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Geology of the Vangorda Pb-Zn-Ag deposit.

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Report 3

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Contents

Introduction

This is the third report dealing with the geology of the Vangorda Pb-Zn-Ag deposit and progress of the Ph.D. research programme into its structure, metamorphism, and genesis. The research programme began during the summer of 1990 and, to date, approximately seven months of field work, and one year of university-based research have been carried out. Fieldwork has involved structural analysis, and textural/mineralogical investigation of the Vangorda open pit mine during its development, and logging of diamond drill core. Follow-up analysis, sample preparation, map and cross section construction, and microscopy have been carried out at the University of London.

Field research emphasis as been placed on detailed (1 : 200 scale) structural analysis of the developing open pit mine from which 1 : 500 scale maps of the pit have been constructed. A map of the open pit (to September, 1991) is enclosed. Detailed (1 : 100 scale) logging was carried out on approximately 3200 meters of Vangorda drill core. Emphasis of the logging was placed on examination of mesoscopic structures, mineral assemblages and textures, and their relationship to the larger-scale structure. Using this information, together with drill log data from Curragh Resources, three parallel 1 : 250 scale cross sections have been constructed. Three cross sections (8 + 00E, 6 + 00E, and 4 + 00E) are enclosed with this report. Preliminary results of field work have been published in the Geological Survey of Canada's *Current Research* (see below).

Sampling of drill core was done and approximately 300 specimens were taken. From these 120 polished blocks and 20 thin sections have been prepared for reflecting and transmitted light microscopy, respectively, and others are in preparation. Microscopy has been carried out on these samples and SEM element mapping analysis done on selected samples. From these, selected massive pyrite samples were etched in NHO_3 and the deformation textures and deformation mechanism in pyrite were documented.

As well as drill core sampling, larger samples were collected for mesoscopic structural and textural examination. These were slabbed, polished, and photographed, and analysis of structures and textures carried out.

Preliminary results of the microstructural and mesostructural analysis were given in an earlier report (see below). As well, results of the textural and deformation mechanism study of pyrite were presented at the Mineralogical Society of Great Britain and Ireland annual winter conference in Cardiff, December 16th - 18th , 1991. A manuscript based on this presentation is now in review with Mineralogical Magazine.

All cross section, long section, and plan view sections of the deposit from Curragh Resources computer data are being changed into AutoCAD files for future analysis. All Pb, Zn, Ag, Au, Ba, and Fe assay data for the deposit will be used to map the 3D element distribution in the deposit.

Publications, Seminars, and Reports

BROWN, D., & MCCLAY, K.R. 1992. Structure of the Vangorda Pb-Zn-Ag deposit, Anvil Range, Yukon. *In* Current Research, Geological Survey of Canada, Paper 92-1a, p.121-128.

BROWN, D., & MCCLAY, K.R. (1991). Deformation textures in pyrite; an example from the Vangorda Pb-Zn-Ag deposit, Yukon, Canada. Mineralogical Society of England and Ireland, Annual Meeting, Programme with Abstracts, p.51-52.

BROWN, D., & MCCLAY, K.R. (in review). Deformation textures in pyrite from the Vangorda Pb-Zn-Ag deposit, Yukon, Canada. Mineralogical Magazine.

BROWN, D., & MCCLAY, K.R. Deformation textures in pyrite; an example from the Vangorda Pb-Zn-Ag deposit, Yukon, Canada. Mineralogical Society of England and Ireland, Metamorphic Studies Group annual meeting, Special Session on Deformation and Metamorphism of Sulphides. Cardiff, December 18, 1991.

BROWN, D. (1991) Mesoscopic and microscopic structure of the Vangorda Pb-Zn-Ag deposit, Yukon, Canada. Report submitted to Curragh Resources.

BROWN, D. (1990). Structural analysis of the Vangorda open pit mine, Anvil Pb-Zn-Ag District, Faro, Yukon. Report submitted to Curragh Resources.

Proposed Future Field Work

A third three month field season is planned for the summer of 1992. The main focus of this field season will be on continued mapping of the deposit as it is developed as an open pit mine. In addition, detailed drill core logging and sampling will be continued. A small, regional mapping project of the Anvil District is also planned. This summers field work will be carried out in conjunction with Curragh Resources, Geological Survey of Canada, and Department of Indian Affairs and Northern Development.

GEOLOGY OF THE VANGORDA DEPOSIT

Regional Geology

The Vangorda Pb-Zn-Ag deposit, Anvil district, Yukon Territory, is a polydeformed, polymetamorphosed SEDEX-type massive sulphide orebody hosted by Cambro-Ordovician phyllites that have been intruded by mid-Cretaceous granitoid rocks of the Anvil Plutonic Suite (Jennings and Jilson, 1986; Pigage and Anderson, 1985). The Anvil District is located on the southwestern flank of the Anvil Batholith adjacent to a major orogen-scale dextral strike-slip fault of the western Canadian Cordillera, the Tintina Fault (Fig. 1).

Five deformation events have been recognised in the Anvil District, the first two of which (D_1 and D_2) are regionally significant (Jennings and Jilson, 1986). D_1 is interpreted to be related to northeast-directed folding, thrusting, and nappe emplacement during the pre- to mid-Cretaceous docking of allochthonous terranes from the southwest onto the ancestral margin of North America. D_1 deformation resulted in the development of northeast-verging F_1 folds and a penetrative regional foliation (S_1), and regional metamorphism. The D_2 tectonic setting appears to be similar to that of a metamorphic core complex and is related to emplacement, uplift, and unroofing of the Anvil Batholith. D_2 resulted in southwest-directed folding, development of a shallowly southwest-dipping, penetrative foliation (S_2), and greenschist to amphibolite facies metamorphism (Jennings and Jilson, 1986; Smith and Erdmer, 1989). Brittle to ductile extensional faulting, related to unroofing of the Anvil Batholith, is late- to post-D_2 folding (Pigage and Jilson, 1985; Brown and McClay, 1992). The D_3 to D_5 deformation events produced minor folding and steeply dipping crenulation foliations that variably overprint the D_1 and D_2 structural elements.

Lithostratigraphy

The lithostratigraphy of the Anvil District consists of up to 5 km of polydeformed, late Precambrian to upper Paleozoic metasedimentry and metavolcanic rocks intruded by Cretaceous granites (Fig. 2). Within this package two lithostratigraphic units are of importance to this report These are, the lower non-calcareous, Mt. Mye formation and the overlying calcareous, moderately carbonaceous Vangorda formation. In the vicinity of the Vangorda deposit these rocks are typically chlorite-muscovite phyllites that, in the case of the Vangorda formation, contain variable amounts of calcite and/or dolomite. The Anvil District deposits straddle the boundary between the Mt. Mye and the Vangorda formations, or occur up to 150 metres below the stratigraphic contact between the two. All ore rocks in the area are

