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DEPARTMENT OF MINES
AND TECHNICAL SURVEYS

PAPER 63-19

GEOLOGICAL RECONNAISSANCE, BOOTHIA PENINSULA, AND SOMERSET, KING WILLIAM, AND PRINCE OF WALES ISLANDS, DISTRICT OF FRANKLIN

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R. G. Blackadar and R. L. Christie

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By

R.G. Blackadar and R.L. Christie

DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
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GEOLOGICAL RECONNAISSANCE, BOOTHIA PENINSULA AND SOMERSET, KING WILLIAM, AND PRINCE OF WALES ISLANDS, DISTRICT OF FRANKLIN

PART I by R.G. Blackadar

INTRODUCTION

'Operation Prince of Wales', designed to fill a gap in the reconnaissance geological mapping between Victoria Island and Baffin Island to the east, was carried out from June to August, 1962. It covered Boothia Peninsula and King William, Prince of Wales, and Somerset Islands. Other similar studies have been carried out to the south ('Operation Back River', 1960—Heywood, 1961)[1], to the west ('Operation Banks - Victoria', 1959—Thorsteinsson and Tozer, 1963) and to the north ('Operation Franklin', 1955—Fortier, et al., 1963).

Rocks in the area range in age from Precambrian to middle Palaeozoic and the terrain features developed on these various rock types dictated a departure from techniques used on past airborne projects. The extensive areas of subdued topography on Prince of Wales Island, King William Island, parts of Somerset Island, and Boothia Peninsula are admirably suited to the use of the Piper Super Cub aircraft equipped with low-pressure tires. This aircraft, so widely used for geological reconnaissance in the Arctic since 1957, when its use was pioneered by the Geological Survey in the western Queen Elizabeth Islands, was used extensively in the areas of low relief. However, it was surmised that sufficient landing sites to give adequate control would not be available for this aircraft on those parts of the area underlain by Precambrian rocks and a Bell 47G2A helicopter was selected for use there. The combination of Piper Super Cub and helicopter gave flexibility and a lower cost than if two helicopters had been used. The Bell 47G2A, a model with a considerably increased payload and thus greater effective range than earlier models, made it possible to carry out the mapping from two main base camps. Much of the fixed-wing flying usually involved in more frequent camp moves was thereby eliminated and costs reduced.

The Piper Super Cub was provided by Bradley Air Services and was piloted by K. Maclennan. The helicopter was supplied by Spartan Air Services and piloted by J. Pridie with A. Hallam as flight engineer. Aviation fuel was sent by ship from Norman Wells to Spence Bay in 1960 and 1961, and part of this fuel was cached near the eastern end of Bellot Strait in the spring, using an Otter aircraft provided by Thomas Lamb Airways Ltd. TransAir

[1]Names and/or dates in parentheses refer to publications listed in the References.

Ltd. moved camp equipment from Churchill to Spence Bay by DC-3 aircraft, and air support for camp moves during the operation was provided by an Otter aircraft belonging to Pacific Western Airlines.

Due to an unusually heavy snow cover it was not until June 16 that the first traverses were made. Field operations were centred at Spence Bay until late July when the camp was moved to a site on Somerset Island, 6 miles north of the abandoned Hudson's Bay Company post at Fort Ross at the eastern entrance to Bellot Strait. Field work was completed on August 21 and the party returned south, some by way of Resolute and some through Cambridge Bay.

TOPOGRAPHY

The region is dominated by the rugged terrain of the Boothia Upland, which extends as a spine through central Boothia Peninsula, and western Somerset and eastern Prince of Wales Islands. Elevations are in excess of 1,800 feet and although the surface is relatively concordant, deeply incised northeast- or northwest-trending canyons and ravines impart a formidable appearance to the land even when seen from the air. Felsenmeer or rock deserts are prevalent on Precambrian upland surfaces, particularly on Somerset Island, and the land is almost totally devoid of vegetation. Elsewhere, thin to thick drift mantles the surface and vegetation is widespread. Outcrops are generally plentiful on the upland surfaces and are especially abundant on the eastern and northern parts of Boothia Peninsula.

