MEMORANDUM:

UPDATE ON THE STRUCTURAL GEOLOGY OF THE SICKER GROUP AT MT. SICKER

To: Gary Wells

From: J. Keith Glover

Date: April 10, 1990.

827174

The purpose of this project was to evaluate the possibility of structural repetition, either by folding or faulting (or a combination of both), of the Lenora-Tyee horizon(s) to the north of the old workings on the Mt. Sicker Property. From April 2 to April 6, 1990, a total of five days were spent on the property in order to achieve this objective: three days were spent on the structural logging of core from six diamond drill holes (MTS 75, 80, 24, 37 and 10) and a further two days were spent visiting critical outcrops.

Although conclusive evidence for this hypothesis could not be found, circumstantial evidence does exist to suggest that argillite and pyritic chert horizons along the Gabriel Zone and at the Postuk-Fulton showing, respectively, are laterally equivalent to the Lenora-Tyee horizon. This conclusion is based upon:

1) At each of these three localities the sequence comprises intermediate tuff, argillite and/or pyritic chert, and altered felsic tuff. At Lenora-Tyee, the argillite -pyritic tuff package coincides with the ore sequence, which contains bedded massive sulphides. Here, the intermediate tuff unit appears to be at the stratigraphic base of the sequence and contains sulphide stringers adjacent to its contact with the ore sequence along the south side of the Lenora open pit.

2) Previous work in the Lenora-Tyee area has demonstrated the existence of small-scale, tight to isoclinal F1 folds with pronounced axial planar schistosity (S1); a well developed elongation direction ((L1), coaxial with these folds, plunges at a shallow angle, generally toward the east (Glover, 1989). The rocks exposed along the north slope of Mt. Sicker have undergone similar deformation with respect to the degree to which the schistosity and elongation direction are developed.

3) The occurrence of six closely spaced argillite layers south of the collar of DDH MTS 10, suggests the existence of small-scale F1 folds within the Gabriel Zone. This is supported by the fact that at least one of these argillite layers is structurally south-facing, i.e. on the north limb of a syncline, whereas at Northeast Copper north-dipping pyritic cherts indicate a position on the south limb of a syncline. Therefore, at least one fold hinge must occur somewhere between the chert occurrences at Northeast Copper and the argillite bed(s) along the Gabriel Zone.

D2 deformation appears to be more intense in the Lenora-Tyee area than elsewhere on the property, as shown by the abundance of small-scale F2 chevron folds in the Lenora open pit. Here, the schistosity dips steeply to the south whereas along the north slope it is characterized by moderate to steep northerly dips. No flat or shallow dipping S1 planes are recorded from the volcanic sequence within the intervening area, although some of this ground is obscured by surface exposures of diorite. Thus, it seems likely that D2 deformation has merely resulted in rotation of the schistosity about the vertical rather than any large-scale F2 folds. Consequently, folds of this generation cannot be called upon to repeat the Lenora-Tyee horizon to the north, e.g., in the vicinity of MTS 24 and MTS 37.

No structural evidence was found in exposures along the Postuk-Fulton road or along Nugget Creek for the existence of the Nugget Creek Fault. As a result, there is no obvious candidate for a major thrust fault that would repeat the Lenora-Tyee horizon to the north.

Logging of diamond drill core from shallow holes in the vicinity of the Lenora-Tyee area (MTS 75 and MTS 80) revealed several changes in structural facing and fold vergence from one argillite intersection to another, and, in some cases, across individual argillite intersections. This indicates that these argillite intersections are repeated by folding and may in fact be the same horizon (Figure 1). Most of these folds appear to belong to the first phase of deformation (D1). The resulting geometry is very similar to the cross-section for the Lenora open pit along strike to the west (Figure 2).

All the above evidence points to possible repititions of the Lenora-Tyee horizon along the north slope by F1 folding rather than by later D2 folding or faulting.

Moreover, the South Zone (and possibly the North Zone) occurs within the hinge of an F1 fold, as shown by exposures in the Lenora open pit, whereas no ore is found on the limbs of the fold, literally metres away from this hinge. Thus, argillite-pyritic chert horizons within F1 fold hinges provide an exploration model for the north slope that is compatible with all available data.

Respectfully submitted,

J.Keith Glover
Geological Consultant

STRUCTURAL FACING AND FOLD VERGENCE IN CORE

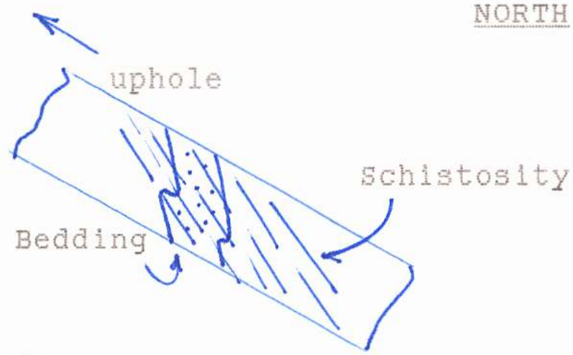
SOUTH NORTH

CASE A:

Folds climb uphole:-

Structurally southfacing
or
Fold vergence to the north

Core Angles: Bedding > Schistosity



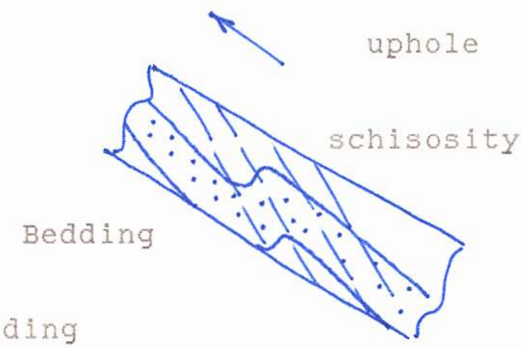
CASE B:

Folds climb downhole:-

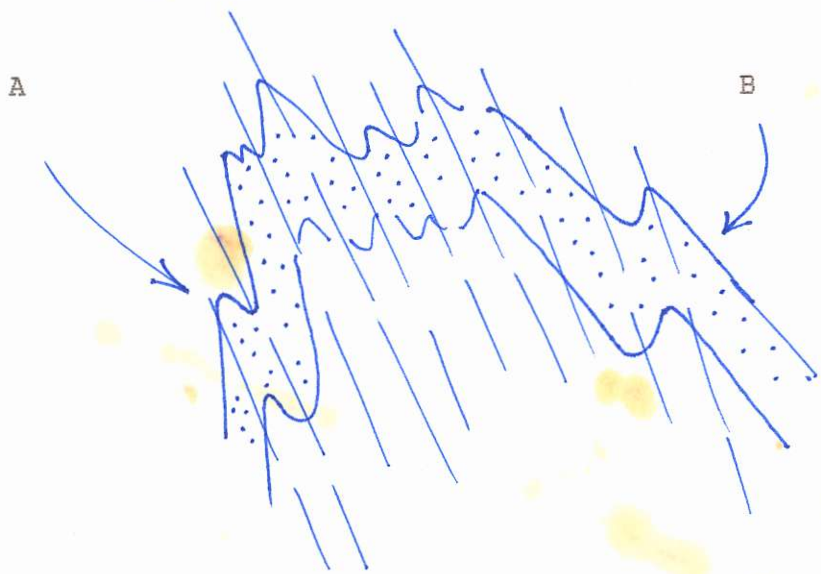
Structurally northfacing

or
Fold vergence to the south

Core Angles: Schistosity > Bedding



Position on larger scale structure:



J.K.G

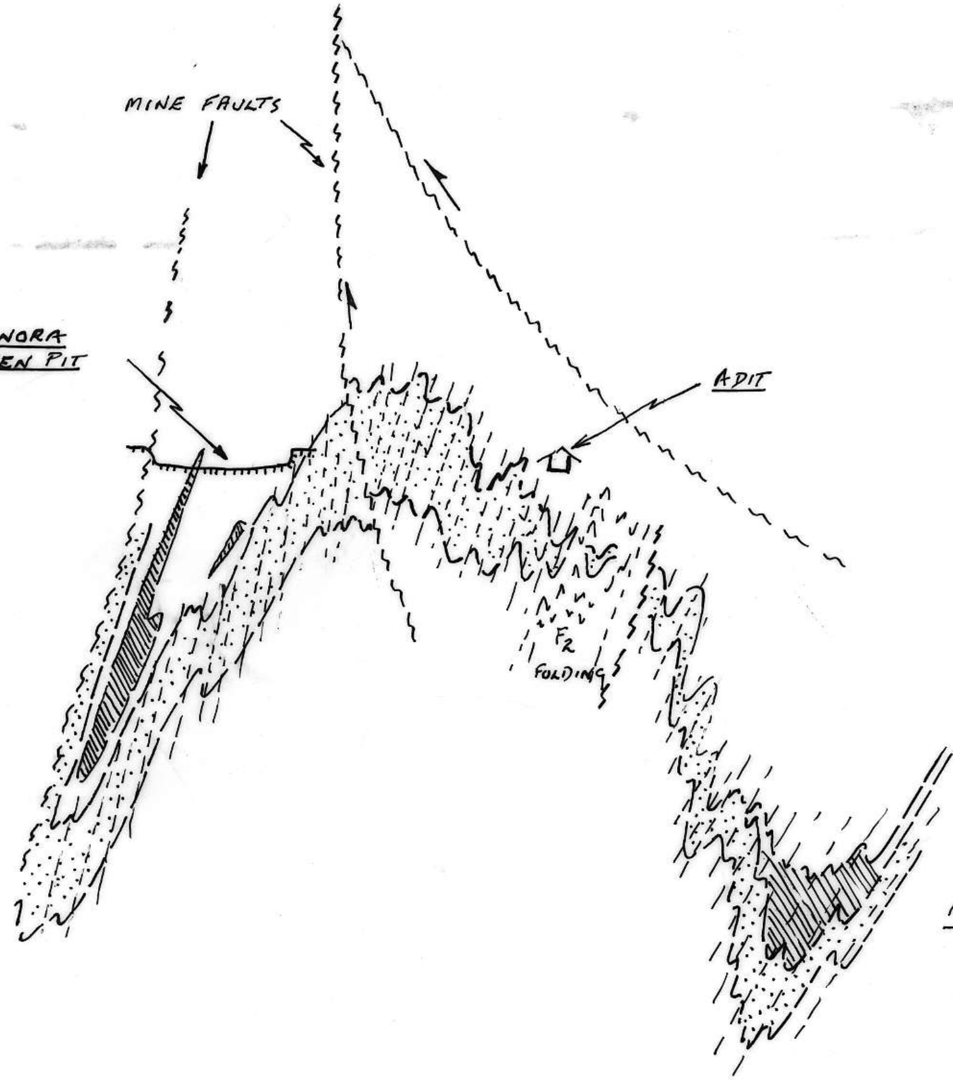


FIGURE 2: SCHEMATIC SECTION THROUGH LENORA OPEN PIT AREA (LOOKING WEST)

ARGILLITE

BEDDED SULPHIDE

TRACE OF SCHISTOSITY

J.K.G.

SICKER PROJECT:
STRUCTURAL GEOLOGY REPORT
ON THE
LARA AND MT. SICKER PROPERTIES

By

J. Keith Glover

Confidential Report to Minnova Inc., June 5, 1989

INTRODUCTION

The purpose of this project was to determine the structural setting of mineralization on both the Mt. Sicker and Lara properties in order to aid their interpretation and exploration. Thirty-three days were spent on the project from April 17 to June 5, 1989; three quarters of this time was allocated to the Lara property and the remainder to Mt. Sicker. The project comprised the following aspects:

1. Detailed mapping (at 1:100 and 1:500 scales) in the Lenora-Tyee area on the Mt. Sicker property (Figures 1 and 2);

2. 1:50 scale mapping of Trenches 43 and 44, which expose massive, semi-massive and "stringer" mineralization of the Coronation Zone on the Lara property (Figure 3);

3. One regional traverse was completed on the Mt. Sicker property, whilst five regional traverses were completed on Lara.

4. Structural logging of diamond drill core from:

   (a) D.D.H. 129, 131, 132 and 136 (Section 105 + 50W), which are on section with cross-cut 1-3653E and raise 1-3662E from the underground workings and with Trench 44 (Figure 4);

   (b) DDH 193, 205, 208 and 210 (Section 102 + 00W). These holes were selected in order to provide the most complete structural section from the Fulford Fault, southwest of the Coronation Zone, to the gabbro of "Break 3", northeast of the felsic sequence that is tentatively correlated with the Lenora-Tyee

Horizon (Figure 5).

The orientations of planar and linear fabric elements and small-scale structures were recorded from both outcrops and diamond drill core. For the detailed surface mapping these features were plotted stereographically using a Schmidt (or equal area) net and contoured using the Kamb method.

Despite the lack of a detailed property stratigraphy on either Lara or Mt. Sicker, I think that a clear image is emerging of the geometry and type of structures relevant to the present distribution of known mineralization. Hopefully, this will aid future exploration for the "big one(s)".

STRUCTURAL OVERVIEW

Three major phases of deformation have affected volcanic, volcaniclastic and sedimentary rocks of the Sicker Group:

Phase 1 (D1)

This is characterized by a vertical to steeply dipping, west-northwesterly trending penetrative foliation (S1) and a pervasive mineral lineation/stretch direction (L1) with shallow plunges, generally to the east.

These fabric elements are defined by the preferred orientation of phyllosilicates such as chlorite and sericite and by flattening and stretching (in the order of 10:1) of strain indicators such as quartz eyes and lapilli. Some primary flattening parallel to bedding undoubtedly occurred during deposition of the pyroclastic rocks, but their subsequent deformation has obscured this, i.e. the foliation in the matrix is essentially coplanar with the plane of flattening in the clasts.

Unambiguous bedding planes are rare in outcrop, particularly in the volcanic rocks, whilst the interpretation of compositional layering in the less competent lithologies, such as argillite and sulphide horizons, requires caution due to probable transposition of bedding parallel to S1.

D1 was accompanied, at least locally, by tight to isoclinal folding along axes parallel to L1. Small-scale F1 buckles or ptygmatic folds are commonly developed within chert horizons, although they are rarely clearly visible, especially in outcrop. At the Lenora open pit the southern ore zone is located along the axial trace of an F1 syncline. On the Lara property, an F1 anticline is inferred to occur within the southern felsic sequence, close to the Coronation Zone.

Upper Triassic Karmutsen gabbroic intrusions are generally massive and were therefore emplaced after D1. However, there are some narrow mafic dykes that possess a well developed schistosity; in addition, well foliated margins are evident along some of the larger mafic dykes, the more massive portions of which are sometimes mesoscopically indistinguishable from the Karmutsen gabbros. These variably foliated dykes are interpreted as being coeval with the Sicker Group. In these dykes, the regularity of S1 generally serves to distinguish it from shear fabrics associated with D2 thrust faults (see below), but the lack of shear planes at an acute angle to the penetrative fabric is more diagnostic. Thus, the intensity of the foliation (S1) along the margins of Sicker-age dykes progressively diminishes toward their interiors. Ambiguities do arise where a D2 shear zone overprints S1.

Within the volcanic rocks, the intensity of S1 generally increases toward the margins of the larger early dykes, due to contact strain effects caused by the competence contrast between dyke and country rock. Therefore, this should not be taken as proof of faulting along the margin of the dyke.

The relative development of the foliation versus the stretch direction is a measure of the type of strain which the rocks have undergone, i.e.