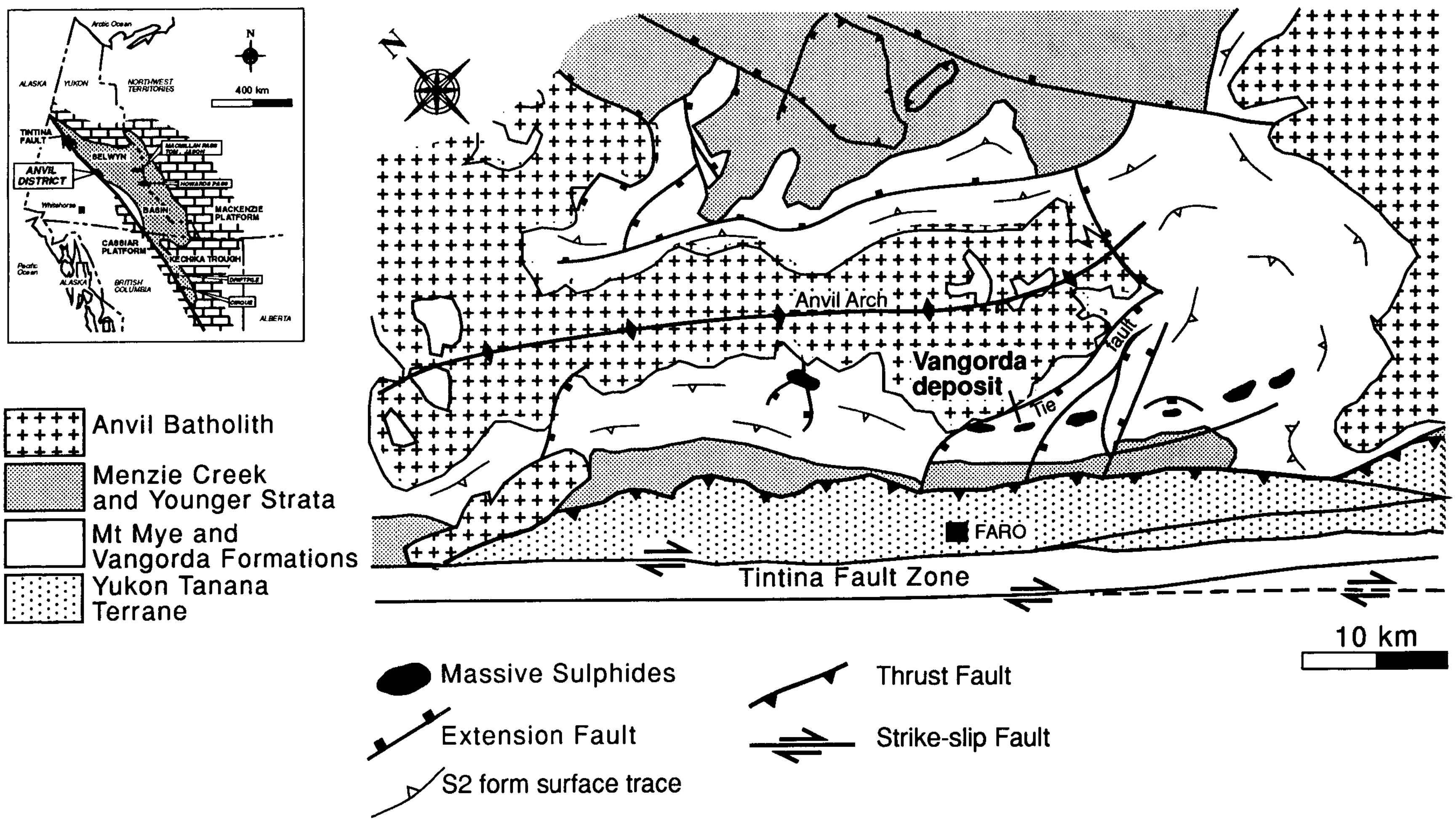

Fig.1. Generalised geological map of the Anvil District

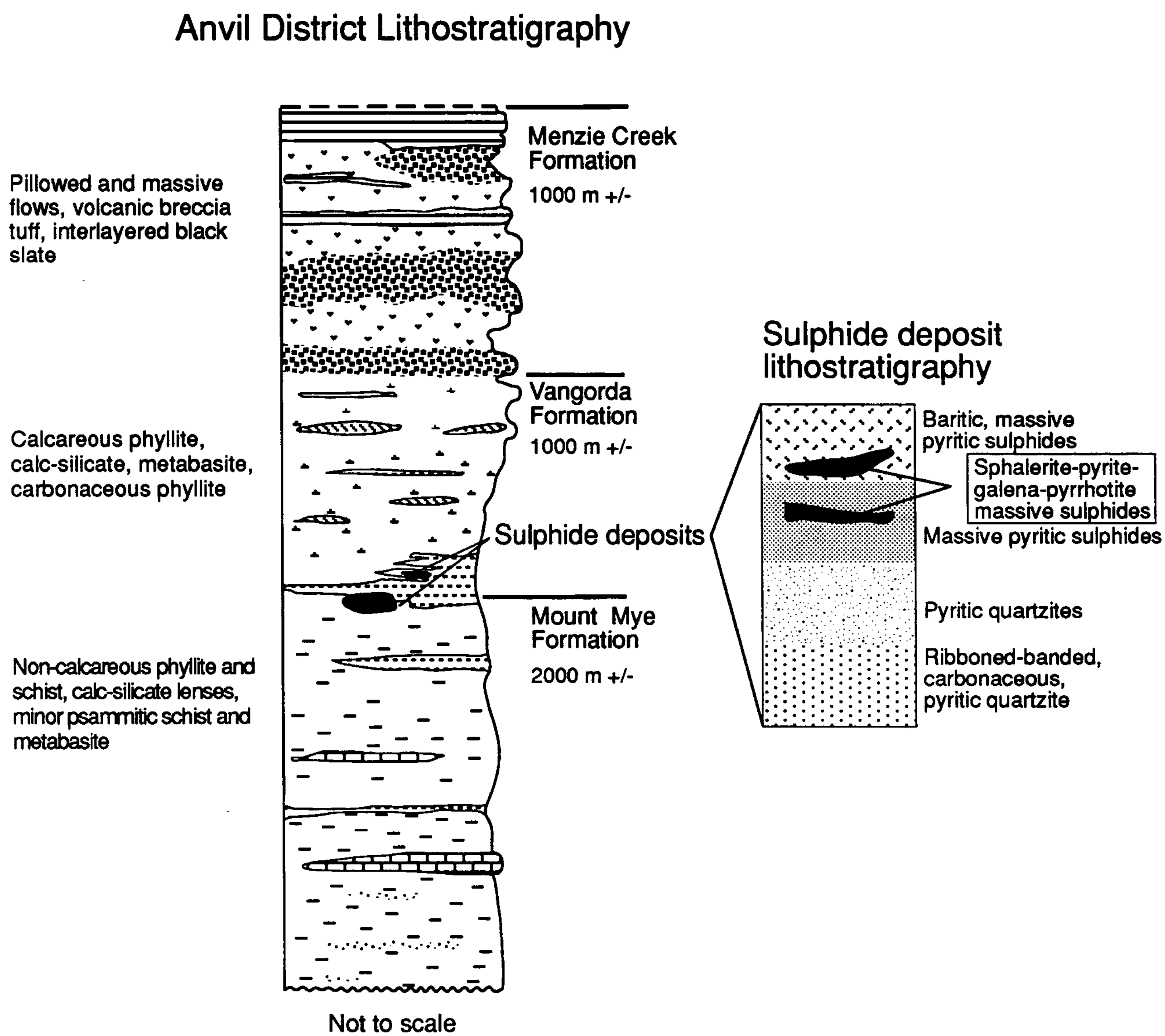

Fig. 2. Lithostratigraphic column of the Anvil District with the generalised lithostratigraphic sequence of the Vangorda deposit.

part of the Anvil Cycle as defined by Jennings *et al.* (1980) and Jennings and Jilson (1986), who recognised a number of sulphide lithofacies in the Anvil Cycle that are common to all the deposits in the Anvil District.

The Vangorda Deposit

The Vangorda deposit lies immediately below the base of the Vangorda formation, completely within the Mt. Mye phyllites. The orebody plunges shallowly towards the northwest and is interpreted to be structurally located in the hinge to overturned limb of a regional-scale F_2 fold (Jennings and Jilson, 1986; Pigage, 1990). Syn- to post- D_2, northwest-southeast-dipping extensional faults truncate the deposit (Pigage, 1990; Brown and McClay, 1992).

Ore lithofacies

The deposit appears to consist of a number of sulphide lenses of varying thickness (see enclosed cross sections) and bulk sulphide composition that are typically accompanied by a phyllitic, muscovite-chlorite alteration zone that grades into the ore lithofacies. Ore lithofacies are interbanded on a scale of centimetres to metres and commonly display a complete gradation from one to another. The salient features of each ore lithofacies in the Vangorda deposit (Brown and McClay, 1992; in review) are outlined below.

