46.

RIFT-RELATED LATE PROTEROZOIC SEDIMENTATION AND VOLCANISM ON NORTHERN BAFFIN AND BYLOT ISLANDS, DISTRICT OF FRANKLIN

Project 770013

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Abstract

More than 5600 m of late Proterozoic quartzarenites, shales, stromatolitic and biohermal carbonates, arkoses, greywackes and conglomerates, were deposited in environments ranging from fluvial to subtidal on northern Baffin and Bylot islands. A delta-fan complex occurs in the lower part of the succession, coastal sabkha-type evaporites in the middle part, and an alluvial fan complex in the upper part. As much as 80 m of tholeiitic plateau basalts occur near the base of the succession.

Syndepositional faulting had a significant effect on the sedimentation pattern. Paleocurrent trends are varied, but most indicate northwesterly transport in central graben areas and in some horst areas. Transport away from fault zones active during sedimentation and toward central graben areas, is indicated in marginal trough areas. Rifting was probably related to a late Proterozoic ocean opening event to the northwest; perhaps an early phase of the Franklinian Geosyncline.

Introduction

The 1979 field season was the third on the project and the second in which a full-sized party was active. The major goals of the project continue to be the study of the several thousand metres of strata present in the Eqalulik and Uluksan groups. Early work is well documented by Lemon and Blackadar (1963) and by Blackadar (1970). More recent studies include those by Galley (1978), Geldsetzer (1973a, b), Iannelli (1979), Jackson and Davidson (1975), Jackson et al. (1975, 1978), and Olson 1977).

About 19 400 km^2 (7500 sq. miles) remained to be examined in 1979 during a 2 1/2 month field season (48 D, eastern two-thirds of 48 A, northern 37 G, western 38 B, northern 38 C). Because of poor weather relatively little work was carried out on the basement gneisses, and several large patches of late Proterozoic strata on northern Borden Peninsula and Bylot Island remain to be studied (Fig. 46.1, 46.2).

A Bell 206 B helicopter from Aerotrades Ltd. was used by the 9-man party headed by G.D. Jackson, and also provided support for W.F. Fahrig and K. Christie in their paleomagnetic studies. Excellent Twin Otter support was provided periodically by Polar Continental Shelf Project.

This preliminary report for the most part summarizes data gathered during the 1979 field season. Most of the work in the Eqalulik Group and the overlying Arctic Bay Formation was carried out by Iannelli (Contract No. 95704) who is responsible for those rocks in this report (Table of Formations). Jackson and Tilley worked chiefly in the Uluksan Group. Tilley provided a résumé of her work and a preliminary draft of the paleocurrent diagrams (Fig. 46.1, 46.2).

Basement Complex

A variable complex assemblage of Archean-Aphebian gneisses and igneous rocks is separated from the overlying late Proterozoic strata by a nonconformity. Most of the gneisses are irregularly banded migmatites which are commonly intruded by two or more generations of granitic rocks. Upper amphibolite metamorphic grade predominates but granulite grade occurs in several places and seems to have superseded late granitic emplacement.

Regolithic material up to 6 m thick is preserved beneath the Proterozoic strata at several localities. Basement rocks grade upward into poorly consolidated varicoloured rocks containing kaolinized feldspar, granular quartz and fine chlorite-sericite matrix and partings. The contact with overlying Nauyat and Adams Sound strata is undulatory and disconformable.

Nauyat Formation

The Nauyat Formation outcrops chiefly from south of Adams Sound southeast to south of Tremblay Sound (Fig. 46.1), east of Elwin Inlet and on northern Bylot Island. It is the basal formation of the late Proterozoic succession, nonconformably overlies the basement complex, ranges from 16 to over 90 m thick, and has been divided informally into two conformable members, N_1 and N_2 (Jackson et al., 1978).

Rb-Sr and K-Ar ages recently completed by the Geochronology Section of the Geological Survey of Canada range from 762 to 1060 Ma. Preliminary considerations of the results suggest that an age of 917 to 1032 Ma is most likely for the formation.

N_1 Member

The lower (N_1) member consists chiefly of thin- to medium-bedded, grey-white to pink, dark red, buff and brown quartzarenite. Thin layers of quartz-granule to quartz-pebble conglomerate occur as basal units of fining upward cycles in the lower part of the member. Sedimentary structures include trough- and planar-crossbeds, wave and current ripple marks, load casts, and synaeresis cracks. Crossbeds indicate unimodal northwesterly paleocurrent trends. The member ranges from 8 to 20 m in thickness.

N_2 Member

Nauyat volcanics overlie basement gneisses nonconformably where the N_1 member is absent. The flows occur in a single sequence containing 1 to 5 flows of fine grained, massive, amygdaloidal tholeiitic plateau basalt with alkalic affinities (Galley, 1978; Jackson et al., 1978). Some layers on northern Bylot Island are fine- to medium-grained, olive green, ultramafic, and may be ultrabasic sills. Thin, baked quartzarenite, siltstone, dolosiltite and chert beds are interbedded with the flows locally.

