6. EVAPORITES AND FOLDING IN THE NEOHELIKIAN SOCIETY CLIFFS FORMATION, NORTHEASTERN BYLOT ISLAND, ARCTIC CANADA

Project 770013

G.D. Jackson[1] and L.M. Cumming[2]

Jackson, G.D. and Cumming, L.M., Evaporites and folding in the Neohelikian Society Cliffs Formation, northeastern Bylot Island, Arctic Canada; in Current Research, Part C, Geological Survey of Canada, Paper 81-1C, p. 35-44, 1981.

Abstract

Redbed and associated coastal marine gypsum-bearing, sabkha sequences occur within the lower member of the Neohelikian Society Cliffs Formation of eastern Borden (Rift) Basin. Intricate folds and numerous steep, small-scale, faults occur in these strata on northeastern Bylot Island. These structures probably developed prior to emplacement of Hadrynian Franklin diabase dykes, and Phanerozoic sedimentation in the region. The folds developed partly in response to movement along nearby major fault zones, but the style of folding was controlled predominantly by the volume of contained evaporites. Although the preserved evaporite mineral is gypsum, data suggest that percolating water removed original halite.

Introduction

In this paper, we describe and interpret folding and faulting in the evaporitic Society Cliffs strata of northern Bylot Island, and compare these structures with those in some younger evaporitic sequences, as well as in other Bylot Supergroup strata.

Gypsum was first recognized in eastern Borden (Rift) Basin by members of Geological Survey of Canada during "Operation Bylot" in 1968 (Jackson and Davidson, 1975; Jackson et al., 1975, 1978b). Gypsum was identified subsequently near Arctic Bay and also in southeastern Borden Basin by Gildsetzer (1973, 1974) and Olson (1977).

Spectacular castellated cliffs formed along the inlets and fiord-like sounds of mountainous northern Baffin and Bylot Islands display up to 6100 m of varicoloured Neohelikian (late middle Proterozoic) strata. These strata, defined as the Bylot Supergroup (Jackson and Iannelli, in press), nonconformably overlie an Archean-Aphebian high grade metamorphic complex. The supergroup is intruded by Hadrynian Franklin diabase dykes, and is overlain unconformably by Paleozoic and Cretaceous-Eocene strata.

The general Neohelikian stratigraphic succession was established, and previous exploratory work documented, by Lemon and Blackadar (1963), and by Blackadar (1956, 1970). Recent studies include those by Blackadar (1968a-d), Fahrig et al. (in press), Galley (1978), Geldsetzer (1973, 1974), Graf (1974), Iannelli (1979), Jackson (1969), Jackson and Davidson (1975), Jackson and Iannelli (in press), Jackson and Morgan (1978), Jackson et al. (1975, 1978a, b, 1980), Olson (1977), and Sangster (1981). Paleomagnetism of the Franklin dykes has been studied by Fahrig et al. (1971) and Fahrig and Schwarz (1973).

Bylot Supergroup

The Bylot Supergroup is one of several successions that contain basic extrusive and/or intrusive rocks correlated with the Mackenzie Igneous Event (e.g. Fahrig et al., in press), and which were deposited in penecontemporaneous, possibly interconnected, basins now partially preserved along the northeast margin of the Canadian Shield. Jackson and Iannelli (in press) interpreted these basins as having formed during a 1200-1250 Ma opening of the Proto-Arctic Ocean – the Poseidon Ocean.

Contemporaneous faulting was an important tectonic element during deposition of the Bylot Supergroup in the Borden Basin, which developed as a second order structure within the North Baffin Rift Zone (Jackson et al., 1975). Paleocurrents and facies changes suggest a major landmass to the east or southeast. Several grabens and horsts, third order structures, developed during sedimentation and were modified by subsequent faulting in Hadrynian-Cenozoic time (Jackson et al., 1975; Jackson and Iannelli, in press). The most extensive third order structure, the Milne Inlet Trough, which extends for 1200 km, is interpreted as an aulacogen.

The Bylot Supergroup comprises three groups of strata in the Borden Basin, whose contact relationships range from gradational to abruptly conformable and disconformable with one another (Jackson and Iannelli, in press):

1. The lower part of the basal Eqalulik Group is chiefly fluvial and shallow marine quartz arenites that contain one to two plateau basalt sequences (e.g. Galley, 1978). The upper part of the group is chiefly marine, pyritiferous, shales that grade laterally into marine influenced delta fan complexes of conglomeratic sandstones.
2. The Society Cliffs and overlying Victor Bay formations are abruptly to gradationally conformable with one another, and constitute the Uluksan Group, a carbonate platform deposit. These strata are chiefly shelf dolostones with lesser limestones, shales and sandstones. Redbed and coastal sabkha sequences occur in the eastern part of the basin. The distribution, in northeastern Bylot Island, of Society Cliffs and Victor Bay strata (Uluksan Group), as well as the underlying Eqalulik Group, is shown in Figure 6.1.
3. The lower part of the uppermost Nunatsiaq Group is mostly alluvial and intertidal shales, siltstones and sandstones. Conglomeratic alluvial fan complexes, a biohermal dolostone carbonate platform, and turbidite sequences predominate in various areas, whereas limestones predominate in the southeastern part of the Borden Basin. The upper part of the Nunatsiaq Group is mostly marine shelf quartz-rich sandstones.