Ribboned-banded, carbonaceous, pyritic quartzite: these are well banded, sulphide-bearing quartzite, with lesser sphalerite and galena. Bands are on a millimetre- to centimetre-scale and consist of quartz-sulphides and carbonaceous, phyllitic quartzites. In areas where F_2 folding occurs, S_1 is typically preserved in millimetre- to centimetre-scale lithons. Detailed mapping and drill core logging shows that this lithofacies may occur alone or be absent from the previously defined Anvil Cycle.

Pyritic quartzite: consists predominantly of quartz with up to 40% pyrite and minor sphalerite and galena. These rocks are moderately to poorly banded with, locally, a well developed micaceous (muscovite) foliation. Sulphides are typically fine to medium grained (0.1mm - 0.5mm) , with local coarse grained patches. Commonly the pyritic quartzites display a 'mottled' texture in which sulphides and quartz occur in discontinuous, random, shapeless segregations. Galena, and less commonly sphalerite, may occur in coarse-grained patches.

Massive pyritic sulphides: these are typically massive pyrite with lesser sphalerite, galena, pyrrhotite, and minor magnetite. Quartz, barite, and carbonates are disseminated throughout or occur in aggregates. Total sulphide content varies from between 60% to close to 100%. Texturally the massive pyritic rocks are homogeneous to banded. Banding is developed on a scale of millimetres to centimetres as alternating thick bands of pyrite and thin bands of sphalerite + magnetite + galena. This lithofacies may be interbanded with the pyritic quartzites on a scale of centimetres to metres and often grades into it. A foliation, defined by chlorite + carbon occurs locally.

Baritic, massive pyritic sulphides: these consist predominantly of, well-banded barite with pyrite, sphalerite, galena, with minor magnetite. Quartz and carbonate are major matrix components. Clasts of pyrite and phyllite are common. Total barite content varies but may be has high as 50 %. Millimetre- to centimetre-scale interbanding of pyrite-rich and barite-rich layers is ubiquitous.

As well as the above lithofacies, whose distribution are believed to be relics of primary depositional ore types, there is another lithofacies that occurs in areas of high strain and is interpreted to be the result of metamorphic reactions and mobilisation during deformation (c.f. Brown and McClay, in review).

Pyrrhotite-sphalerite-pyrite-galena (breccia): this lithofacies is a variant of the pyritic quartzite in which the dominant sulphides are pyrrhotite and sphalerite with lesser pyrite, galena. Coarse patches of sphalerite or galena are common. Pyrite typically occurs as 0.1 to 1.5mm-sized porphyroblasts in a inhomogeneous, discontinuous foliation, or in isolated breccia clasts. This lithofacies is typically highly strained and often contain breccia clasts of other rock types around which a well developed foliation anastomoses. Tailed clasts and rolling structures are common.

Structure

Despite the interpreted structural position of the deposit in an overturned F_2 fold limb to hinge zone, the overall lithostratigraphy in this part of the deposit appears consist of a single, right way up, idealised Anvil Cycle. An extensional fault of unknown offset truncates the orebody to the northwest (the Northwest Fault), and in the southeast it also appears to be truncated by extensional faulting. The deposit is cut approximately in half by a northwest-dipping (?) extensional fault of unknown throw (the Cross Fault) which juxtaposes two fault blocks of marked structural and lithostratigraphic style. Northwest of the Cross Fault the deposit consists of a thick body of sulphides, whereas southeast of the Cross Fault it consists of a number of thin lenses of individual lithofacies or group of lithofacies interbanded with phyllite.

Regional metamorphic grade in the area decreases outward from the Anvil Batholith. Metamorphism in the Vangorda deposit, defined by a chlorite + muscovite assemblage in phyllites, is lower-greenschist facies. Locally, biotite-chlorite intergrowths are found and biotite commonly forms rims on chlorite porphyroblasts. The chlorite + muscovite (and biotite) assemblage defines the S_1 foliation. There is very little evidence, to date, to suggest that any significant new mineral growth occurred during the D_2 event. D_2 fabrics in phyllites are defined by transposed chlorite/muscovite porphyroblasts, and by carbon (graphite ?). However, this study has not yet concentrated on the metamorphic signature within the deposit.

The following structural analysis of the Vangorda deposit open pit is based on 1 : 200 scale mapping of pit walls between cross sections 12 + 00E and 32 + 00E, and from the 1116 bench to the 1152 bench. A 1 : 500 scale geological map of this area is enclosed with this report.

The open pit is elongate in a northwest-southeast orientation, with phyllites dominating in the southeast to south. The exposed deposit can be broadly divided into three fault blocks, separated by extensional fault zones (Fig. 3). There is very little difference in internal structure within these fault blocks (stereoplots of structural elements from each fault block are given in Appendix 1), with the exception of the occurrence of thrust faults in phyllites in the southeast corner of the pit, and the structural style of the deposit will therefore be discussed as a whole.

All rocks in the Vangorda deposit have been penetratively deformed by the D_1 and D_2 deformation events, making definition of any primary depositional features on a scale other than microscopic ambiguous at best. However, the macro-scale ore rock lithostratigraphic sequence presented in figure 2 may be a relic primary feature. In most lithofacies in the deposit, banding is well developed on a scale of millimetres to centimetres. This banding is commonly folded by south- to southwest-verging folds accepted to be F_2 and is therefore taken to be a D_1 feature (i.e. S_1). Throughout the deposit, S_1 is commonly preserved as lithons in the hinges of F_2 folds in phyllites and the ribbon banded, carbonaceous quartzite. In the more sulphide-rich lithofacies, however, S_1 is shallowly northwest through to southwest-dipping (Fig.4), and is typically transposed into subparallelism with the F_2 axial surface. S_1 is used throughout this report as the datum marker for referencing relative ages of structural elements in the Vangorda deposit.

Positive identification of F_1 folds in the Vangorda deposit has not been made previously due to penetrative overprinting by F_2. However, this study has identified several of a number of thin lenses of individual lithofacies or group of lithofacies interbanded with phyllite.

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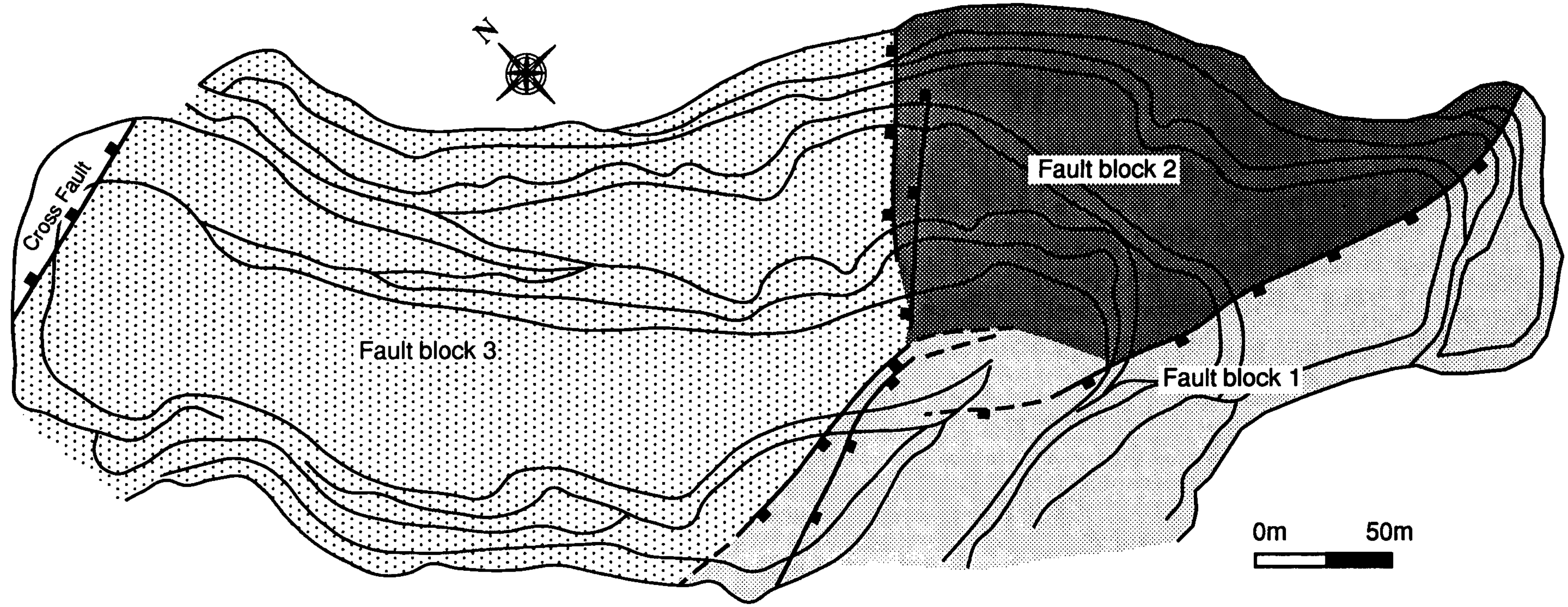

