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AEX MINERALS CORPORATION

VANGORDA AREA GEOLOGY

Notes to accompany geology map

by

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INTRODUCTION

In 1975 the area between Swim Lake and Doal Lake was geologically mapped at a scale of 1" = $\frac{1}{2}$ ml.

The area is one of moderate relief with elevations ranging from 2500 to 4500 feet.

Rock outcrop is limited; most exposure is encountered in creek beds, road-cuts or hill knolls.

GEOLOGY

General

The map-area is underlain by a sequence of Cambro-Ordovician low-grade metamorphic rocks (phyllites and meta-volcanics) which is unconformably overlain by a eugeoclinal pile of basalts and chert of probable Pennsylvanian-Permian age. One outcrop of Devonian limestone, occurs on the road 2 miles south of Swim Lake. This may be in fault-contact with underlying younger Pennsylvanian-Permian Rocks.

The Upper Paleozoic eugeoclinal sequence is unconformably overlain by Triassic chert-pebble conglomerates and intercalated shales.

The Anvil Batholith, a mesozonal and epizonal complex of granodiorite, and quartz-monzonite porphyry intruded the metamorphic rocks in mid Cretaceous. Associated quartz-feldspar porphyry dykes crosscut the phyllites southeast of Vangords deposit.

The zinc-lead deposits; GRUM, VANGORDA and SWIM are confined to phyllitic members of the Cambro-Ordovician sequence.

A brief description of rock units follows.

See Map and Cross Sections A-A', B-B', C-C'. D-D'.

CAMBRO-ORDOVICIAN

Units 1-3

Phyllitic rocks have been subdivided on basis of lime or graphite content.

The commonest phyllite (1) is a fine-grained, grey quartz-sericite rich rock with a well defined planer schistosity (Fig.2) Thin (1-2 mm) quartz-rich laminae alternate with micaceous laminae. Locally the rock may be quite rich in chlorite which imparts a distinctive greenish tinge to the phyllite. Chlorite-rich units are quite common in the hanging wall of the GRUM zinc-lead deposit.

Unit 1 grades locally to unit 2 with increase in lime content. Thin quartz carbonate laminae which alternate with lustrous grey micaceous laminae may contain up to 25-30 per cent calcite. In addition thicker (0.5-1') boudinaged horizons of ochre-weathering ankerite or siderite are abundantly distributed throughout unit 2.

Black graphitic phyllite (3a) is a most distinctive marker horizon within the phyllitic pile. The graphitic units have textural and mineralogical features similar to the grey sericite phyllites but contain up to 30 per cent black granular graphite. Fine grained pyrite and pyrrotite generally cause them to weather with a rusty brown aspect. As graphite content decreases unit 3a grades to 3b. Graphitic units are commonly associated with sulphide sections in the GRUM deposit.

UNIT 4

Thin units of banded calc-silicate (4) occur within the pile of meta-volcanic and phyllitic rocks southwest of the GRUM deposit. On weathered surface these have a ribbed appearance; quartz-rich layers up to 1' in thickness weather positively and alternate with recessive white limy (calcite) bands.

UNIT 5-8

Meta-volcanic units intercalated with phyllites are found mainly to the south and southwest of GRUM and VANGORDA DEPOSITS and south of the SWIM DEPOSIT. The amount of meta-volcanic rocks around the SWIM deposit is apparently much less than that

around GRUM and VANGORDA; this, however may be the result of limited exposure in the SWIM LAKE area.

Meta-volcanic complexes generally weather resistantly and are found on glacially scoured hill knolls or crag and tail features in the Vangorda Creek area.

The meta-volcanics are composed mainly of medium to coarse-grained massive greenstone (5) which has a mottled appearance due to glomero-porphyritic aggregates of dark-green chloritized hornblende or pyroxene? set in a pale grey feldspathic matrix. These units may have been flows or sills of andesite or basalt. Closely associated with these are banded quartz-chlorite rocks which may be metamorphosed laminated tuffs(7).Thin (1-2cm) bands of hard quartz alternate with green quartz-chlorite bands. Pyrite cubes (1" square) are common in this unit. These meta-tuffs? have been as complexly deformed as surrounding phyllites. Other greenstones include feldspar-poor schistose chlorite-hornblende? rocks with well defined F2 foliation (6), and dark-green, schistose amygdaloidal volcanics (8). These volcanics are chlorite-rich with calcite-filled amygdales flattened and sheared within F2 foliation.

