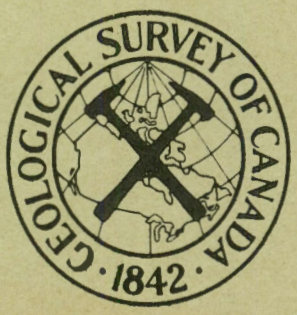

GEOLOGICAL
SURVEY
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CANADA

DEPARTMENT OF MINES
AND TECHNICAL SURVEYS

PAPER 66-10

GEOLOGICAL NOTES ON OPERATION WAGER, NORTHWEST TERRITORIES

(Report and 4 figures)

W. W. Heywood

Price, 75 cents

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CONTENTS

Illustrations

ABSTRACT

This report describes the results of a reconnaissance geological survey carried out in northwestern District of Keewatin and southern Melville Peninsula, District of Franklin.

Although the oldest rocks are probably metamorphosed volcanics and sediments, more than 70 per cent of the area is underlain by granitic and gneissic rocks. Peridotite, pyroxenite, and serpentinite occur in and near the metasediments and metavolcanics and a few diorite and gabbro plugs were seen.

Diabase dykes intrude all Precambrian rocks but do not intrude the Ordovician and Silurian sandstones and dolomites that outcrop here and there in the northern, northeastern and southeastern parts of the mapped area.

GEOLOGICAL NOTES ON OPERATION WAGER, NORTHWEST TERRITORIES

INTRODUCTION AND GENERAL GEOLOGY

Operation Wager, a reconnaissance geological mapping project, was carried out in northwestern District of Keewatin and Melville Peninsula, District of Franklin. About 55,000 square miles were investigated during the 1964 field season by W.R.A. Baragar, J.A. Donaldson, C.I. Godwin and G.D. Jackson under the direction of W.W. Heywood.

This interim report presents a brief summary of the regional geology and additional details on three selected areas that are of more than general interest. [1]

Metamorphosed volcanic and sedimentary rocks are probably the oldest rocks in the area, and although widespread, they are most common in the northern half of the area. More than 70 per cent of the area is underlain by a variety of granitic and gneissic rocks that are grouped in broad divisions rarely separated by clearly defined contacts. Layered gneiss, paragneiss and schist grade into both metasedimentary and granitoid gneisses. The granitoid gneisses may vary widely in age. Where foliation is vague these rocks are mapped as massive granite. Migmatites consist of gneissic, schistose and metasedimentary rocks mixed with granitic material. Massive granite, granodiorite and quartz-monzonite are widely distributed. Here and there they are slightly foliated and near Wager Bay and on Melville Peninsula porphyritic varieties are common.

Peridotite, pyroxenite and serpentinite occur in and near the metasediments and metavolcanics in the northern half of the map-area. Locally soapstone is developed and some asbestiform minerals were observed. There are diorite and gabbro plugs southwest of Committee Bay, east of Repulse Bay, and west of Daly Bay.

Diabase dykes and sills intrude all Precambrian rocks and although not abundant, many have been traced for several tens of miles. They range in thickness from a few feet to more than 500 feet, but most average about 100 feet. Here and there in the northern, northeastern and southeastern parts of the map-area Ordovician and Silurian sandstone and dolomite outcrop.

SEDIMENTARY-VOLCANIC ASSEMBLAGE OF NORTHERN MELVILLE PENINSULA

Two northeasterly trending belts of metamorphosed sedimentary and volcanic rocks (Figs. 1, 2) that outcrop on Melville Peninsula near the northern boundary of the map-area, are probably the oldest rocks and their

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[1] A more complete report is given in "Geological Notes on the northeastern District of Keewatin and Melville Peninsula, District of Franklin, Northwest Territories; Geol. Surv. Can., Paper (in preparation)".