Society Cliffs Formation

This formation consists mostly of dolostones, interbedded with lesser amounts of various terrigenous clastics. Throughout Borden Basin, an abrupt upward decrease in the terrigenous clastic content of the Society Cliffs Formation allows it to be divided into two members: a lower member of abundant terrigenous clastics interbedded with the dolostones, and an upper member containing very little terrigenous clastics (Jackson and Iannelli, in press). Most of the gypsum occurs in the eastern part of Borden Basin.

[1]Precambrian Geology Division
[2]Economic Geology Division

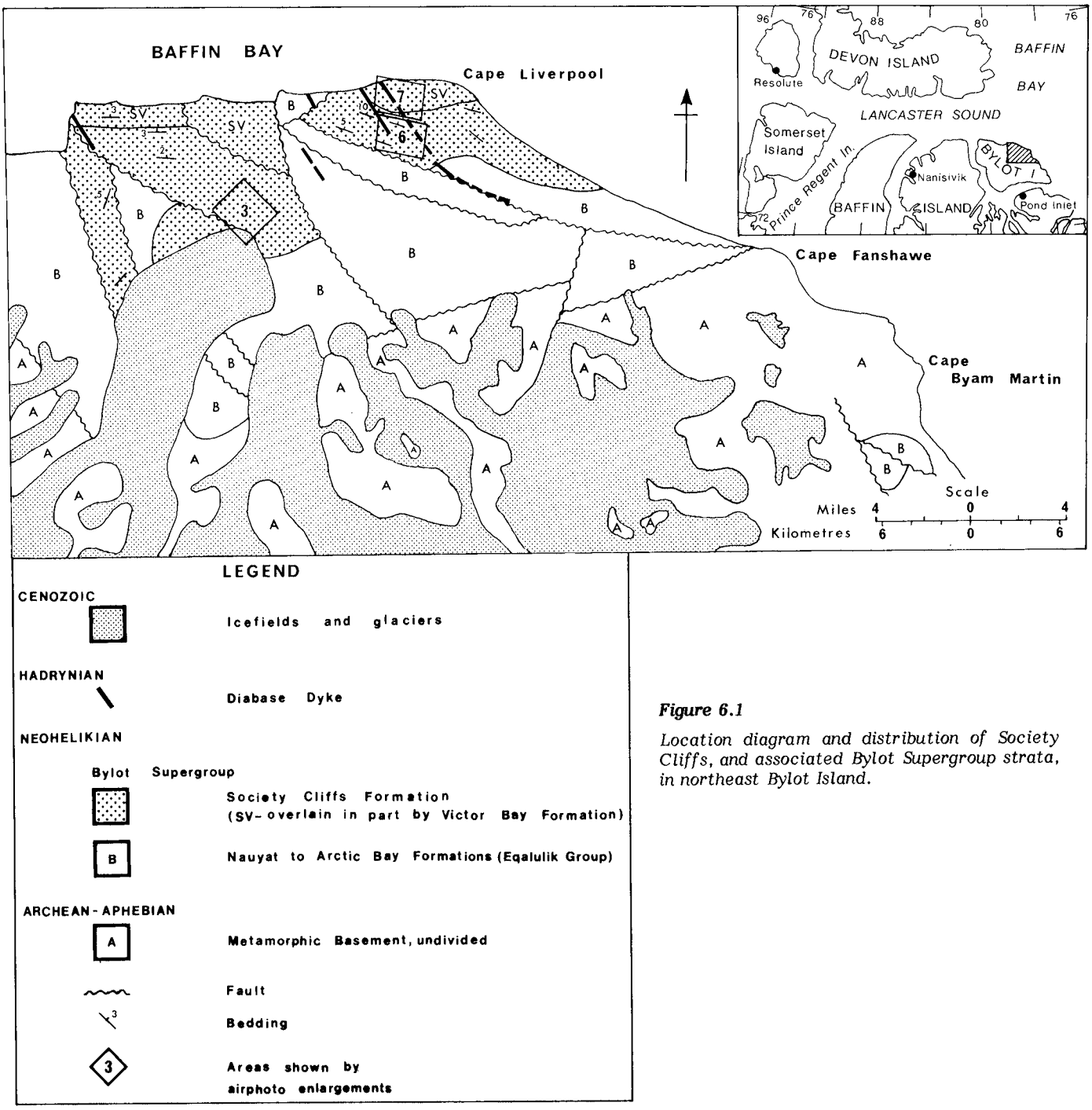

Figure 6.1

Location diagram and distribution of Society Cliffs, and associated Bylot Supergroup strata, in northeast Bylot Island.

The Society Cliffs Formation thickens from 260 m west of Nanisivik to 856 m at Milne Inlet south of western Bylot Island. Measurements and rough estimates suggest that thicknesses may range from 450-600 m on Bylot Island.

The Society Cliffs Formation of northeastern Bylot Island is typical of the formation elsewhere throughout eastern Borden Basin. However, unlike elsewhere, it is commonly poorly exposed and weathered to a mud. Where the sedimentary contacts with adjacent formations are exposed, they appear conformable and sharp to gradational. The contact between the two Society Cliffs members is gradational.

Description

Most of the formation comprises several types of laterally and vertically interfingering grey to buff and greyish brown, finely crystalline, dolostones that weather buff to locally brown, orange, and reddish brown. The dolostones commonly emit a petroliferous odour when freshly broken and contain blebs of black bituminous material. The dolostones include thin bedded to massive types with cryptalgal laminates, plus other stromatolitic dolostones, and dolostone breccias and conglomerates. Minor limestone occurs locally. Many dolostones contain shaly to sand terrigenous material. A large variety of sedimentary structures are present and include local halite casts, and soft

sediment deformation features such as slump folds. Breccias are abundant and widespread. Most breccias are related to karstification, syndepositional erosion and solution of evaporites. Dolomitization and locally faulting also may account for some of the breccia developments. The Society Cliffs commonly contains many vugs, some of which contain gypsum. Minor varicoloured replacement chert is common, and stylolities occur locally.