Fig.3 . Sketch map of the Vangorda deposit showing the location of individual fault blocks and the bounding fault zones. For orientation data of structural elements within each fault block see Appendix 1.

examples of refolded folds in drill core and in pit wall exposures, suggesting that F_1 folding may play an important, but as yet undeterminable, role in the present geometry of the deposit. The widespread presence of S_1 in the ore lithofacies and surrounding phyllites, and the evidence for F_1 folding in rocks in close proximity to the deposit (see Jennings and Jilson, 1986, figure 21) also point to the relative importance of F_1 folding.

The dominant fold phase in the Vangorda deposit is F_2. F_2 folds are typically east-west- to northwest-southeast-plunging (Fig. 4), tight to isoclinal (interlimb angle is commonly between 5 to 25 degrees) similar folds. F_2 antiforms and synforms with wave lengths of approximately 10 metres can be mapped in the sulphide lithofacies in the southeast end of the pit. However, large-scale folds aren't easily recognised because of the lensoidal nature of lithofacies involved, and post-F_2 extensional faulting. F_2 fold morphology changes somewhat between different lithofacies as a result of relative competency and ductility contrasts between them, but in general the similar style is maintained. However, in areas where competency contrast is high, F_2 folds become disharmonic and are often non-cylindrical.

There is, to date, very little evidence for the relationship between F_1 and F_2 folds in the Vangorda deposit, but the rare occurrence of refolded folds indicate that the style of overprinting is the same as that recorded regionally, that is type 3 of Ramsay (1967).

In the surrounding phyllites, a penetrative, wavy F_2 axial planar foliation (S_2) is developed. S_2 dips predominantly towards the southwest but is typically shallow and wavy and may dip in any direction (Fig. 4). In some sulphide lithofacies, such as the ribboned-banded, carbonaceous quartzite, a differentiated axial planar S_2 foliation is well developed. However, S_2 appears to be non-penetrative in the sulphides and is found only rarely in fold hinges. In general, the S_1 banding is transposed into subparallelism with the S_2 orientation, and may be easily mistaken for S_2. In high strain zones, shearing has disrupted the S_1 banding and a new, inhomogeneous foliation is developed parallel to S_2.

Locally, steeply south- to southwest-plunging to subvertical, open folds fold the S_2 foliation and tighten F_2 folds. These folds are here termed F_3. F_3 folds are of minor importance and there is only a minor crenulation foliation associated with them.

The Vangorda deposit is very strongly faulted by moderately to steeply northwest- to southeast-dipping (Fig. 5a) brittle extensional faults (see map) that, together with F_2 folding, provide the dominant control on the present geometry of the orebody. Pyrite slickensides on polished fault surfaces are typically subhorizontal or have a shallow pitch angle, indicating a final phase of stike-slip to oblique-slip movement (Fig. 5b). All extensional faults examined in the open pit truncate the S_2 foliation and F_2 folds and therefore clearly post-date or are late D_2.

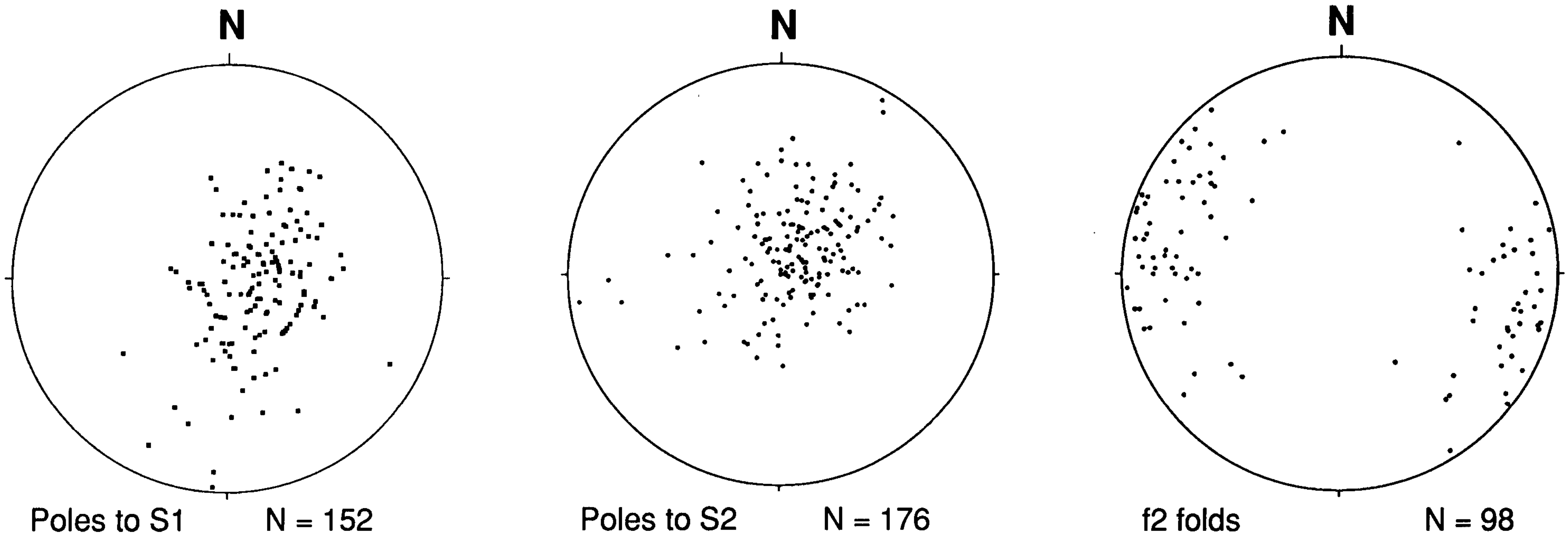

Fig. 4 .Stereoplot data of structural elements in the Vangorda deposit. All data have been combined in this figure. For a breakdown of data to individual fault blocks, see Appendix 1.

Extensional faults range in scale from millimetres to several meters in structural thickness and have an offset of centimetres to metres (see enclosed map). Due to paucity of marker horizons it is often impossible to determine the exact amount of offset on any one fault. However, faults have been divided into those with greater than one metre apparent offset and those with less than one metre apparent offset.

Major extensional faults (faults with > 1m offset) in the deposit commonly consist of segmented and overlapping fault that form fault zones. Locally graben and half-graben type structures are developed (Fig. 6). Minor faults (faults with < 1m offset) form synthetically and antithetically to the major faults.

Extensional faults in the deposit are typically gouge zones consisting of phyllosilicates and/or sulphide-quartz sand and/or breccias, or are zones of intense fracturing. Breccias contain angular clasts of phyllite and sulphides ranging in size from several millimetres up to several centimetres. Locally, breccias are cemented by a matrix of quartz and calcite and, in some instances, by pyrite.