(a) **S tectonites ("pancakes") - pure flattening**
Well-developed schistosity with no stretch direction visible on the foliation plane. This is relatively rare in folded sequences and was not observed on either property;

(b) **S/1 tectonites - apparent flattening**
Well-developed schistosity and stretch direction. This

occurs on the limbs of folds, but can occur in fold hinges within incompetent rocks adjacent to more competent lithologies ;

(c) **1 tectonites ("cigars") - constriction**
Well-developed stretch direction with a weak or absent foliation. There are various explanations for the occurrence of this type of tectonite fabric, but the commonest and most likely cause is location along a fold hinge.

The distribution of l-tectonite fabrics on the Lara and Mt. Sicker properties indicates the occurrence of F1 fold hinges in the vicinity of both the Coronation Zone and the Lenora-Tyee, respectively.

Phase 2 (D2)

This is characterized by southwesterly directed thrust faults that dip moderate to steeply toward the northeast. The major thrust, the Fulford Fault, dips at about 45 degrees northeast on the Lara property, where it juxtaposes volcanic rocks of the Sicker Group in the hanging wall against sedimentary rocks of the Upper Cretaceous Nanaimo Group in the footwall. The amount of displacement on this fault could be in the order of several kilometres. Similar but steeper northeast dipping structures with (presumably) significantly less displacement occur within the volcanic sequence and define many of the lithologic contacts on Lara. One of these faults follows the locus of the Coronation Zone, and another, the Southern Rhyolite Fault, defines the northeast margin of the felsic sequence which hosts the zone.

These faults are distinguished by an array of associated small-scale structures characteristic of brittle-ductile shear zones, such as c-s fabrics, cataclastic textures, rotated porphyroclasts and asymmetric folds. However, in places individual thrust faults may lack these diagnostic features and can therefore only be recognized on the basis of truncations of either bedding or foliation. Bedding glide zones, where a thrust is parallel to primary layering in both the hanging wall and foot wall, can only be identified on the basis of stratigraphy. Therefore, thrusts of this type are next to impossible to identify on either property, although their existence is strongly suspected.

At Lara, generally shallow, easterly plunging small-scale chevron folds of the foliation (F2) are developed close to the thrusts. A larger scale F2 anticline-syncline pair in the hanging wall of the Southern Rhyolite Fault may be responsible for local repetition of the "Lenora-Tyee" horizon, north of the Andesite Sequence. In plan, the axial trace of these folds is apparently truncated at a low angle by the Southern Rhyolite Fault (John Kapusta, personal communication).

Phase 3 (D3)

This appears to be the final phase of deformation. It is characterized by northeasterly trending high-angle cross-faults, many of which have apparent left-lateral movement along them. These are probably Tertiary in age and may represent the conjugates to the regional northwesterly trending transcurrent fault systems, such as the Fraser and Queen Charlotte faults, that have affected the western part of the Cordillera throughout the Tertiary.

Some of these faults have a dip-slip component of movement along them, but no evidence for significant rotation has been demonstrated on them as yet on either the Lara or Mt. Sicker properties. It is not sufficient that bedding attitudes are different on either side of the fault in order to prove a rotational component; all previously formed structures and fabric elements should be rotated in the same sense.

Kink bands are relatively common on both properties. Their geometry and spatial distribution relative to left-lateral cross faults indicate that these structures belong to D3. Conjugate kinks are developed locally; left-lateral kinks trend toward the northeast, whilst right-lateral kinks are north-northwesterly trending.

Some cross faults are terminated by or merge with D2 thrust faults. These are most probably tear faults that occurred synchronously with thrusting and are therefore earlier than D3. No evidence was found for right-lateral strike-slip remobilization of D2 thrust faults, as proposed by Massey et al (1988), although this may be an important factor in places.

MT. SICKER

At the Lenora open pit, layered polymetallic sulphide/barite mineralization in the South Orebody is hosted by quartz-sericite schists (felsic ash tuff, crystal tuff and cherty tuff), close to their stratigraphic contact with argillite. Layering in the sulphides is more or less parallel to this contact and is interpreted as bedding, albeit transposed into S1. Both the mineralized horizon and the argillite are repeated by a shallow, easterly plunging, tight to isoclinal F1 syncline, although the fold closure is not exposed within the sulphides or the argillite (Figure 1). Mineralized quartz veins, boudined within S1, are found in the footwall of the massive sulphides along the south limb of this fold. The structural evidence is therefore compatible with a volcanogenic massive sulphide origin for the South Orebody.

The Lenora Thrust, a southerly directed thrust fault that strikes at about 110 degrees and dips at 55 degrees to the north, is exposed along the east side of the pit. This thrust, which is characterized by a 50 centimetre-wide brittle-ductile shear zone, juxtaposes unaltered quartz feldspar porphyry above the South Orebody and associated altered felsic rocks. To the east it is truncated by a north-northeast trending cross fault, but the left-lateral fault offset of the thrust is inferred to occur along the southern margin of a large body of Karmutsen gabbro, located between the Lenora area and the Tyee shaft (Figure 2). To the west, the thrust is again exposed one hundred and eighty metres northwest of the pit. Here it exhibits a northerly dipping weak C-S fabric, the sense of movement along which also indicates that the QFP in the hanging wall moved south relative to the altered sericitic volcaniclastic rocks in the footwall. Although the thrust is not exposed further north, the distribution of outcrops of the QFP and altered felsic rocks indicates that its trace contours the slope to the northeast. This would suggest that the thrust flattens abruptly toward the north, possibly due to late folding caused by movement up a longidutinal step ("ramp") along another thrust at a deeper structural level.

In the footwall of the Lenora thrust, both the bedding in the argillite and the foliation (S1) in the altered felsic rocks are intensely folded along shallow easterly plunging F2 fold axes (Stereonet C, Figure 1). These small-scale folds are generally disharmonic, but in detail they commonly have profiles that resemble chevron folds. Near the upper adit, they have upright axial planes and are symmetric, indicating a position in the hinge zone of a larger scale F2 fold. Further, south toward the pit, they become progressively overturned with axial planes inclined toward the south. Here their sense of asymmetry indicates a position on the south limb of a larger scale F2 synform, the axial trace of which is inferred to lie close to the upper adit (Figure 1).

These F2 folds are thought to have developed in response to movement along the overlying Lenora thrust. Stevenson (1945) describes similar small-scale folds in the argillite from underground near the North orebody; from his photograph (Figure 3, page 297) it is clear that these folds overprint S1 and therefore belong to D2. However, it is not clear whether the "two main drag folds" along which the North and South orebodies lie belong to the first or second phase of folding. Evidence from the Lenora open pit indicates that the primary structural control for the distribution of the South orebody was the hinge zone of an F1 syncline, which has been severely modified by F2 folds and truncated by the Lenora thrust.

The final phase of deformation (D3) is represented by a steeply southeast-plunging synform that is superimposed upon both F1 and F2 folds. Its axial trace trends north-south and is located close to the west end of the pit (Figure 1). This is thought to be a drag fold that developed in response to left-lateral movement along the major northeast trending cross fault located to the west of the detailed map area (the Lenora Fault of previous workers).

In the hanging wall of the Lenora Thrust, the quartz feldspar porphyry exhibits a pronounced l-tectonite fabric; where the foliation (S1) is present it is only weakly developed. This suggests a position along an F1 hinge zone. This is supported by bedding attitudes from a chert horizon located between the QFP and overlying gabbro. North of the gabbro, along the road to the Tyee shaft (Figure 2), structural facing within argillite, felsic ash tuff and chert interbeds indicates a position on the north limb of an F1 syncline, the axial trace of which is therefore assumed to lie below the gabbro.

The regional traverse on the Mt. Sicker property served to emphasise the anomalously structurally complex nature of Lenora-Tyee area: for the most part the foliation follows the regional east-west trend on the property with vertical to steeply inclined dips, whilst L1 lineations vary little from the horizontal. No F2 folds were observed. Possible exceptions to this relative simplicity include the areas of the Postuk-Fulton Showing and the Northeast Showing, although insufficient work has been done on the structure in these areas to warrant sweaping conclusions.

More work is required to define the role of post-Nanaimo thrusting and associated folds (D2) at Mt. Sicker, but sufficient common denominators exist between this property and Lara to infer the importance of these structures.

