New formations in the Eureka Sound Group, Canadian Arctic Islands

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Abstract

The Eureka Sound Group, in eastern Arctic Islands, is divided into four new, lithologically distinct formations of regional extent. The oldest is the Expedition Formation of middle or late Campanian to early Paleocene age, consisting predominantly of sandstone and minor shale, that originated as wave dominated delta, barrier island and estuarine deposits; a major shale unit, the Strand Bay Formation of early to middle Paleocene age, that represents basin-wide marine transgresssion (early Paleocene), followed by regressive prodelta and shelf deposits; the Iceberg Bay Formation of middle or late Paleocene to middle Eocene age, consisting of fluvial sandstone and coal (mostly delta plain); and the stratigraphically highest unit, the Buchanan Lake Formation of middle Eocene age, possibly extending into the late Eocene, that consists of syntectonic conglomerate shed from adjacent thrust sheets, and signifying a major phase of the Eurekan Orogeny. Correlations are made with Eureka Sound strata on Bylot Island, Amund Ringnes Island, Lougheed Island, Banks Island and at Lake Hazen.

Résumé

Le groupe d'Eureka Sound dans la partie est des îles de l'Arctique est divisé en quatre nouvelles formations lithologiquement distinctes d'étendue régionale. La formation d'Expédition, la plus ancienne, date du Campanien moyen ou supérieur au Paléocène inférieur; elle se compose surtout de grès avec de petites quantités de schiste argileux qui, à l'origine, étaient des dépôts d'estuaire, de crête d'avant-plage et de delta, dominés par l'action des vagues. Une importante unité de schiste argileux, la formation de Strand Bay, du Paléocène inférieur à moyen, représente une transgression marine survenue dans l'ensemble de bassin (Paléocène inférieur), suivie par des dépôts de plate-forme et de prodelta en régression; la formation d'Iceberg Bay, du Paléocène moyen ou supérieur à l'Éocène moyen, se compose de grès et de charbon fluviatiles accumulés en grande partie sur une plaine deltaïque. L'unité stratigraphiquement la plus élevée, la formation de Buchanan Lake de l'Éocène moyen et peut-être même de l'Éocène supérieur, se compose d'un conglomérat syntectonique issu de nappes de charriage contiguës et représentant une importante phase de l'orogenèse d'Eureka. Une corrélation a été établie avec les strates d'Eureka Sound dans l'île Bylot, l'île Amund Ringnes, l'île Lougheed et le lac Hazen et l'île Banks.

Introduction

The Late Cretaceous and Early Tertiary Eureka Sound Formation underlies large tracts of the Arctic Archipelago, especially in the eastern Arctic (Fig. 39.1). Although local map units have been defined in some areas, the succession as a whole has not been subjected to detailed regional mapping. The present investigation, begun in 1983, was undertaken to re-evaluate current concepts in Late Cretaceous and Tertiary basin evolution in the Arctic, to determine more precisely the timing of Eurekan orogenesis, and to provide more detailed information on coal resources in the Canadian Arctic. Complete mapping of the Eureka Sound Group, on a scale of 1:50 000, is at present underway (Ricketts, 1984, 1985). Mapping of the Eureka Sound succession on Axel Heiberg and Ellesmere islands has resulted in the identification of four basic lithostratigraphic units of regional extent, and these are formally introduced herein.

Previous terminology

The name Eureka Sound 'group' was first used by Troelsen (1950) for the predominantly nonmarine, coal-bearing, Cenozoic strata underlying Fosheim Peninsula (Table 39.1). Eureka Sound strata were originally interpreted as postdating the last period of orogeny (Troelsen, 1950, 1952) but later were discovered by Thorsteinsson and Tozer (1957) to have been included in the deformation. Following the more extensive investigations of Operation Franklin, Tozer (1963) redefined the unit as a formation, to comply with the current North American stratigraphic practice, and suggested that strata exposed on Fosheim Peninsula were 'typical' of the formation. However, a type section was inadvertently erected by Souther (1963) at Strand Fiord on western Axel Heiberg Island (see discussion by Balkwill, 1983, p. 45), and this designation has continued in the literature.

As a result of preliminary mapping in the Bay Fiord and Strathcona Fiord area of Ellesmere Island, West et al. (1981) identified four informal members within the Eureka Sound Formation. Map unit boundaries established in the same area during the present investigation (Ricketts, 1985, GSC Open File 1182), coincide only approximately with those established by West et al. (1981) and therefore the latter designations are not used here. Miall (1984) has indicated that the Eureka Sound Formation should be raised to group status. Because of considerable lithofacies variations, Miall (1984) considers it unlikely that any unit can be mapped regionally, and suggests that the lithostratigraphic framework should be based on (genetic) depositional systems. As an alternative approach, I intend to introduce a simple nomenclatural scheme based on the general lithological homogeneity of rock units and their mappability.

Rationale

A thick sequence of shale (up to 287 m) has been identified and mapped in the Strand Fiord area, and subsequently found as a distinct mappable unit in the areas surrounding Strathcona and Bay fiords, Vesle Fiord, Canon Fiord and northward along Fosheim Peninsula. At Strand Fiord, the age of the shale sequence is Early to Middle Paleocene (Ricketts, in press) and this age is also confirmed in the other areas (McIntyre, personal communication, 1985). Thus, the shale unit is a particularly useful stratigraphic marker throughout the area. Wherever the shale unit occurs, it is underlain and overlain by thick sequences consisting predominantly of sandstone. The Eureka Sound succession can be divided into four formations based primarily on shale, sandstone or conglomerate content. Although sedimentary facies may vary within any one formation, this feature in itself does not invalidate the scheme, but provides the basis for further subdivision into members. Each formation is also mappable at a scale of 1:250 000 (Fig. 39.2, 39.3). Corresponding stratigraphic sections are shown schematically in Figure 39.4 (Strand Fiord area), and in Figure 39.5, central Ellesmere Island (Fosheim Peninsula and Strathcona Fiord). Following Miall (1984), the Eureka Sound is now referred to as a group.

Lithostratigraphy

Expedition Formation

Definition. The Expedition Formation is the lowest stratigraphic unit of the Eureka Sound Group, and consists predominantly of quartz-rich sandstone, with subordinate shale and coal. The Expedition Formation is overlain by shale of the Strand Bay Formation. Thickness varies from 500 m at Strand Fiord, to a maximum of 836 m at Canon Fiord; other measured sections are at Strathcona Fiord (502 m+), and at the north end of Fosheim Anticline (632 m). The formation is named after Expedition Fiord on western Axel Heiberg Island.

The type section is located on the east side of Kanguk River, 2.5 km due north of Strand Fiord, latitude 79°16'N; longitude 90°35'W (Fig. 39.2). This lies above the type section of the Kanguk Formation.

Synonyms. The Expedition Formation includes Member I and the lower part of Member II of West et al. (1981).

Contacts. Where the Expedition Formation is conformable with the Kanguk Formation, the contact is flat; where it is in contact with Lower Paleozoic bedrock, basal strata of the Expedition Formation overlie an erosional relief of up to 50 m, with profound unconformity.