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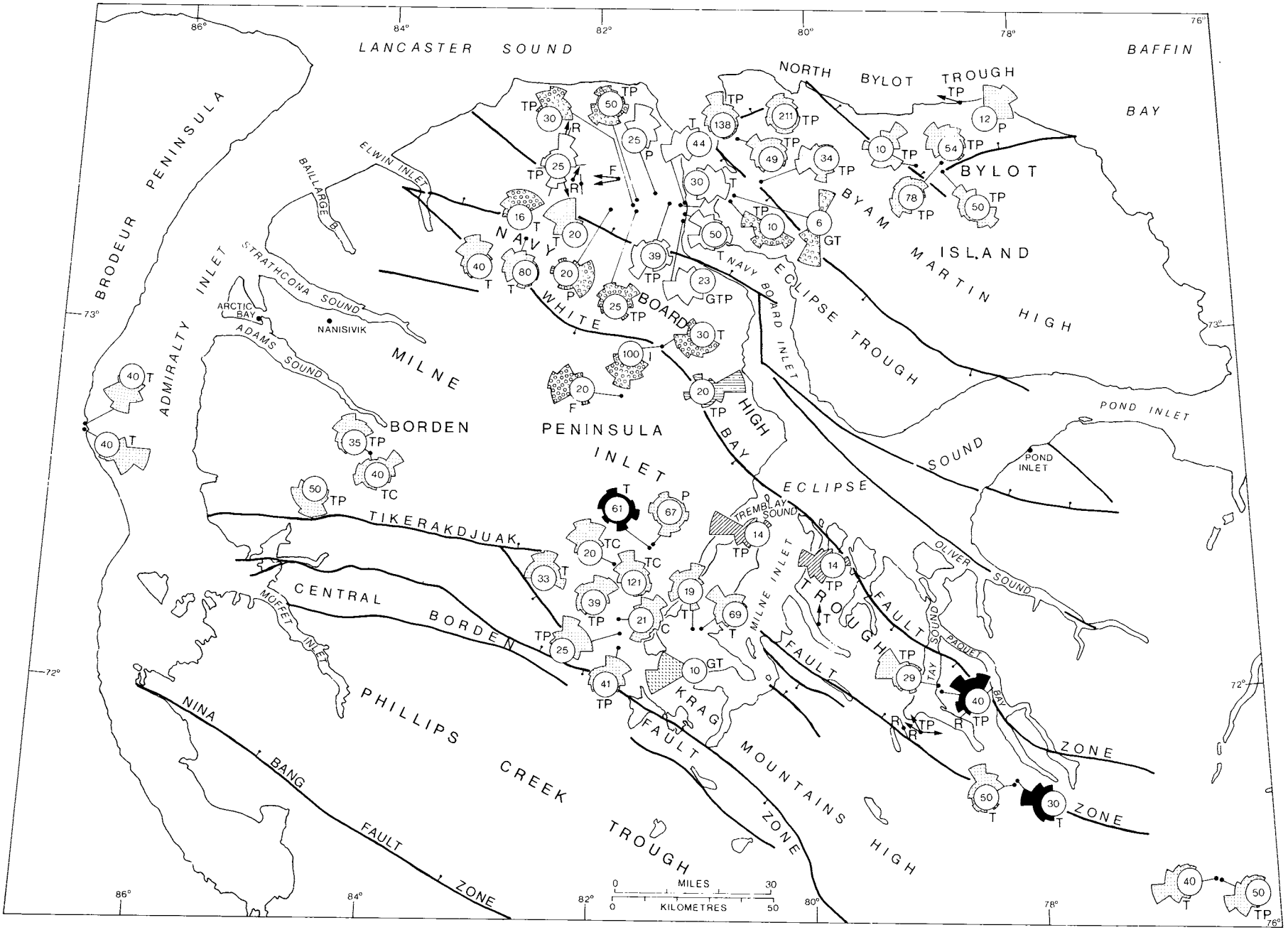
LANCASTER SOUND
BAFFIN BAY
BRODEUR PENINSULA
ADMIRALTY INLET
NORTH BYLOT TROUGH
BYLOT ISLAND
BYAM MARTIN ISLAND
MARTIN HIGH
ELWIN INLET
BAILLARGE B.
STRATHCONA SOUND
ARCTIC BAY
NANISIVIK
ADAMS SOUND
NAVY BOARD INLET
ECLIPSE TROUGH
WHITE BOARD
MILNE INLET
BORDEN PENINSULA
BAY
ECLIPSE SOUND
POND INLET
TREMBLAY SOUND
OLIVER SOUND
TIKERAKDJUAK
CENTRAL BORDEN
MOFFET INLET
PHILLIPS CREEK TROUGH
NINA BANG FAULT ZONE
KRAG FAULT
MOUNTAINS HIGH
TROUGH FAULT
PADDET BAY
ZONE
0 MILES 30
0 KILOMETRES 50

The flows contain amygdules filled with quartz, agate, calcite, and dolomite. Columnar joints and flow banding occur locally. Small pillows occur south and southwest of Tremblay Sound. Individual flows range from 2.5 to 20 m thick. The sequence thickens to the northwest, ranging from 8 to 16 m thick near the Central Borden Fault zone to over 80 m thick east of Elwin Inlet.

Interpretation

Deposition of N_1 quartzarenite in a braided fluvial environment was interrupted by extrusion of chiefly subaerial basalt. Continued sedimentation buried the flows before they could be eroded. The flows are spatially related to major fault zones and were probably extruded along them.

Adams Sound Formation

Adams Sound strata are exposed along the southern edge of the study area, east of Elwin Inlet, and on northwestern Bylot Island. The formation consists chiefly of thin- to thick-bedded quartzarenite with minor shale and siltstone. Quartz-pebble conglomerate occurs mostly in the lower and upper parts of the formation. Sedimentary structures include trough- and planar-crossbeds (Fig. 46.1), current ripple marks, scours, channels, load casts, graded beds, synaeresis and dessication cracks, microfaults and small vugs. Pyrite and marcasite occur locally.

The formation is about 65 m thick from Tremblay Sound east to Paquet Bay and 340 m thick on northwest Bylot Island. It thickens toward the north and northwest. Adams Sound Formation is conformable with the Nauyat Formation and rests conformably on basement gneisses where the Nauyat is absent. The contact with the overlying Arctic Bay Formation is gradational. The Adams Sound Formation has been divided into three intergradational members on Borden Peninsula (AS_1, AS_2, AS_3), two members in the Paquet Bay area (AS_4, AS_5) and into a lower and upper member (AS_L, AS_U) on Bylot Island (Jackson and Davidson, 1975).

AS_1 Member

This member is mostly pink, purple-red to cream-brown quartzarenite with pebble- to cobble-polymictic conglomerate interbeds at the base of fining upward cycles. Paleocurrent trends are unimodal and northwest to northeast (Fig. 46.1). Thicknesses range from 8 to 16 m near Tremblay Sound to over 30 m east of Elwin Inlet.

