



LEGEND

STRATIFIED UNITS

ORDOVICIAN TO DEVONIAN

8 ROAD RIVER GROUP
black shale, chert

EARLY CAMBRIAN TO DEVONIAN

7 CD6 FORMATION
pale grey dolostone

6 SLATS CREEK GROUP
dolostone, mudstone, sandstone, conglomerate

MIDDLE TO LATE PROTEROZOIC

5 UPPER FIFTEENMILE GROUP
dolomitic limestone and dolostone

4 LOWER FIFTEENMILE GROUP
c: mudstone, limestone and sandstone
b: dolostone and dolomite breccia;
a: limestone, shale, sandstone and olistoliths;

EARLY? TO MIDDLE PROTEROZOIC

3 GILLESPIE LAKE GROUP
b: buff-weathering silty dolostone,
a: orange-weathering dolostone

2 QUARTET GROUP
sandstone, mudstone and argillite

1 FAIRCHILD LAKE GROUP
b: pink-weathering silty dolostone,
mudstone and quartzite
a: light grey to buff weathering
bluish dolomitic limestone

INTRUSIVE UNITS

PROTEROZOIC AND YOUNGER

MAFIC DYKES
diabase and gabbro

OGILVIE MOUNTAIN BRECCIAS

PROTEROZOIC

HETEROLITHIC BRECCIA
BHcb: carbonate-rich matrix breccia;
BHh: hematite-rich matrix breccia;
BHcl: chlorite-rich matrix breccia

MONOLITHIC BRECCIA
BM1: Fairchild Lake Group fragments;
BM2: Quartet Group fragments;
BM3: Gillespie Lake Group fragments

UNCLASSIFIED PERIPHERAL BRECCIA
Note: Peripheral geology (see text)
was provided by R.L. Thompson,
Geological Survey of Canada

SYMBOLS

Bedding (inclined, vertical)

Cleavage, foliation (inclined, vertical)

Joints (inclined, vertical)

Layering

Minor fold axes

Anticline, syncline

Contacts (known, approximate, assumed)

Faults (ball denotes side down)

Disrupted bedding

Mineral Occurrence

REGIONAL SETTING

Two belts of hematite breccias occur in the southern Ogilvie Mountains, west-central Yukon Territory. These breccias, here called the Ogilvie Mountains Breccias (OMB), intrude sedimentary rocks of the Middle Proterozoic Wernecke Supergroup and lower Fifteenmile group, and are thought to be equivalent to the Wernecke Breccias, located 250 km to the east. They are exposed in the Coal Creek Inlier, an oval-shaped and east-trending erosional window, one-tenth of the Ogilvie and Wernecke mountains of north-central Yukon that reveal Middle and Late Proterozoic epizonal clastic and carbonate rocks beneath Lower and Middle Paleozoic carbonate rocks of Mackenzie Platform (Greene, 1972; Thompson and Roots, 1982). Only the Wernecke Supergroup and the Fifteenmile group are described below.

Wernecke Supergroup (Units 1-3). In its type area, contains up to 10 km of shallow water, fine-grained clastic and carbonate rocks that Delaney (1981) divided into the Fairchild Lake, Quartet, and Gillespie Lake Groups. The base of the Wernecke Supergroup is not exposed and its total thickness is unknown. A pervasive cleavage (Mercier, 1987) and a marked erosional unconformity separate the Wernecke Supergroup from the Fifteenmile group.

Fairchild Lake Group (Unit 1) is the oldest unit and is here divided into Unit 1a, dolomitic siltstone and silty dolomitic limestone that is locally argillitic, and Unit 1b, resistant pink to grey silty dolomite and dolomitic mudstone with lesser grey to purple quartzite and jaspilite beds. Ogilvie Mountains Breccias commonly occur in these units.

Quartet Group (Unit 2) overlies the Fairchild Lake Group with angular discordance in some areas and conformably in others. It is a turbidite succession of monotonous, grey to brown weathering, medium to thick bedded fine grained sandstone, siltstone, dolomitic siltstone and mudstone. Thin interbeds of rusty weathering dolomite in the upper part mark the transition into platform carbonate of the overlying Gillespie Lake Group.

Gillespie Lake Group (Unit 3) overlies the Quartet Group with a conformable and locally transitional contact (Thompson and Roots, 1982). In the Coal Creek Inlier, orange weathering, in part laminated, grey dolomite dominates the lower part of the unit; grey to buff weathering silty dolomite dominates the upper part.