Although much of the area underlain by Precambrian rocks is rugged, low-lying areas are present within this terrain. Several low, drift-filled valleys and the low-lying area north of Spence Bay are examples. Most striking is the broad, drift-filled valley that extends south from Wrottesley Inlet. Its margin has steep, in places almost vertical cliffs, rising more than 500 feet above the valley floor.

In contrast to the generally rugged Precambrian terrain are the Palaeozoic lowlands and plateaux. The former flank the Boothia Upland on Boothia Peninsula, form all of King William Island (which nowhere exceeds 300 feet in elevation), western Prince of Wales Island, and southeastern Somerset Island. Northeastern Prince of Wales Island and most of northern Somerset Island are plateaux with elevations in excess of 1,000 feet. Magnificent raised beaches have been formed from the debris of the Palaeozoic carbonate rocks; those near Pasley Bay on the west coast of Boothia Peninsula are perhaps the most outstanding. Good outcrops in the Palaeozoic lowlands and plateau regions are generally confined to river valleys, the surface being covered by frost-shattered bedrock or extensive drift.

Many river courses in the area are structurally controlled. Thus on Boothia Peninsula, northeast- and northwest-trending linears in the crystalline rocks are usually the sites of streams. Many rivers in eastern and northern Boothia Peninsula are deeply incised almost to their headwaters, where even during run-off there is very little flowing water to be seen. It may be that much of the drainage pattern is preglacial and that these features reflect a time when erosion was more active.

Lord Lindsay River and its tributaries control the largest drainage system within the map-area. In its upper reaches

west of Sanagak Lake, it flows through broad, flat-floored, generally drift-filled valleys. Although commonly several hundreds of feet wide there, it is rarely more than a few feet deep. South of Sanagak Lake the river flows in a canyon some 50 feet deep in lower Palaeozoic strata, thence into Lord Lindsay Lake, a steep-sided structurally controlled feature, and finally, in a series of rapids, it reaches the sea near the Mission at Thom Bay.

Drainage in lowland areas is disorganized, and characteristic are many small ponds and lakes—some joined by streams, others with no apparent outlets. The large rivers that traverse the Palaeozoic lowlands have their sources in upland or plateau areas.

Rivers on northern Somerset Island, such as the Aston, Hunting, or West Creswell, closely follow structural trends. Most flow north or south and for the most part parallel the trend of the Boothia Arch, which in turn has affected the trends in the Palaeozoic strata through which they flow. Many are deeply entrenched especially in their lower reaches.

HISTORY OF DISCOVERY AND PREVIOUS GEOLOGICAL WORK

The area covered by 'Operation Prince of Wales' was one of the first to be visited during the resurgence of British interest in the polar regions that followed the cessation of the Napoleonic Wars. Sir Edward Parry in 1819 entered Lancaster Sound, sailed as far west as Melville Island, and wintered there. Northern Somerset and Prince of Wales Islands were sighted during this voyage. In 1825 Parry's ship FURY was wrecked at Fury Beach, eastern Somerset Island, following a rather unsuccessful season, even though parts of northwestern Baffin Island and eastern Somerset Island were observed for the first time. Sir John Ross discovered and named Boothia Peninsula and spent the years 1829-32 near Felix Harbour and the winter of 1832-33 at Fury Beach. During this time he travelled the entire east shores of the area covered by this report although the nature of Bellot Strait, the key to the puzzle of the Northwest Passage for which he was searching, was not realized. His nephew, James Clark Ross, located the site of the North Magnetic Pole and explored northern King William Island.

The disappearance of Sir John Franklin's expedition, sent in 1845 to seek the Northwest Passage, initiated an extensive and widespread search all through the Arctic between 1848 and 1859, and most of the area under consideration was explored at that time. It was later discovered that Franklin's ships, EREBUS and TERROR, had been abandoned near Victory Point, King William Island, and the entire crew is presumed to have perished in their attempt to reach the interior posts of the Hudson's Bay Company by way of Back River.