LARA

The Coronation Zone

Results from detailed structural mapping of trenches 43 and 44 (Figure 3), together with logging of diamond drill core from holes along Section 105 + 50W (Figure 4) and Section 102 + 00 W (Figure 5) have established the importance of southwesterly directed thrust faulting (D2) in the vicinity of the Coronation Zone. This is supported by underground mapping (Harris et al., 1988)

The Coronation Zone itself defines the locus of a thrust duplex that dips at about 60 degrees toward the northeast. A complex imbricate array of both steep and shallow dipping splays links the bounding footwall fault of this duplex with its hanging wall fault. These splays define the margins of individual blocks of massive, semi-massive and veined polymetallic sulphide mineralization, as well as barren rock. They are commonly accompanied by well developed C-S fabrics and cataclastic textures, the best exposures of which were seen in cross-cuts along the East Drift (Plate 1).

Plate 1: East panel of X-cut 3662 E (?), East Drift: Shows C-S fabric between imbricate thrust faults along the footwall of the Coronation Zone (looking east).

At Trench 44 the zone is defined by a massive to semi-massive sulphide layer that generally dips at about 80 degrees to the north. On the west and east sides of the trench, this layer thickens where its hanging wall contact swings to the north. The foliation (S1), together with isoclinally folded and boudined mineralized quartz veins within the plane of S1, are truncated by the structural hanging wall of the sulphide layer. This clearly makes this contact a fault that post-dates the first phase of deformation.

The poles to S1 measurements in the hanging wall are distributed about a weakly defined girdle, the pi-pole to which plunges at 1*/292* (Stereonet A, Figure 3). This indicates F2 folding along a flat east-west axis. Similarly, the distribution of L1 lineations (Stereonet E) clearly shows the effects of F2 folding. Small-scale, shallow easterly plunging symmetric F2 folds were in fact measured from the hanging wall (Stereonet C). These are thought to be drag folds that developed in response to southerly directed thrusting along the hanging wall fault. This sense of movement is supported by slip vectors, defined by elongate quartz rods and slickensides that were measured on individual slip planes in the hanging wall of the zone (Stereonet C). Comparison of this stereonet with the pattern of slip vectors measured from the foot wall sequence (Stereonet D) demonstrates that rotation of these L2 lineations has occurred during movement along the thrust.

A variably pyritic argillite with associated polymetallic sulphides is exposed in the foot wall of the Coronation Zone in Trench 44. This "foot wall argillite" dips at about 80 degrees to the north. It may locally be the locus of thrust faulting but its attitude appears to reflect bedding (Figure 4).

At Trench 43 shear fabrics occur adjacent to both the hanging wall and footwall of the massive sulphide lens. They indicate that both contacts are thrust faults. In this trench, L1 lineations still plunge at a shallow angle to the east. This appears to contradict the notion that in the vicinity of the West Drift, above which this trench is located, the ore zone plunges to the west. However, the relative role of the L1 stretch direction versus D2 thrusting with respect to the plunge of the ore zone is still poorly understood, although both must play a part.

Figure 4 clearly shows the spatial relationship between the mineralization and D2 thrust faults along Section 105 +50 E. It is interesting to note that the massive sulphide layer exposed on surface is not present in DDH 135 eight metres downdip. Similarly, the hanging wall to this lens becomes the ore zone 6 metres downdip in DDH 135. Both these structural panels contain massive sulphide 7 metres downdip in DDH 132, but semi-massive sulphide a further 7 metres downdip, and by the level of the cross-cut they are replaced by a different fault panel that contains both semi-massive and massive sulphide. Given the amount of data on this section it becomes obvious that massive sulphide "hits" are impossible to predict from surface diamond drilling.

Many of the sections through the deeper parts of the Coronation Zone (below the 400 metre level) show that the zone steepens to about 75 degrees adjacent to and parallel with the Southern Rhyolite Fault (Figure 5). Here, the zone is structurally equivalent to the Hanging Wall Zone at higher structural levels. This suggests that the duplex that bounds the zone is repeated by the Southern Rhyolite Fault.

On section 102 + 00 W both the zone and the duplex that follows it, together with the Southern Rhyolite Fault, are truncated at an elevation of about 250 metres by the Fulford fault. To the west, this truncation occurs on surface at an elevation of 650 metres, thus indicating that D2 structures have a plunge toward the east.

Lack of stratigraphic markers, complexity of the structure and ambiguity of core angles combine to make interpretation of the geology on Section 102 +00W extremely difficult. However, although many of the individual structures portrayed in the hanging wall of the Southern Rhyolite Fault are poorly constrained, there is considerable evidence to support this overall style of deformation: brittle-ductile shear zones with well-developed C-S fabrics and cataclastic zones; small-scale F2 folds that become increasingly abundant and tight close to these shear zones. In addition, the repetition of the Felsic Sequence and the "Lenora-Tyee" horizon in DDH 205 and 193 require the presence of thrust faults and/or folds in this part of the section. DDH 205 has numerous shear zones and F2 folds throughout its length. It is difficult to ascertain exactly where the major structures occur, but I am confident of their existence. As a result, I think that the same fault pattern that characterizes the Coronation Zone and its structural foot wall continues into the hanging wall, despite repeated attempts to discard my "fault pencil".

CONCLUSIONS

Model for the structural evolution of the Coronation Zone and implications for future exploration

For the most part, the early structural history of the mineralization within the Coronation Zone is obscured by shear fabrics associated with D2 thrusting. However, at Trench 44 boudined and isoclinally folded mineralized quartz veins clearly show that at least one episode of mineralization occurred prior to the first phase of deformation. Many of the DDH intersections have a similar appearance to these veins, but some late-stage remobilization, particularly of grey coppers, is evident from cross-cutting relationships with respect to both S1 and D2 shear fabrics. Nevertheless, the major mineralizing event is thought to have occurred prior to D1, distributed along a feeder zone that developed during the same period in which the Felsic Sequence was deposited. This is supported by the observation that in detail, the mineralization cross-cuts the volcanic stratigraphy and does not coincide with a recognizable stratigraphic break. In other words, the zone is a vein.

The variably pyritic argillite that occurs in the structural footwall of the zone, together with the geochemically anomalous chert and felsic ash tuff horizon in the structural hanging wall of the andesite sequence (the "Lenora-Tyee Horizon") is thought to be the hiatus in volcanism and exhalative expression of this period of mineralization. Moreover, structural repetitions of this sequence may occur to the north, for example the Randy Zone. Considering the lateral and vertical extent of the Coronation Zone, the potential of economically significant volcanogenic massive sulphide deposit(s) along this horizon is high.

The subsequent structural history of the Coronation Zone and its related V.M.S. deposit(s) - yet to be discovered - is portrayed schematically in Figure 5:

A. Prior to deformation: The Andesitic Sequence at the stratigraphic base, with the V.M.S. deposit/"Lenora -Tyee" horizon near the base of the Felsic Sequence;

B. The onset of the first phase of deformation (D1): During this time small-scale F1 folds developed along chert layers within the Lenora-Tyee Horizon, while the thicker, more massive volcaniclastic units deformed more homogeneously;

C. By the close of D1 a relatively tight, large-scale anticline, overturned toward the southeast, had developed; an l-tectonite fabric had been acquired by the more competent felsic lithologies within the hinge zone of this fold. It is possible that overtightening of this fold resulted in the development of a southerly directed forelimb thrust, which may have been an early precursor to the much later D2 thrusting);