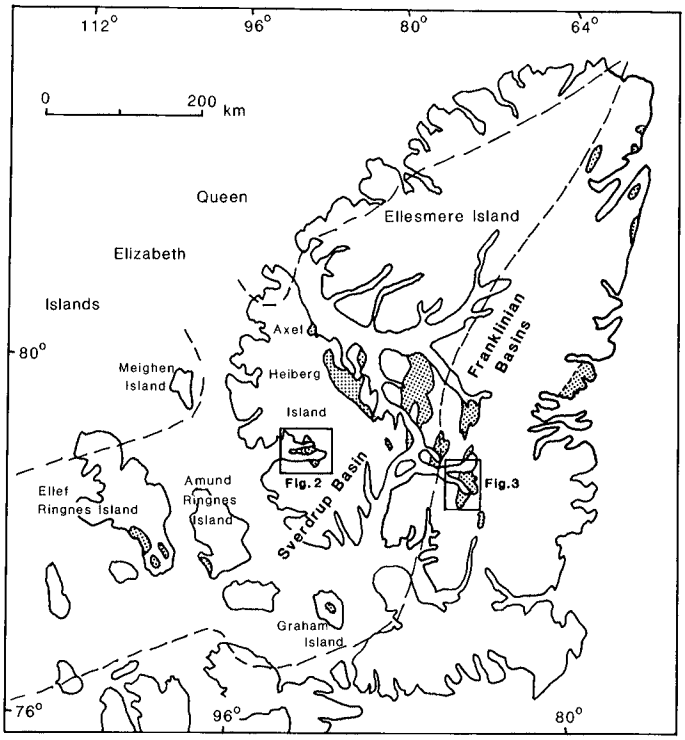

Figure 39.1. A map of the eastern Arctic Islands, showing general distribution of Upper Creteaceous and Tertiary strata (stipple), with respect to Sverdrup Basin and Franklinian bedrock. The insets show the locations of more detailed lithostratigraphic maps in the Strand Fiord and Strathcona Fiord areas.

Table 39.1. Eureka Sound Group nomenclature Axel Heiberg Island and central Ellesmere Island

			Troelsen, 1950	Tozer, 1963	West et al, 1975		This Study
TERTIARY	EOCENE	U	Eureka Sound Group (undivided)	Eureka Sound Formation (undivided)			Buchanan Lake Formation
		M			Eureka Sound Fm	member IV	Iceberg Bay Formation
		L				member III	
	PALEOCENE	U				member II	Strand Bay Fm
		L				member I	Expedition Formation
CRETACEOUS	MAASTRICHTIAN		Mesozoic	Kanguk Formation	Kanguk Formation		
	CAMPANIAN	U					Kanguk Formation
		M					

It has been found necessary to modify the definition of the Kanguk Formation – Eureka Sound Group contact, as indicated in the ensuing discussion. In most places the contact is gradational, and Tozer (1963) placed the boundary beneath the first major sandstone bed. However, the thickness of this bed was left undefined, and in fact is quite variable; at many localities the first major sandstone actually forms part of a coarsening- and thickening-upward sequence that is tens of metres thick. An additional problem is encountered at the type section (Fig. 39.6), where the upper part of the Kanguk Formation contains several tens of metres of sandstone and thin interbedded shale, overlain by a 30 m thick unit of shale containing **Inoceramus lundbreckensis** (Jeletzky, personal communication, 1984). Souther (1963) and Tozer (1963) placed the top of the Kanguk Formation immediately above this shale, which would mean that the Kanguk contains a sandstone facies that is identical to sandstone units found elsewhere in the Eureka Sound Group; logically, the sandstone could be included in the Eureka Sound Group. During the present mapping program, a useful criterion for determining the contact was found to be the stratigraphic level above which the sandstone/shale ratio approximates 2:3. At this level the outcrop is much more resistant to weathering and the contact may be mapped clearly.

In most places, contact with the overlying Strand Bay Formation is abrupt. Sandstone at the top of the Expedition Formation is succeeded by thick, blocky weathering shale. Stratigraphic relationships across this contact vary from conformable to unconformable.

Lithology. The proportion of major lithotypes varies considerably across the Eureka Sound Basin. In the area around Strand Fiord, sandstone and shale units are arranged into coarsening- and thickening-upward cycles that rarely are capped by thin coal seams. Coarsening- and thickening-upward cycles also occur in the lower half of the formation from Strathcona Fiord and north along Fosheim Peninsula. The lowest of these cycles includes the 'basal' white sandstone that is so prominent in the west-central Ellesmere Island area, particularly where the formation overlies Paleozoic bedrock. Coal seams that cap the cycles here are better developed than at Strand Fiord; the number and thickness of seams increase northward toward Hot Weather Creek, thickness ranging from a few centimetres to more than a metre.

Along western Ellesmere Island, the Expedition Formation is easily recognized by two principal criteria: a basal white sandstone unit, and a distinctive, striped weathering pattern in strata above the white sandstone bed, which reflects the thin, regular alternation of sandstone, shale and coal beds. In the upper part of the formation, these rock types are arranged in thin, fining-upward sequences.

Age. The base of the Expedition Formation appears to be diachronous; at Strand Fiord it ranges from middle Campanian to Maastrichtian. Palynological evidence has led to the identification of a disconformity at the top of the Expedition Formation at Strand Fiord (D.J. McIntyre, personal communication, 1984). This disconformity is considered to be a result of nondeposition and possibly local erosion. At the northwest end of Fosheim Peninsula, the Expedition Formation is probably middle Campanian to Early Paleocene. Where the formation directly overlies Paleozoic bedrock, as in the Strathcona – Canon Fiord area, it is Early Paleocene in age (e.g. Canon Fiord). A disconformity like that recognized at Strand Fiord has not been identified at the top of the Expedition Formation in the Fosheim Peninsula – Strathcona Fiord area. However, this does not preclude the possibility of a hiatus, especially if its duration were too short to be resolved by palynological studies.

Interpretation. A variety of facies are represented. At Strand Fiord, the Expedition Formation originated as a series of wave dominated deltas (Ricketts, in press), whereas between Strathcona and Canon fiords, barrier island and estuarine conditions prevailed. Basal strata near Hot Weather Creek and Fosheim anticline also represent barrier island deposition, although upper strata here probably accumulated on delta plains.

Strand Bay Formation

Definition. This unit is easily recognized in most areas as a thick sequence of dark grey shale. Tabular bedded sandstones are minor, composing less than 10 per cent at Strand, Strathcona and Vesle fiords. However, the sandstone component increases north and west along Fosheim Peninsula, and at the north end of Fosheim anticline, sandstone locally composes up to 60 per cent of the formation; thin coal seams also are present. Maximum thicknesses occur at Strand Fiord and Canon Fiord (287 and 276 m, respectively), and at other localities values range from 122 to 196 m. The Strand Bay Formation is conformably overlain by the Iceberg Bay Formation.

The type section is located on a ridge along the north shore of Strand Fiord, 15.5 km due west of the mouth of Kanguk River and 3 km due east of Twin Diapirs, at latitude 79°14'N and longitude 91°27'W (Fig. 39.2, 39.7). The formation is named after Strand Bay, which marks the entrance to Strand and Expedition fiords on west Axel Heiberg Island.

Synonyms. The Strand Bay Formation includes approximately the upper 200 m of Member II at south Strathcona Fiord, recorded by West et al. (1981).