In the course of the "Franklin search", James Clark Ross wintered in 1848-49 at Port Leopold, northeast Somerset Island, and explored much of the western coast of the island. Parts of Prince of Wales Island were examined by parties from ships of the 1850-52 search expeditions which wintered off the south coast of Cornwallis Island. At the same time, Bellot Strait was at last discovered and southern Prince of Wales Island explored by parties from a private expedition sent out by Lady Franklin in 1851. Although Rae, an officer

of the Hudson's Bay Company, while exploring the Arctic continental coast had heard stories from the Eskimos regarding the fate of Franklin's ships and had obtained articles known to belong to members of the crews, it was left in the end to Lady Franklin to sponsor a final expedition to settle the fate of her husband and his crews. This was carried out by Leopold M'Clintock who wintered his ship FOX in Kennedy Harbour at the eastern entrance to Bellot Strait (1859-60). During sledging trips he and Lieutenant Hobson circumnavigated King William Island and discovered the only written record ever found from Franklin's ill-fated expedition. Young, master of the ship FOX, had during this same period explored the western coast of Somerset Island.

Thus by 1860 the broad outlines of the geography of this area had been determined. Common to all official expeditions of the nineteenth century, some natural history studies had been made on most of the trips. Extensive areas underlain by crystalline rocks were known to be present on Boothia Peninsula and western Somerset Island and a few fossil collections had been made (see especially Ross, 1835; Haughton, 1860). A Silurian age was assigned to much of the Palaeozoic outcrops within the area covered by this report. Further geographical exploration during the next 100 years resulted in random collections of fossils and recognition of the presence of Ordovician strata (see especially Foerste, 1921, 1929).

SETTLEMENT AND ACCESS

Spence Bay and Gjoa Haven, both in the extreme south, are the only permanent non-military settlements in the area. Spence Bay, the larger, comprises a Hudson's Bay Company store, a nursing station, a Royal Canadian Mountain Police detachment, offices of the Northern Administration Branch of the Department of Northern Affairs and National Resources, a federal day school, and Anglican and Roman Catholic missions.

A small Hudson's Bay Company store, a federal day school, and a Roman Catholic mission are situated at Gjoa Haven. The Roman Catholic mission at Thom Bay is occupied at various times throughout the year and is served by the missionary from Spence Bay. The Hudson's Bay Company formerly operated a trading post at Fort Ross but this was closed in 1948 and Spence Bay became the trading centre for the area. The buildings at Fort Ross are in excellent condition and offer emergency shelter.

At present the area is served by air from Cambridge Bay although heavy freight is brought in by sea. Spence Bay is equidistant from Yellowknife and Churchill where charter air services are available.

The Eskimo population lives mainly in the southern part of Boothia Peninsula and on King William Island, but camps at Creswell Bay, Somerset Island, Levesque Harbour just south of Bellot Strait, and on the east coast of Boothia Peninsula south of Thom Bay were visited by members of the party. No camps were seen on Prince of Wales Island; the Eskimos generally make only short hunting forays there.

Wildlife observations were made during all flights for the Canadian Wildlife Service. The entire region is remarkable for

its lack of large land-animals but seals, white whales, and narwhals are common. Many of the rivers and lakes provide excellent fishing.

ACKNOWLEDGMENTS

'Operation Prince of Wales' was directed by the writer who together with F.C. Taylor was responsible for mapping the Precambrian rocks. R.L. Christie, assisted by W. Nassichuk, a graduate student, studied the Palaeozoic stratigraphy of the area. B.G. Craig examined the surficial deposits, and his results will be published separately.

The assistance and hospitality of the residents of Spence Bay, especially R.E. Knight of the Hudson's Bay Company, J.W. Pringle, R.C.M.P., and M. Shand, Department of Northern Affairs and National Resources, are gratefully acknowledged.