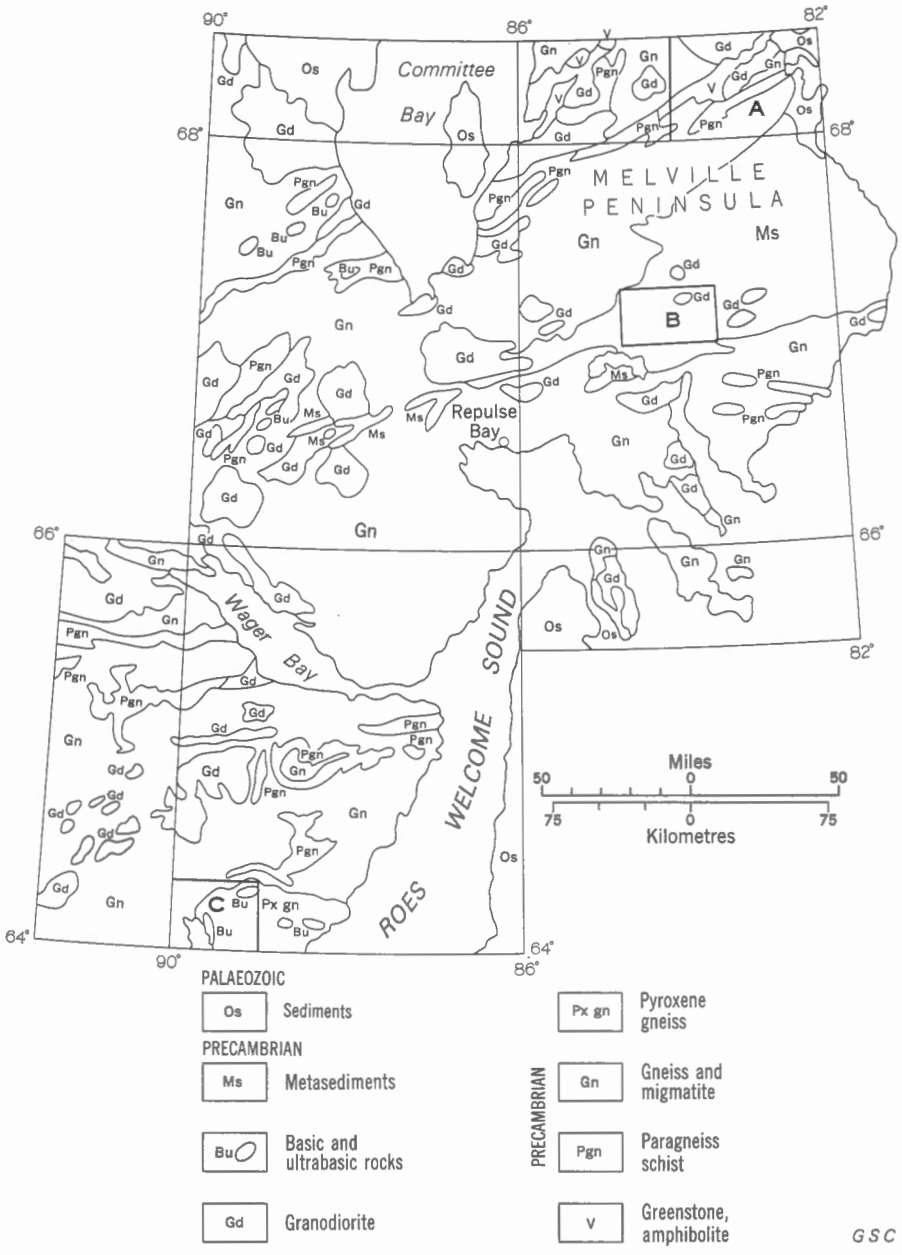

Figure 1. Geological sketch map of area mapped on Operation Wager. Detailed maps of areas A, B and C are shown on Figures 2, 3 and 4.

lithologic similarities suggest that they are parts of the same sequence.

The eastern belt is representative of these rocks and is illustrated in Figure 2. The oldest rocks are greenstones, greenschists and amphibolites derived from intermediate to basic volcanic rocks. They are strongly sheared and only vague suggestions of primary features remain. Minor amounts of acid volcanics occur in the western belt.