Another type of fault common in the sulphide rocks are characterised by tectonic mixing of angular to rounded clasts of brecciated quartz, phyllite, and sulphides in a well foliated pyrrhotite-rich or, often, sphalerite and galena-rich matrix. These faults occur within the sulphide lithofacies (but have been found in phyllites), along the limbs of the major fold structure, and range in size from several millimetres up to several metres thick (see enclosed cross sections). The boundaries of these faults are commonly diffuse and marked by an increase in pyrrhotite content or, in many cases, very sharp and contain breccia clasts in a matrix of pyrrhotite and sphalerite. Clasts are often tailed or rotated (c.f. Brown and McClay, 1992, fig. 5b), and in some cases are internally folded, with the foliation flowing around them. Late (?) porphyroblasts of pyrite are common in the matrix and in sulphide clasts. Along the boundaries of small shear zones with sharp boundaries there is a marked increase in pyrite grain size. In several instances banding within these shear zones are clearly folded by F_2 folds. These shear zones appear to be the extremely high strain end-member of durchbewegung structure.

A number of low-angle, post-D_2, northeast-directed thrusts occur within phyllites in the southeast end of the deposit (see enclosed map). These thrusts cut the S_2 cleavage and have offsets ranging from centimetres up to several (tens?) of metres. To date, thrusts have been identified only in the phyllites.

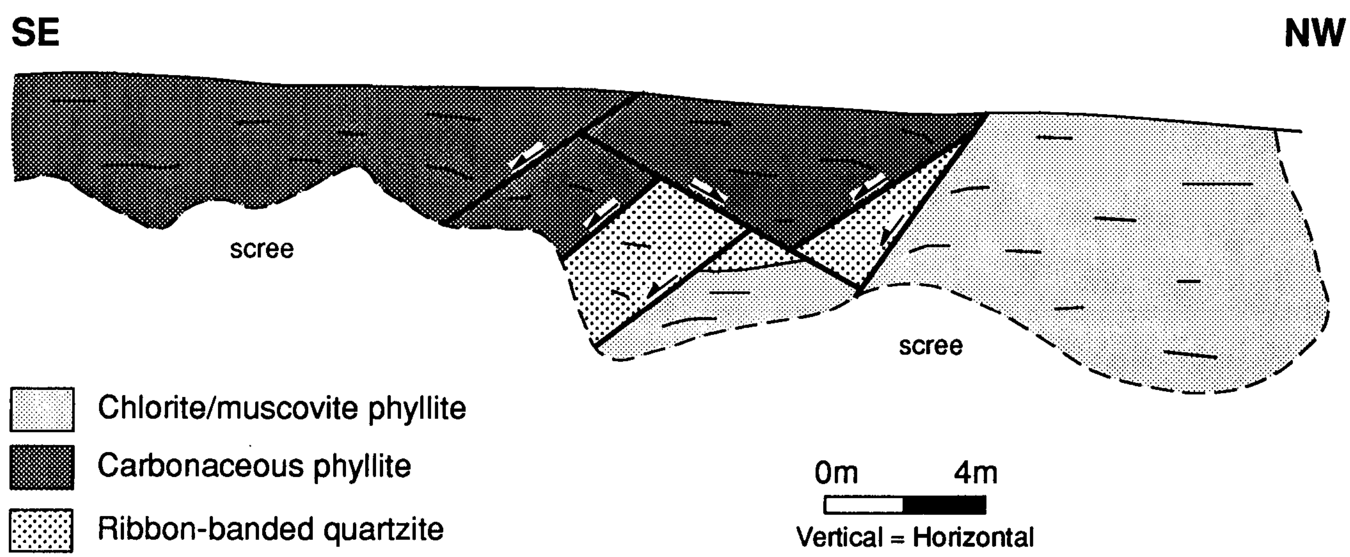

Fig. 6. Schematic pit face section showing the extensional fault style. 1116 Bench, looking southwest.

Cross sections

Three parallel cross sections have been constructed through the northwestern part of the deposit (8 + 00E, 6 + 00E, and 4 + 00E). These cross sections are a result of detailed (1 : 100 scale) logging of drill core and re-interpretation of existing Curragh Resources drill logs. These sections have not been constrained using data from the open pit because this part of the deposit was not being mined during the 1991 field season.

Cross sections were constructed using strip logs of drill core (see Fig. 7) that show the textural and structural elements in the core. Fold asymmetries were interpreted assuming a southwest-dipping S_2 foliation. However, open pit mapping has shown that S_2 is wavy and not always southwest-dipping (Fig. 3). Therefore a strong cautionary note must be given when these types of structures are interpreted in unoriented drill core such as that in the Vangorda deposit.

The overall distribution of ore lithofacies has not changed significantly from that of earlier cross section interpretations (c.f. Jennings and Jilson, 1986; Pigage, 1990; Brown and McClay, 1992). However, a significant number of new drill holes have been added to these sections during 1990, which accounts for changes in the position of some lithofacies boundaries. For the sake of simplicity all phyllites have been grouped into chlorite-muscovite phyllites of the Mt. Mye formation.

There is no evidence in drill core or in thin section to support the existence of a major fault truncating the deposit at its base, juxtaposing it against phyllites, as previously suggested. This contact is everywhere gradational, and marked by an increase in chlorite/muscovite content and concomitant decrease in quartz and sulphide content, together with development of a penetrative S_2 foliation. However, other previously interpreted faults in these sections have strikingly similar positions and orientation to the shear zones given in the present interpretation. The interpretation presented in this report reflects the tight, similar fold style that has been mapped in open pit exposures to the southeast.

The cross sections show the overall morphology of the deposit to be a southwest-verging, west- to northwest-plunging, tight F_2 fold, cored by phyllites. The dominant mesoscale fold asymmetry is S in the upper limb, with M asymmetries, or rapidly alternating S and Z asymmetries, occurring in the fold core. A package of baritic massive sulphides occurs above massive pyritic sulphides, that in turn overlie pyritic quartzite. Ribbon-banded, pyritic quartzite also appears in the core of the fold and, in sections 6 +00E and 4 + 00E it occurs in