PRECAMBRIAN ROCKS

Archaean

Schists and Gneisses (1, 2)[1]

Although extremely complex in detail, the schists and gneisses that constitute most of the Precambrian rocks in the area have been grouped into two broad divisions, map-units 1 and 2. Map-unit 1 comprises rocks with a predominantly mafic aspect, including biotite-hornblende schists and gneisses, amphibolite, and rusty-weathering pyritiferous graphite-biotite schists and gneisses. All gradations between biotite-hornblende gneisses (1) and quartz-feldspar gneisses of map-unit 2 exist and an arbitrary division between the two was made for mapping purposes. Where quartz and feldspar-rich components exceeded 50 per cent, the rocks were grouped as quartz-feldspar gneiss (2).

Rocks of map-unit 1 vary in colour and degree of lamination, due to differences in mineral content. Where the lamination is well developed, banded gneisses result. The darker bands are rich in biotite or hornblende or both with lesser amounts of feldspar and quartz, and even in the lighter quartz-feldspar bands there may be streaks of biotite- or hornblende-rich rocks. In some, pyroxene may exceed 10 per cent. Apatite is widespread but rarely exceeds 1 per cent. Garnet is found in many of the mafic gneisses but is random in distribution. Here and there the felsic component of the rocks of map-unit 1 appears intrusive and the resulting rocks are more correctly termed "lit-par-lit gneiss". On the west coast of Boothia Peninsula between Tasmania Islands and Bellot Strait these gneisses are well exposed along the wave-washed coast, and there the arbitrary nature of the division between map-units 1 and 2 is obvious.

The rocks of map-unit 1 are cut by randomly oriented, pink or white, medium- to coarse-grained dykes and sills, and irregular masses of quartz and microcline. Medium-grained biotite occurs in a few of these. These rocks cut not only the mafic phase of the gneisses but, in the banded and lit-par-lit gneisses, they also cut the quartz-feldspar phase. None of these intrusive masses is large

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[1]Numbers in parentheses refer to map-units.

enough to be shown on the accompanying maps and they rarely exceed a few feet in greatest dimension.

Amphibolite bands, composed mainly of hornblende with minor feldspar, are included in unit 1. Most are less than a few tens of feet in length and breadth although some may be measured in hundreds of feet.

Narrow discontinuous bands of crystalline limestone are present in an area of abundant rusty schists and gneisses that outcrops on both sides of Bellot Strait. The limestone is coarsely crystalline and weathers to a yellowish grey. Some bands are siliceous, and irregularly shaped cherty layers may form more than half the rock. Greenish diopside is the most abundant accessory mineral associated with the carbonate bands, but phlogopite, graphite, and biotite may be present. The rocks of map-unit 1 are probably a succession of metamorphosed sedimentary and volcanic rocks.

The felsic gneisses of map-unit 2 are grey to pink in colour and well foliated. Bands of paragneiss (1) are commonly included and migmatites are widespread. Quartz, microcline, and plagioclase are the main constituents, but where unit 1 grades into unit 2 biotite and hornblende may be abundant. These minerals are commonly altered to chlorite. Garnet although widespread is spotty in occurrence.

Rocks of unit 2 grade into the massive granitic rocks (3) that occupy much of southeastern Boothia Peninsula.

Cataclastic gneiss and mylonite occur along many of the larger linear features but are not extensive enough to show on the map.

Granite (3)

Although granitic rocks in small bodies outcrop in all parts of the map-area underlain by Precambrian rocks, they are most widespread in southeastern Boothia Peninsula. Many of these rocks are medium grained and here and there, such as west of Spence Bay settlement, they exhibit a porphyritic texture. Quartz and microcline form most of the rock, but biotite, chlorite, and plagioclase are present in various amounts, and apatite, zircon, and magnetite are common accessory minerals. The microcline is moderate orange-pink in colour and gives the pinkish surface colour to the granite outcrops. Phenocrysts of microcline are commonly darker around the margins and the colour grades from greyish orange-pink in the centre to moderate reddish orange along the crystal margins. Smoky quartz is common and gives a much darker appearance to the granites than their mineral composition warrants.