AS_2 Member

AS_2 strata are chiefly buff-white, pink-white to purple-grey quartzarenites that contain fining upward cycles. Unimodal northwest to northeast paleocurrent trends predominate. Southeast trends are less common. The member is 33 m thick at Tremblay Sound and over 100 m thick east of Elwin Inlet.

Figure 46.1. *Location map and rose diagrams showing crossbed measurements. The radius of the centre circle is 20 per cent. Single determinations are indicated by a straight line or arrow.*

- *Adams Sound Formation*
- *Arctic Bay Formation*
- *Fabricius Fiord Formation*
- *Society Cliffs Formation*
- *Victor Bay Formation*
- *Athole Point Formation*
- *Strathcona Sound Formation*

VEES - Elwin Formation

C - channels
F - flutes
G - giant trough crossbeds
I - imbricate clasts
P - planar crossbeds
R - ripple marks
S - stromatolite elongations
T - trough crossbeds

AS_3 Member

White and grey to grey-brown quartzarenite with interbeds and lenses of pebbly quartzarenite and quartz-pebble conglomerate dominate the AS_3 member. Minor shale and siltstone interbeds occur in the uppermost part. Fining upward cycles occur in some sections. Most paleocurrent trends are polymodal to bimodal, although some are unimodal northwest to northeast. The member is 16 m thick near Tremblay Sound and over 70 m thick east of Elwin Inlet.

AS_4, AS_5 Members (see Iannelli, 1979)

These strata are grey-white to buff-grey quartzarenite. Minor quartz-pebble conglomerate occurs chiefly at the base. Paleocurrents are unimodal and trend north-northwest. These strata are 45-65 m thick in the Paquet Bay area.

AS_L Member

The AS_L member is chiefly pink, buff-orange to purple-red quartzarenite with interbeds of pebbly quartzarenite and pebble conglomerate. Siltstone and shale beds occur in the upper part. Poorly defined fining upward cycles are present. Bipolar-bimodal northwest and southeast trending paleocurrents predominate. Polymodal trends and northwest to southwest unimodal trends occur locally. Thicknesses of 88 to over 200 m occur on northern Bylot Island, but the member is absent locally on central western Bylot Island.

AS_U Member

This member is composed of buff-grey, white to pink-grey quartzarenite with thin interlayers of siltstone, and quartz-pebble conglomerate. Fining upward cycles are seen in some sections. Paleocurrent trends are unimodal to the northwest and bimodal southwest to west. Thicknesses range from over 70 m on central west Bylot Island to 140 m on northeast and 196 m on northwest Bylot Island.

Interpretation

During early Adams Sound time braided fluvial sediments were deposited in the southern and southeastern parts of the map area, whereas mixed fluvial and intertidal sediments were deposited in the northern part. Regional basin transgression ended this fluvial deposition, which was followed by intertidal to shallow subtidal deposition.

Arctic Bay Formation

The Arctic Bay Formation outcrops in the same general areas as does the Society Cliffs Formation. The strata are chiefly laminated shale and thin- to medium-bedded siltstone, quartzarenite, dolosiltite, doloarenite and stromatolitic dolostone. Structures include cone-in-cone, concretions, soft sediment folds, load casts, microfaults, convoluted beds, wave and current ripples, trough- and planar-crossbeds, scours, rip-up clasts, synaeresis and dessication cracks, dewatering structures, and vugs filled with carbonates, quartz, and bituminous material. White gypsum efflorescence is common on the shales. Some beds emit a strong petroliferous odour and others contain disseminated pyrite and marcasite.

The Arctic Bay Formation exceeds 260 m in thickness west of Tremblay Sound, and 600 m east of Elwin Inlet. It is 466 m thick at the head of Tremblay Sound and is more than 414 m thick west of Tay Sound. The formation rests nonconformably on basement gneisses at several places. The contact with the overlying Society Cliffs Formation ranges from conformable to erosional. Four intergradational and regionally variable members have been identified (Iannelli, 1979).