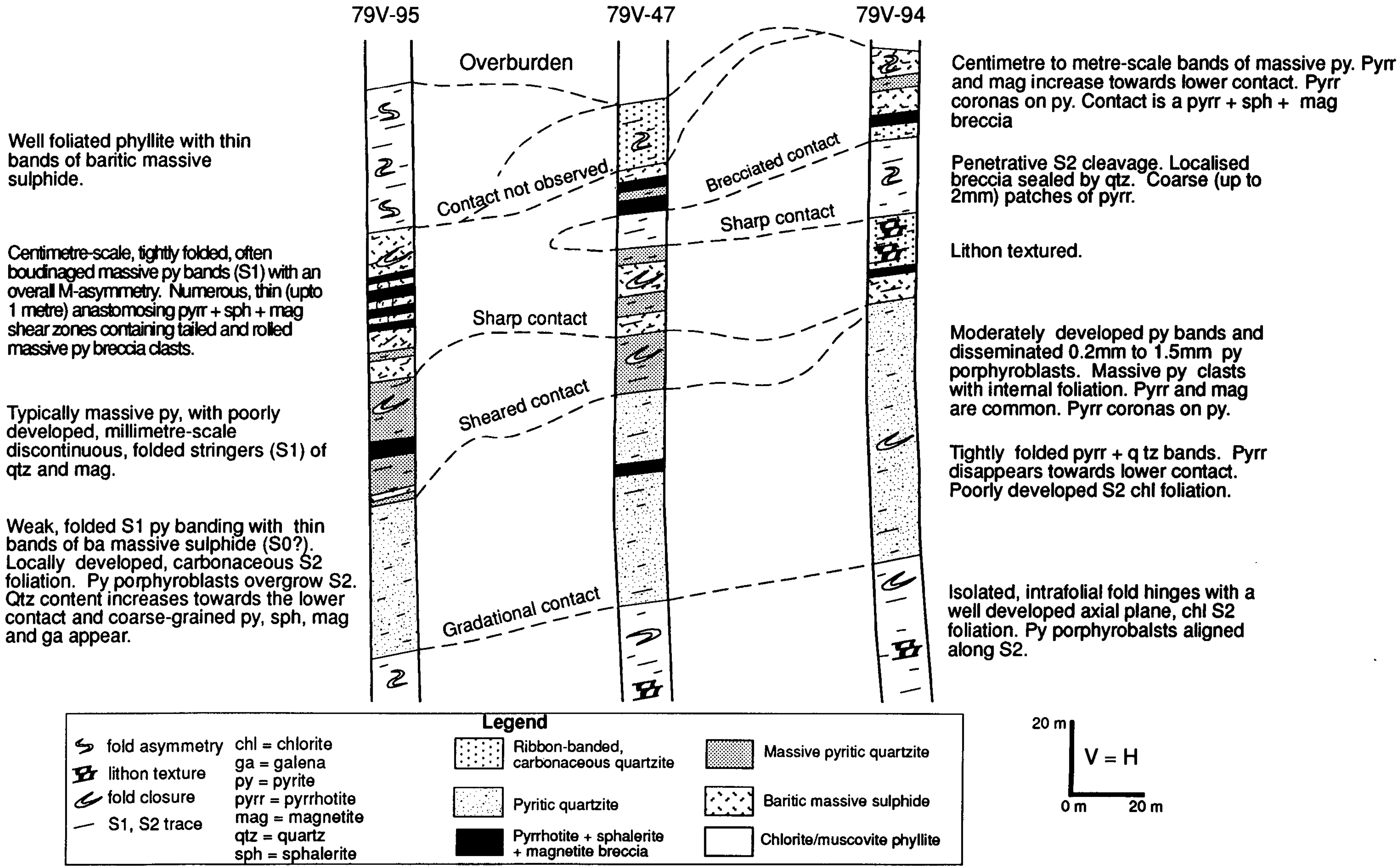

Fig. 7. Strip log of selected diamond drill holes through section 6 + 00E giving an example of the textures, structural elements, and contact relationships. This is a much simplified example of the method used in cross section construction and interpretation.

the top limb of the fold structure. The sulphide lithofacies packages appear to thicken towards the northwest, from section 8 + 00E to 4 + 00E. Pyrrhotite, sphalerite, pyrite, galena (breccia) occurs as southwest dipping bands along the limbs of the fold and, to a lesser degree, in the hinge zone, parallel to its axial surface. Between sections 8 + 00E and 4 + 00E these form lens shaped zones that appear to thicken and thin laterally, likely being discontinuous between sections. Other lithofacies types are commonly incorporated into these bands.

Conclusions

This report illustrates some of the characteristics of the deformational style in the Vangorda deposit. The dominant fabric element found in the deposit is a penetratively developed banding and/or foliation, S_1, which can be used throughout the deposit as a datum marker to reference the relative ages of later structural elements.

S_1 is everywhere folded by tight to isoclinal, northwest-southeast- to east-west-plunging F_2 folds with, commonly, a class 2, similar, geometry. In host rocks and some sulphide lithofacies, S_1 is preserved as lithons in the hinge zones of F_2 folds, whereas in fold limbs S_1 has been transposed into parallelism with the F_2 axial surface (compare stereoplots of S_1 and S_2 in Fig. 3). S_2 is typically poorly, or not developed in the more massive pyritic rocks, but forms a wavy, penetrative foliation in the phyllites. The widespread occurrence of S_1 and the relative rarity of S_2 in the sulphides suggests that D_1 may have played an important role in the deformation and remobilisation of the orebody and may be responsible for some of the deformation textures in the sulphides. However, it is clear that the D_1 distribution of sulphide lithofacies is tightly folded by F_2 folds which, together with extensional faults, control the present structural geometry of the deposit.

The interference pattern between F_1 and F_2 folds has still not been rigorously defined within the Vangorda deposit. However, the examples discussed above indicate the refolding pattern is likely a type 3 (or hook structure), similar to that recorded regionally.

Extensional faults in the Vangorda deposit appear to post-date or are late D_2 and clearly offset earlier D_2 features such as S_2 and F_2 folds (Brown and McClay, 1992). These faults dip steeply towards the northwest or southeast. Major (< 1m offset) extensional faults are commonly segmented, and have both antithetic and synthetic, hangingwall and footwall minor faults associated with them. Graben-type structures are common. It is typically impossible to determine the exact amount of throw on these faults. However, major extensional faults in the open pit have offsets larger than one metre, and often several metres.

Determination of the amount of offset is further complicated by a final strike-slip to oblique-slip component of movement.

Shear zones defined by pyrrhotite, sphalerite, pyrite, and galena occur in areas of high bulk strain, along the limbs and hinge zone of the major fold structure. Although it is often difficult to recognise these as shear zones their remarkable down-dip and along strike continuity, often cutting across other lithofacies or occurring along lithofacies boundaries, provide strong evidence for this interpretation. Further evidenced is provided by the similar orientation and location of these shear zones as previously interpreted faults. A speculative mechanism for development of these shear zones involves reaction strain softening (pyrite > pyrrhotite) combined with increased pore fluid pressure. Clearly, more work is needed to resolve this.

Northeast-directed thrust faults occur in phyllites in the southeast part of the deposit. These are typically minor faults, but offset on the order of 10 metres has been observed. The structural association of the thrusts has not been determined, but they may be a result of thrust nucleation off bends in extensional fault planes.

The tight to isoclinal, similar fold style and complex internal deformation indicates that the Vangorda deposit has undergone significantly high strains. Strain partitioning has produced breccia zones and shear zones in part controlled by the sulphide and matrix rheologies. Shear zones in particular are localised in the baritic massive sulphide facies, commonly along the limbs of the large F_2 fold structure . Late brittle extensional faulting has truncated all previous fabrics.

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Appendix 1

Stereoplot data of structural elements within the three fault blocks shown in Figure 3. Fault data does not include measurement made on the major bounding faults. All stereoplots are equal area projections.