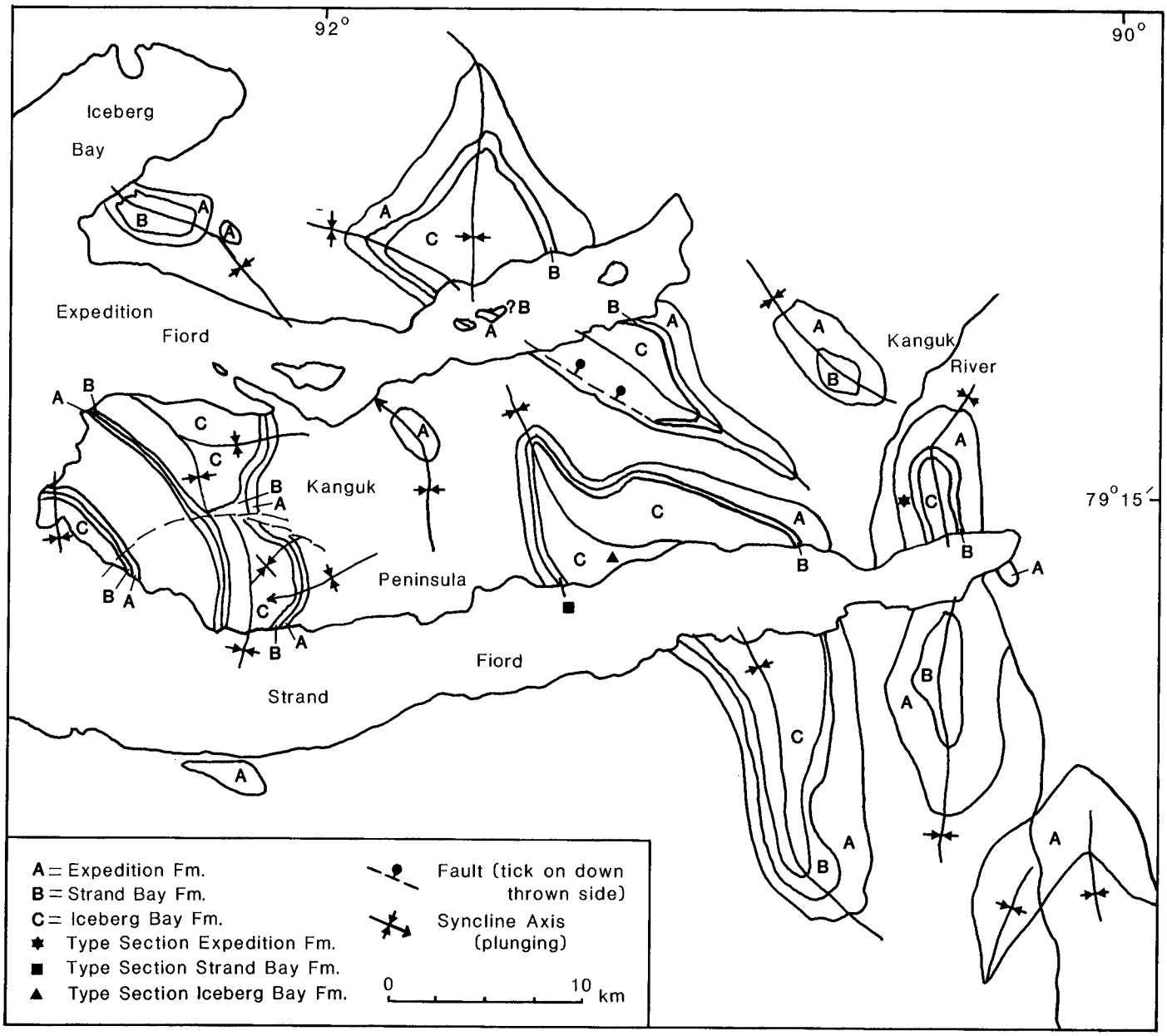

Figure 39.2. Lithostratigraphic map of the Eureka Sound Group at Strand Fiord. The map is summarized from Open File 1147. Formations are designated by letters. Type sections for the Expedition, Strand Bay and Iceberg Bay formations also are located. The map area is shown in Figure 39.1.

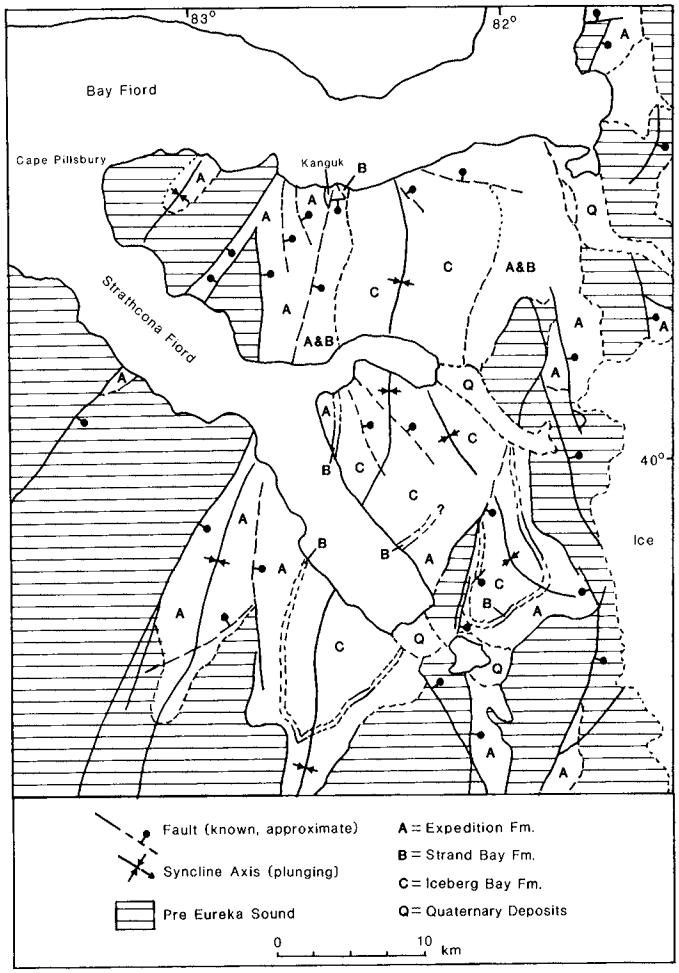

Figure 39.3. Lithostratigraphic map of the Eureka Sound Group in the Strathcona Fiord area. Data has been summarized from Open File 1182. All formations are indicated by letters. The map area is located in Figure 39.1.

Contacts. Contact with the underlying Expedition Formation is described in the preceding section. Contact with sandstone of the superjacent Iceberg Bay Formation generally is conformable and gradational over a few metres of interbedded shale and sandstone. Even in areas of poor exposure, shale of the Strand Bay Formation can be traced as a recessive interval bounded by formations of resistant sandstone.

Lithology. The shale weathers to a grey or blue-grey colour and has a blocky fracture. Resistant sandstone beds that have tabular geometries and cumulative thicknesses of 25 to 30 m occur in the lower third of the formation at Strand Fiord. In comparison, sandstone units exposed at Canon Fiord and elsewhere along Fosheim Peninsula form distinct coarsening- and thickening-upward cycles, that locally are capped by thin coal seams. The proportion of sandstone also incrases northward along this trend although shale remains the dominant rock type. Hummocky crossbeddng occurs in several cycles at Canon Fiord. Tidal bedding is common in the lower parts of these cycles on Fosheim Peninsula. These features indicate overall eastward- and northward-shoaling trends in the Strand Bay Formation.