Iron-formation, present in both belts, is associated with metasedimentary and volcanic rocks. The sedimentary rocks include massive to bedded quartzite, phyllite, schist, paragneiss and a mafic gneiss possibly derived from basic volcanic flows or pyroclastics. The rocks in contact with the iron-formation vary from place to place which suggests that the iron-formation rests unconformably on metasedimentary and metavolcanic rocks.

The iron-formation consists of thin alternating laminae of magnetite or quartz-magnetite rock, and fine-grained quartzite. The laminae range from 1 mm to 10 cm thick but a few quartz-magnetite-rich layers are as much as 10 feet thick.

Many elongate map-units throughout the area are composed of schist, paragneiss, and layered gneiss derived largely from sedimentary rocks (Figs. 1, 2, 3). They may be of the same general age as the volcanic-sedimentary sequence described above.

DALY BAY COMPLEX

Gabbro and anorthosite occur in a generally mafic-rich group of gneisses and granulites in the Daly Bay area and form a distinct lithologic association (Fig. 3).

The main anorthosite body consists of a central massive to slightly layered core of medium- to coarse-grained anorthosite and anorthositic gabbro. Surrounding this is a fine- to medium-grained group of layered anorthositic and mafic rocks comprising layers that are 6 inches to 8 feet thick. The anorthositic layers are composed of medium- to coarse-grained plagioclase but contain as much as 30 per cent pyroxene, amphibole and garnet. The mafic layers are gabbroic to dioritic in composition and are medium-grained rocks characteristically composed of plagioclase, pyroxene, amphibole and garnet, with minor orthoclase, quartz, muscovite, biotite and magnetite. Commonly these rocks have a sharp contact with an underlying anorthositic layer, and within the space of a few inches grade into an overlying anorthositic layer. Several sills of gabbroic composition occur between Daly Bay and Roes Welcome Sound but in these layering is generally not well developed, and the layers tend to feather-out along strike.

The layering in the northern and western sides of the main anorthosite body dips inward beneath the core. Steep dips prevail near the margins, more gentle ones near the centre. The layering on the eastern side dips steeply both toward and away from the core.