UNIT 9

Ultrabasic rocks are associated with meta-volcanic complexes southwest of GRUM deposit and south of VANGORDA deposit. The intrusion near Vangorda is a coarse-grained dark-green pyroxenite with disseminated chalcopryrite. The ultramafics southwest of GRUM deposit are contorted magnesian schists composed of pale talc, antigorite and possibly white sprays of tremolite. These rocks were probably olivine-rich flows or intrusions emplaced within the volcanic pile prior to the major F2 deformation event.

UNITS 10-11

A thick eugeoclinal pile of submarine basalts and intercalated red and grey argillaceous cherts unconformably overlies the Cambro-Ordovician metamorphic sequence. These rocks were probably deposited in an island arc during Pennsylvanian-Permian time.

Cherts vary from brick red (10a) to greyish (10b) in colour, and are often conglomeratic. Some pebbles have been strained into ellipses with long-axes plunging twenty degrees to the northwest. Locally grey cherts have thin intercalations of now weakly metamorphosed, shales (10c).

Contacts between cherts and basalts (11) are often complex zones composed of a mélange of pillowed basalt blocks, four to six feet across, set in a matrix of red argillaceous chert with small pebbles of grey chert.

These zones are probably indicative of rapid effusion of lava on unstable submarine slopes. Basalts are generally fine-grained dark green rocks which have been hydrothermally altered. Saussuritization is pervasive and quartz-epidote veins and fracture fillings are common throughout. Local horizons of dark green basaltic agglomerate are evidence of violent eruptive activity.

UNIT 12

One outcrop of grey Devonian limestone with diagnostic 'two-hole' crinoids occurs on the road two miles south of the Swim deposit.

This horizon is probably in fault contact with the underlying chert-basalt sequence, and is in turn disconformably overlain by conglomeratic and shaley Triassic rocks.

UNIT 13

Immediately south of Blind Creek bridge rusty weathering conglomerates (13a) with pebbles of grey gneiss, chert, dark volcanics, crinoidal limestone (Devonian?) and quartzite has been assigned a Triassic age by Tempelman-Kluit (1972). These may interdigitate with shaley rocks of the same age (13b) both of which disconformably overly the Upper Paleozoic sequence of basalt and chert.

UNIT 14-15

Granitic rocks of the Anvil Batholith range from biotite-quartz monzonite to biotite-granodiorite, but most are quartz monzonite. (15)

East-west trending dykes (14) of quartz-feldspar porphyry south of Vangorda deposit, are probably apophyses from the underlying granite.

The granitic rocks were probably emplaced prior to mid-Cretaceous; (ie.) before 100 - 117 m. years. (Tempelman-Kluit, 1972).

STRUCTURAL GEOLOGY

The Lower Paleozoic sequence of phyllites and meta-volcanics was complexly folded and metamorphosed probably before Ordovician time. The history of polyphasal deformation is best recorded by minor structures preserved in the phyllitic rocks. These units have been folded three, possibly four, times and most rock outcrops of phyllite have planar and linear elements similar to those shown in Figure 1.

The earliest lamination (F1) (So) may be bedding planes or a metamorphic fabric developed parallel to bedding planes. This is locally seen to have been folded into tight isoclinal (F1) which are sometimes homo-axial with F2 folds. An example from graphitic phyllite of DDH A29 (GRUM DEPOSIT) displays marked