The terrigenous clastics of northeastern Bylot Island are chiefly red, green, and grey to black, locally calcareous shales and siltstones that occur in units up to 2 m thick, but which are locally 12 m. Terrigenous sandstones occur locally, and one arkosic conglomerate unit has dolomitic arkose and siliciclastic dolostone clasts up to 0.4 m in diameter. The terrigenous clastics are interlayered with dolostone units of similar to greater thicknesses and with laminated to massive gypsum beds up to 1 m thick. Gypsum-rich beds constitute 5-20 per cent of the strata locally.

Most strata of the lower member are arranged in shallowing-up and fining-up cycles (terrigenous clastic up into dolostone) which are also common locally in the upper member. The stratigraphic level of the boundary between the two members is gradational, and varies from one region to another because the development of gypsum and associated redbeds is lenticular. Thus the lower member comprises the whole formation on western Bylot Island, and constitutes much of the formation south and west of Maud Bight and Cape Liverpool. However, the lower member is relatively thin south of the east end of Maud Bight and west of Cape Hay (Fig. 6.1, 6.2).

Interpretation

The gypsiferous redbed cycles have been interpreted as lenticular coastal sabkha sequences developed chiefly in embayed areas within grabens (Jackson and Iannelli, in press). They may also have developed in foreland basins, and/or interbar zones as described by Borchert and Muir (1964). Major marine evaporite deposits are considered to be confined mostly to two tectonic settings (e.g. Davies, 1976):

a) relatively stable intracratonic or interior basins on a single plate.

b) linear rift troughs or basins of continental rift valley systems or of continental-oceanic margins, both resulting from divergent lithospheric plate movements.

Society Cliffs evaporites are clearly related to a continental-oceanic margin rift environment. In addition to the data presented by Jackson and Iannelli (in press), the ubiquitous presence of bitumen traces also supports this conclusion (Borchert and Muir, 1964). In addition, the bituminous nodular dolostone in southwestern Borden Basin (e.g. Arctic Bay area west of Nanisivik) may be equivalent, environmentally, to the typical pre-saline bituminous marl or dolostone of deep (subtidal) basins free of currents, where circulation has begun to be restricted (Borchert and Muir, 1964), rather than an intertidal deposit (Geldsetzer, 1974; Jackson and Iannelli, in press).

The lower member of the Society Cliffs Formation represents a variety of depositional environments ranging from alluvial plain to subtidal and intertidal (Jackson and Iannelli, in press). Most of the upper member represents deposits of shallow subtidal to intertidal environments.

Siliciclastic dolostones and conglomeratic strata in the upper part of the Society Cliffs Formation suggest some rejuvenation of source areas, possibly by faulting, along the Cape Hay Fault Zone and mild uplift of the Byam Martin High. This high, however, probably was not significantly uplifted until near the close of deposition of the overlying Victor Bay Formation.

Folds

Interesting fold patterns are displayed by gypsiferous Society Cliffs strata of northeastern Bylot Island (Fig. 6.1, 6.2). These structures, which are rare in the Bylot Supergroup, are excellently portrayed on several airphotos (e.g. Fig. 6.2, 6.3, 6.6, 6.7) and are best exposed north of glacier D91 (Fig. 6.3-6.5) and southwest of Cape Liverpool (Fig. 6.6, 6.7). These folds are associated with numerous steep, small displacement faults that commonly trend both subparallel to the northwest-directed Hadrynian Franklin diabase dykes and north-northeast at 75° to this northwest trend. The apparent separation varies, but is primarily right-lateral for the northwest faults and left-lateral for the north-northeast faults (see Fig. 6.3, 6.6, 6.7).

Folds southwest of Cape Liverpool (Fig. 6.1) are gentle, open and plunge very shallowly in various directions, but primarily to the northwest and northeast. The exposed fold pattern is enhanced on the airphotos by the gentle relief of the area; small displacement faults are common. The folds north of glacier D91 (Fig. 6.3, 6.4, 6.5) are relatively tight and plunge gently northwest. The dip of bedding on the flanks of the folds is up to 60°. Small displacement faults are relatively uncommon, possibly due to the nature of the outcrop and the overburden.

Slightly larger, gentle open folds are developed in Eqalulik Group strata adjacent to the Central Borden Fault Zone along the southern margin of the Borden Basin (Jackson and Iannelli, in press). Folds in Bylot Supergroup strata occur locally in several other localities adjacent to fault zones.

The present folding in the northeast Bylot Island Society Cliffs strata may be the result of several periods of deformation. Extensive evidence for syndepositional faulting throughout Borden Basin (Jackson and Iannelli, in press) suggests that some deformation may have occurred during or shortly after deposition.

Folding in the northeast Bylot Society Cliffs strata is probably related, at least in part, to movement chiefly along the Cape Hay Fault Zone that separates the north Bylot coastal plain from the Byam Martin Mountains to the south (Fig. 6.2) and possibly along the Northern Baffin Fault that trends east just north of Baffin and Bylot islands (e.g. Kerr, 1980). Evidence elsewhere in Borden Basin indicates that much, if not most, of the Bylot Supergroup folding and some faulting preceded deposition of early Paleozoic strata, which are less folded and faulted than the Bylot Supergroup, but more so than the Cretaceous-Eocene strata on northern Baffin and Bylot islands. In all these strata the folding occurs primarily adjacent to, and is probably related to, faults.