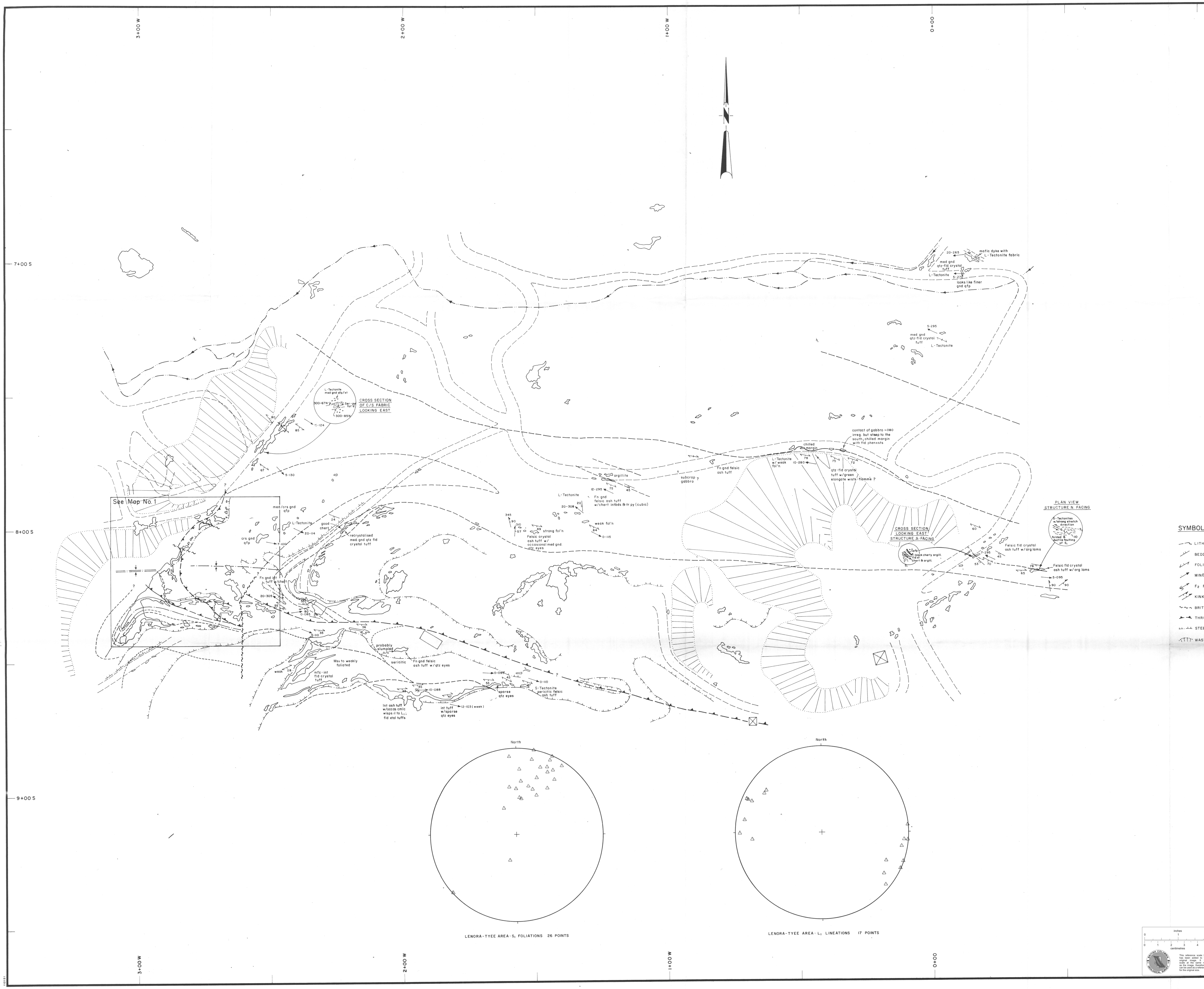
   Karmutsen Gabbros are emplaced in the Upper Triassic (after D1 but before D2). These intrusions occur both as both sills that follow lithologic contacts and as dykes that follow foliation planes.

D. The main imbricate thrust fault occurs along the feeder zone (Coronation Zone): continued movement along this duplex results in overprinting of D1 fabric elements by D2 shear fabrics; displacement along the fault causes juxtaposition of the feeder zone against its own overturned exhalative horizon in the foot wall (now represented by the Footwall Argillite);

E. Continued thrusting results in the the duplication of the Coronation Zone by the Southern Rhyolite Fault to form the Hanging Wall Zone. By this time other thrust faults have developed within the Andesitic Sequence; yet others, controlled by dykes of Karmutsen Gabbro, may repeat the sequence (and therefore the "Lenora-Tyee" Horizon). Finally, the Fulford Fault truncates these structures and juxtaposes the Sicker Group above the Nanaimo sediments.

In Figure 6 (E), the present erosion level, as it pertains to most of the sections through the Coronation Zone, indicates the removal of the hypothetical V.M.S. deposit. The easterly plunge of L1 lineations, F2 fold axes (at least in Trench 44) and the probable easterly plunge of the truncation of the Coronation Zone and Southern Rhyolite Fault by the Fulford Fault, all point to the preservation of a proximal V.M.S. deposit toward the east. However, D3 cross-faults, some of which are known to have vertical displacements along them, may juxtapose different structural levels, and therefore may downdrop higher structural levels to the west. In addition, any repetition of the "Lenora-Tyee" horizon by thrust faults to the north of the Coronation Zone may provide the appropriate setting for more distal V.M.S. deposits that accumulated in a basinal environment. Therefore, all chert-argillite-felsic ash tuff horizons, particularly with polymetallic or barite signatures or zones of sodium depletion should be adequately tested.


B
North
MINERAL LINEATION / STRETCH DIRECTIONS
HANGING WALL OF LENORA THRUST: L1 18 POINTS △
FOOTWALL OF LENORA THRUST: L1 23 POINTS +
C
North
FOOTWALL OF LENORA THRUST: F2 AXES 15 POINTS □
A
North
Fold axes 9→094°
POLES TO FOLIATION (S1)
HANGING WALL OF LENORA THRUST: S1 8 POINTS □
FOOTWALL OF LENORA THRUST: S1 34 POINTS △
LENORA THRUST
C/S Fabric
Folded L1
Asymmetric F2 folds showing folded L1 lineations
Pyritic chert bands
Fault plane
Gouge and fault Bx
Possible F1 synform defined by folded qtz. veins
Intensely kink-folded close to cross fault
LEGEND
DIORITE
VARIABLY SERICITIC AND PYRITIC FELSIC ASH TUFF WITH MINOR CHERT; MEDIUM GRAINED FELSIC CRYSTAL TUFF
LAYERED MASSIVE TO SEMI-MASSIVE SULPHIDE
ARGILLITE
MEDIUM TO COARSE GRAINED QUARTZ FELDSPAR PORPHYRY
QUARTZ VEIN
SYMBOLS
BEDDING, TOPS UNKNOWN
COMPOSITIONAL LAYERING (TRANSPOSED BEDDING ?)
FOLIATION / SCHISTOSITY
STRETCH DIRECTION / MINERAL LINEATION
F2 FOLD AXES, SHOWING SENSE OF ASYMMETRY
INTENSE F2 FOLDING, SHOWING TRACE OF S1
AXIAL PLANE OF F2 FOLD; CRENULATION CLEAVAGE
KINK BAND
ORIENTATION OF QUARTZ VEIN
THRUST FAULT
LATE BRITTLE FAULT, SHOWING DIRECTION OF MOVEMENT
AXIAL TRACE OF F1 SYNCLINE, OVERTURNED TO THE NORTH (SOUTH DIPPING AXIAL PLANE)
AXIAL TRACE OF F2 SYNFORM
AXIAL TRACE OF F3 SYNFORM
MINNOVA Inc.
MT. SICKER PROJECT
LENORA OPEN PIT
STRUCTURAL GEOLOGY
0 2 4 6 8 10
SCALE: 1:100 metres
N.T.S.
DRAWN BY: J.K.G.
DATE: MAY, 1989
MAP:
1



MINNOVA Inc.