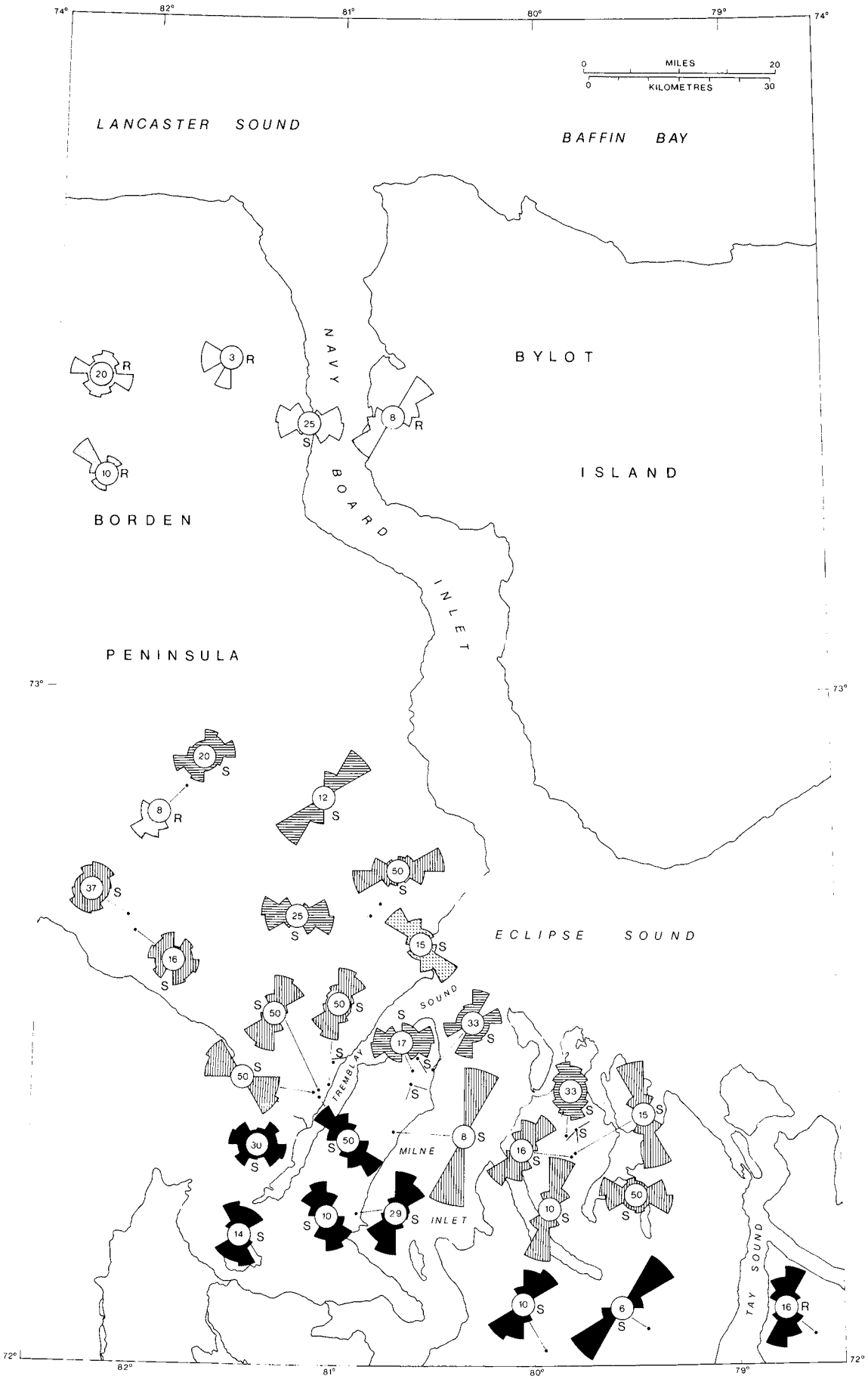

Figure 46.2. *Rose diagrams showing measurements for ripplemarks and stromatolites. See Figure 46.1 for legend.*

TABLE OF FORMATIONS

HADRYNIAN

Franklin Intrusions: Diabase

Intrusive Contact

ULUKSAN GROUP

Elwin Fm. (700 m+): Siltstone, quartzarenite, siltstone

Gradational

Strathcona Sound Fm. (870 m+): Arkose, conglomerate, shale, greywacke

Gradational

Athole Point Fm. (585 m): Limestone, sandstone, shale

Gradational — Gradational to unconformable

Victor Bay Fm. (724 m):
- VB_2: Limestone, dolostone, flat pebble conglomerate
- VB_1: Shale, siltstone, sandstone

Gradational?

Society Cliffs Fm. (825 m+):
- SC_2: Stromatolitic and massive dolostone
- SC_1: Stromatolitic dolostone, shale, sandstone, gypsum

Unconformable

Fabricius Fiord Fm. (1500 m+)
- FF_4: Conglomerate, dolostone
- FF_3: Subarkose
- FF_2: Shale, quartzarenite
- FF_1: Sandstone, shale

Gradational to unconformable

Arctic Bay Fm. (600 m)
- AB_4: Shale, dolostone
- AB_3: Shale
- AB_2: Shale, quartzarenite
- AB_1: Siltstone, quartzarenite

Gradational

NEOHELIKIAN?

EQALULIK GROUP

Adams Sound Fm. (340 m):
- AS_3: Quartzarenite, conglomerate
- AS_2: Quartzarenite
- AS_1: Quartzarenite
- $AS_{4,5}$: Quartzarenite, conglomerate
- AS_U: Quartzarenite
- AS_L: Quartzarenite, conglomerate

Conformable

Nauyat Fm. (90 m+)
- N_1: Basalt
- N_2: Quartzarenite

Nonconformity

ARCHEAN-APHEBIAN

Granitic gneiss basement complex

AB_1 Member

Throughout most of the area this member consists of interbedded green-grey siltstone and quartzarenite and pink-red or grey to white quartzarenite. At the southeast corner of the map area the member is composed of a basal quartz-cobble conglomerate which grades up into interbedded purple-orange to brown-grey quartzarenite, subarkose, quartz-feldspar pebble conglomerate and siltstone. Bimodal-bipolar northwest to southeast paleocurrent trends predominate. Polymodal trends also occur. Thicknesses range from 12 m southeast of Paquet Bay to 36 m west of Tremblay Sound and 15 m east of Elwin Inlet.

AB_2 Member

This member is composed of 5 to 15 coarsening upward cycles, up to 20 m thick each, which are shale dominated west of Milne Inlet and quartzarenite dominated east of Milne Inlet. The lower parts of the cycles are chiefly grey-black shale. The upper parts are green-grey, buff-white, and pink interlayered quartzarenite, subarkose, siltstone, dolostone, and quartz pebble-cobble conglomerate. Paleocurrents include unimodal southwest to northwest trends and polymodal patterns. Thicknesses west of Milne Inlet range from 150 to 261 m and to the east from 65 to more than 100 m.

AB_3 Member

This member comprises black to grey shale. Minor interlayers of dolosiltite, siltstone, and quartzarenite increase in amount of the south and southeast. However, the member increases in thickness from 200 m west of Tremblay Sound to 285 m on the west side of Milne Inlet and more than 400 m east of Elwin Inlet.

AB_4 Member

West of Milne Inlet this member consists chiefly of black-grey shale with thin interbeds of buff-grey to orange-brown siltstone, dolosiltite, stromatolitic dolostone and limestone. Locally, the top 10 m is stromatolitic dolostone. The stromatolites include planar, small mounds, and branching columnar types. Mound and stromatolite elongations indicate paleocurrent trends ranging from northwest-southeast to north, northeast to south and southwest. The member contains more that 112 m on the west side of Milne Inlet. It is 152 m thick at the head of Tremblay Sound, 25 m thick just west of it, and 132 m about 50 km northwest of the head of the Sound. More than 30 m occur east of Elwin Inlet.