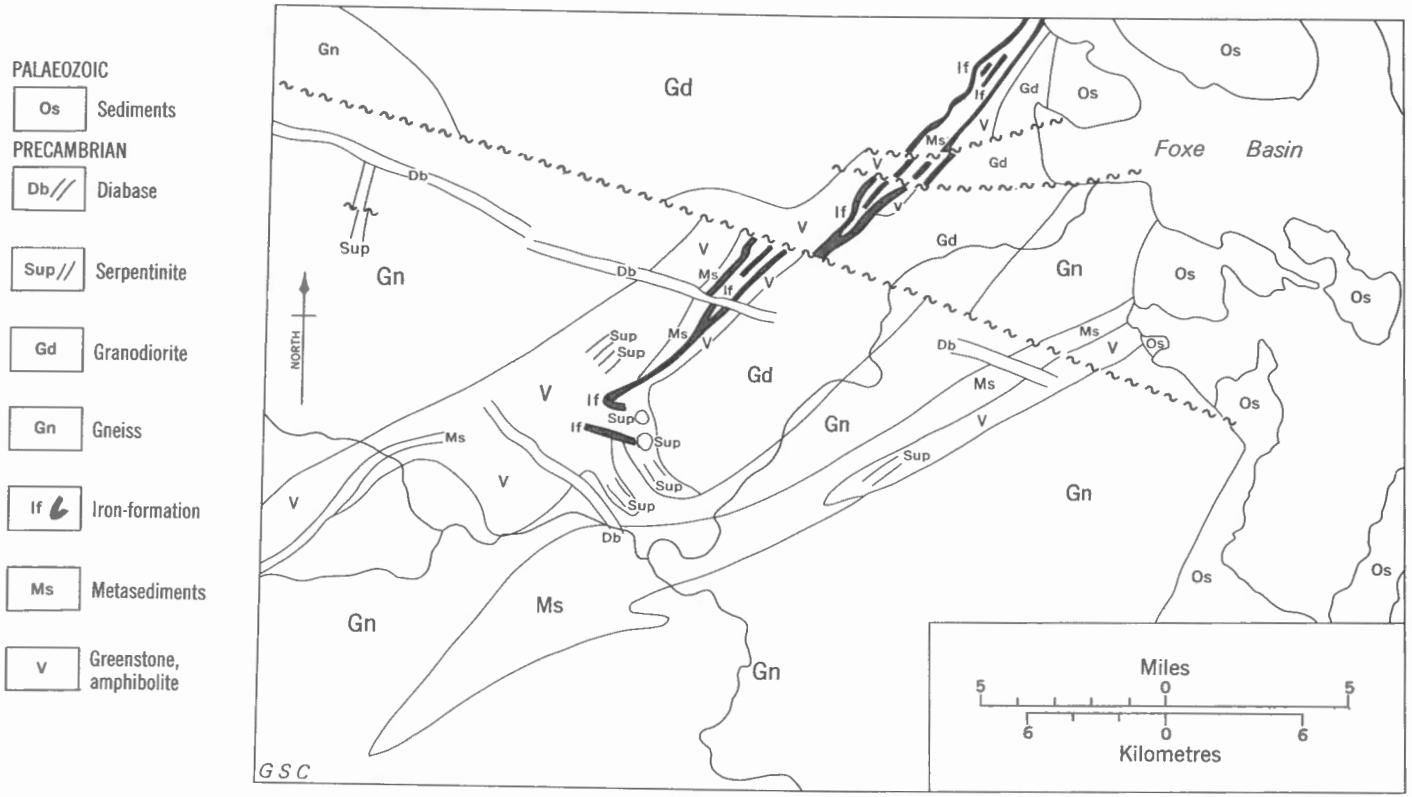

Figure 2. Sketch map of sedimentary-volcanic assemblage and associated iron-formation on Melville Peninsula.

The major rock type (Fig. 3, unit Px-gn) is a mafic-rich quartz-feldspar gneiss, but rocks ranging in composition from amphibolite to impure quartzite are included in this unit. Amphibole, pyroxene and garnet are present in most rocks, and biotite, sillimanite and staurolite in many.

The migmatites of the Daly Bay Complex are mixtures of gneiss and massive granodiorite.

MANTLED DOMES OF SOUTHERN MELVILLE PENINSULA

A conformable sequence of deformed and metamorphosed sedimentary rocks outcrops in southern Melville Peninsula (Figs. 1 and 4). Quartzite and crystalline limestone are most abundant in the lower part of the section, and impure quartzite, meta-argillite, meta-greywacke and derived paragneisses are most abundant in the upper part.

In the western area there are dome-like structures consisting of granitic cores bordered by metasediments. The core rocks, ranging in composition from granite to granodiorite, are medium-grained, equigranular and moderately- to well-foliated. Small areas of massive granite and granodiorite are present.

The contacts between the cores and the sediments are generally sharp, and the foliation in the core is parallel to the bedding of the sediments. Some contacts were traced more or less continuously for several thousand feet, but it was not clearly established whether or not they were entirely concordant.

Here and there migmatite occurs between the core rocks and the metasediments and, in one area,paragneiss highly permeated with granitic material is indistinguishable from well-foliated core rocks. An intrusive contact was observed between massive granite and sedimentary rocks on one side of a dome. The massive granite grades into well-foliated granite gneiss on the other side and the foliation of the core is parallel to the bedding of the metasediments.

The metasediments dip away from the cores in most areas and most of the thin metasedimentary septa separating areas of granitic gneiss are synclinal. The metasediments at the noses of the domes are anticlinal.