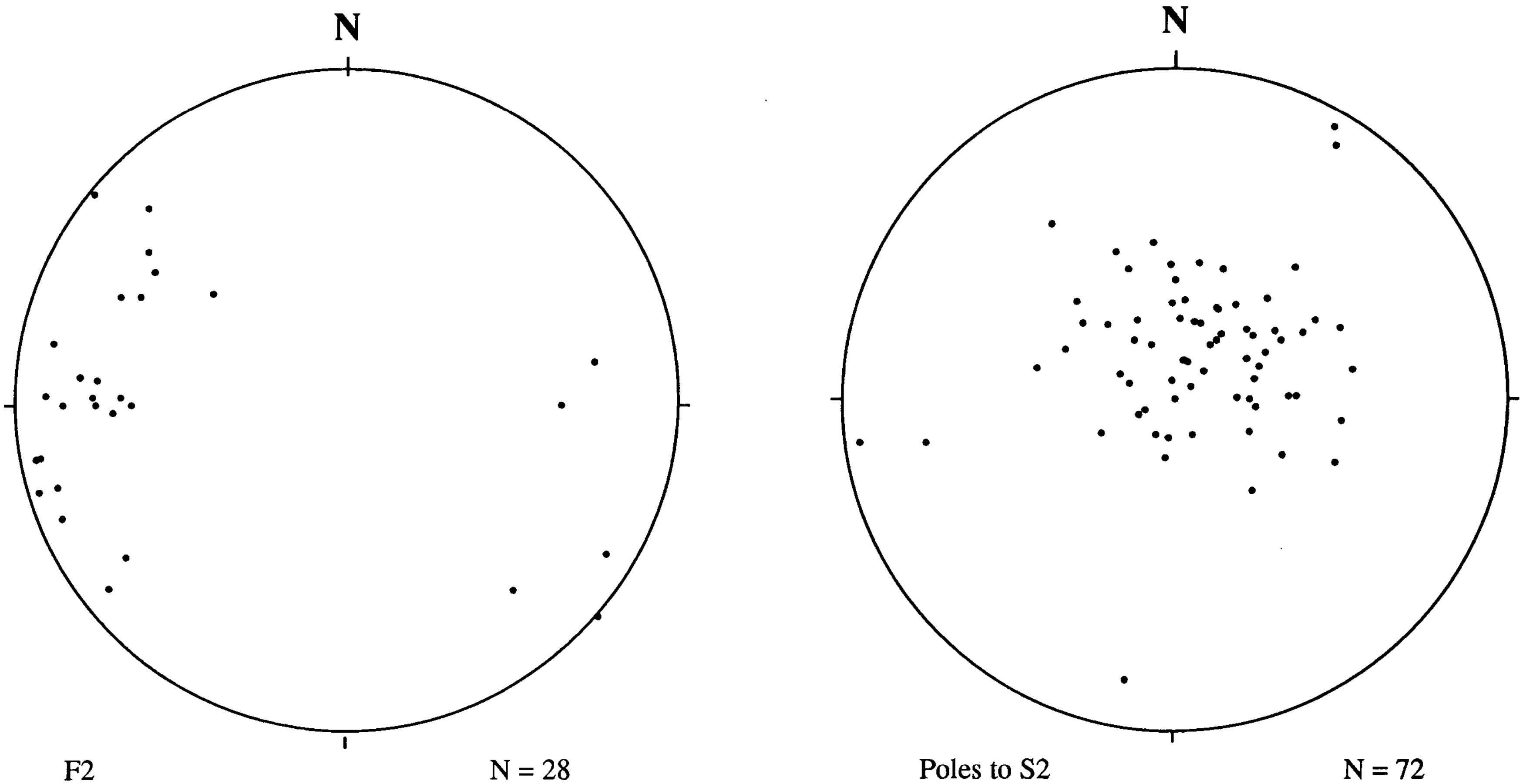


Fig. A.1. Stereoplot data of structural elements in fault block 1. See figure 3 for location.

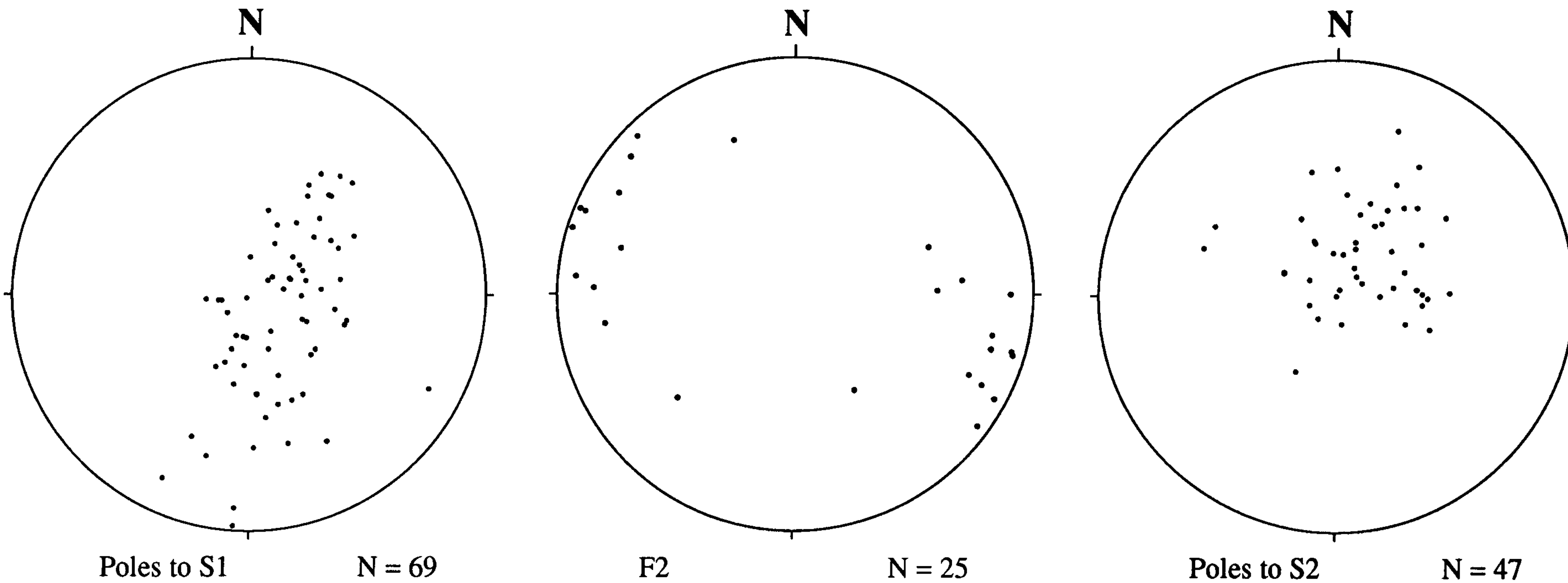


Fig. A.2. Stereoplot data for structural elements in fault block 2. See figure 3 for location.