East of Milne Inlet the AB_4 member constitutes most of the Arctic Bay Formation. It consists chiefly of over 30, 3-15 m thick, coarsening up cycles whose lower parts are composed of black-grey shale which grades into the upper part composed of interbedded green-grey and orange-buff to brown siltstone, quartzarenite, dolosiltite, stromatolitic dolostone and flat pebble conglomerate. Coarsening-upward arkose-rich wedges or fans occur along the White Bay Fault Zone. Elongate stromatolites indicate northeast to southwest paleocurrent trends. The AB_4 member is over 130 m thick in the Tay Sound area and may be 414 m thick between Tay Sound and Milne Inlet.

Interpretation

Basin transgression initiated in late Adams Sound time continued throughout most of Arctic Bay time. Deposition west of Milne Inlet was under mixed intertidal and subtidal environments. East of Milne Inlet alluvial and delta fans accumulated adjacent to active fault zones and interfingered basinward with alluvial plain and intertidal sediments.

Fabricius Fiord Formation

Fabricius Fiord strata outcrop locally north of the Central Borden Fault Zone. Similar strata outcrop locally south of the White Bay Fault Zone west of Eclipse Sound. Only two of the four subdivisions were examined in 1979.

FF_2 strata consist of about 12 coarsening up cycles in which black-grey shale grades up into interlayered siltstone, and quartzarenite. The FF_2 member grades up into FF_3 interbedded quartzarenite, subarkose and conglomerate which contain trough-crossbeds, current ripples, and synaeresis cracks. Three-metre high crossbeds southwest of Milne Inlet indicate southwest transport. Incomplete sections range from 30 to more than 100 m thick.

Interpretation

The FF_2 and FF_3 strata were deposited in marine influenced delta fan complexes that prograded northward. These strata pass laterally northward into AB_2 to AB_4 basinward facies equivalents.

Society Cliffs Formation

Society Cliffs strata outcrop in a belt from Adams and Strathcona sounds southeast to Tremblay Sound and Paquet Bay. They also outcrop west of southern Navy Board Inlet, east and southeast of Elwin Inlet, and on western and northern Bylot Island. In all of these areas, except for the first-mentioned belt, it is difficult to differentiate Society Cliffs from Victor Bay strata because of the general absence of the lower Victor Bay member (VB_1). Therefore, total thicknesses at these localities are for strata between the Arctic Bay and Strathcona Sound formations.

Laminated to thin bedded, commonly stromatolitic and thick bedded to massive (faintly internally bedded) dolostones predominate in units up to 40 m thick. Thin, flat pebble conglomerate beds are common. Most stromatolites are individual to laterally linked low domal and hemispheroidal types, and columnar types are also present. Cryptalgal laminites are abundant. Bioherms of various sizes are common and varieties 30 to 60 m across are locally abundant. Most elongations of stromatolites and bioherms indicate northeast to southwest paleocurrent trends. Chert has commonly replaced the carbonate rocks and is particularly abundant on Bylot Island where red varieties are common, and east of Milne Inlet where brown and black varieties are common. Dolomitization and brecciation has obscured primary structures in much of the rock. Petroliferous odours and specks of black bituminous material are common. Disseminated pyrite occurs locally. Sedimentary structures include tepees, molar tooth, wave ripple marks, synaeresis and dessication cracks, convoluted to disrupted beds, dewatering structures, load casts, scours, local unconformities, soft sediment deformation, vugs, and microfaults.

The Society Cliffs Formation is about 665 m thick at the head of Tremblay Sound. Partial sections indicate thicknesses of 825 m near the mouth of Tremblay Sound, 345 m east of Milne Inlet, 450 m thick east of Elwin Inlet, and about 750 m on western Bylot Island. The formation is conformable with the overlying Victor Bay Formation. Two members have been differentiated.

SC_1 Member

West of Milne Inlet a 10 to 15 m thick lower unit contains pebbly calcareous quartzarenite to sublitharenite interlayered with stromatolitic dolostone, limestone, and flat pebble conglomerate. This unit is overlain by two 120 m thick internally cyclic shallowing upward sequences containing shale, brown-grey stromatolitic dolostone and flat

pebble conglomerate or breccia. This member thins abruptly northwestward and ranges from 165 to more than 315 m in the vicinity of Tremblay Sound, to 45 m west of Tremblay Sound, and 15 m east of Elwin Inlet.

East of Milne Inlet and on Bylot Island the SC_1 member is relatively thick due to the presence of black shale and redbed sequences interbedded with grey to brown-grey, black-grey, green-grey and pale pink dolostones. The shaly units contain interbedded purple to red, green, black, brown and grey shale, dolostone, calcareous quartzarenite and subarkose. A few white gypsum beds occur east of Milne Inlet and are extensively developed on Bylot Island. The gypsum rarely occurs in beds more than 1 m thick. At one locality on western Bylot Island gypsum is abundant throughout the lower 240 m of the formation and occurs interbedded with shales and dolostones in units up to 40 m thick. Salt casts occur locally. East of Milne Inlet measured thicknesses, most incomplete, range from 75 to 165 m. On western Bylot Island the gypsiferous zone, which may contain as much as 20 per cent gypsum, is over 240 m thick and the SC_1 member may be at least 380 feet thick.

SC_2 Member

This member consists chiefly of grey to brown-grey dolostones as already described for the formation. Beds of red and green shale, siltstone and arkose, occur throughout the member on Bylot Island and in the Tay Sound area, and are accompanied by hematite staining of the associated strata. About 250 m are present in the Tay Sound area. Elsewhere, incomplete sections indicate thicknesses of 660 m west of Milne Inlet, 370 m on western Bylot Island and west of Tremblay Sound, and 450 m east of Elwin Inlet.

Interpretation

West of Milne Inlet the formation was deposited in shallow subtidal to intertidal environments, whereas to the east of the inlet and on Bylot Island it originated in an environment that varied from alluvial plain to shallow subtidal. The gypsiferous units probably represent coastal sabkha evaporites.