Age. Palynological analysis by D.J. McIntyre (personal communication, 1984) indicates an Early to Middle Paleocene age for the Strand Bay Formation. The Paleocene age is generally confirmed by a sparse assemblage of arenaceous foraminifera (J.H. Wall, personal communication, 1985).

Interpretation. Because of its regional extent and abrupt appearance in the stratigraphic succession of the eastern Arctic Islands, the base of the Strand Bay Formation is considered to represent an Early Paleocene marine transgression. Transgression was followed by a depositional phase, and the bulk of the shales and minor sandstone represent prodelta and shelf deposits of the subsequent regression. Continued progradation gave rise to the overlying sandstones of the Iceberg Bay Formation.

Iceberg Bay Formation

Definition. In many areas of the eastern Arctic, the Iceberg Bay Formation is the highest stratigraphic unit preserved. It is characterized by three principal lithotypes: a unit of noncalcareous or slightly calcareous sandstone and shale; a calcareous, flaggy, white siltstone and sandstone unit; and a unit containing sandstone and thick coal seams (Ricketts, 1984, 1985). All units can be mapped separately and, in a future publication, will be designation as members.

The preserved thickness of the Iceberg Bay Formation at its type section at Strand Fiord is 1950 m, with additional thick sections located at Mokka Fiord (1500 m recorded by Bustin, 1977), 1240 m at Strathcona and Bay fiords, 600 m preserved at Canon Fiord, and possibly as much as 2000 m near Hot Weather Creek. In most cases, the top of the formation in these areas is eroded and thickness values are a minimum.

The only continuous and well exposed section through the entire formation is the type section (Fig. 39.8), which is located on the north shore of Strand Fiord, immediately above the type section of the Strand Bay Formation. The base of the section is located at latitude 79°14'N and longitude 91°27'W; the top of the section is latitude 79°14.5'N and longitude 91°15'W, 11 km due west of the mouth of Kanguk River. The formation is named after Iceberg Bay, situated north of Expedition Fiord on west Axel Heiberg Island.

Synonyms

The Iceberg Bay Formation is equivalent to both members III and IV recorded at Strathcona Fiord by West et al. (1981).

Contacts

Where basal strata of the Iceberg Bay Formation include thick brown sandstone (as at Strand Fiord), or calcareous, flaggy siltstone and sandstone (as at Canon Fiord and Strathcona Fiord), the contact with the underlying Strand Bay Shale is easily mapped. The contact is gradational over a few metres, in which the proportion of coarse grained rock types interbedded with shale increases.

Contact with the overlying Buchanan Lake Formation is abrupt and disconformable, although locally it may be conformable, as noted at Lake Hazen by Miall (1979a). At the head of Mokka Fiord, in the footwall of Stolz Thrust and 8 km due south of Mokka Fiord Diapir, the contact is defined by the abrupt transition from pale brown weathering, quartz-rich sandstones interbedded with coal seams, to dark brown, lithic sandstones and diabase-pebble conglomerates.

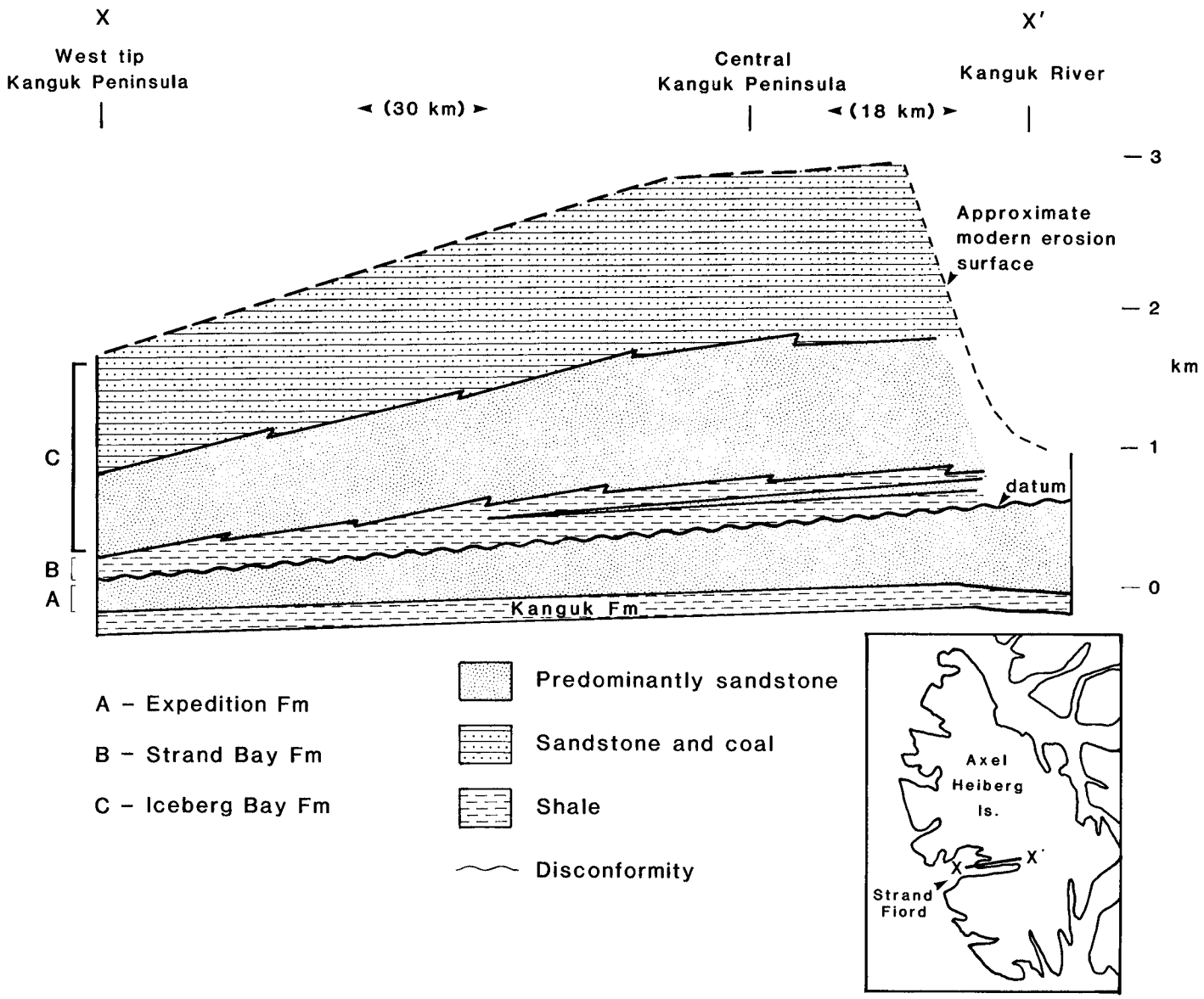

Figure 39.4. A stratigraphic cross-section of the Eureka Sound Group at Strand Fiord. The datum is placed at the base of the Strand Bay Formation. The letter designation for formations is the same as that in Figure 39.2. Stratigraphic thicknesses are approximate. Note that the Iceberg Bay Formation is subdivided into two distinct lithological units that in the future may be designated as members.