Fifteenmile group (Unit 4) (informal designation after Thompson, pers. comm., 1988) unconformably overlies Wernecke Supergroup rocks. It consists of a lower succession of clastic rocks with minor dolostone, overlain by 1-3 km of platform dolostone. Only the lower clastic rocks are in contact with the OMB.

Dyabase dykes intrude the Wernecke Supergroup strata, but not the Fifteenmile group. The dark green to brown weathering dykes generally are 1-5 m thick, trend dominantly east or north-northeast, and dip steeply. These mafic intrusions contain mostly of medium to coarse-grained chloritized hornblende or actinolite and saussureitized plagioclase. Angular fragments of diabase in the matrix of OMBs show that the dykes locally predate the breccia. Dykes of similar appearance and orientation, however, cut the breccias. Where dykes cut breccia bodies, they are amygdaloidal. A galena lead isotopic date (Lane, 1990) of mineralization from a cross-cutting dyke is about 0.9 Ga.

BRECCIAS

The breccias form two discontinuous east-trending belts, the Northern Breccia Belt and the Southern Breccia Belt. These belts coincide with, and were probably intruded along faults. The faults are Proterozoic and are marked by large vertical offsets of stratigraphic units. The Northern Breccia Belt coincides with the Monster fault, a steep to moderately south-dipping reverse fault. The Southern Breccia Belt lies along the trace of the Fifteenmile fault, a substantial north side down fault.

Six breccia localities were studied in detail and show wide variations in shape and structural relations. Their configurations are described in Table 1. The breccias are generally discordant to bedding, but locally concordant. Discordant breccias have steeply dipping to vertical contacts, are locally associated with diabase dykes, and probably occupy faults. Concordant breccias typically have gradational contacts.

TABLE 1. Breccia localities examined in detail.

LOCALITY	CONFIGURATION
DONUT	Circular in plan, about 3 km wide, flanked by Gillespie Lake and Quartet Groups; cored by Quartet Group.
SLAB	South-dipping tablet, up to 1.5 km in maximum dimension, that truncates Quartet Group and contains massive blocks of Quartet Group.
BEEHIVE	Concordant wedge, 60 m thick, with gradational contacts of fractured Fairchild Lake Group.
LALA	Complex area of approximately 45 ha consisting of irregularly shaped bodies accompanied by hydrothermal alteration and anomalous copper mineralization.
DYKE	Thin and discontinuous, snake-like, 15 km long and averaging about 75 m in width, occupies a fault between Quartet Group and lower Fifteenmile group.
ISOLATED POD	Half km wide oval flanked by lower Fifteenmile group.

Weathered outcrop surfaces of the breccia are knobby and pitted. The contrast between resistant and recessive weathering of matrix and matrix brings out many otherwise subtle textures. A chaotic jumble of mixed clasts is typical. Milled or abraded fragment margins, and crushed fragments are less common. Delicate bedding, east alignment and foliation occur locally. Outcrop colour reflects breccia composition. Buff-colored breccias are carbonate-rich, pink to maroon breccias are hematite-rich and green breccias are chlorite-rich.

Composition of the breccias is variable. Generally they are matrix-supported, but both matrix- and fragment-supported varieties are common and can occur in the same outcrop.

Fragment comprise 30 to 80% of the rock. Wernecke Supergroup lithologies make up more than 90% of the fragment population. Fairchild Lake Group rock clasts are the most common. Rare lower Fifteenmile group fragments occur locally in the Southern Breccia Belt. The remainder (<1%) consists of mafic igneous fragments, quartz and carbonate vein material and speckled aggregates. Fragments range widely from angular to rounded, but are generally subangular to subrounded. They rarely are plastically deformed with irregular shapes and seriated terminations. Sizes range from <1 cm to greater than 5 m. Modal fragment diameter is 1 to 2 cm.

Matrix is composed of finely fragmented rock that is typically gradational in size with fragments. Secondary components include carbonate, hematite, chlorite and quartz. The proportion of matrix varies appreciably over distances of less than two metres.

Alteration includes carbonatization, hematization, chloritization and silicification. These four alteration types variably affect the breccias and their host rocks, and display no consistent zonation. Alteration of host rocks is generally weak to moderate, but more extensive than the intense alteration within parts of the breccias or at wallrock contacts. The four major alteration types are described below.