Victor Bay Formation

The Victor Bay Formation outcrops in the same general areas as the Society Cliffs Formation. It is about 460 to 640 m thick 50 m northwest of Tremblay Sound, 724 m east of Milne Inlet, and 423 m west of southern Navy Board Inlet. It is divisible into two members in the southern part of the area. The lower member (VB_1) is absent west of Eclipse Sound and in most of the northern part of the area. In these localities it is very difficult to separate the SC_2 from the VB_2 member.

VB_1 Member

Grey to black and brownish grey laminated to very thin bedded shale, calcareous to dolomitic shale, siltstone, dololutite and dolosiltite predominate in this member. Minor graphitic shale, quartzwacke, quartzarenite and subarkose, flat pebble carbonate conglomerate and pyrite laminae, occur locally. Scour channels, soft sediment deformation, crossbeds, ripple marks, synaeresis cracks; and molar tooth, load, and ball and pillow structures are rare.

The VB_1 member is 170 to 370 m thick 50 km northwest of Tremblay Sound, 100 to 140 m 15 km west of Tremblay Sound, 15 m along northern Tremblay Sound, 120 m west of Eclipse Sound and 44 m east of Milne Inlet.

VB_2 Member

This member is composed of various light to dark grey and black limestone and dolostone lithologies that occur in 1 to 20 m thick units (rarely as thick as 55 m). East of Milne Inlet, for example, the lower 200 m are chiefly limestones, the upper 260 m are chiefly dolomites, and the middle 220 m contain both. Petroliferous odours are most common in the limestone. Major lithologies are flat pebble-boulder conglomerate, laminated to very thick bedded carbonates, stromatolitic carbonate, cryptalgal laminites, lumpy bedded carbonate, evenly nodular carbonate, and vuggy carbonate. Minor round clast conglomerate, "turbidite" units, shale and replacement chert, are common. Lenses of quartzarenite, quartzwacke and subarkose occur locally.

Stromatolites occur individually and in bioherms up to 1.5 km in length. Individual and laterally linked hemispheroidal and columnar and digitate columnar types are the most common. Hemispheroidal stromatolites are elongated in predominantly east-west to northeast-southwest directions at several localities (Fig. 46.2). Other common structures are molar tooth, teepee, rip-up clasts, scour channels, synaeresis and dessicaiton cracks, load casts, convoluted beds, soft sediment folds, dewatering structures, birds eye structures, ripple marks, crossbeds, and microfaults.

Thickness for the VB_2 member are: about 290 m 50 km west of Tremblay Sound, 470 m 15 km west of Tremblay Sound, 680 m east of Milne Inlet, 300 m west of Eclipse Sound and 450 m est of Elwin Inlet. VB_1 and VB_2 members are conformable and interfinger at most localities. However, a lcoal disconformity may occur at the contact 50 km west of Tremblay Sound where 10 m of round clast limestone conglomerate occurs at the base of VB_2.

Interpretation

Most of the VB_1 member was probably deposited under subtidal conditions. Influx of fine terrigenous clastic material probably prevented algal growth. The upper (VB_2) member was probably deposited under chiefly shallow subtidal to intertidal conditions.

Athole Point Formation

Athole Point Formation outcrops from east of Milne Inlet to about 50 km northwest of Tremblay Sound. Medium to dark grey and black laminated to medium bedded limestones, cryptalgal laminites and stromatolitic limestones predominate in units 2 to 40 m thick. Minor lithologies include lumpy bedded carbonates and flat-pebble and round-clast conglomerates. At least one "debris-flow" carbonate breccia bed occurs near the base of the formation east of Milne Inlet. Orange-weathered 1 to 10 m thick siliceous carbonate beds occur sparsely throughout the formation. Stromatolites other than planar types are relatively uncommon, but include low domal hemispheroidal and small columnar types as well as bioherms. Carbonate-cemented sandstone, quartzarenite, sublitharenite, subarkose, shale, siltstone, and flat-pebble conglomerate occur chiefly in the upper part of the formation in fining upward turbidite sequences, and become increasingly abundant northwestward. Observed structures include graded beds, flutes, load casts, flame structures, small scale crossbeds, synaeresis and dessication cracks, soft sediment deformation channels, scours, birds eye structures, convoluted beds, molar tooth, tepees, concretionary structures, and microfaults. Unimodal crossbeds indicate west-northwesterly transport.

Athole Point Formation may be divided into a lower member containing abundant cryptalgal laminites and an upper member in which turbidite sequences are common. The formation is probably about 500-585 m thick in the vicinity of Milne Inlet and thins westward and abruptly northward. It is conformable with both the underlying Victor Bay and overlying Strathcona Sound Formation.

Interpretation

Most of the strata were probably deposited in intertidal to subtidal environments with relatively deep water lying to the south. The formation is considered to be the seaward equivalent of the lower and possible middle parts of the Strathcona Sound Formation with which it interfingers laterally.

Strathcona Sound Formation

This formation outcrops chiefly in a broad belt south of the White Bay Fault Zone west of Eclipse Sound. It also underlies small areas between Elwin Inlet and northern Navy Board Inlet and on western Bylot Island.

