GEODRILLING REPORT

SECTION D

GEOLOGIC DRILLING

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INTRODUCTION

The DNR Minerals Division has drilled fourteen diamond core holes during the current biennium. Geologic logs and analytical results from these and four previous drill holes are covered in this section. The location maps for the drill holes are Figures 1 and 2. The earlier introduction summarized the drilling footages and the drill hole locations with respect to county, section, township and range.

After the core was logged, intervals were split (or sawed), and sent in for analysis. Many samples were composited in an attempt to save analytical costs. Compositing involved combining splits from individually prepared adjoining short sections of core. Thus, one analysis could represent a large interval (generally 8-14′) of core, yet allow the shorter (1-2′) individual samples (within the composite) to be analyzed separately, if the composite shows interesting analytical results.

The commercial lab analytical techniques are summarized in Table D-1. Analyses from the Division of Minerals Chemistry Laboratory were run by atomic absorption, after a HCl, HNO_3 and HF acid digestion of the pulverized sample.

Two standard Au samples were sent into Bondar-Clegg, North Vancouver, B.C., which did most of our gold assays. Canadian Certified Reference Materials Project, Gold Ore, GTS-1 was diluted with "barren" pulp (from earlier assay work) to calculated values of 200 ppb and 50 ppb. Bondar-Clegg's results for these samples were 220 ppb and 45 ppb, respectively. Since the submission of standards is an important part of analytical quality control, the Minerals Division hopes to expand its use of known standards.

The remaining part of this section is comprised of the drill logs and the tables of analytical results that follow them. The logs are written out and/or condensed from graphic or detailed logs. Like the assay results, the logs are available for public examination, along with the core itself, and any other open file material.

CONDENSED GEOLOGIC LOG FOR DDH ZM-1

Hole drilled at a 50° angle and an azimuth of 0°.

0′-110′ **Overburden.**

110′-119′ **Not Cored.**

119′-392.2′ Interlaminated-interbedded, siltstone-mudstone (dark grey) and calcareous-siliceous siltstone - fine-grained dolomitic quartzarenite-calcarenite (light grey). Light grey calcareous-siliceous siltstone - fine-grained calcareous quartzarenites typically form thicker laminae and beds. Bedding is planar to undulose, parallel to non-parallel. Contacts are fairly sharp. Sedimentary structures include load casts, pseudonodules, local graded laminae, minor slumping, and channeling(?). Calcareous subunits occur below 167′. Calcarenite subunits contain up to 95% calcite. Total carbonate in whole unit is less than 5%. Tension fractures locally cut across individual beds. Below 167′, these tension fractures contain calcite and minor pyrite. Other veins parallel bedding. Largest veins are 2-3 mm thick from 171′-173′. Few, scattered 1-2 mm calcite concretions locally.

392.2′-405.7′ Interlaminated siltstone-mudstone, minor calcareous siltstone; and interbeds of interlaminated yellow-brown-orange-green silty claystone. Similar to above unit, except for claystone. These beds are talcy and more fissile, with siltier laminae containing fine-grained quartz grains, and altered white feldspathic(?) fragments. 5 mm quartz vein at 405′. Claystone believed to be altered ashy tuff.

405.7′-1303′ T.D. Interlaminated-interbedded siltstone-mudstone and calcareous-siliceous siltstone- fine-grained dolomitic quartzarenite-calcarenite. Rock similar to 119′-392.2′. Unit as a whole is slightly more quartzarenitic-calcarenitic, however, with perhaps 5-10% total carbonate. Local soft sediment deformation. Soft sediment folds from 742.7′-743.5′. More soft sediment deformation than normal in unit from 803′-850′, especially slumping and loading. Steep, cross cutting, calcite-quartz-pyrite veins and associated pseudobrecciation (and minor brecciation) in intervals 410.5′-413′, 634.1′-634.3′, 706.1′-

706.2', 938'-948', 973'-975' (scattered), 1246'-1270' (scattered). Stratiform veins at 421.7'-421.8', 630'-669' (scattered), 973'-975' (scattered), 975'-1303' (few, scattered). Local, scattered 1-2 mm calcite concretions. 3 x 1/2 cm pyrite concretion at 952'.