Lithology. Fine grained, brown sandstone and shale beds composing the lower 890 m of the formation at Strand Fiord (map unit 4, Ricketts, 1984), are arranged into a large number of coarsening- and thickening-upward cycles. A few thin coal seams appear in the upper cycles of this map unit. In comparison, fining-upward sandstone sequences, commonly capped by coal seams (locally up to 6 m thick), constitute the upper 1060 m of the formation at this locality (map unit 5, Ricketts, 1984).

A sequence of calcareous, flaggy siltstone and white sandstone, at least 600 m thick, occurs in the lower part of the Iceberg Bay Formation at Strathcona, Bay, Vesle and Canon fiords. Like their stratigraphic counterparts at Strand Fiord, the flaggy lithotypes are arranged into coarsening-upward cycles, some of which contain abundant hummocky crossbedding (for example at South Bay), and channels filled with coarse grained calcareous sandstone. In the Canon Fiord area, the calcareous rock types form prominent cliffs.

An additional unit of shale, up to 158 m thick, has been mapped locally at south Strathcona Fiord, where it abruptly overlies a coal seam that caps the calcareous flaggy strata (Fig. 39.5). This shale thins northward to Bay Fiord where it is replaced laterally by a thin, pebble conglomerate, indicating the presence of a hiatal surface of local extent within the Iceberg Bay Formation.

Coal-bearing sandstones that cap fining-upward, sandstone-shale sequences occur in the upper 600 m of the formation at Bay Fiord, and correlate with the principal

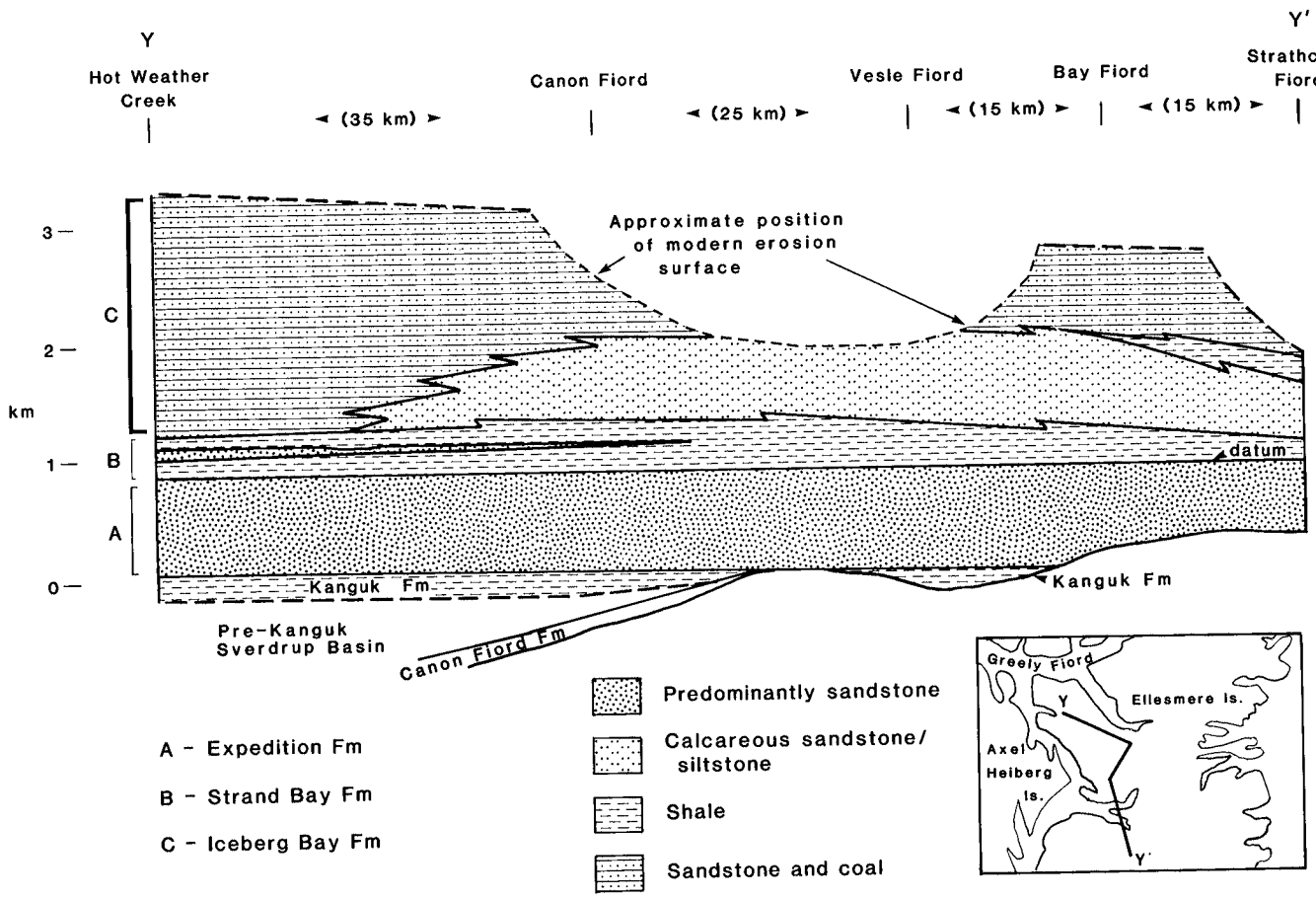

Figure 39.5. A stratigraphic cross-section of the Eureka Sound Group, from Strathcona Fiord to northern Fosheim Peninsula (see map inset). The datum is placed at the base of the Strand Bay Formation. Formations are designated by letters. Stratigraphic thickness is approximate. Note that the Iceberg Bay Formation has been subdivided into three distinct lithological units that in future may be defined as members.

coal-bearing sequence at Strand Fiord (map unit 5, Ricketts, 1984, 1985). Toward the northwest along Fosheim Peninsula, the lower, calcareous rock types are replaced laterally by the coal-bearing sequence, and at Hot Weather Creek the formation consists almost entirely of fining-upward sandstone-coal cycles (Fig. 39.5).

Age. The age of the Iceberg Bay Formation, based primarily on palynomorphs (D.J. McIntyre, personal communication, 1985) ranges from Middle or Late Paleocene to Middle Eocene. Additional evidence is provided by Paleocene calcareous foraminifera (J.H. Wall, personal communication, 1985), found for the first time in the Eureka Sound Group at Strathcona Fiord, and also a diverse assemblage of vertebrate fossils found in Eocene coal-bearing rocks near the top of the formation, south of Bay Fiord (West et al., 1977).

Interpretation. The Middle Paleocene to Middle Eocene regressive phase of deposition at Strand Fiord gave rise to deltaic deposits that reflect a greater fluvial influence than the wave dominated deltas that deposited the Expedition Formation. However, the eastern side of the Eureka Sound Basin (west-central Ellesmere Island) also contain barrier island, lagoon and shelf deposits, in addition to more local prodelta shale. Coal-bearing strata at the top of formation are also of delta plain origin and appear to have extended across the entire basin by Early Eocene time; laterally equivalent delta front facies are probably preserved in the subsurface offshore and beneath Meighen Island (north and west of Axel Heiberg Island).