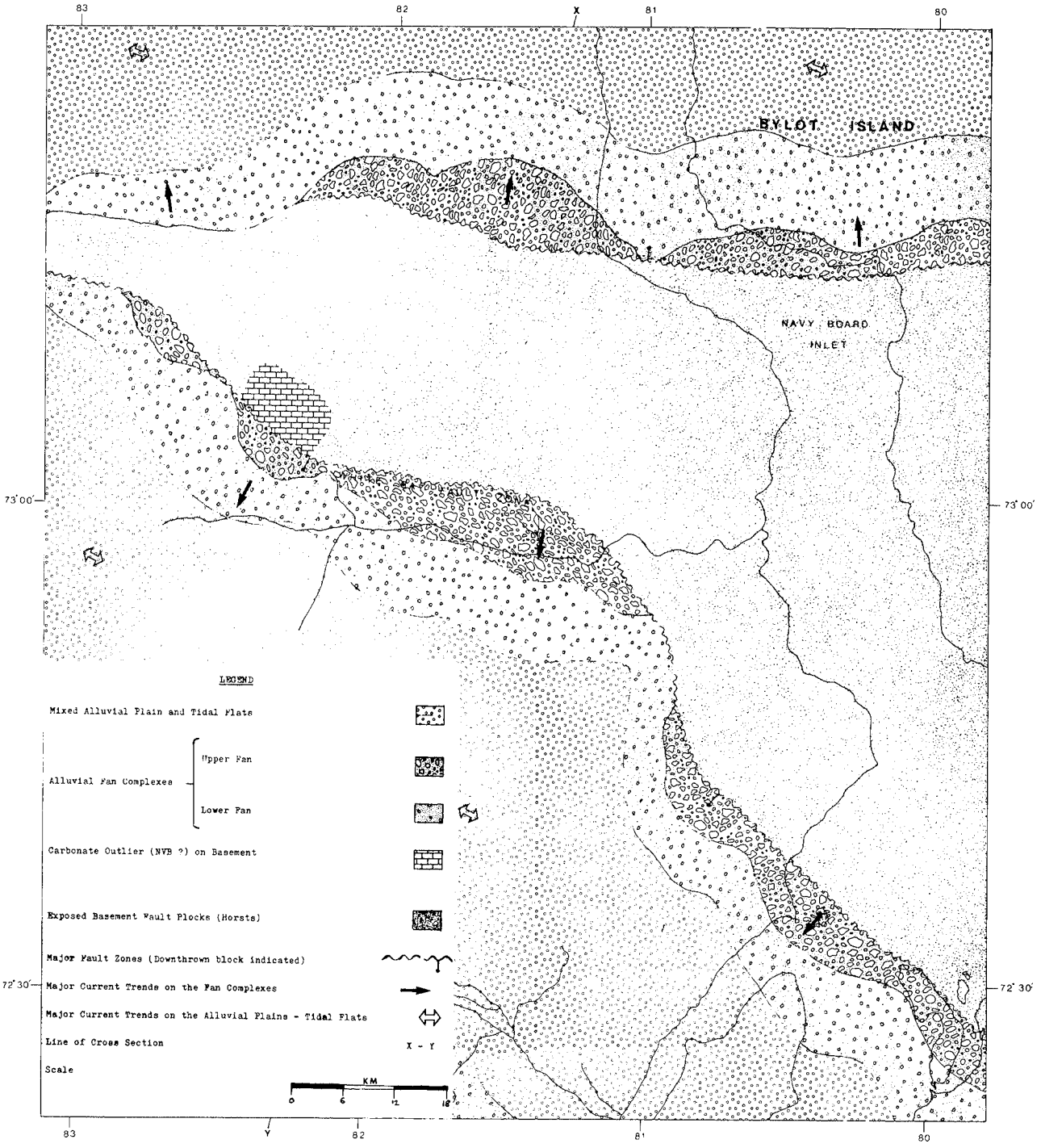

Figure 46.3. *Tentative reconstruction of facies distribution around basement fault blocks during the early depositonal history of the Strathcona Sound Formation.*

Most of the strata are laminated to thin bedded, although many are medium to very thick bedded. The various lithologies occur chiefly in alternating units from 1 to 20 m thick, but which range to more than 100 m thick. These units may contain a single lithology or may contain several interbedded lithologies. Fining upward sequences predominate. Sedimentary structures include graded bedding, trough, planar and herringbone crossbeds, ripple marks, imbricated clasts, soft sediment folds, slump features, convoluted and disrupted beds, scours, channels, flutes, synaeresis cracks, and microfaults.

Paleocurrent trends adjacent to and south of the White Bay Fault Zone are moderately unimodal and indicate chiefly southerly to westerly transport. North of the fault they range from unimodal to bimodal and polymodal, and indicate chiefly northerly to easterly transport west of Navy Board Inlet and southwesterly transport on western Bylot Island.

More than 110 m of grey interlayered siltstone, sandstone, fine calcareous clastics, and limestone form the basal member of the Strathcona Sound Formation about 50 km west of Eclipse Sound. This unit thins northward to about 40 m locally near the White Bay Fault Zone. It seems to be absent north of the fault zone. It represents a transition zone between the Victor Bay, Athole Point and Strathcona Sound sediments.

In the same region west of Eclipse Sound these strata are overlain by more than 400 m of grey, brown, green and chiefly red shale, siltstone, feldspathic wacke, and arkose. The sandstones commonly have a calcareous matrix. One or more beds or lenses of oligomictic angular clast carbonate breccia in the lower part of this member probably are debris flow breccias. These strata are overlain by grey-green, coarse calcareous feldspathic wacke and minor polymictic conglomerate.

Northward, adjacent to the White Bay Fault Zone, more than 870 m of Strathcona Sound strata are composed chiefly of red arkoses and polymictic conglomerates that contain carbonate clasts and clasts from the basement complex in varying proportions. Flat pebble conglomerate and oligomictic carbonate conglomerate clasts occur locally (Fig. 46.3, 46.4). The conglomerates are absent from the lower 170 m in some places but in others are interbedded throughout the formation. At one locality more than 186 m of chiefly oligomictic carbonate conglomerate rests directly on the Society Cliffs-Victor Bay Formation and contains clasts up to 10 m across. The upper part of the formation is chiefly conglomerate as described above.

Strathcona Sound strata west of northern Navy Board Inlet are similar to the strata west of Eclipse Sound above the basal grey siltstone member and includes a debris-flow breccia in the lower part of the section. Bylot Island strata are also similar, but red arkose predominates in the basal part, and contains crossbeds more than 3 m high. Orange weathering, locally stromatolitic carbonate beds range up to 10 m thick and occur sparsely throughout the Bylot Island strata which are more than 365 m thick.