ECONOMIC GEOLOGY

Little prospecting has been undertaken in the past, due largely to the remoteness of the region, but also to the short summer season and lack of systematic geological mapping. Data collected during Operation Wager will assist in outlining areas favourable for prospecting.

Gossans and rusty zones are most common in the sedimentary and volcanic rocks of Melville Peninsula, in the metasediments northeast of Repulse Bay (Fig. 4), in and associated with basic and ultrabasic rocks, in the metasedimentary belt extending southwest from Committee Bay

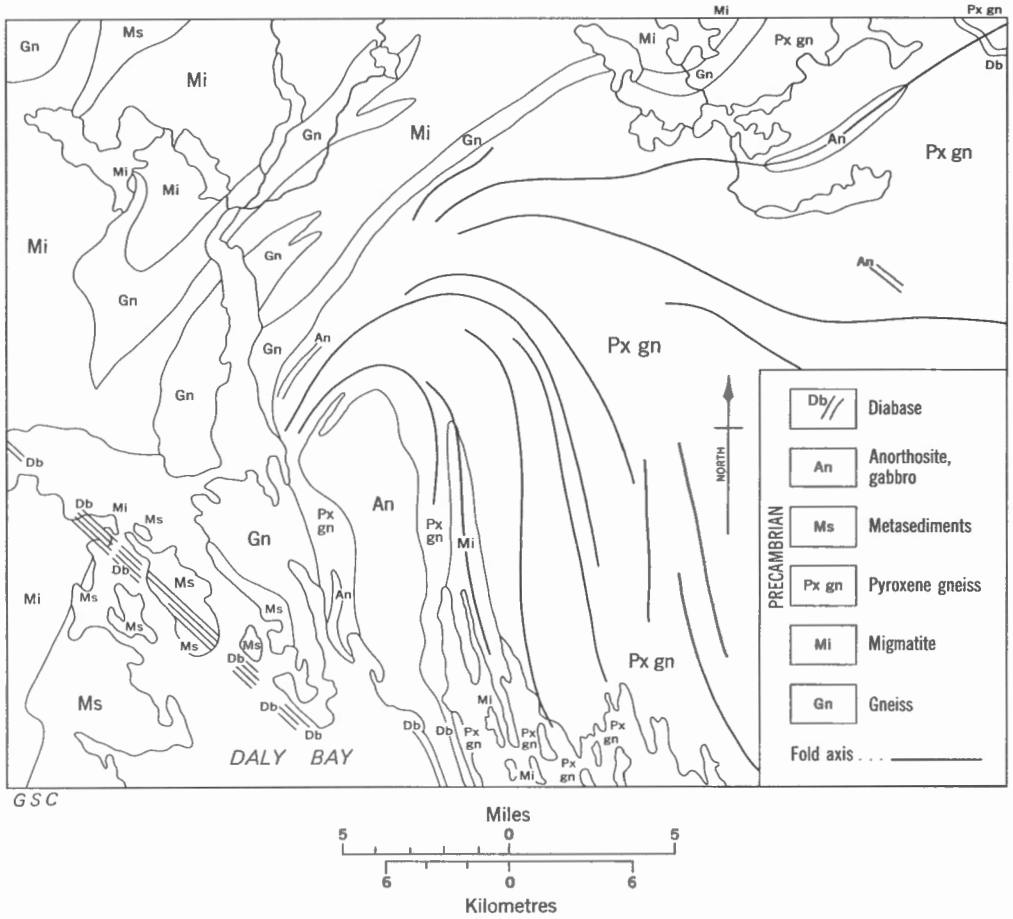

Figure 3. Daly Bay complex.

(Fig. 1) and to a lesser extent in the Daly Bay area (Fig. 3). These are small rusty zones throughout most of the area underlain by gneissic rocks.