Buchanan Lake Formation

Definition. Besides being the highest stratigraphic unit in the Eureka Sound Group, the Buchanan Lake Formation is critical because it formed in response to a major period of faulting and folding during the Eurekan Orogeny. At Mokka Fiord, interbedded quartz arenite and coal seams belonging to the Iceberg Bay Formation are abruptly overlain by diabase conglomerates, lithic arenites, and minor amounts of siltstone and shale. Thick units of conglomerate with a variety of clast compositions are now known from several localities on Axel Heiberg and Ellesmere islands, and herein are named the Buchanan Lake Formation. Because stratigraphic and structural relationships are reasonably well exposed in the strata along the south shore of Mokka Fiord (Fig. 39.9), the area is designated as the type locality (lat. 79°32'N, long. 87°34'W). At the type locality, the formation occurs in the immediate footwall of the Stolz Thrust and hence the 370 m of section is a minimum value. Similar thicknesses are recorded at Geodetic Hills (possibly up to 1000 m, Bustin, 1982; this study) and Otto Fiord (about 300 m). A thick conglomerate unit (300 m) occurring in the Franklin Pierce Bay area of eastern Ellesmere Island is tentatively placed in the Buchanan Lake Formation. The formation is named after Buchanan Lake, which drains into Mokka Fiord (eastern Axel Heiberg Island).

Synonyms. Conglomerate and sandstone exposed at Geodetic Hills were formerly included in the Beaufort Formation by Bustin (1982), but now are reclassified as

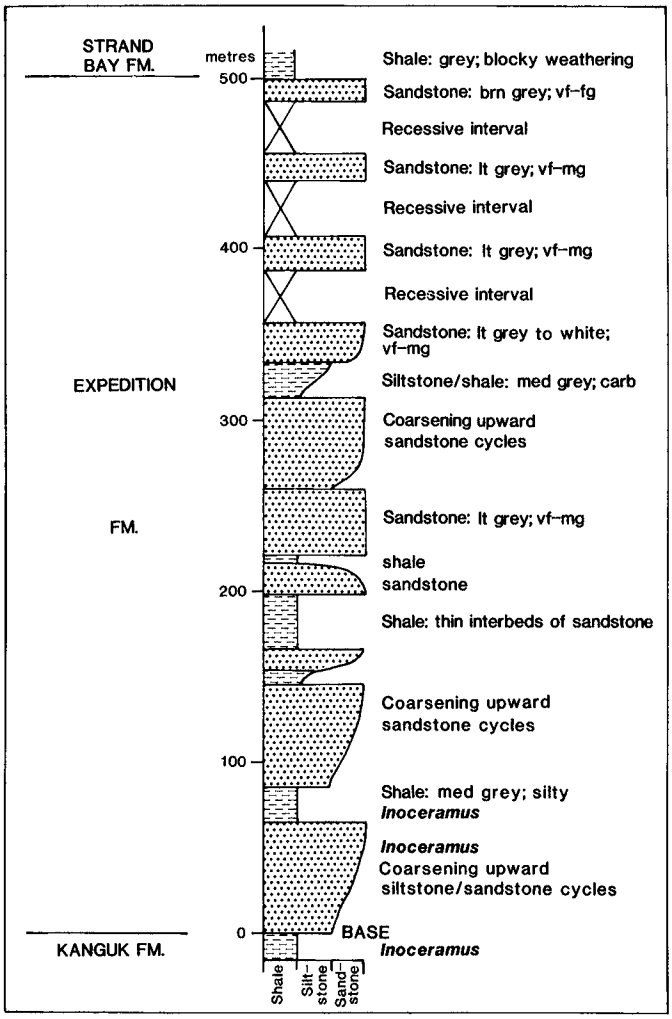

Figure 39.6. A schematic representation of the Expedition Formation type section, east of Kanguk River (lat. 79°16'N; long. 90°35'W). Detailed description of this section is given in Ricketts (in press).

Buchanan Lake Formation (Ricketts and McIntyre, 1986). Conglomerates at the Boulder Hills locality near Lake Hazen (conglomerate member of Miall, 1979a) are also assigned to the Buchanan Lake Formation.

Contacts. As previously noted, the basal contact at Mokka Fiord is disconformable. At other localities along eastern Axel Heiberg Island there is a slight discordance with underlying Mesozoic bedrock (for example 5-8° in exposures due west of Stang Bay). Conglomerates at Boulder Hills, are seemingly in conformable and gradational contact with underlying sandstones and interbedded coal seams that are included in the Iceberg Bay Formation. The basal contact at Franklin Pierce Bay (east coast of Ellesmere Island) appears to be disconformable; conglomerate composed of highly indurated sandstone and limestone clasts overlies Early Paleozoic, Franklinian strata of similar composition. The upper contact of the Buchanan Lake Formation is faulted, and conglomerates lie in the footwalls of major thrusts, such as the Stolz, Parrish Glacier and Lake Hazen thrusts.

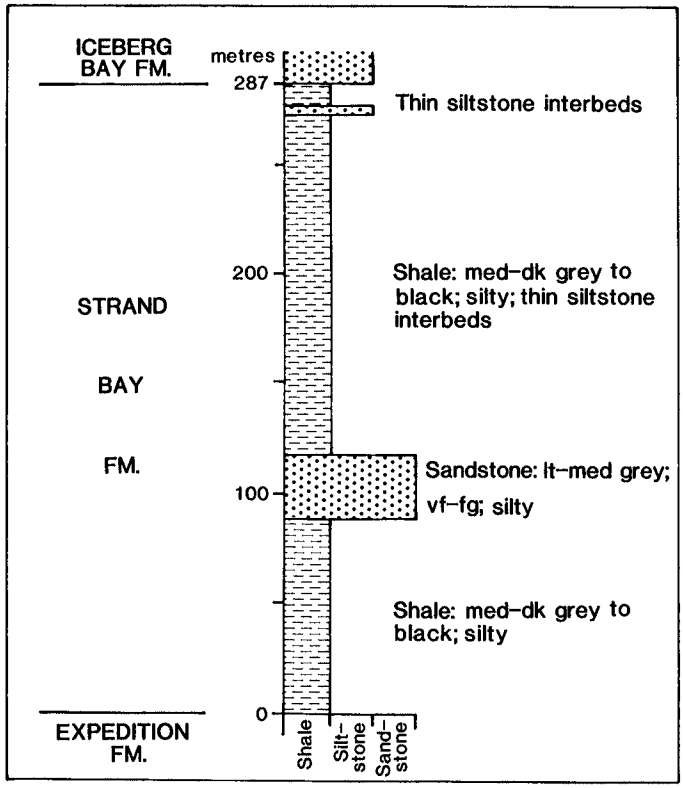

Figure 39.7. A schematic representation of the Strand Bay Formation type section, north shore of Strand Fiord (lat. 79°14'N; long. 91°27'W). Detailed description of this section is given in Ricketts (in press).