Interpretation

The boulder conglomerates and arkoses adjacent to the White Bay Fault Zone probably represent alluvial fan complexes that were deposited rapidly along an active fault (Fig. 46.3, 46.4). These deposits interfinger with the shales, siltstones and sandstones to the south, which represent alluvial plain and mixed alluvial and intertidal to shallow subtidal deposition. The alluvial deposits may include minor channel deposits.

Elwin Formation

These strata outcrop from northern Navy Board Inlet west to Elwin Inlet. In the east they consist chiefly of red to minor green arkose, siltstone and shale interbedded with buff sandstone, white quartzarenite and grey to buff and light red sandy to stromatolitic dolostone. Stromatolites include planar, low domal and hemispheroidal types. Some dolostone beds are brecciated at the top. The strata are laminated to medium bedded and occur in lithological units 1 to 20 m thick. Most of the redbed strata occur in sequences 5-130 m thick separated by 8-50 m thick sequences of grey to green strata. Both sequences are cyclic. Carbonate strata seem to decrease in abundance upward as well as toward the west, whereas the proportion of white quartzarenite and buff sandstone seems to increase westward. Frosted sand grains are common in the sandstones and dolostones.

Cycles within the redbed sequences are 2-40 m thick and commonly consist of lower arkose-shale that grades upward into dolostone. A less common cycle contains basal arkose that grades upward into quartzarenite which grades into dolostone. Shale may occur above or below the latter dolostone as part of the cycle. Cycles in the grey to green sequences include arkose or quartzarenite grading upward into siltstone or dolostone.

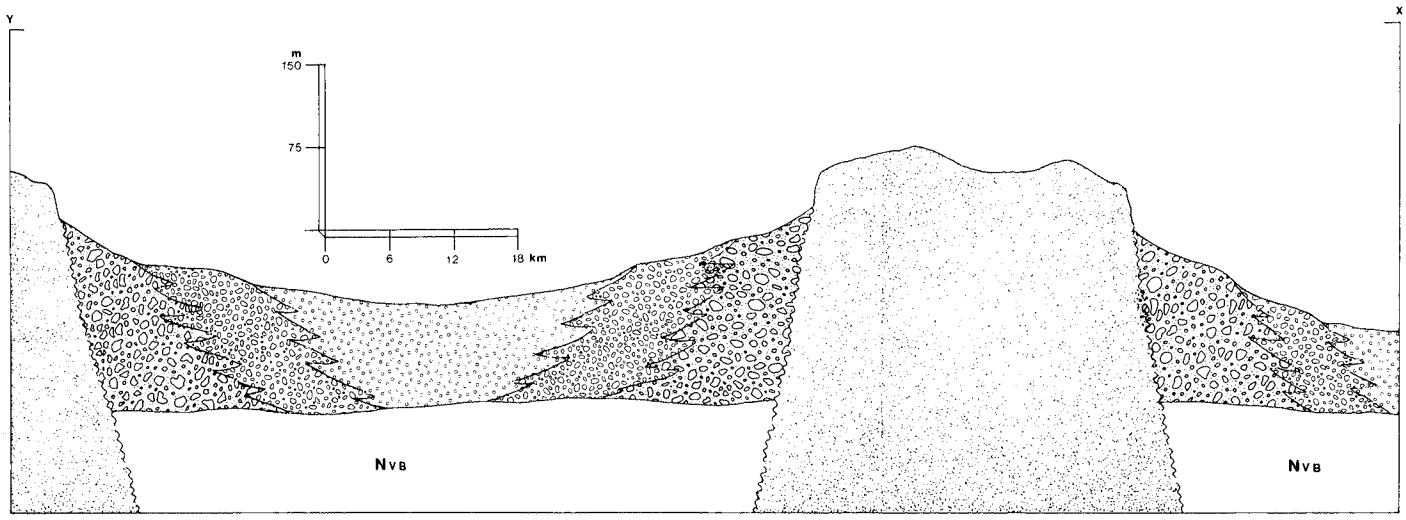

Figure 46.4. *Cross-section along the line X-Y in Figure 46.3. Legend as in Figure 46.3.*

Sedimentary structures include trough crossbeds (some 2 m), planar crossbeds, ripple marks, synaeresis and dessication cracks, local unconformities, microfaults, tepees, dewatering structures, birds eye structure, channels, stylolites, oolites and pisolites, shale chips and rip-up clasts, ball and pillows, flutes, soft sediment folds and convoluted beds. Crossbed measurements indicate unimodal to bimodal and weakly bipolar patterns which indicate chiefly westerly and northerly transport. Stromatolite and ripple measurement indicate chiefly east-west paleocurrents.

The Elwin Formation is at least 470 m thick on the west side of Navy Board Inlet. The lower contact with the Strathcona Sound Formatin is conformable and possibly gradational. A low-angle unconformity separates the Elwin from overlying Lower Paleozoic strata.

Interpretation

Most of the strata were probably deposited in locales that ranged from alluvial plain to intertidal. Some channel deposits are present and some aeolian deposits may be present in both the Elwin and Strathcona formations.

Notes

There is little evidence that Adams Sound deposition was significantly affected by contemporaneous faulting, although the association of Nauyat basalt with major fault zones suggests that some rifting had already occurred in early Adams Sound time. The onlap of Arctic Bay strata onto basement gneisses in the Tay Sound region supports this. Faulting was active during Arctic Bay sedimentation, at which time the effects of movement along the Central Borden Fault Zone were greater than for the White Bay Fault Zone. The reverse seems to have been true in Strathcona Sound time. Also, the Byam Martin Mountain High does not seem to have been significantly uplifted until late or post Society Cliffs time.

Paleocurrent measurements crudely outline portions of the Milne Inlet and Eclipse troughs. The facies changes in the Milne Inlet area, and the fact that the known westerly extent of Society Cliffs gypsiferous redbeds is a north-northwesterly trending line, suggest that some syndepositional faulting may have occurred in a north-south direction and that the Borden Peninsula component of the Navy Board High may have been an island. This is supported by a few paleocurrent measurements.

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