Hadrynian Franklin dykes cut across some of the Society Cliffs structure (Fig. 6.6, 6.7), but locally may be slightly deformed themselves. Also, some Franklin dykes were emplaced along fault zones. If these were subsequently reactivated, resulting deformation may have been more extensive on one side of the dyke than the other. Probably, however, most of the Society Cliffs deformation occurred some time between deposition of the formation and emplacement of the 750 Ma old Franklin dykes, possibly during the later closing of the Poseidon Ocean, that opened at 1200-1250 Ma.

Evidence for Evaporites

Fold patterns within the Society Cliffs strata in northeast Bylot Island are better developed, more intricate, and tighter than elsewhere in the Bylot Supergroup throughout Borden Basin. These folds (Fig. 6.4, 6.5) and associated faults bear a marked similarity to the structural pattern present in evaporitic sequences elsewhere, such as those in

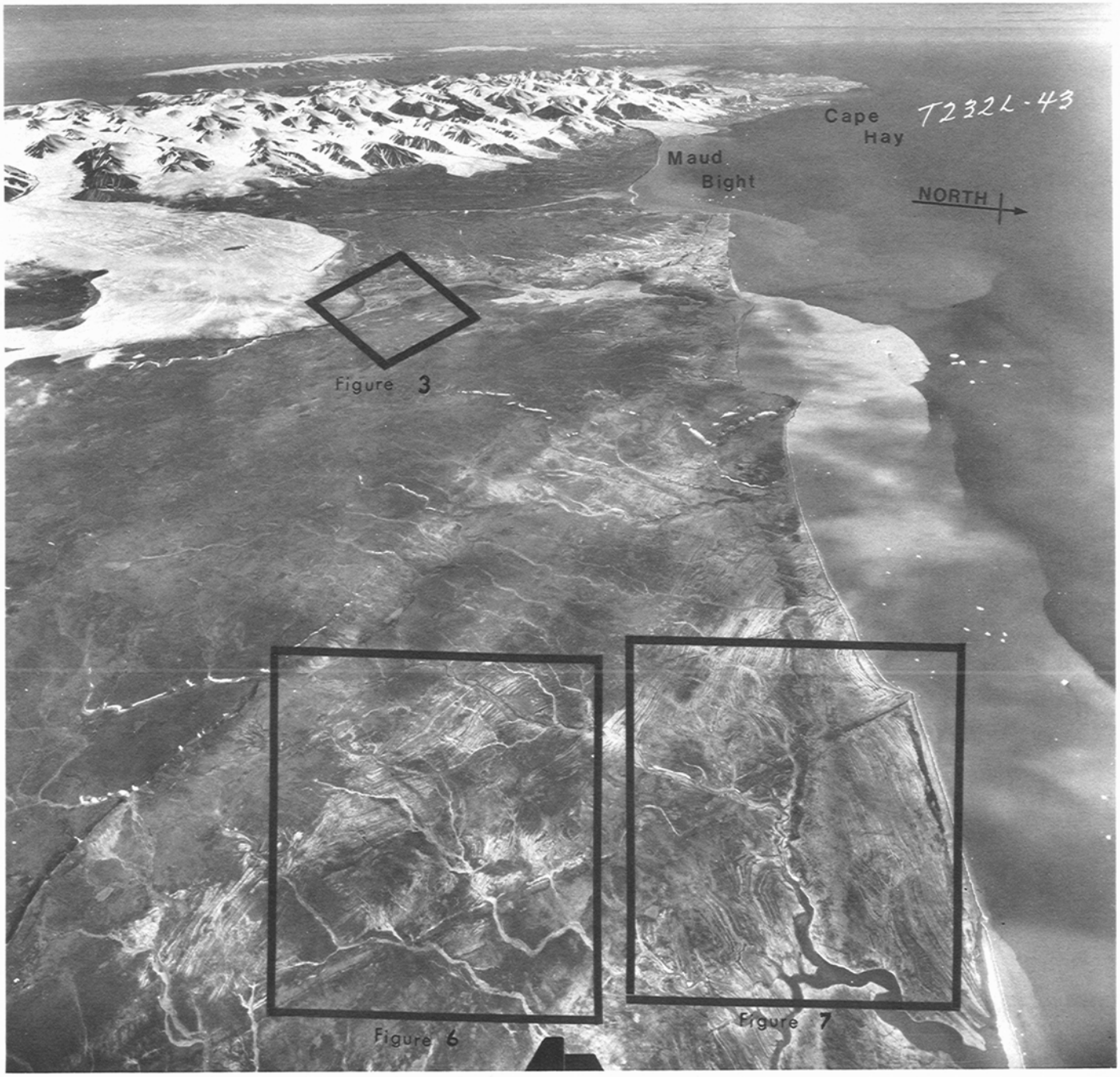

Figure 6.2. *View west of north-central Bylot Island coastal lowlands, showing folded gypsiferous beds of the Neohelikian Society Cliffs Formation intruded by Hadrynian Franklin dykes. Areas shown in Figures 6.3, 6.6 and 6.7 are outlined. The Byam Martin Mountains and Borden Peninsula are in the background. Oblique airphoto T232L-43*

the Mississippian of New Brunswick (e.g. Howie and Cumming, 1963) and Nova Scotia (e.g. Evans, 1965). Similar structures in evaporitic sequences elsewhere have been related to salt or gypsum tectonics (e.g. Evans, 1967). On a smaller scale some minor structures in Mississippian gypsum beds are similar to the larger pattern seen on northeast Bylot Island (Fig. 6.8). On northeast Bylot Island the fold structures, and small-scale faults, although related to regional fault activity, may also have been controlled in their formation by evaporitic sequences which may originally have contained salt bodies as well as gypsum.