Gradations between units 1, 2, and 3 are common and patches of gneissic rock are included within the boundaries of map-unit 3.

Ultrabasic Rocks (4)

Several small exposures of deeply weathered,

serpentinized rocks occur between Bellot Strait and Amituryouak Lake on Boothia Peninsula, and similar rocks outcrop on Prescott Island.

These rocks weather moderate yellow-green to moderate yellowish brown. They are very fine grained and fresh surfaces are dark greenish grey. Moderate yellow-green veinlets and irregular patches of serpentine occur throughout. North of Amituryouak Lake, pyrrhotite is associated with these rocks. There the rocks are deeply weathered, and gossan covers an area several hundreds of feet in diameter. Little solid mineralized rock is exposed on or near the surface.

Proterozoic

Aston (5) and Hunting (6) Formations

Unfossiliferous sedimentary strata, presumed to be of Proterozoic age outcrop south of Aston Bay, Somerset Island, and were first recognized and mapped during 'Operation Franklin' (1955). Two formations were established—the Aston (5), an assemblage of red, grey, and yellow quartzitic sandstones with minor shales and conglomerate; and the Hunting (6), an assemblage of dolomite and argillaceous dolomite containing minor sandstone units (Blackadar, in Fortier, et al., 1963). Both these formations are intruded by gabbro sills and dykes.

Physical difficulties prevented detailed stratigraphic studies in the Aston Bay region during 'Operation Prince of Wales'. However a one-day helicopter traverse was possible and revisions were made both in the mapping of the Aston and Hunting Formations and in the data on the lithology of the latter.

A banded unit comprising moderate orange-pink and light grey dolomite (6a) is present near the base of the Hunting Formation. The thickness of the individual bands varies but averages about 100 feet, and the total thickness of the unit may exceed 2,000 feet.

Quartzitic members appear to be more abundant in the Hunting Formation than previously thought. Indeed, when A.E. Woakes traversed the area about 8 miles east of Cape Granite during 'Operation Franklin', the only outcrops observed through the snow were of quartzite, and the rocks were therefore assigned to the Aston Formation on GSC Map 19-1959.

Numerous northeast-trending faults mark the lower contact of the Hunting Formation.

Felsenmeer covers much of the area underlain by the Aston Formation (5) and the adjacent gneissic rocks; and this, as well as their similarity in colour, makes it difficult to distinguish between the gneisses and quartzites, either from the air or by air-photo interpretation. Similarly it is impossible on air photographs to distinguish the innumerable gabbro dykes and sills intruded into the Aston Formation from the sedimentary rocks. For these reasons contacts are generalized on the accompanying map, and only the larger intrusions are shown.

Gabbro (7)

Sills and dykes of gabbro intrude the Precambrian strata in all parts of the map-area but are most abundant on Somerset Island where they form a plexus of diversely oriented, narrow, steeply dipping dykes. Although rarely more than a few tens of feet wide, some of these dykes can be traced for many miles. Others disappear and reappear apparently along the same zone of fracture.

Gabbroic rocks are also abundant within the area of units 1 and 2 north of Stanwell-Fletcher Lake and near Bellot Strait. At the latter place the gneissic rocks are well banded and steeply dipping and many thin sills have been emplaced in the gneisses as well as dykes.

Two dykes, several hundreds of feet wide, extend more than 70 miles northwest from north of Thom Bay. Here and there are smaller dykes, some of which closely parallel the main dykes and others that are northeast-trending offshoots from them.

Where the gabbroic magma was intruded into Proterozoic sedimentary strata, particularly the Aston Formation (5), sills rather than dykes predominate. Thicknesses exceed 600 feet and differentiation has resulted in the formation of 'red-rock' and segregations of quartz. Sills in the Aston Formation form wide outcrops because of the prevailing gentle dips. Narrow dykes are present in the Hunting Formation (6) but none was observed cutting the overlying Palaeozoic strata.

The gabbroic rocks weather moderate reddish brown and are generally well jointed. Contact-metamorphic effects are limited to a narrow chilled margin within the intrusion; the country rock is unaffected.