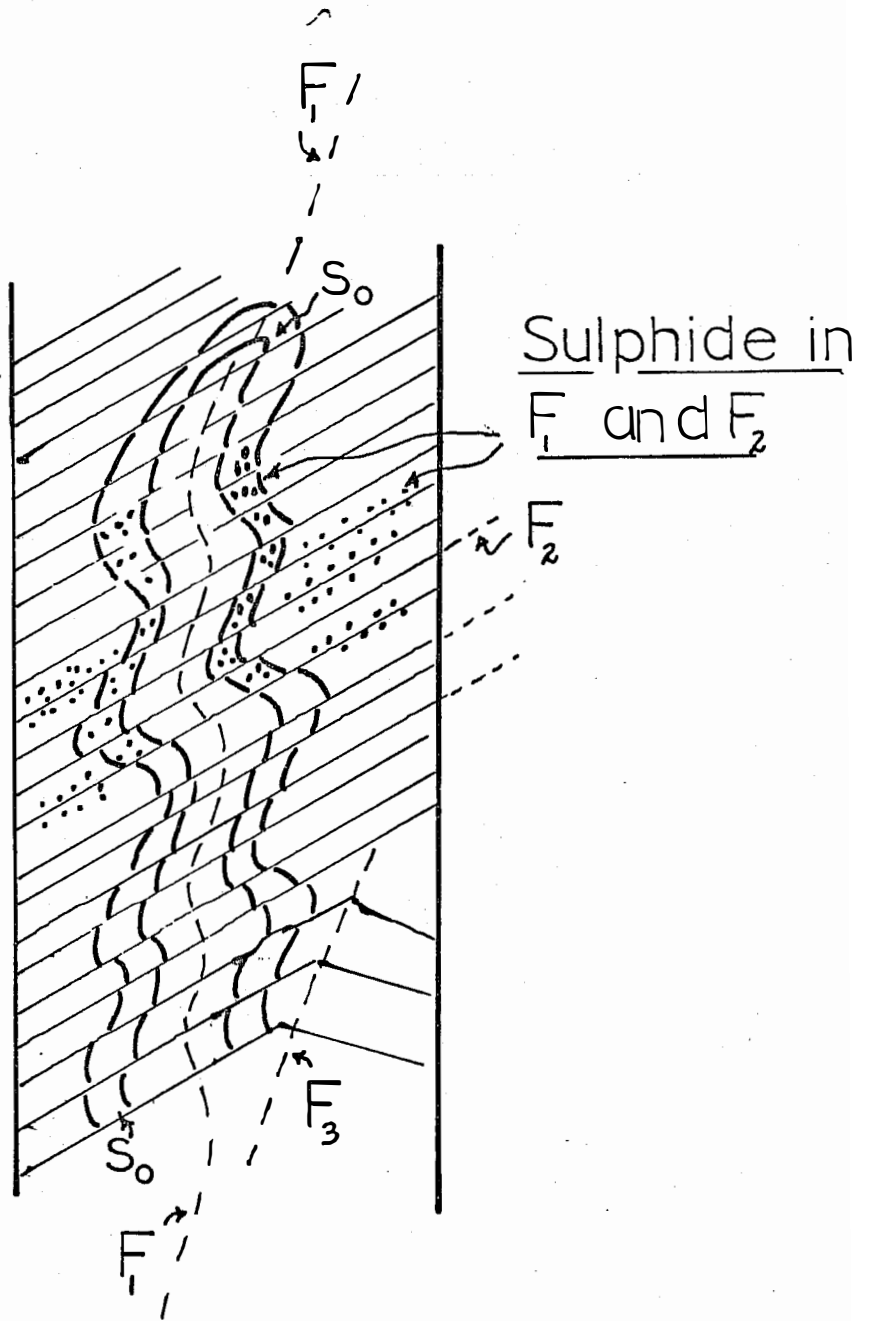


FIGURE 1

angular discordance between F1 and F2 fold axes. Another example of F1 isoclinal folding was encountered in limy phyllites on the upper Blind Creek road, north of Vangorda deposit. (Fig.2) Large-scale examples of F1 folds have not been delineated but such structures may be represented by repetitions of meta-volcanic and phyllitic units as seen in cross sections A-A', B-B', C-C' and D-D'.

F2 small-scale folds are common throughout the phyllitic rocks. F1 (So) laminae have been folded into open concentric or tight similar style folds. In phyllitic units F2 folds have a well defined axial-planar schistosity (F2); F2 foliation is not nearly so well developed in greenstones. Large-scale F2 folds are well demonstrated in the accompanying cross sections.

Flat-lying recumbent F2 axial surfaces have been gently warped into open antiforms and synforms by the third folding event (F3). (See cross Sections) A prominent northwest-trending F3 antiform deforms the rocks around Swim deposit, thus accounting for the northeast dip of the mineral deposit.

Linear elements associated with folding events include; orientation of small-scale F1 & F2 fold axes. (B), wrinkle lineations parallel to F2 fold axes (L2) or similar micaceous wrinkles associated with F3 flexures (L3). These elements, as well as poles to F1 & F2 axial surfaces, have been plotted in Figures 3 & 4. Data from Swim Lake Area southeast of Blind Creek fault have been plotted separately in Fig. 4.

Poles to F1 or So are subvertical and dip steeply to northeast or southwest. Poles to F2 foliation dip gently to northeast or southwest, having been gently warped by F3. F2 linear elements (L1 wrinkles or B2 axes) trend between 290-300° and dip gently to northwest or southeast. Those in Swim Lake area range from 265-300°. L3 wrinkles are widely dispersed and do not parallel axes of F3 warps. The random orientation of these wrinkles is probably the result of Flexural-slip movements within F2 foliation planes.