Diapiric structures occur in most Phanerozoic salt deposits around the present Atlantic Ocean (Rona, 1976). In northeast Bylot Island, salt, if present, may have been too thin to form diapirs and was removed in solution, or diapirs may ahve formed but were removed when strata overlying the Society Cliffs formation were eroded.

The regional abundance of karst-related breccias and solution breccia, the close spatial relationship between redbed and/or sabkha sequences and extensive varicoloured replacement chert in eastern Borden Basin, and possibly the ubiquitous traces of bitumen (Borchert and Muir, 1964)

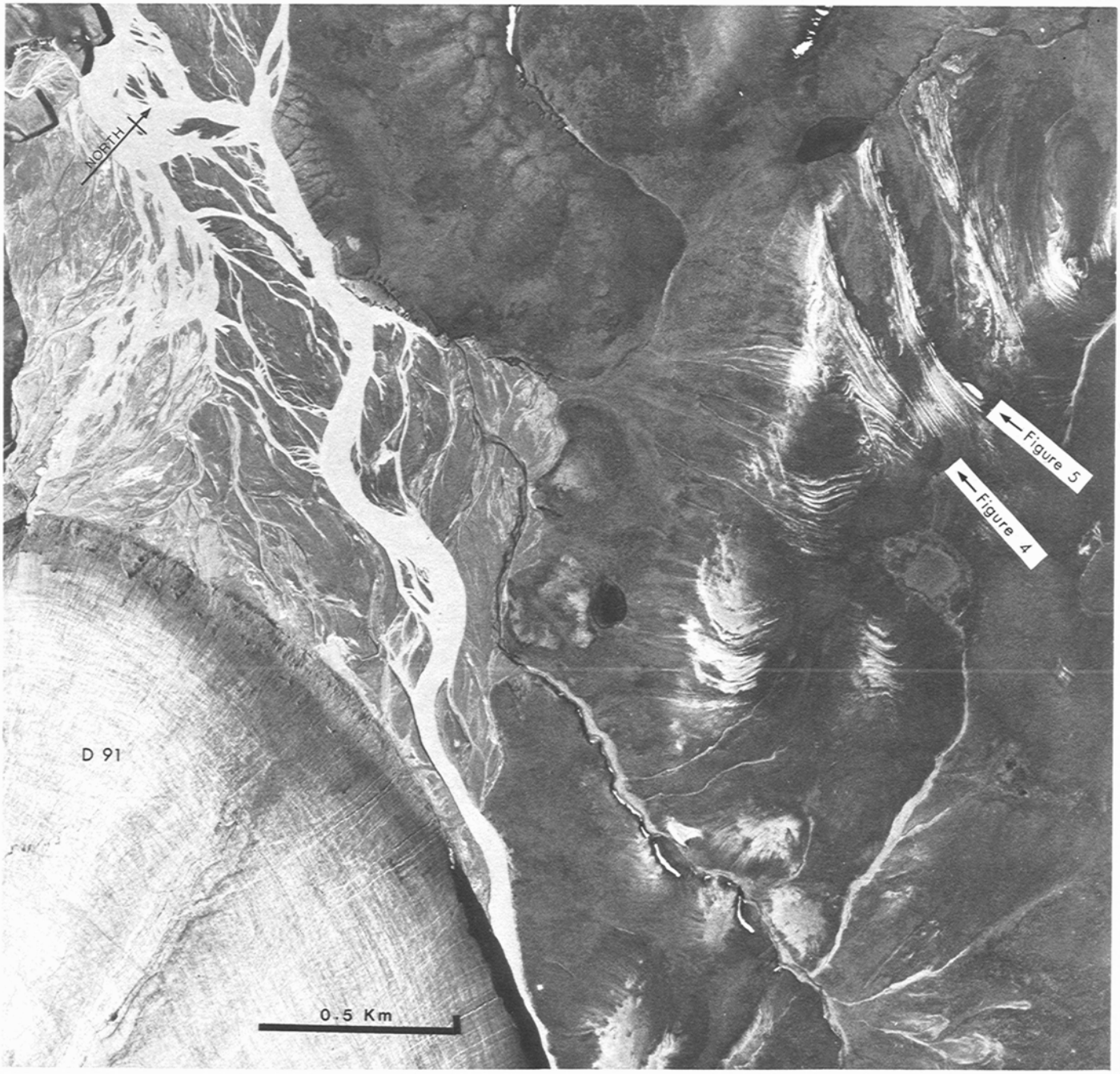

Figure 6.3. *Folds in gypsiferous Society Cliffs Formation at 73°25'N, 78°36'W, 11 km southeast of Maud Bight. The orientations of views in Figures 6.4 and 6.5 are indicated. The melting margin of piedmont glacier D91, with flow lines perpendicular to the margin, is on the lower left. Enlargement from vertical airphoto A-16214-56*

all attest to an abundance of percolating waters that could have dissolved and removed salt. The ubiquitous non-tectonic carbonate breccias, such as those in the Society Cliffs, are an indication that salt may originally have been present in the formation (e.g. B.V. Sanford, personal communication). The common occurrence of vugs, some containing gypsum, may also be an indication of removal of evaporites. The Society Cliffs sabkha sequences, together with the occurrence locally of fluorite in the overlying Victor Bay Formation, are indicators of arid climate during deposition of the Uluksan Group.