Acid Test Results

Footage	Angle of Hole from Horizontal	Bedding Angle with Core Axis
120	49°	60°
420	56°	67°
720	63°	75°
1000	65°	79°

Notes: Eight thin section heels have been cut. Six composite samples have been sent in for analysis. Analytical results follow in Table ZM-1. Can tuffs be correlated with volcanism in other parts of the basin? Detailed log is available for study.

CONDENSED GEOLOGIC LOG FOR DDH TS-1

Hole drilled at 90° angle (vertical).

0'-3' **Ice.**

3'-10' **Water.**

10'-32' **Gyttja.**

32'-99' **Overburden.**

99'-241' T.D. Interlaminated-bedded black-dark brownish grey-grey hornfelsed siliceous-sideritic siltstone. Minor color variations due to graphite, pyrite, and/or siderite content. Bedding angles to core axis are 35° near top to 5° at base. Schistosity is poorly developed near the top (37° to core axis), but becomes more recognizable with depth (50° to core axis). Schistosity cuts across bedding, and locally offsets it. Core is locally very broken. Pyrite varies from 2-10%, with higher disseminated amounts in darker bands. Pyrite also found along cleavage and in quartz-calcite veinlets (often subparallel to core axis). 155'-156.7' is a disturbed (folded-brecciated), recrystallized, somewhat calcareous zone with local coarse-grained calcite; very fine-grained brown sideritic mudstone; green-black serpentine-chlorite; and medium-grained altered plagioclase(?) (calcite) and pyroxene-olivine (serpentine-chlorite). Believed to be edge of dike from Duluth Complex.

Notes: Ten thin section heels have been cut. Rock may show slightly increased recrystallization with depth. One composite and seven individual samples have been sent in for analysis. Analytical results follow in Table TS-1. Detailed log is available for study.

CONDENSED GEOLOGIC LOG FOR DDH BM-2

Hole drilled at a 51° angle and an azimuth of 182°.

0'-85' **Overburden.**

85'-97' **No core.**

97'-554.3' Medium-dark grey phyllitic siltstone. Slightly graphitic. Very minor, thin, white siliceous-clayey altered tuff(?) laminae. Phyllite may contain up to 5% fine disseminated pyrite. Core fairly broken to 323' and sporadically to 554.3' (decreasing in general with depth). Foliation is typically 45-60° to core axis. Bedding is folded and is often at a low angle to core axis. Graphite decreases(?) with depth. Local hairline fractures-veinlets with pyrite. Local thicker, irregular quartz-pyrite veins-masses. They typically appear deformed to broken and are subsequently healed. Veins at: 212.8'-213'; 529'-540' (with few scattered irregular masses to .2'); 545-545.2' (irregular with minor vugs and chlorite); 546.4'-546.8'; 552'-555.7' (interval with irregular veining with vugs and chlorite).

554.3'-1025' Interbedded phyllite, para- and orthoconglomerate, and siliceous-tuffaceous greywacke. Ratio phyllite:conglomerate:greywacke = 4.0:4.7:1. Phyllite similar to above unit, except black to dark grey to dark grey-brown. Typically with good cleavage, local tuffaceous laminae and slightly calcareous. Greywacke poorly to moderately sorted, typically very siliceous with grey silty-graphitic to green chloritic matrix. Orthoconglomerate composed of coarse to fine pebbles and is generally polymictic, largely quartz pebbles, with lesser pink felsic pebbles, K-spar and plagioclase phenocrysts, phyllite pebbles, chloritic pebbles, and tuffaceous greywacke intraclasts and/or volcaniclasts. Quartz is typically sub-moderately rounded, with other pebbles less rounded. Some quartz pebbles appear to be embayed (phenocrysts?). Matrix is usually fine-grained, chloritic, and may be tuffaceous. Minor sand also in matrix. Monomictic-oligomictic "greywacke" intraclast orthoconglomerate, may be volcaniclastic (in either case, matrix is similar to clasts). Grain shapes tend to be subangular, subprismoidal. As conglomerate pebbles become finer grained, grain size distribution becomes less bimodal, and sediment grades into paraconglomerate and coarser greywackes. There is also some tendency for finer greywackes to grade into tuffaceous phyllites. In general, lithologic contacts are fairly sharp. Some contacts show slickensides and may, in part, be tectonic. Little grading within beds. Quartz pebbles-grains