Carbonate alteration is ubiquitous. Ferruginous dolomite is most common, with rhombs 1 to 3 mm in diameter replacing both clasts and matrix constituents. Carbonatization of carbonate host rocks is not conspicuous because of their primary carbonate mineralogy.

Hematization is common in the breccias and in host rocks. It varies from pale pink to blood-red stained carbonate matrix to massive specularite. Hematite-rich bodies commonly form resistant craggy towers and pinnacles that can be recognized from a distance by their pink to maroon colour.

Chlorite occurs as medium- to coarse-grained platy masses and isolated elongated laths in the matrix. It sometimes accounts for 80% of the matrix. Chlorite is also abundant in altered mafic dykes, where it formed after Fe-Mg silicates as a result of lower greenschist grade regional metamorphism.

Silicification is locally intense and replaces silty to sandy dolomite-rich sedimentary fragments. Textural features common to silicified breccias include obscuring of fragment-matrix boundaries and general bleaching of the altered rock. Quartz, hematite stockworks occur locally in moderately to densely brittle fractured Quartet sediments at breccia margins. More permeable layers in interbedded argillite-siltstone units are also selectively silicified. Silica replacement and open space filling textures occur at the Lala mineral prospect.

Breccias were divided in the field into two groups: monolithic (oligometric), and heteroclastic (polyclitic). Each of these were subdivided on the basis of clast and matrix composition, respectively (Table 2, Legend). Three other uncommon types of breccia were recognized. These may not be related to the OMBs.

TABLE 2. Description and Classification of Ogilvie Mountains Breccias.

TYPE	DESCRIPTION	AREA
MONOLITHIC BRECCIAS		
Fairchild Breccia (BM1)	O/c: mottled pink to purple weathering. Fragments: dominantly pink silty dolomite, subordinate pale green dolomitic siltstone; angular to subrounded; <1 cm to 3 m dia. Matrix: carbonate, crushed rock, minor hematite, chlorite and quartz.	Slab Donut
Quartet Breccia (BM2)	O/c: dull grey weathering. Fragments: grey to black argillite and fine grained siltstone-sandstone, angular to subangular; <1 cm to 0.8 cm. Matrix: crushed rock, silica, carbonate and minor sulphide minerals.	Lala
Gillespie Breccia (BM3)	O/c: buff weathering. Fragments: angular, <1 cm to 3 m dia., pale grey or buff dolostone. Matrix: cement: crushed rock, coarse grained dolomite or iron carbonate, minor quartz, and rare chlorite and hematite.	Donut
HETEROCLASTIC BRECCIAS		
Carbonate-rich matrix Breccia (BH*)	O/c: pale brown to mottled pink and green weathering. Fragments: dominantly Fairchild Lake Group, subordinate Quartet Group, rare Gillespie Lake Group and mafic dyke. Subangular to subrounded; 2 cm to 4 m dia. Matrix: crushed rock, dolomite and minor spiny calcite, minor hematite (pink stain), rare chlorite.	Beehive Donut Slab
Hematite-rich matrix Breccia (BHh)	O/c: limited in extent, pink to purple weathering. Fragments: Fairchild Lake Group, Quartet Group, rare mafic dyke, aggregates of specularite. Matrix: crushed rock, hematite (specular and earthy varieties), abundant carbonate (intensely hem. stained), common chlorite, minor quartz.	Dyke Lala
Chlorite-rich matrix Breccia (BHcl)	O/c: limited in extent, mottled dark green and pale brown weathering. Fragments: Fairchild Lake Group, Quartet Group, rare mafic dyke. Matrix: chlorite (fine to med. grained), subordinate carbonate hematite (specular and earthy varieties), crushed rock, minor quartz.	Lala Isolated Pod
OTHER BRECCIA TYPES (MAY NOT BE OMB)		
Quartz-speckled Breccia	A low relief sub-circular zone in intensely hematized Quartet Group sandstone. Fragments are coarse-grained translucent, crystalline quartz and medium to coarse-grained specular hematite. Pyrite and chalcopyrite, associated with hematite, are rare. Quartz-sulphide veins (Pettit copper mineral occurrence) about 20 m south of this breccia, may be genetically related.	800m SE of Beehive
Infrastructural Breccia	Several exposures along one stratigraphic horizon at the base of unit 3a. Best exposure, 150 m long and 4 m high. Weathering of the exposed joint faces has highlighted the "tiger" or mosaic breccia texture of the outcrop. Cemented by an orange brown matrix of siltstone and fine dolomite silt. Textures displayed at this locality are similar to those seen at the Tart lead zinc prospect, located on the western edge of the map area. Tart is also hosted in Gillespie Lake dolostone.	NE of Beehive
Pebble dykes	Rare, only two known, both are 1.5 m wide or less. One crosses the folded Quartet Group core of the Donut breccia complex. The other cuts hematite stained Quartet Group sediments north of the Lala mineral showing. Fragments are resistant blocks against the recessive weathering matrix. Matrix consists of white quartzite or laminated quartz sandstone are between 2 mm and 6 cm in diameter and comprise the only fragment types. The matrix consists of almost 100% coarse grained recrystallized, dolomite with rare fine-grained felds of white mica and anhedral opal.	Donut Lala