Economic Resources

Several mineral deposits in the region, with a wide range of geologic age, have aroused interest. Lead-zinc and iron deposits of economic and near economic size occur in northern Baffin Island. In addition, oil, coal, copper, uranium and other minerals have attracted prospecting activity.

Some of the highest grade iron deposits in the world were discovered in 1962 by Murray Watts in the late Archean Mary River Group at Mary River, 250 km south of northern Bylot Island, where several ages of iron ore may be present

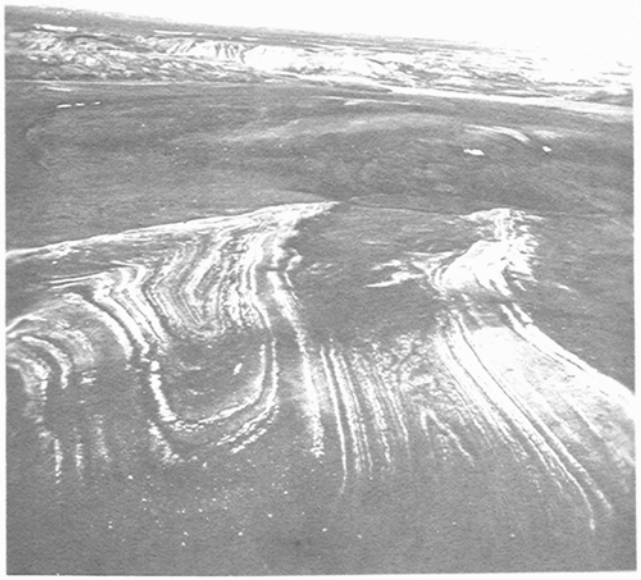

Figure 6.4. *Folds in Society Cliffs Formation accentuated by white weathering gypsiferous beds. View to west from helicopter at altitude 200 metres at 73°35'N, 78°36'W (see Fig. 6.3). GSC photo 202821-I by L.M. Cumming*

Figure 6.5. *Hinge zones of northwest-trending folds in gypsiferous Society Cliffs beds immediately north of 73°35'N 78°36'W (see Fig. 6.3). View to west from helicopter at altitude 150 metres. Northeast margin of uplifted block of Archean-Aphebian crystalline rocks of central Bylot Island (Byam Martin Mountains) in background. GSC 202821-H by L.M. Cumming*

(Gross, 1966; Jackson, 1966). Pods of hematite in the Society Cliffs Formation near Nanisivik may represent oxidized iron sulphides and closely resemble some of the younger ore at Mary River.

Mississippi Valley-type, silver-bearing, lead-zinc mineralization occurs chiefly in the Society Cliffs Formation within the Nanisivik area of the Milne Inlet Trough (Geldsetzer, 1974; Graf, 1974; Olson, 1977). Nanisivik Mines has been shipping concentrates of about 150 000 tonnes per year since 1977. The Nanisivik mine, next to coal mining on Spitsbergen Islands, is at present the most northerly mine in the world. The Nanisivik mineralization was discovered originally by a prospector, A. English, who accompanied Bernie (1911) on his 1910-11 trip to the region. The area was subsequently mapped by Blackadar (1956, 1970).

Major lead-zinc mineralization in Paleozoic strata on Little Cornwallis and Cornwallis islands to the northwest, and traces of lead-zinc mineralization in late Archean lower Mary River Group strata to the southeast on Baffin Island are both probably within the North Baffin Rift Zone (Jackson and Iannelli, in press). Traces of copper mineralization are associated chiefly with the Neohelikian plateau basalts but at one locality, copper occurs in red gypsiferous Society Cliffs shale (Jackson et al., 1975).

Beds of gypsum are most abundant in Bylot Island Society Cliffs strata, are known to be as much as 2.5 m thick, and predominate with minor interbedded shale in units up to 8.5 m thick. The gypsum occurrences on Bylot Island are adjacent to a major Arctic shipping route for ore carriers travelling to and fromNanisivik. Massive gypsum (alabaster) might provide stone for carving by the Innuit who sometimes use the massive, altered, banded carbonate of the Society Cliffs Formation which occurs at baked contacts along Franklin dykes.

Within the Bylot Supergroup, specks of bituminous materials and petroliferous odours are particularly common within Society Cliffs dolostones. A limestone sample from the Nunatsiaq Group in southeast Borden Basin indicated a faint trace of oil when examined with ultraviolet light (Jackson et al., 1975). Age of the bituminous material has not yet been determined.

Coal beds and lenses occur within the Cretaceous-Ecocene strata on Bylot and northern Baffin islands, and a small amount of coal was mined locally near Pond Inlet (Weeks, 1924). Much interest has recently been shown in the oil potential of strata believed to be of Cretaceous-Eocene age in Lancaster Sound north of Bylot Island and in Baffin Bay.

Acknowledgments

This paper is based on data gathered primarily by members of the Geological Survey of Canada's Operation Borden, and includes data collected on Operation Bylot. The field officers included: S.L. Blusson, W.J. Crawford, A. Davidson, T.R. Iannelli, P. Jarvie, L. Maclaren, J.H. McEwen, W.C. Morgan, B.J. Tilley, and P.J. Wallace. We are grateful to Polar Continental Shelf Project for Twin Otter flying time and other support. We also thank D. Willson (Aero Trades), our helicopter pilot. R.A. Klassen supplied some geological data and logistical support. F.H.A. Campbell reviewed the manuscript and suggested several improvements.

