocks appear to have been deposited in small alluvial basins formed during post-Acadian subsidence and wrench faulting. They grade up into much more widely distributed early Carboniferous red beds of the Horton Group which were deposited over much of Cape Breton Island.

NORTHWESTERN HIGHLANDS ZONE

The northwestern Highlands are composed of a distinctive assemblage of basement rocks including felsic and mafic gneisses, monzodiorite, anorthosite and syenite (Raeside *et al.* 1986). These rocks, informally termed the Blair River complex, are separated by major mylonitic fault zones (Red River and Wilkie Brook fault systems) on the south and east from gneisses and schists of the Cape North and Money Point Groups (Macdonald and Smith 1980) which are characteristic of the Highlands zone. Zircons from syenite in the Blair River complex have given a U-Pb age of 1045 Ma (Barr *et al.* in press), and this combined with the lithologies present indicates that the complex represents Grenvillian basement, probably correlative with the Long Range Inlier-Indian Head Complex and equivalent rocks of western Newfoundland.

The Blair River complex consists of the Polletts Cove Brook Group, an intimately mixed assemblage of quartzofeldspathic gneiss, amphibolite, granitic gneiss, and minor calcareous rocks, intruded by varied diorite, granite, syenite, and anorthosite, and mappable plutons of monzodiorite, anorthosite, syenite and granite, as described by Raeside *et al.* (1986) and Barr *et al.* (in press). Discontinous occurrences of volcanic and sedimentary rocks around the periphery of these crystalline rocks have been correlated with the Devono-Carboniferous Fisset Brook Formation of the Highlands to the south (Kelley and MacKasey 1965, Smith and Macdonald 1981).

DISCUSSION

The purpose of this paper has been to document differences in stratigraphy, metamorphism and plutonism within four areas of Cape Breton Island. Because of limitations of the data base, evaluations of the significance of the observed differences are preliminary. However, it is clear that the Northwestern Highlands zone is Grenvillian, probably correlative with the Long Range Inlier-Indian Head Complex of western Newfoundland, and it seems probable that at least the Southeastern zone is Avalonian. The Bras d'Or zone does not appear to have an equivalent in Newfoundland, although correlations with the Grey River gneisses of southern Newfoundland and with marine clastic rocks and associated limestone-bearing slump breccias on the Burin Peninsula in the Avalon Terrane are a possibility (e.g. O'Brien *et al.* 1983). By analogy with the generally accepted relationship among the Brookville Gneiss, and the Greenhead and Coldbrook groups in southern New Brunswick (e.g. Rast and Skehan 1983, O'Brien *et al.* 1983), the Bras d'Or zone may represent a deeper level of the Southeastern zone, and hence both are Avalonian. Similarity of granitoid units and Cambrian sequences in the two zones is in support of this interpretation.

The increased understanding of the geology of Cape Breton Island indicates that terrane boundaries previously inferred in the Gulf of St. Lawrence (e.g. Williams 1978, Williams and Hatcher 1983) have to be modified, perhaps as suggested in Figure 2. The Wilkie Brook fault system separating the Northwestern Highlands from the Highlands can be interpreted to be an extension of the surface expression of the eastern boundary of the Humber Zone, now marked by the Long Range Cabot Fault (Fig. 2). This correlation implies that the area southeast of the fault system in Newfoundland, an area generally included in the Gander Terrane (Williams 1978, Chorlton and Dallmeyer 1986), is correlative with the Highlands zone, as originally proposed by Neale and Kennedy (1975). Alternatively, the Highlands could be correlative with the Fleur de Lys belt (Hibbard 1983) or the recently defined Piedmont Terrane (Fig.2) of Williams and Hatcher (1983) which also appear to have many geological features in common with the Cape Breton Highlands.

Although this paper has emphasized correlation with Newfoundland, as the "type area" of northern Appalachian terranes, the proposed subdivisions have important implications in northern mainland Nova Scotia which, like Cape Breton Island, has been generally classified as Avalonian (e.g. O'Brien *et al*. 1983, Williams and Hatcher 1983), and in the rest of the northern Appalachians. Correlation between Cape Breton geology and that of northern mainland Nova Scotia is not readily apparent (B. Murphy, personal communication 1986) and hence a fault may separate these areas (Fig. 2). Elements of both the Southeastern and Bras d'Or zones of Cape Breton Island are recognizable in southern New Brunswick, but tectonic relations there appear more complex than in Cape Breton Island (e.g. O'Brien *et al*. 1983).