MT. SICKER PROJECT

LENORA - TYEE STRUCTURAL GEOLOGY

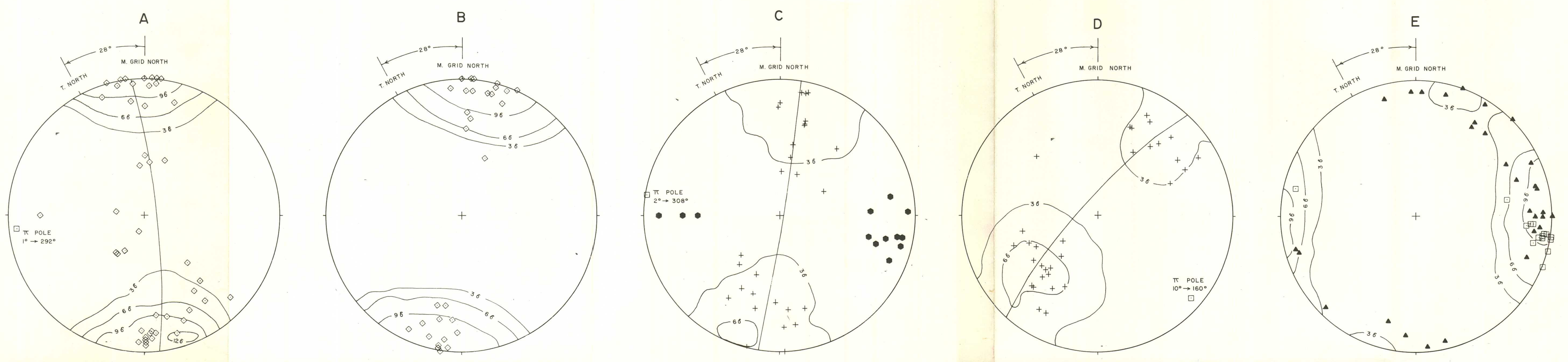
5 0 10 20 30 40 50

SCALE: 1:500 metres

N.T.S.	MAP:
DRAWN BY: J.K.G.	2
DATE: MAY, 1989	

inches 0 1 2
0 1 2 3 4 5 centimetres
BRITISH COLUMBIA GEOLOGICAL SURVEY

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.



POLES TO FOLIATION (S1) IN HANGING WALL 48 POINTS ◇

POLES TO FOLIATION (S1) IN THE FOOT WALL 31 POINTS ◇

SLIP VECTORS FOR HANGING WALL 28 POINTS +
F2 FOLD AXES 13 POINTS ●

NOTE : 1 Sigma (6) = 1 STANDARD DEVIATION

SLIP VECTORS FOR FOOTWALL 31 POINTS +

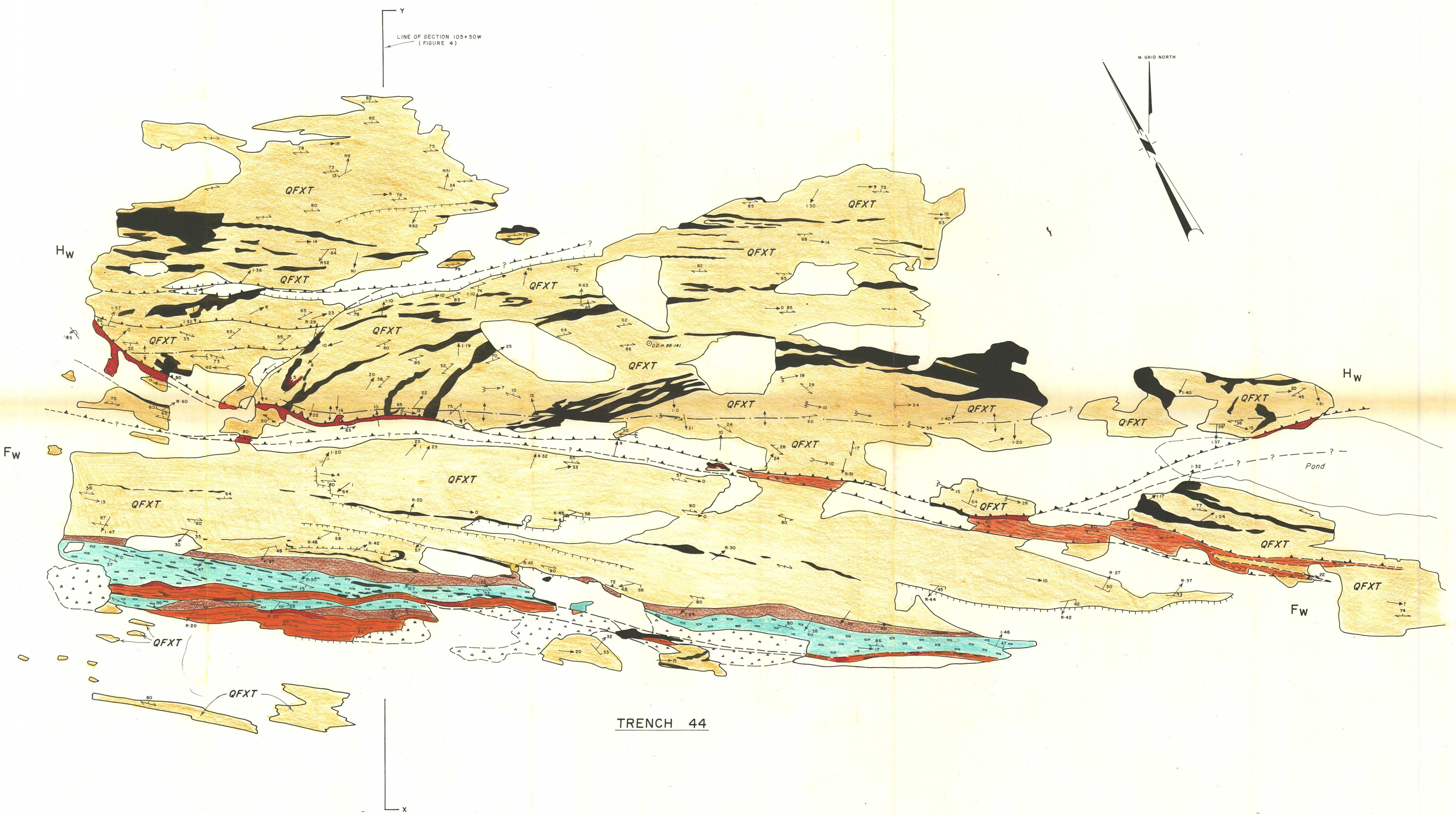
MINERAL LINEATIONS / STRETCH DIRECTIONS (L_1):
HANGING WALL 30 POINTS ▲
FOOTWALL 15 POINTS ⊡

LEGEND

- QFXT — MEDIUM GRAINED QUARTZ FELDSPAR CRYSTAL TUFF WITH ORANGE WEATHERING CARBONATE-ALTERED FELDSPAR CRYSTALS.
- COARSE GRAINED FELDSPAR CRYSTAL TUFF
- WEAKLY MINERALIZED CRYSTAL TUFFS
- ARGILLITE
- SEMI-MASSIVE TO MASSIVE SULPHIDE, BANDED IN PLACES
- QUARTZ VEINS
- FERRICRETE