Figure 6.6. *Shallow-plunging folds in gypsiferous Society Cliffs Formation southwest of Cape Liverpool. View to the west with northwest-trending Franklin dykes (D) in foreground and background. Enlargement from oblique airphoto T232L-43 (Fig. 6.2)*

Figure 6.7. *View to the west of shallow-plunging folds and minor faults in gypsiferous Society Cliffs strata west of Cape Liverpool. Minor faults are both parallel to and at high angles to Franklin dykes (D). Enlargement from oblique airphoto T232L-43 (Fig. 6.2)*

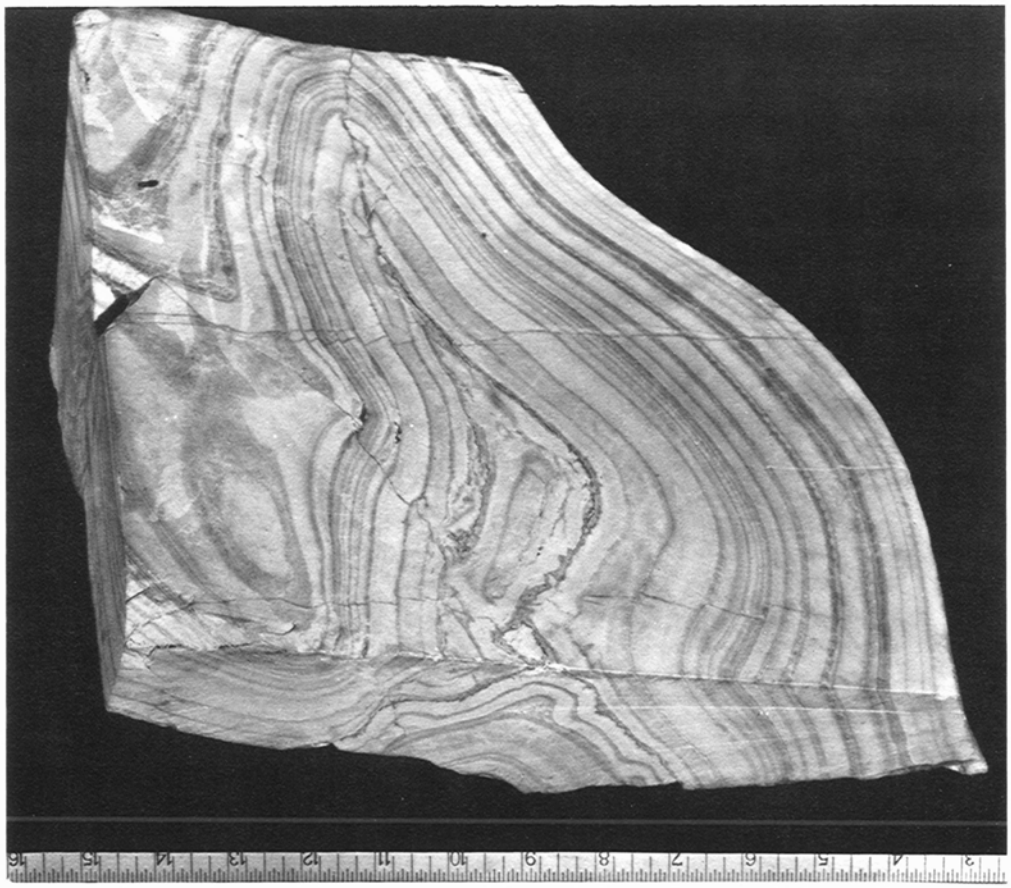

Figure 6.8.

Polished surfaced on a sample of intraformationally folded banded gypsum show, on a small scale, structures similar to those of the Society Cliffs Formation in north-central Bylot Island (compare Fig. 6.4). Sample (GSC no. 8577) collected by A.T. McKinnon from Mississippian strata at Hillsborough, New Brunswick; scale in inches. GSC photo 112361-C by L.M. Cumming

References

Bernier, J.E.
1911: Report on the Dominion Government Expedition to the Northern Waters and Arctic Archipelago of the D.G.S. "Arctic" in 1910; Department of Marine and Fisheries, Ottawa, 161 p.

Blackadar, R.G.
1956: Geological reconnaissance of Admiralty Inlet, Baffin Island, Arctic Archipelago, Northwest Territories; Geological Survey of Canada, Paper 55-6.

1968a: Milne Inlet, District of Franklin (map with marginal notes); Geological Survey of Canada, Map 1235A.

1968b: Navy Board Inlet, District of Franklin (map with marginal notes); Geological Survey of Canada, Map 1236A.

1968c: Arctic Bay-Cape Clarence, District of Franklin (map with marginal notes); Geological Survey of Canada, Map 1237A.

1968d: Moffet Inlet-Fitzgerald Bay, District of Franklin (map with marginal notes); Geological Survey of Canada, Map 1238A.

1970: Precambrian geology northwestern Baffin Island, District of Franklin; Geological Survey of Canada, Bulletin 191, 89 p.

Borchert, H. and Muir, R.O.
1964: Salt Deposits, the Origin, Metamorphism and Deformation of Evaporites; D. Van Nostrand Co. Ltd., London, 338 p.

Davies, G.R.
1976: Evaporites, mineralogy, sedimentology and economics, Paper 1; in Evaporite basins of Canada, Phase I – an overview, a collective study by members of the Geological Survey of Canada; Geological Survey of Canada, Internal Report, p. 1-13.

Evans, R.
1965: The structure of the salt deposit at Pugwash, Nova Scotia; Maritime Sediments, v. 1, no. 3, p. 21-23.