Lithology. Internal organization and sedimentary facies in the Buchanan Lake Formation conglomerates are similar from one area of exposure to another, despite considerable differences in clasts composition; crossbedding and channel structures abound. Exposures along eastern Axel Heiberg contain a variety of bedding types, with massive cliff-forming conglomerate in the lower part of the formation, and interbedded conglomerate, sandstone, grey mudstone, and lignitic coal higher in the succession. Pebble composition here and at the type section is predominantly diabasic, with minor amounts of sandstone. Clasts at Franklin Pierce Bay consist predominantly of carbonate and highly indurated sandstone derived from Lower Paleozoic rocks in the hanging wall of the Parrish Glacier Thrust. At Otto Fiord, diabase pebble conglomerate occurs at the base of the sequence, whereas siliceous limestone clasts predominate at stratigraphically higher levels, a compositional change that may reflect an inverse stratigraphic derivation; namely, diabase eroded from sills intruding the Triassic Blaa Mountain Group, and siliceous limestone from the Upper Paleozoic Nansen Formation

Age. Lignite seams and mudstone at Geodetic Hills contain a rich, well preserved flora. The assemblages indicate a Middle Eocene age. A more detailed description of the flora is given in Ricketts and McIntyre (1986).

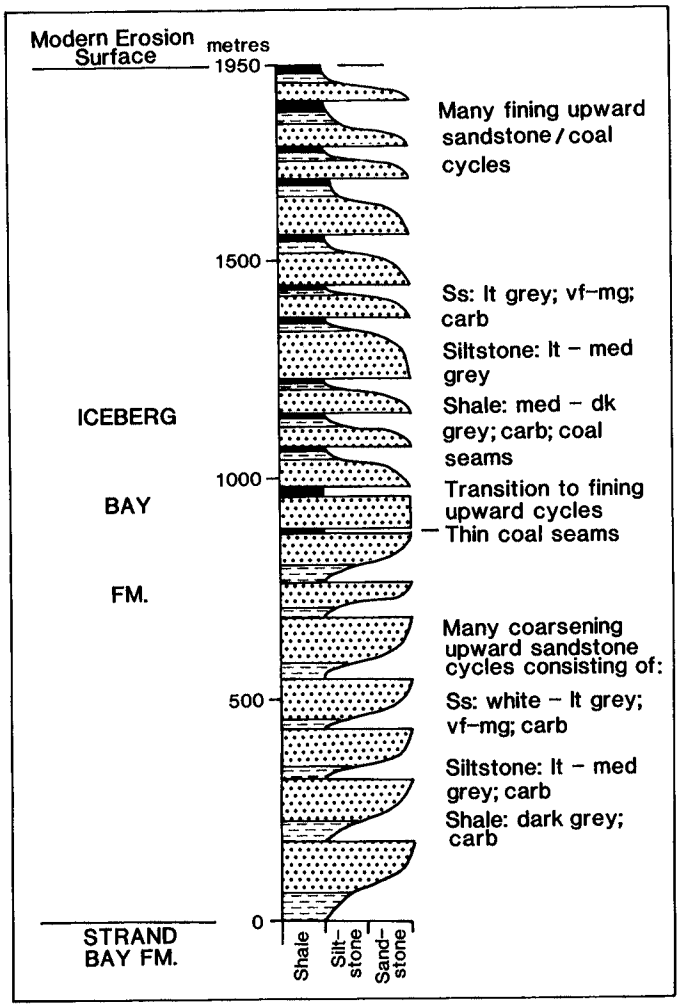

Figure 39.8. A schematic representation of the Iceberg Bay Formation type section, north shore of Strand Fiord (lat. 79°14'N; long. 91°27'W). Detailed description of this section is given in Ricketts (in press).

Interpretation

The conglomerate and sandstone that compose the bulk of the Buchanan Lake Formation were deposited by fluvial processes, commonly braided rivers, and locally, by debris flows. The clastic debris of the alluvial fans and braidplains was derived from adjacent thrust sheets of Mesozoic and Paleozoic bedrock. The Buchanan Lake Formation is syntectonic and represents a major phase of Eurekan tectonism.

Use of the Eureka Sound Group nomenclature in other areas of the Arctic Archipelago

The terminology proposed here can be applied to a number of other areas in the Arctic that contain Eureka Sound Group strata (summarized in Table 39.2). Thick bedded conglomerate at Lake Hazen and Judge Daly Peninsula (Miall, 1979a, 1982) display lithological, stratigraphic and structural relationships that are similar to those in the Buchanan Lake Formation. Underlying sandstone, shale and coal, up to 450 m thick and mostly of fluvial origin, can logically be included in the Iceberg Bay Formation.

Changes to the Kanguk-Eureka Sound contact at Bylot Island are suggested. The upper 'sandstone member' of the Kanguk Formation (Miall et al., 1980) correlates with the Expedition Formation, basal Eureka Sound Group; contact relationships with the Kanguk Formation and lithological criteria are similar to those at the type section of the Expedition Formation at Strand Fiord. The 'lower mudstone member' of Miall et al. (1980), which is almost 500 m thick on southwestern Bylot Island, is correlated with the Strand Bay Formation. An abrupt and disconformable basal contact, an upper contact that is gradational with the overlying sandstone, and a general Paleocene age, all are similar features to those of the Strand Bay Formation at its type section. The disconformity at the base of the mudstone member may correlate with a similar hiatus at Strand Fiord. The remainder of the Eureka Sound strata, which consists mainly of sandstone, is assigned to the Iceberg Bay Formation.

On Amund Ringnes and Cornwall islands, approximately 300 m of sandstone and shale, in gradational and conformable contact with the Kanguk Formation and apparently of Late Cretaceous age (Balkwill, 1983), are included in the Expedition formation. A major unconformity between much younger 'unnamed' brown sandstone (possibly Late Paleocene-Eocene) and Triassic and Lower Cretaceous bedrock (Balkwill, 1983), may also correspond to the disconformity discovered at Strand Fiord. These younger sandstones are tentatively included in the Iceberg Bay Formation. The Strand Bay Formation has not been recognized on Amund Ringnes Island.

About 60 m of sandstone, probably of Maastrichtian age (Balkwill et al., 1982), that disconformably overlie Kanguk shale on south-central Lougheed Island, also are correlated with the Expedition Formation.

On Banks Island, Miall (1979b) divided the Campanian to Eocene succession into the Kanguk Formation, with a shale member and an upper sandstone member, and the Eureka Sound Formation, with a shale member and an overlying cyclic member. The lithotypes and ages of these units indicate that the upper sandstone member of the Kanguk Formation can be assigned to the Expedition Formation, the shale member of the Eureka Sound Formation to the Strand Bay Formation, and the overlying cyclic member to the Iceberg Bay Formation.