Several samples were submitted to the Geological Survey of Canada for quantitative spectrographic analyses of nickel, copper, lead, zinc, cobalt and molybdenum, and to the Mines Branch of the Department of Mines and Technical Surveys for gold and silver assays. Gold and silver were present in trace amounts. The results are tabulated in Table 1. It must be emphasized that all are samples of deeply weathered material and the analyses are included in this report only to indicate the presence of some of these elements.

Seven samples of iron-formation were submitted to the Mines Branch for Davis Tube tests and analyses. The following is a résumé of Mineral Processing Division Test Report MPT-65-30 by D.E. Pickett, and Mineral Sciences Division Report AC-65-53 by J.C. Hole. Chemical analyses and the results of the Davis Tube tests are given in Table 2.

Two samples DF-316 and JD 283-7 yielded concentrates of acceptable grade assuming that the product would be used for pelletized iron ore. Iron recovery was very good in both samples but some research would be necessary to reduce the phosphorus in sample JD 283-7 to 0.05 per cent, an acceptable quantity. Recovery was also good from DF 196-A and JD 431-1 but concentrate grade was low although this might possibly be improved by finer grinding of the concentrates and retreatment by magnetic separation, hydroseparation or flotation. Sample DF 302 with a total iron content of 49 per cent yielded only 4.1 per cent as magnetic concentrate indicating that this sample must be mainly hematite or goethite.