1967: The structure of the Mississippian Evaporite Deposits at Pugwash, Cumberland County, Nova Scotia; Economic Geology, v. 62, p. 262-275.

Fahrig, W.F., Irving, E., and Jackson, G.D.
1971: Paleomagnetism of the Franklin Diabases; Canadian Journal of Earth Sciences, v. 8, no. 4, p. 455-467.

Fahrig, W.F., Christie, K.W., and Jones, D.L.
Paleomagnetism of the Bylot Basins: Evidence for Mackenzie continental tensional tectonics; in Proterozoic Basins of Canada, ed. F.H.A. Campbell; Geological Survey of Canada Paper 81-10, Contribution 17. (in press)

Fahrig, W.F. and Schwarz, E.J.
1973: Additional paleomagnetic data on the Baffin diabase dikes and a revised Franklin pole; Canadian Journal of Earth Sciences, v. 10, no. 4, p. 576-581.

Galley, A.
1978: The petrology and chemistry of the Nauyat Formation volcanics, Borden Peninsula, northwestern Baffin Island; unpublished B.Sc. thesis, Carleton University, Ottawa, 53 p.

Geldsetzer, H.
1973: Syngenetic dolomitization and sulfide mineralization; in Ores in Sediments, ed. G.G. Amstutz and A.J. Bernard; Springer-Verlag, p. 115-127.

1974: The tectono-sedimentary development of an algal-dominated Helikian succession on northern Baffin Island, N.W.T.; in Symposium on Arctic Geology; Geological Association of Canada, Memoir 9, p. 99-126.

Graf, C.W.
1974: A trace metal analysis across the Arctic Bay-Society Cliffs formations contact, Borden Peninsula, Baffin Island, Northwest Territories; unpublished B.Sc. thesis, University of British Columbia, Vancouver, 63 p.

Gross, G.A.
1966: The origin of high grade iron deposits on Baffin Island, Northwest Territories; Canadian Mining Journal, v. 87, p. 111-114.

Howie, R.D. and Cumming, L.M.
1963: Basement features of the Canadian Appalachians; Geological Survey of Canada, Bulletin 89, 18 p.

Iannelli, T.R.
1979: Stratigraphy and depositional history of some upper Proterozoic sedimentary rocks on northwestern Baffin Island, District of Franklin; in Current Research, Part A, Geological Survey of Canada, Paper 79-1A, p. 45-56.

Jackson, G.D.
1966: Geology and mineral possibilities of the Mary River region, northern Baffin Island; Canadian Mining Journal, v. 87, no. 6, p. 57-61.

1969: Reconnaissance of north-central Baffin Island (27C-G, 37C-H, 38A-C, parts of 48A, 48D); in Report of Activities, Part A; Geological Survey of Canada, Paper 69-1A, p. 171-176.

Jackson, G.D. and Davidson, A.
1975: Bylot Island map area, District of Franklin; Geological Survey of Canada, Paper 74-29, 12 p.

Jackson, G.D. and Iannelli, T.R.
Rift-related cyclic sedimentation in the Neohelikian Borden Basin, northern Baffin Island; in Proterozoic Basins of Canada, ed. F.H.A. Campbell; Geological Survey of Canada, Paper 81-10, Contribution 16. (in press)

Jackson, G.D. and Morgan, W.C.
1978: Precambrian metamorphism on Baffin and Bylot islands; in Metamorphism in the Canadian Shield, ed. J.A. Fraser and W.W. Heywood; Geological Survey of Canada, Paper 78-10, p. 249-267.

Jackson, G.D., Davidson, A., and Morgan, W.C.
1975: Geology of the Pond Inlet map area, Baffin Island, District of Franklin; Geological Survey of Canada, Paper 74-25, 33 p.

Jackson, G., Iannelli, T.R., Narbonne, G.M., and Wallace, P.J.
1978a: Upper Proterozoic sedimentary and volcanic rocks of northwestern Baffin Island; Geological Survey of Canada, Paper 78-14, 15 p.

Jackson, G.D., Iannelli, T.R., and Tilley, B.J.
1980: Rift-related late Proterozoic sedimentation and volcanism on northern Baffin and Bylot islands, District of Franklin; in Current Research, Part A; Geological Survey of Canada, Paper 80-1A, p. 319-328.

Jackson, G.D., Morgan, W.C., and Davidson, A.
1978b: Geology of Icebound Lake, District of Franklin; Geological Survey of Canada, Map 1451A, 1:250 000.

Kerr, J.W.
1980: Structural framework of Lancaster Aulacogen, Arctic Canada; Geological Survey of Canada, Bulletin 319, 24 p.

Lemon, R.R.H. and Blackadar, R.G.
1963: Admiralty Inlet area, Baffin Island, District of Franklin; Geological Survey of Canada, Memoir 328, 84 p.

Olson, R.A.
1977: Geology and genesis of zinc-lead deposits within a late Precambrian dolomite, northern Baffin Island, N.W.T.; unpublished Ph.D. thesis, University of British Columbia, Vancouver, 371 p.

Rona, P.A.
1976: Salt deposits of the Atlantic; Anais de Academia Brasileira de Ciencas, v. 48 (Suplemento), p. 265-274.

Sangster, D.F.
1981: Three potential sites for the occurrence of stratiform shale-hosted lead-zinc deposits in the Canadian Arctic; in Current Research, Part A, Geological Survey of Canada, Paper 81-1A, p. 1-8.

Weeks, L.J.
1924: Coal at Salmon River, Baffin island, N.W.T.; Geological Survey of Canada, unpublished manuscript, 8 p. and map.