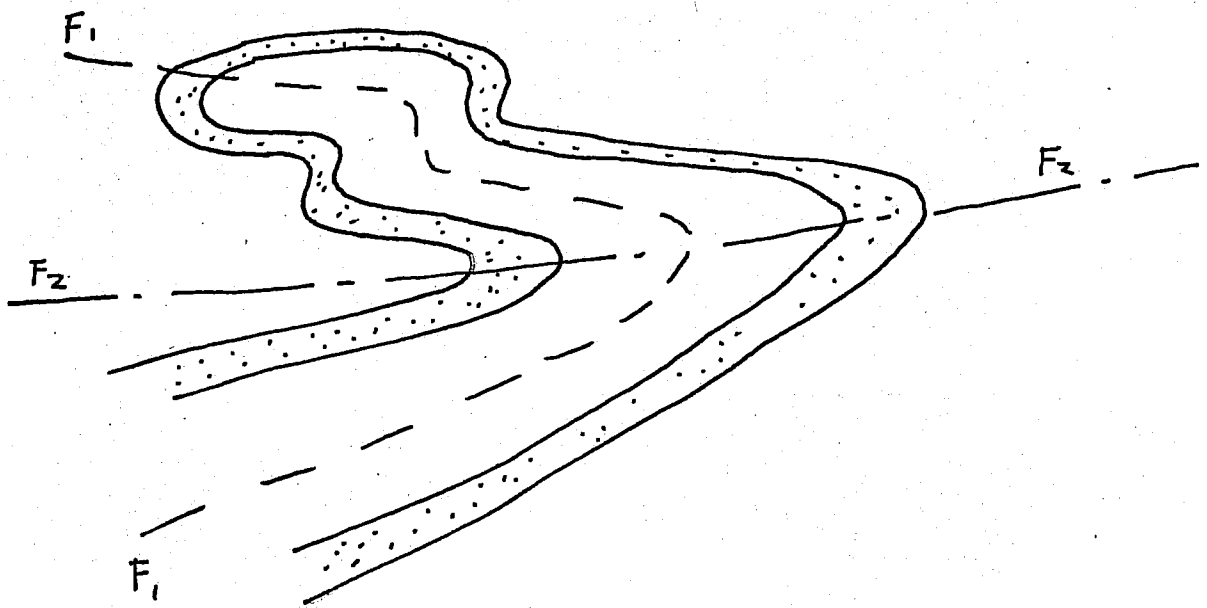
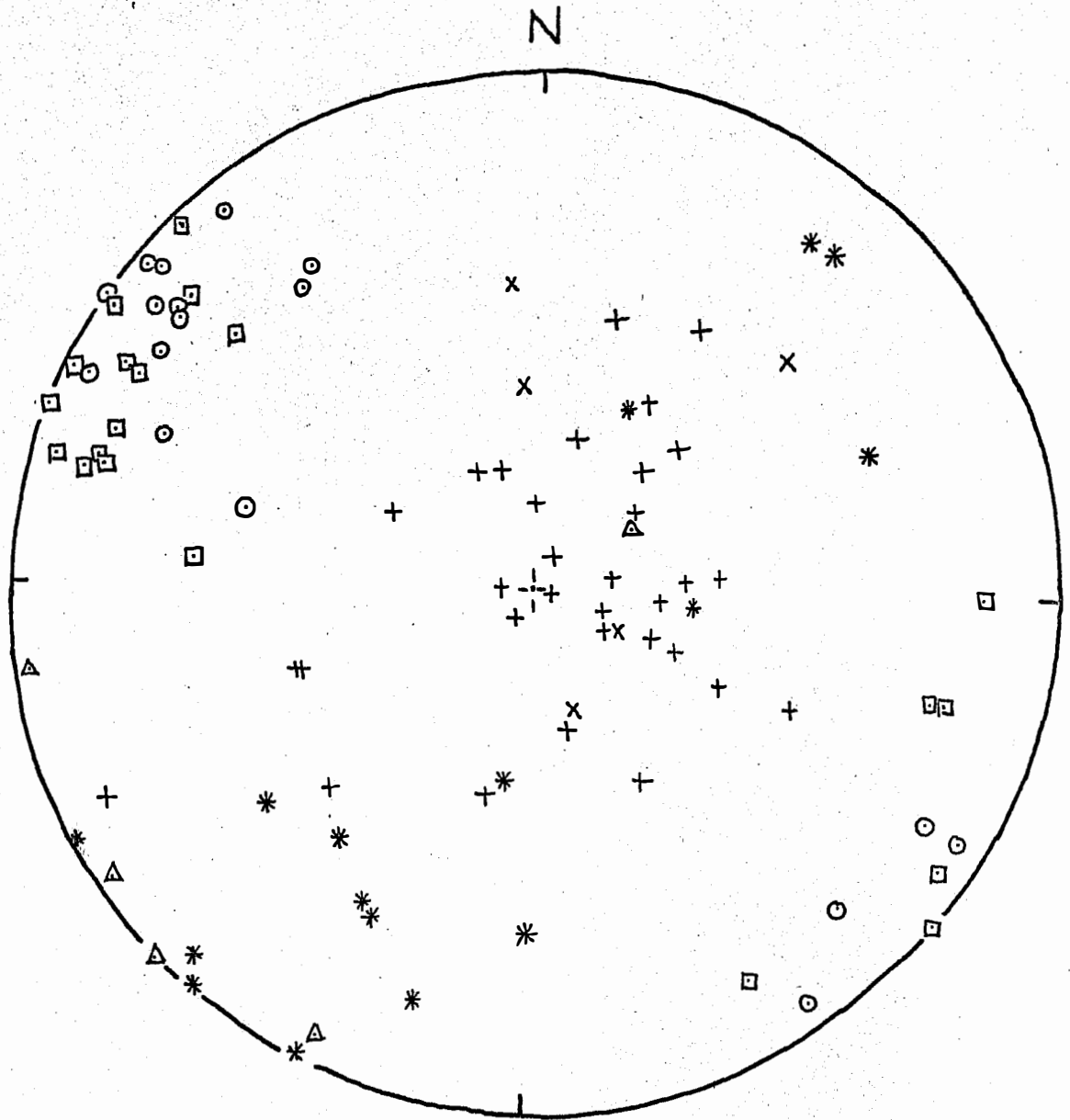