The dykes and sills appear to be similar in all respects to the "Diabase Series" (Fortier, 1957) so widespread in the Canadian Arctic. Nowhere within the area was gabbro found intrusive into fossiliferous strata, and by analogy with similar intrusive rocks in northern Baffin Island, shown to be pre-Lower Middle Ordovician (Lemon and Blackadar, in press), they are considered to be Precambrian in age.

PART II by R.L. Christie

THE PALAEOZOIC ROCKS

The Boothia region includes parts of three structural provinces, comprising two basins of relatively little deformed Palaeozoic sedimentary rocks separated by the north-trending Boothia Arch of Precambrian rocks. They are named the "Jones - Lancaster basin" on the east and the "Victoria Straits - Melville basin" on the west (Fortier, McNair, and Thorsteinsson, 1954, p. 2078). Although the basins are now separated by a positive arch, they apparently were not so during lower Palaeozoic time, when Cambrian, Ordovician, and Silurian sediments, mainly carbonates, were deposited. The Boothia Arch rose in mid-Palaeozoic time to become a positive area contributing detritus to the newly divided basins to the east and west, and to the north. The Precambrian rocks were uplifted at least 4,500 feet relative to the base of the Palaeozoic section as an elongate belt bounded by faults. Differential uplift apparently was accomplished mainly by movement on the bordering faults[1]. The syntectonic, Lower Devonian Peel Sound Formation, flanking the arch, and comprising clastic material derived from it, is itself folded and faulted by movements of the arch.

Stratigraphy

Flat-lying to gently dipping beds containing Cambrian, Ordovician, and Silurian fossils underlie the peninsular and island areas flanking the Boothia Precambrian belt. Outliers of Palaeozoic rocks occur within the belt, preserved in downfaulted or tilted blocks. Flat-lying Ordovician, and possibly Silurian, beds are exposed on King William Island.

The basal, Cambrian beds (8) include weakly cemented sandstone, sandy dolomite, shaly dolomite, and intraformational breccia and conglomerate. These beds total about 300 feet in thickness, and have been identified in outliers on southern Boothia Peninsula and along the margins of the Precambrian belt on the peninsula and on Somerset Island. The Cambrian beds are characterized by relative incompetence and by brown weathering. A collection of fossils from the lower beds of the formation near Kangikjuke Lake has been examined by A.W. Norris, who reports as follows (GSC loc. 51208):

? Hyolithes sp.
undet. trilobite genal spines
cf. Glossopleura sp. —two pygidia
cf. Elrathia sp. —cephalons

Both trilobite genera, Glossopleura and Elrathia, suggest a Middle Cambrian age according to Norris, who suggests further that the beds may be roughly correlated with the Bear Point Formation of Dundas Harbour, Devon Island. The uppermost beds of the basal formation on Boothia Peninsula, however, may be Ordovician.

Conformably overlying the basal formation are beds (9) aggregating a considerable thickness of light-weathering, relatively

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[1]Conclusions that confirm deductions made by Gregory, Bower and Morley (1961, pp. 6, 22) from geophysical and earlier field data.

competent dolomite, dolomitic sandstone, and minor sandstone containing Ordovician and probably Silurian fossils. The mainly Ordovician beds form a variable, generally narrow zone along both east and west flanks of the Precambrian and Cambrian exposures. The thickness of the Ordovician - Silurian beds is uncertain, but is estimated to be at least 1,000 feet on the east side, and more than twice that on the west side of the Boothia Precambrian belt. The 'Arctic Ordovician' fauna occurs about in the middle of the dolomitic group of beds, which apparently is equivalent to the Cornwallis and Allen Bay Formations of Cornwallis Island. A collection of fossils from the 'Arctic Ordovician' horizon at a locality on West Creswell River, Somerset Island, was examined by G.W. Sinclair who reports (GSC loc. 50721):

Manipora sp. (not particularly like M. amicarum)
Receptaculites sp.
Rafinesquina cf. lata (Whiteaves)
Maclurites sp.
Rhynchotrema sp.