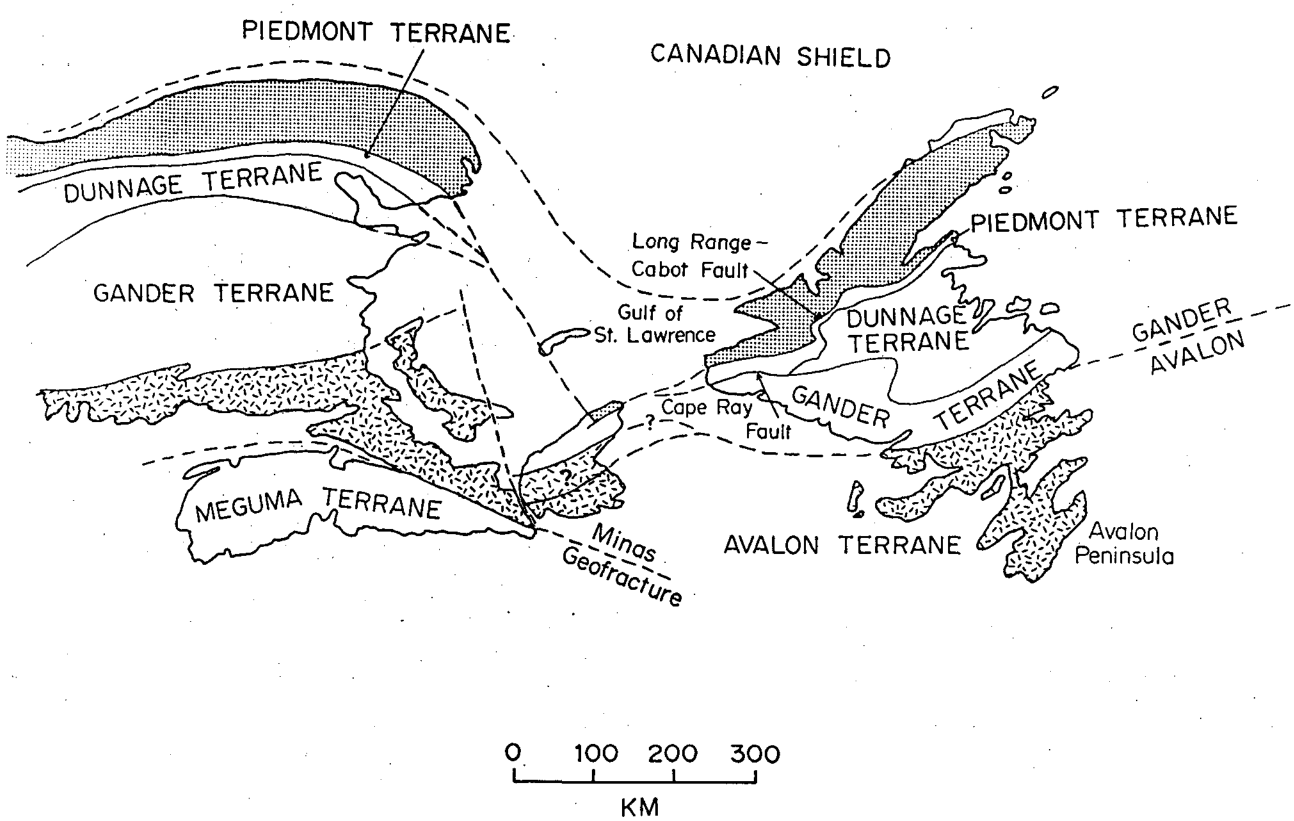

Fig. 2. Possible terranes and terrane boundaries in the northern Appalachians (modified from Williams and Hatcher 1983). Slash pattern indicates Avalon Terrane. Stippled area is late Precambrian - early Paleozoic miogeocline (Humber Zone of Williams 1979).

The model of Figure 2 implies correlation between the Cape Breton Highlands and the Gander-equivalent Miramichi zone of New Brunswick. Similarities in the plutonic rocks of the Miramichi zone (e.g. Fyffe *et al*. 1981) and the Cape Breton Highlands are apparent, but stratigraphic correlations are not as obvious.

In conclusion, although Cape Breton Island is a relatively small area of the northern Appalachians, it occupies a strategic position in attempts to correlate geological subdivisions between Newfoundland and the mainland. The increasingly apparent complexity of the geology in Cape Breton Island emphasizes the problems inherent in proposing regional tectonostratigraphic correlations.

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