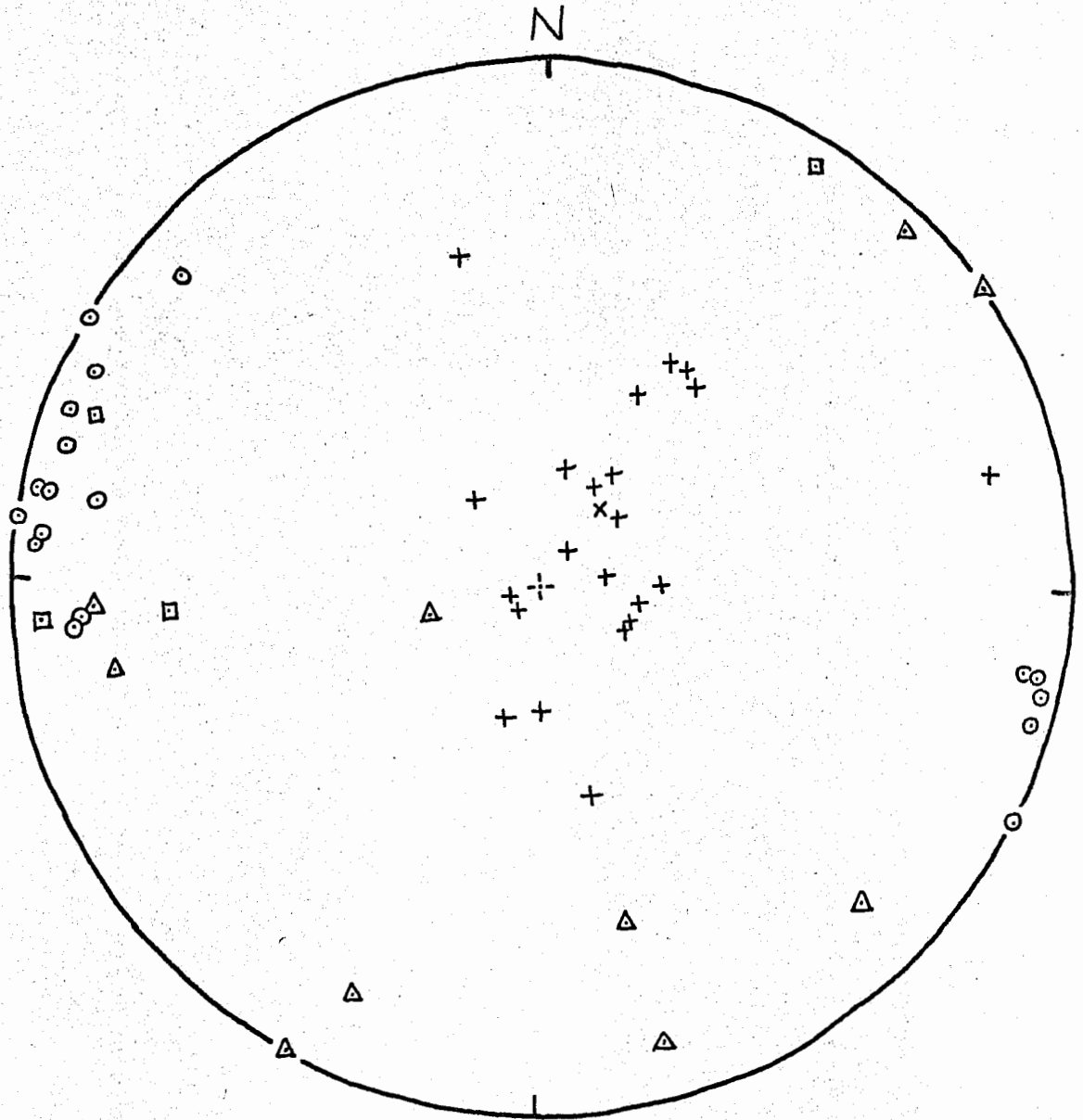
FIG 2. Refolded F_1 isocline defined by
limy layer in grey sericite phyllite.
Actual size.