Sinclair suggests the age to be that of the Dog Head Formation of southern Manitoba, which he considers to be Edenian (earliest Upper Ordovician).

Silurian limy beds (11) correlative with the Read Bay Formation of Cornwallis Island conformably overlie the dolomites. The Silurian formation comprises fossiliferous limestone and dolomitic limestone characterized by thin bedding, irregular silty and shaly bedding-planes, and dark weathering-colours. Measurements showed the unit to be about 1,000 feet thick or slightly less. The formation is richly fossiliferous and shelly faunas may be collected throughout. Fish plates were obtained from both the lowest and highest beds.

The youngest Palaeozoic beds observed are those of the Peel Sound Formation (12), which comprises boulder- and pebble-conglomerate, sandstone, and sandy limestone. The thickness of this formation, the top of which is not known, is uncertain; about 900 feet of beds was measured at one locality but at another the estimated thickness was nearly twice that. The relationship of the Peel Sound Formation with underlying beds is complex and variable. Basal Peel Sound sandstone beds generally overlie Read Bay beds conformably, but marked unconformities occur locally on Prince of Wales Island and the conglomerate (12a) contains fragments of all older formations. Striking facies changes occur in the Peel Sound Formation on Prince of Wales Island. The basal sandstone passes gradationally upward into very coarse gneiss-dolomite-limestone boulder-conglomerate (12a) and the conglomerate beds pass westward into sandstone (12b), then into sandy limestone and limestone (13, in part?). The limy beds (13) resemble Read Bay limestones and are not differentiated on the map. of Prince of Wales Island.

The total measured thickness of lower Palaeozoic beds is in the order of 3,500 feet in the eastern part of the Victoria Straits - Melville basin, but the actual thickness is probably at least 4,000 to 4,500 feet. The thickness of upper Peel Sound beds lost through erosion is unknown. The thickness of pre-tectonic formations in the western part of the Jones - Lancaster basin apparently is about 1,000 feet less

than the thickness of equivalent beds west of the Boothia Arch. This difference in measured thicknesses is of roughly the same order as the differences in calculated depths to basement shown by Gregory, Bower and Morley (1961, p. 114).

Structure

The Palaeozoic beds are mostly flat lying to gently dipping, but are sharply flexed in linear zones and along certain contacts, the flexures in all cases apparently being due to faulting. Structures on the east and west sides of the Boothia Arch (described in following sections) are not symmetrical, and the arch apparently did not arise through simple upward flexing.

Striking similarities may be noted between Boothia structures and those of the Cornwallis Fold Belt (see Thorsteinsson, 1958, pp. 112-116; McNair, 1961, p. 424) along strike to the north, where narrow, relatively steep-flanked anticlines are separated by broad synclinal areas. The cratonic association of these structures, which invade a miogeosynclinal region, contrasts with the geosynclinal association of folds produced during a later, Variscan, stage of orogeny on nearby islands (see Thorsteinsson and Tozer, 1960, p. 9; McNair, 1961, p. 424).

Structures East of the Boothia Arch

The Jones - Lancaster basin of Palaeozoic sedimentary rocks, to the east of the arch, is broadly synclinal; the syncline on Somerset Island separates a large area of flat-lying beds from flat-lying and gently-eastward-dipping beds bordering the Boothia Arch. Eastward-dipping lower Palaeozoic beds form a border zone along the arch about 15 to 20 miles wide. Beds in this zone dip away from the exposed Precambrian basement with a gentle average dip, but are interrupted by numerous faults and undulations. On Somerset Island, linear belts of vertical or steep dips are separated by broad belts of flat-lying or undulating bedding to produce a stepwise structure. The steep-dipping belts trend parallel to known faults, and presumably are due to faults in the underlying basement, the flexures perhaps due to thrust pressure. Probably an appreciable part of the dips of Palaeozoic beds is due to tilting of fault blocks of basement rocks.