MINERAL OCCURRENCES 1

Name: Fifteenmile NTS map: 116B/14 MINFILE: 84	Description: Minor chlorite in silty dolomite veins cutting Quartet Group rocks
Name: Shand NTS map: 116B/13 MINFILE: 88	Description: Traces of copper mineralization in quartz veins that cut Quartet Group sedimentary rocks near breccia margins.
Name: Monster (off map to west) NTS map: 116B/13 MINFILE: 83	Description: Sphalerite and galena in breccia zones and veins that cut Gillespie Lake Group dolostones.
Name: Tart NTS map: 116B/12 MINFILE: 84	Description: Sphalerite, galena and traces of chalcopyrite (and pyrobitumen) in a monolithic Gillespie Lake Group dolostone.
Name: Oz (off map to south) NTS map: 116B/13 MINFILE: 85	Description: Sphalerite and galena in breccia zones cutting Gillespie Lake Group dolostone, minor shale and quartzite also occur in the area.
Name: Seale NTS map: 116B/14 MINFILE: 88	Description: Galena and sphalerite in breccia bodies within Fifteenmile group argillite.
Name: Lala NTS map: 116B/14 MINFILE: 99	Description: Chalcopyrite (up to 0.5%) and minor pyrite in heteroclastic carbonate-rich matrix and monolithic Quartet OMB. Mineralization occurs in the matrix and within fragments. Several stages of brecciation are recognized in hand sample. The latter phase of brecciation cross-cuts sericite bearing breccias and are marked by the addition of abundant quartz, carbonate, hematite and sulphides. Local silica flooding and open space filling textures suggest an epithermal setting.
Name: Od (Miniere) NTS map: 116B/13 MINFILE: 100	Description: Sphalerite in breccia zones cutting shales and siltstones of the Quartet Group.
Name: Witzard (d) NTS map: 116B/13 MINFILE: 102	Description: Chalcopyrite in varieties in a fault zone and as disseminations in Proterozoic shales/quartzites along margins of breccia bodies and/or dykes.
Name: Dash NTS map: 116B/13 MINFILE: 103	Description: Copper-cobalt soil geochemical anomalies associated with chalcopyrite in Proterozoic shales and quartzite near margins of breccia bodies.
Name: Dizzy (off map to west) NTS map: 116B/13 MINFILE: 106	Description: Staked on geochemical (Cu-Co) anomalies; underlain by Fifteenmile group rocks.
Name: Tour NTS map: 116B/14 MINFILE: 106	Description: Staked on geochemical (Cu-Co) anomalies; underlain by Fifteenmile group rocks.
Name: Rayne (Brs) NTS map: 116B/11 MINFILE: 110	Description: Boulders of mineralized float occur in a group of units by Gillespie Lake Group. The float consists of quartz, pyrite and sphalerite in fractures cutting dolomite breccia and massive pyrite in quartz.
Name: Pettit (Rob) NTS map: 116B/14 MINFILE: 113	Description: Chalcopyrite (with minor pyrobitumen) in quartz-barite breccia. The breccia is a quartzite breccia body that was staked on geochemical (Cu-Co) anomalies.

1. Descriptions of the Lala and Pettit occurrences are based on visits by the writer. The others are modified from YUKON MINFILE. MINFILE is a mineral deposits database maintained and distributed by Exploration and Geological Services Division, INAC, 3rd floor, 300 Main Street, Whitehorse, Yukon Territory Y1A 2B5.

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**GEOLOGY OF THE OGILVIE MOUNTAINS BRECCIAS
COAL CREEK INLIER (NTS 116B/11, 13, 14)
YUKON TERRITORY**

by
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