FIG 3. Equal area plot of structural elements.
Wanqorda Creek area



Key: + Pole to F_2 foliation
 x Pole to F_2 axial surface
 * Pole to F_1 axial surface
 O $L_2 = F_2$ lineation
 Δ $L_3 = F_3$ lineation

FIG. 4. Equal area plot of structural elements, Swim Lake area.



Key: + Pole to F_2 foliation
 x Pole to F_2 axial surface
 \square B_2 : F_2 fold axis
 \odot - L_2 = F_2 lineation
 \triangle - L_3 = F_3 lineation

ORE GENESIS

Sections A-A' to C-C' represents deeper levels of exposure as one moves from northwest to southeast. Zinc-lead deposits are seen to be concentrated and repeated about F2 folds (A-A') or on the limbs of F2 folds (B-B'). It would also appear from the map and cross-sections that zinc-lead deposits are concentrated within graphitic units on the flanks of probable submarine volcanic piles. This thus indicates a close genetic relationship between submarine volcanism and mineralization. Moving structurally "up-section" both the lime-content of phyllites and the amount of volcanic material increases: (See map and cross sections). This probably marks a transition from deep-water quiescent volcanism, with accompanying mineralization within a euxinic environment (graphitic phyllites) to one of shallower water (limestones and limy phyllites) with increased submarine volcanic activity. Increased volcanism, apparantly did not mean increased mineralization as evidenced by the lack of mineral deposits found to date in the upper structural section: however any potential mineral deposits may have been more readily eroded and dispersed in a shallower water environment.

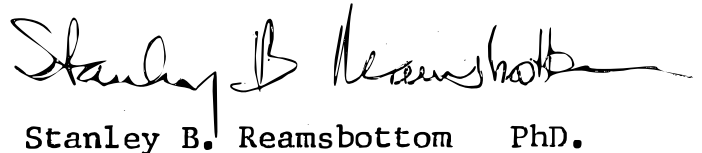
IMPLICATIONS FOR FUTURE EXPLORATION

The zinc-lead deposits appear to be 'distal volcanic' in character, ie. they were deposited in sediments on the flanks of submarine volcanoes. Grum and Vangorda deposits are along strike from a thick meta-volcanic pile. Despite the intense regional deformation the lateral gradation of phyllite-hosted zinc-lead deposits to meta-volcanic sequences is probably representative of the original depositional environment. If the fold pattern presented is in any way representative of the actual structure, these favourable stratigraphic horizons have now been folded into essentially subvertical orientations. Therefore to thoroughly

test for additional ore around Vangorda deposit one should deep-drill through the deposit to check for repetition about an F2 fold nose, and also test immediately to the southeast. In addition the overburden-covered area south of the airfield is along strike from meta-volcanic rocks which outcrop on Vangorda Creek. This area should also be tested.

Possibilities abound outwith our staked ground; those presented above are by way of stimulus for next years exploration.

Respectfully submitted

A handwritten signature in cursive script that reads "Stanley B. Reamsbottom". The signature is written in dark ink and is positioned above the typed name.

Stanley B. Reamsbottom Ph.D.