Numerous faults intersect the Precambrian and lower Palaeozoic rocks to produce a zig-zag contact line. These presumedly normal or tension faults lack associated flexures that might be due to thrust pressure, and result in repetition of the Palaeozoic beds.

Structures West of Boothia Arch

The Palaeozoic beds are essentially flat lying over most of the sedimentary basin west of the Boothia Arch, although broad, east-trending folds occur at the north end of Prince of Wales Island and on Russell Island. However, a zone generally a few thousand feet wide and characterized by vertical and overturned beds lies along the sinuous western Precambrian - Palaeozoic contact. A variable amount of the basal Palaeozoic section is missing along the western contact zone, which apparently for much of its length is one of major

thrust-faulting. Unconformities beneath the Peel Sound Formation occur locally in northern Prince of Wales Island on a probable northward extension of the fault zone, and fault activity in Lower Devonian time is indicated.

The Palaeozoic Outliers

Several large outliers occur a few miles north of Spence Bay on Boothia Peninsula and smaller ones lie scattered on Somerset Island. The outliers on Boothia Peninsula, which are best known, comprise Palaeozoic beds downfaulted and tilted very slightly northeastward. These outliers are bounded on their northerly sides by northwest- and north-northeast-trending faults. Both sets of faults coincide with lineaments extending many miles beyond the outliers, and illustrate the dominant regional trends of faulting.

PART III by R.G. Blackadar

POSSIBLE PALAEOZOIC INTRUSION

Occurring about 4 miles east of West Creswell River at 73° 08'N and 94° 07'W, surrounded by carbonate rocks, are fractured weathered outcrops of what appears to be an extensively altered, basic intrusive rock (A). Three knolls are exposed in an area about 2,000 feet by 800 feet, and the body apparently is irregular in shape. The surrounding rocks are brown- and grey-weathering dolomites referable to the Cambro-Ordovician beds of the region. Fossil remains of crinoid stems were found in the dolomites. The beds apparently are not affected by the intrusive body; the nearly flat dips are characteristic of the local Palaeozoic beds and no evidence of 'baking' or other alteration of the carbonate rocks could be found.

The intrusive rock consists of subangular to subrounded fragments of light grey carbonate-rock and greyish black argillaceous carbonate-rock set in a dusky-yellow to dark grey matrix. Fragments 0.7 inch in greatest dimension are common and a few fragments are about 3 inches in diameter. In thin section the rock is seen to comprise subrounded pyroxene and olivine crystals as well as the subrounded, fine-grained carbonate and argillaceous carbonate fragments. The matrix is mainly coarse-grained carbonate. The pyroxene crystals which form about 30 per cent of the total mineral content of the rock are extensively fractured, and serpentine and other alteration products have formed in the interstices. Olivine appears to form less than 5 per cent of the mineral content. A pronounced mosaic texture results. The pyroxene crystals are about 0.1 inch in diameter. Pyrite and magnetite occur randomly throughout the rock and, although small crystals are most abundant, large masses of both minerals are present.

The contact between this rock and the surrounding carbonate rocks (10) could nowhere be found exposed. Provisionally, however, the body is assumed to be intrusive into the carbonate rocks and is thus post-Ordovician in age. If these assumptions are correct then this mass is one of the few known examples of Lower Palaeozoic igneous activity within the Canadian Arctic. This intrusive rock (A) may reflect activity related to the Boothia Arch. Relationship to a northward extension of the arch is suggested by McNair (1961) for small basaltic laccoliths (?), dykes, and sills on Bathurst Island.

A spectrographic analysis of a specimen of this rock was made in the Spectrographic Analysis Laboratory of the Geological Survey with the following results (report R50-63).

Ca	7.0 per cent	Mn.....	0.10 per cent
Mg	12.0	Ni	0.2
Fe	7.0	Al	1.0
Si	10.0	Cr	0.15
Ti.....	0.3	Cu.....	0.002
Ba	0.15	B	0.01
Sr.....	0.07	Zr	< .005

Tests were made for niobium and rare-earth elements but these are not present in the rock.

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