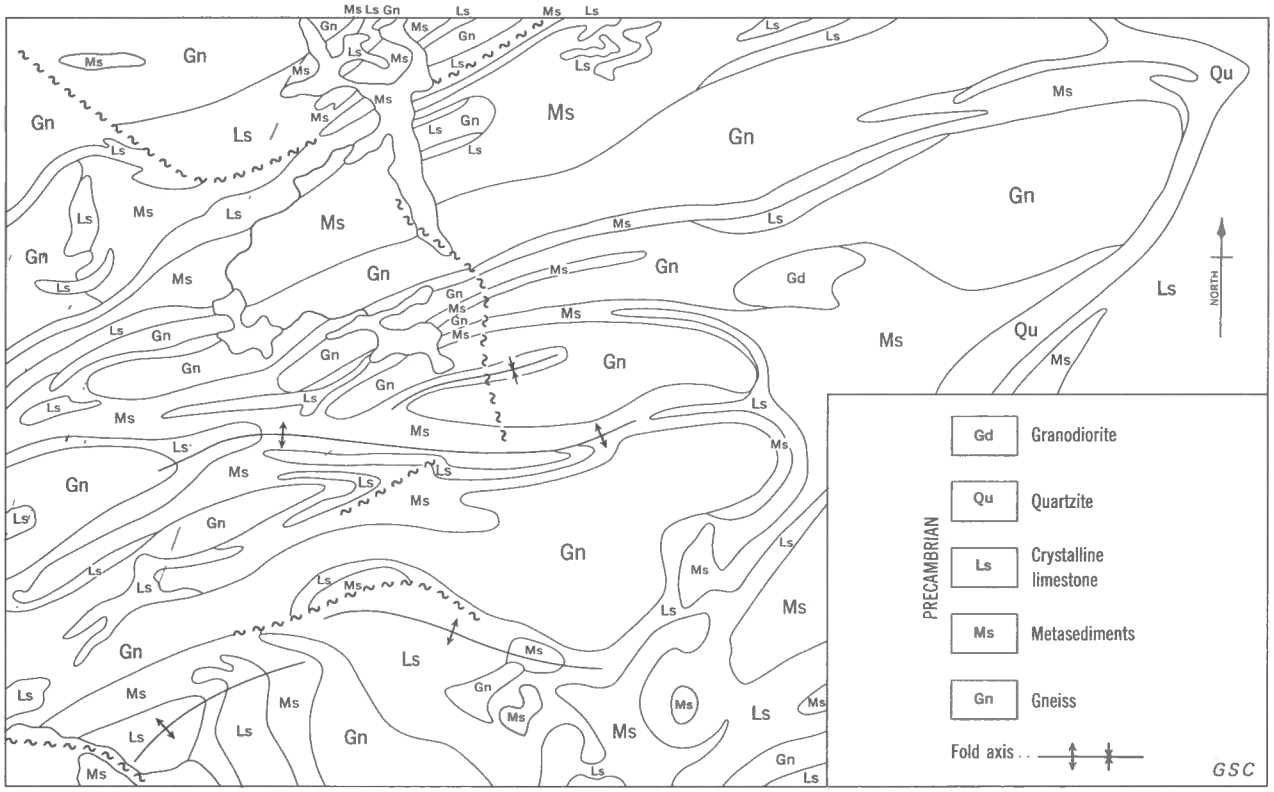

Figure 4. Mantled domes of southern Melville Peninsula.

TABLE 1

Assays of Weathered Material from Rusty Zones and Gossans

Sample	Mi %	Cu %	Co %	Mo %
BL-20	0.0074	0.11		0.012
BL-85	0.0098	0.035	0.010	
BL-96-5	0.018	0.065		0.0060
BL-97-5	0.0062	0.013		
BL-252	0.0048	0.057		
BL-267-3	0.017	0.020		
BL-270-2	0.011	0.025		
BL-304	0.016	0.020		
BL-344	0.0096	0.0079		
BL-366	0.0092	0.011		
HF-126		0.011		
HF-156	0.0094	0.058		
HF-175	0.029	0.069	0.0044	
HF-324	0.0077	0.084	0.021	
HF-331		0.034		
GC-86-2	0.0097	0.025		
DF-269	0.020	0.0066		
JD-113-6	0.0074	0.090		
JD-199-5	0.0044	0.11		
JD-214-4	0.0047		0.0088	
JD-235-6		0.50		
JD-305-1		0.024		
JD-317-5		0.0067		
JD-353-2	0.017	0.025		
JD-361-4		0.074		
JD-384-4	0.17	0.13		0.016
JD-398-4	0.0021	0.023	0.003	
JD-417-3	0.0084	0.025		
JD-420-4	0.0065	0.0045		
JD-424	0.29	0.46	0.036	
JD-427	0.0049	0.025		
JD-429-4	0.012	0.021		
JD-435-2	0.026	0.028		
JD-450-4	0.016	0.015		0.011

TABLE 2 Davis Tube Test Results of Iron-Formations on Melville Peninsula

Sample	Davis Tube Products			Fe (total) % recovery	Analysis of Fe Concentrate %					
		Weight %	Fe (total) %*		Fe sol.	Insoluble	SiO_2	P.	Mn	S
DF-196A	Concentrate	86.1	54.02	97.3	53.71	25.58	24.84	0.05	0.045	0.038
	Tailing	13.9	7.57							
	Head	100.0	47.9							
DF-302	Concentrate	4.1	54.94	6.1	54.88	25.53	25.27	0.06	0.094	A
	Tailing	95.9	35.03							
	Head	100.0	36.0							
DF-316	Concentrate	58.7	65.09	95.0	65.05	9.86	9.82	0.02	0.006	0.02
	Tailing	41.3	4.66							
	Head	100.0	40.12							
JD-283-7	Concentrate	58.7	65.99	96.2	65.81	8.44	8.32	0.10	0.014	0.02
	Tailing	41.3	3.62							
	Head	100.0	40.24							
JD-425-10	Concentrate	54.5	47.83	72.2	45.65	36.46	31.25	0.05	0.059	0.063
	Tailing	45.5	10.65							
	Head	100.0	36.20							
JD-427-1	Concentrate	61.8	43.78	82.5	43.78	41.80	39.00	0.03	0.007	0.064
	Tailing	38.2	15.09							
	Head	100.0	32.76							
JD-431-1	Concentrate	51.1	57.45	88.0	56.93	20.70	19.56	0.06	0.012	0.056
	Tailing	48.9	8.15							
	Head	100.0	33.57							

* Head analyses calculated for each sample.

A Insufficient sample supplied.