SYMBOLS

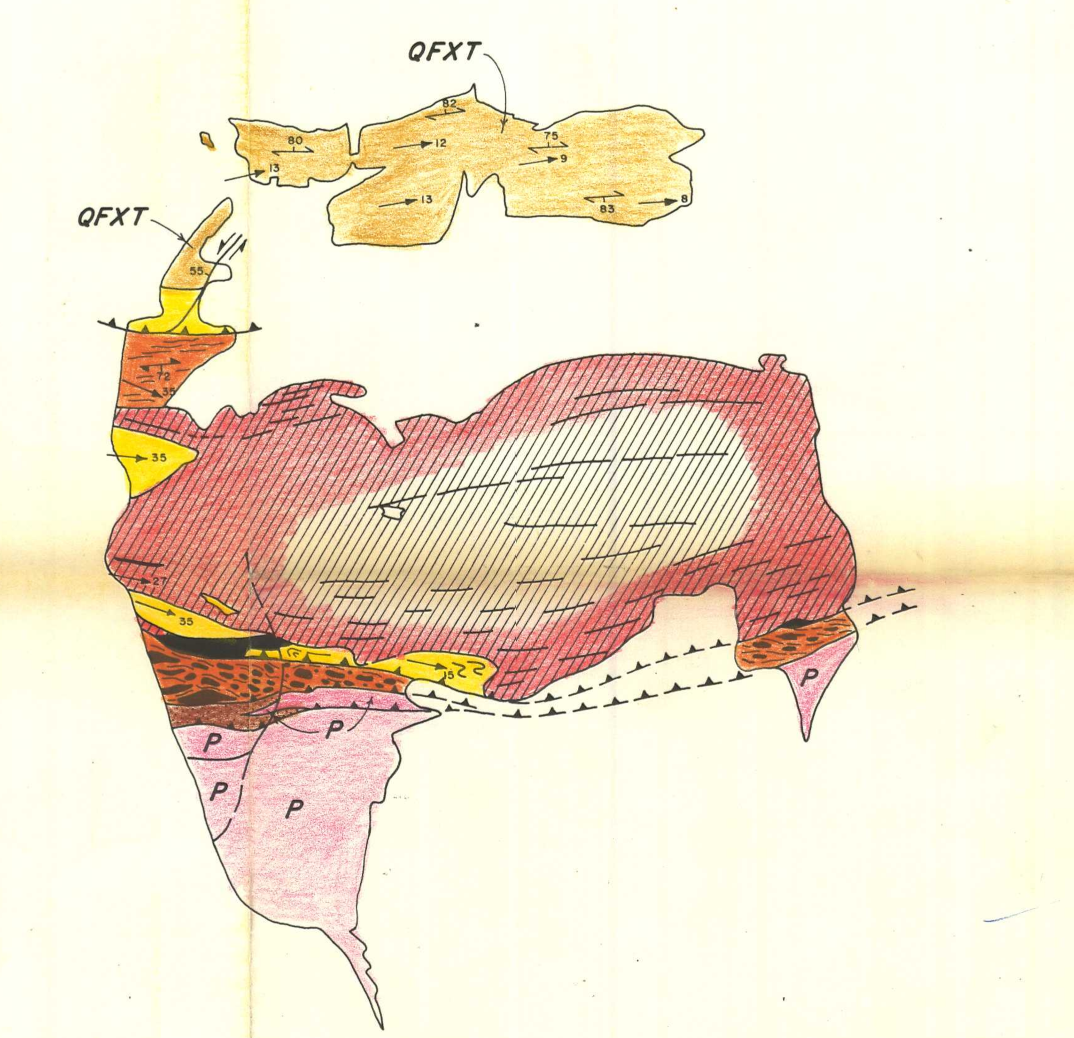
- FOLIATION (S_1)
- COMPOSITIONAL LAYERING OR CONTACT
- PLANAR SHEAR FABRIC
- MINERAL LINEATION / STRETCH DIRECTION
- F2 FOLD AXIS
- AXIAL TRACE OF F2 ANTIFORM
- THRUST
- LITHOLOGIC CONTACT
- EDGE OF STEEP FACE ON OUTCROP SURFACE
- SLIP VECTORS (NORMAL, REVERSE, INDETERMINATE).
- SLIP PLANE WITH VECTOR



TRENCH 44

LEGEND

- SERICITIC FELSIC ASH TUFF
- P — MEDIUM TO COARSE GRAINED QUARTZ FELDSPAR PORPHYRY



TRENCH 43

MINNOVA Inc.