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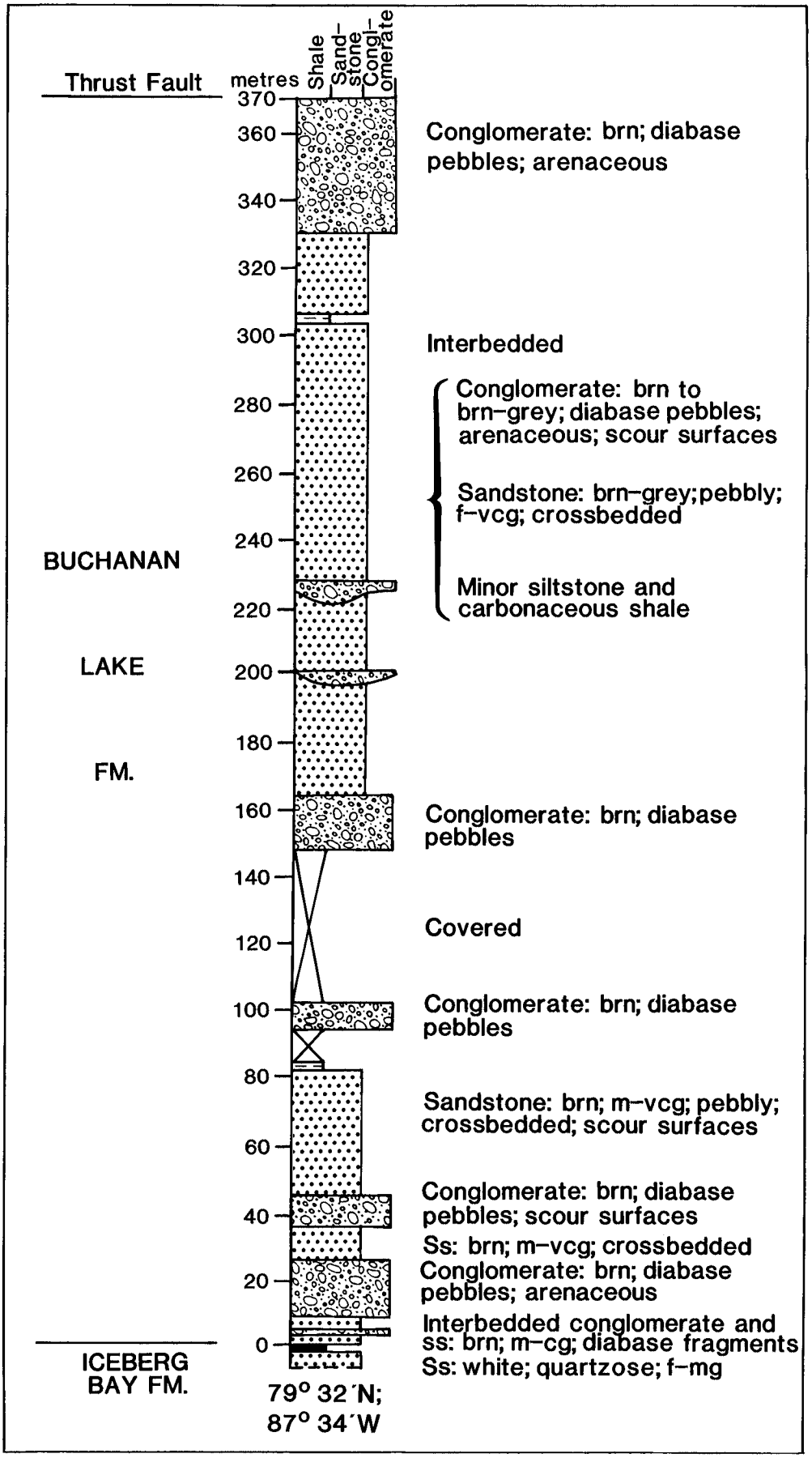
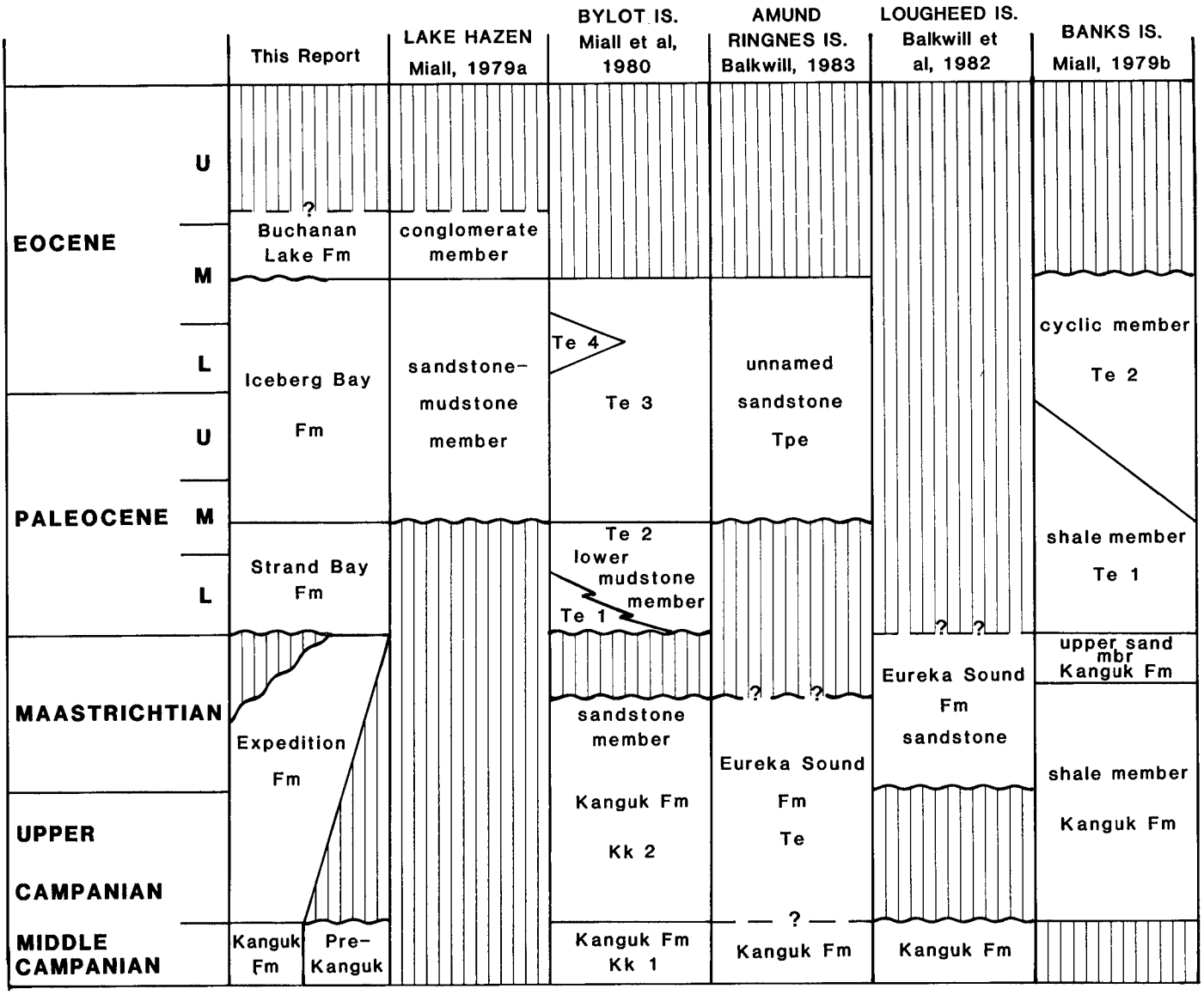


Figure 39.9. Buchanan Lake Formation type section, at the head of Mokka Fiord (lat. 79°32'N; long. 87°34'W).

Table 39.2. Lithostratigraphic correlation of Eureka Sound Group, Arctic Islands



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