LARA PROJECT

CORONATION ZONE

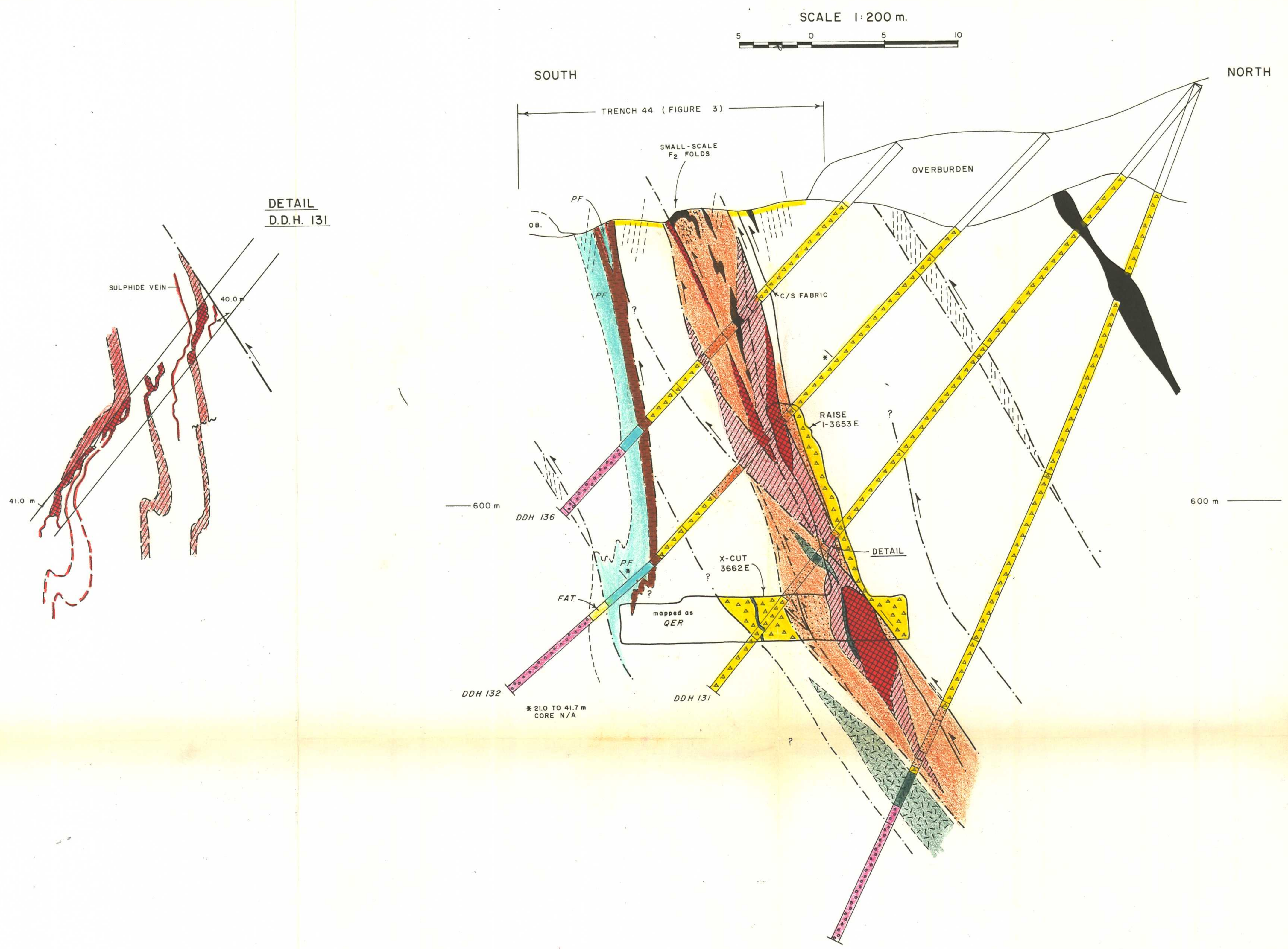
TRENCHES 43 & 44
STRUCTURAL GEOLOGY

0.5 0 1 2 3 4 5
SCALE: 1:50 metres

N.T.S.	MAP:
DRAWN BY: J.K.G.	3
DATE: MAY, 1989	

FIGURE 4

DETAILED STRUCTURAL SECTION
SECTION – 105+50 W
CORONATION ZONE

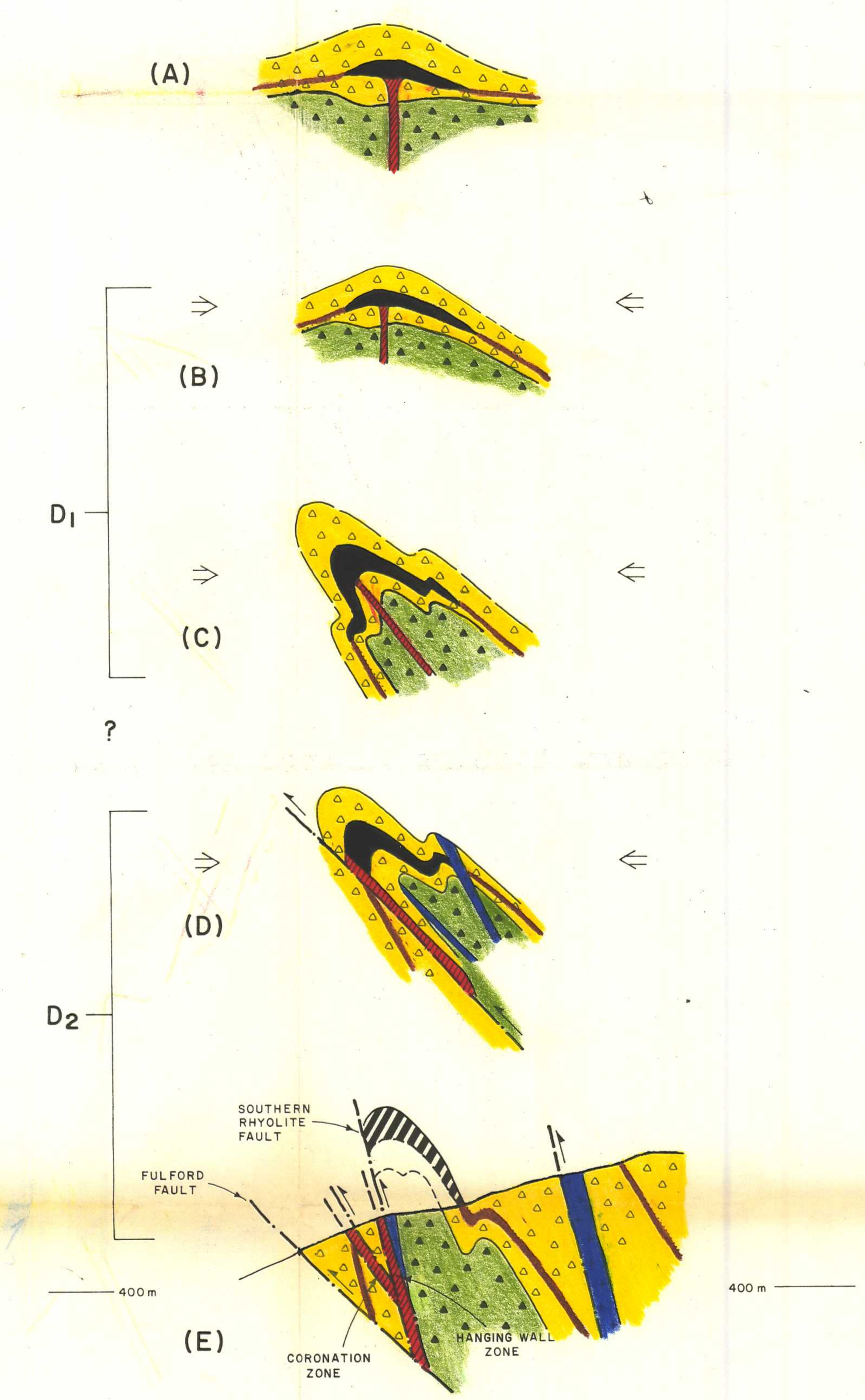


LEGEND

- QUARTZ FELDSPAR CRYSTAL TUFF
- FAT — FELSIC ASH TUFF
- ARGILLITE
- PF — COARSE GRAINED FELDSPAR CRYSTAL TUFF
- QUARTZ-FELDSPAR PORPHYRY
- MASSIVE SULPHIDES
- SEMI-MASSIVE SULPHIDES
- VEINED; BANDED AND LAMINATED SULPHIDES
- QUARTZ VEIN
- MAFIC INTRUSIVES
- LITHOLOGIC CONTACT
- THRUST FAULT
- TRACE OF FOLIATION

FIGURE 6

SCHEMATIC SECTIONS OF STRUCTURAL EVOLUTION:
CORONATION ZONE & 'LENORA-TYEE' HORIZON



LEGEND

- KARMUTSEN GABBRO
- V.M.S.
- EXHALATIVE HORIZON ('LENORA-TYEE' HORIZON)
- FEEDER ZONE
- FELSIC SEQUENCE
- ANDESITIC SEQUENCE

MINNOVA Inc.	
LARA PROJECT	
FIGURES 4&6	
SCALE:	
N.T.S.	MAP:
DRAWN BY: J.K.G.	
DATE: MAY, 1989	


SOUTH
NORTH
DDH-89-231
DDH-87-193
DDH-87-205
DDH-87-208
DDH-87-210
750 m
650 m
550 m
450 m
350 m
250 m
150 m
100+50 N
101+50 N
102+50 N
103+50 N
104+50 N
105+50 N
106+50 N
107+50 N
FS
AS
FP
FAT
Phb
CORONATION ZONE
SOUTHERN RHYOLITE FAULT
Major shear zone
Fault zone
sheared argillite
argillite
shear
gouge
Massive pyrite
Purple fragments
Foliated mafic dyke
F2 fold hinge
F2 folds
Chert fragments
arg. ash tuff
STRUCTURALLY NORTH FACING
Possible early mafic dyke
OVERTURNED LIMITS OF F1 ANTICLINE ?
FULFORD FAULT
NANAIMO GROUP
LEGEND
FELSIC SEQUENCE (FS)
UNDIVIDED FELSIC CRYSTAL, LITHIC AND LAPILLI TUFFS
FAT FELSIC ASH TUFF
ARGILLITE
CHERT
PYRITIC ZONES: GEOCHEMICALLY ANOMALOUS BASE METALS AND/OR BARITE (LENORA-TYEE HORIZON)
MEDIUM/COARSE GRAINED QUARTZ-FELDSPAR PORPHYRY; INCLUDES FELSIC DYKES
CORONATION ZONE
"STRINGER" MINERALIZATION
MASSIVE TO SEMI-MASSIVE SULPHIDE
ANDESITE SEQUENCE (AS)
UNDIVIDED ANDESITIC CRYSTAL, LITHIC AND LAPILLI TUFFS MODERATE TO WELL FOLIATED
MASSIVE TO WEAKLY FOLIATED ANDESITIC FELDSPAR CRYSTAL TUFF; FELDSPARS GENERALLY EPIDOTISED
Phb HORBLENDE PORPHYRY
MASSIVE GABBRO
FOLIATED MAFIC DYKE
SYMBOLS
LITHOLOGIC CONTACT
MAJOR THRUST FAULT, SHOWING SENSE OF DISPLACEMENT
SPLAYS AND IMBRICATE THRUST FAULTS, PROBABLY WITH MINOR DISPLACEMENT
TRACE OF FOLIATION (S1)
BRITTLE FAULT WITH GOUGE AND RANDOMLY ORIENTED FAULT BRECCIA
CORE ANGLE TO BEDDING (S0)
CORE ANGLE TO FOLIATION (S1)
CORE ANGLE TO THRUST FAULT; SHOWING SENSE OF DISPLACEMENT
SEDIMENTARY TOPS
MINNOVA Inc.
LARA PROJECT
STRUCTURAL CROSS SECTION
SECTION 102+00W
AZIMUTH 208°
LOOKING WEST
10 0 20 40 60 80 100
SCALE: 1:1000 metres
N.T.S.
DRAWN BY: J.K.G.
DATE: MAY, 1989
MAP:
5
inches
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.