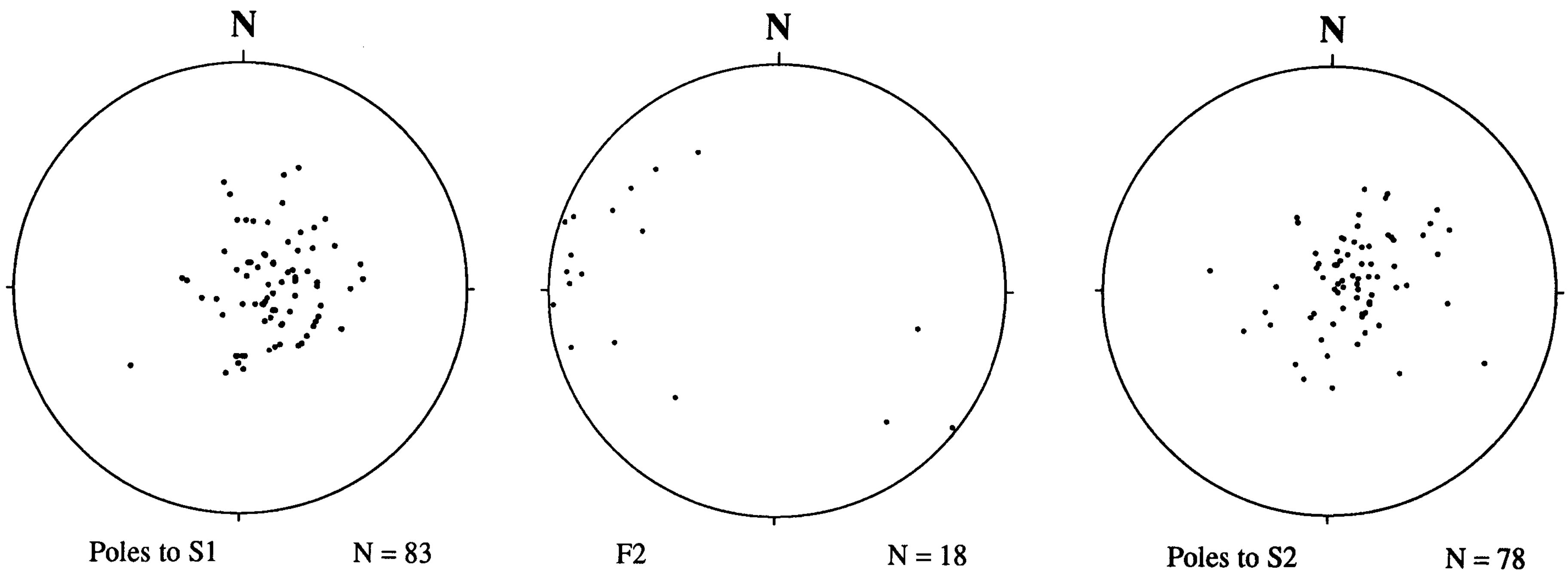
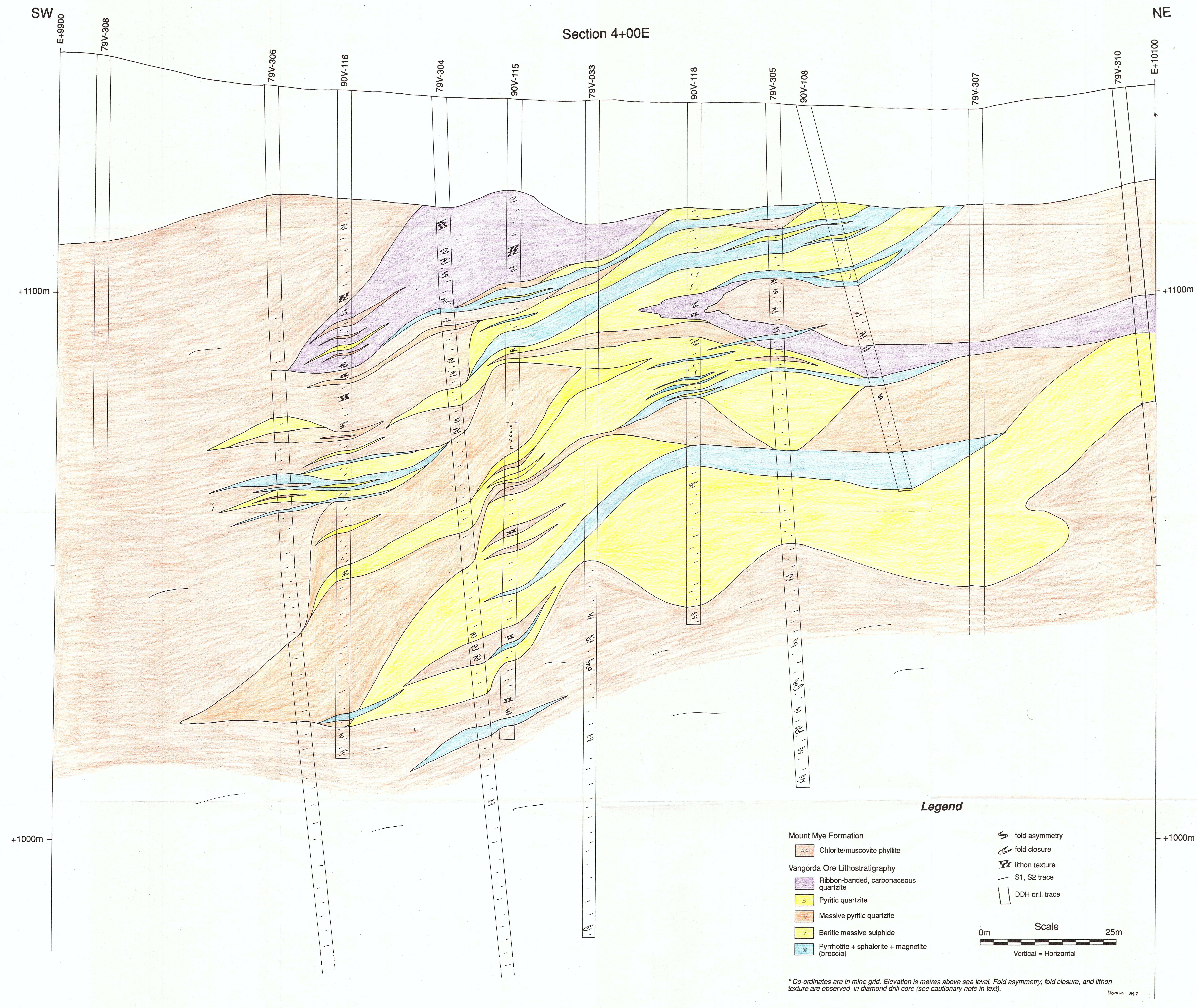
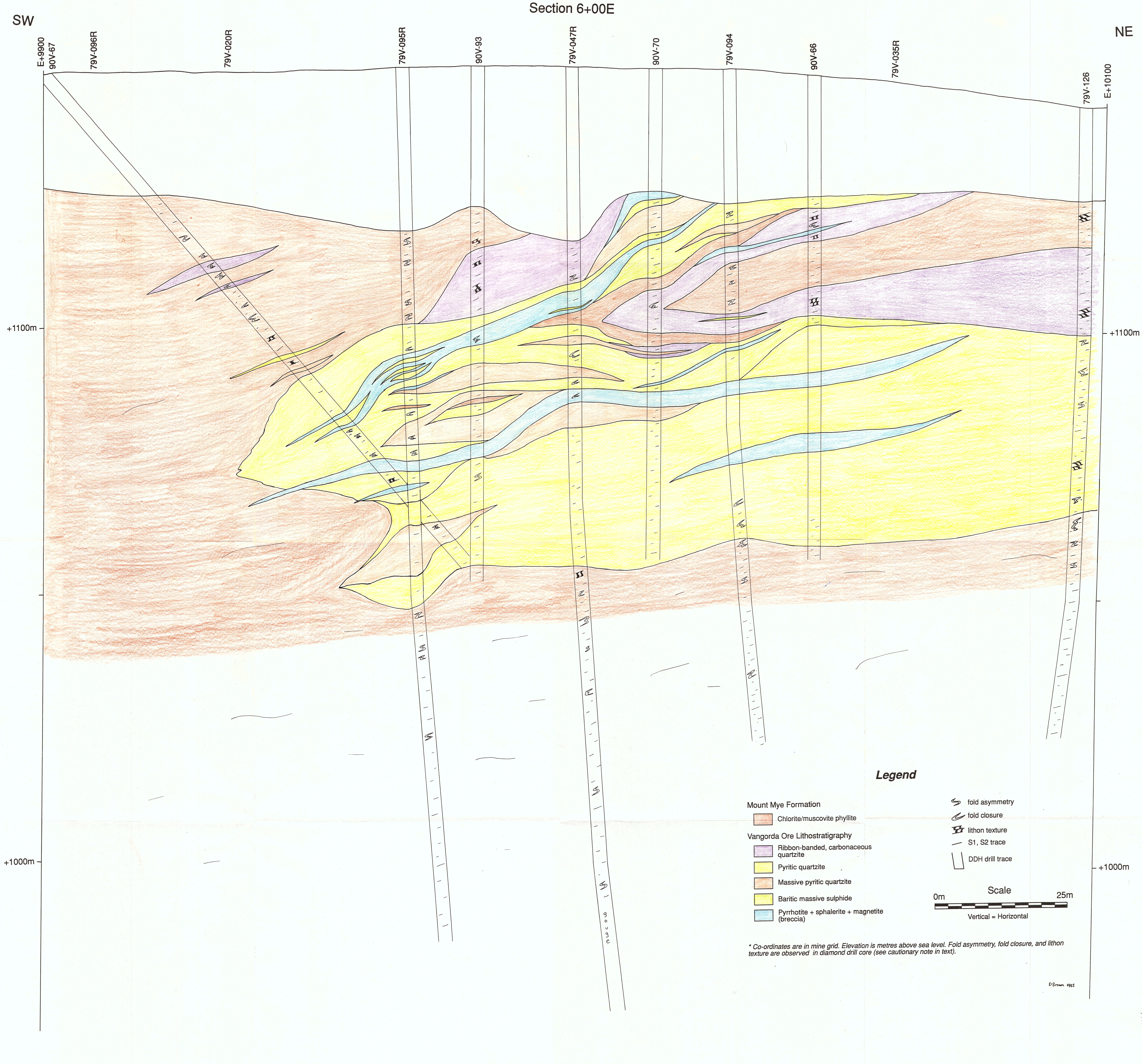


Fig. A.3. Stereoplot data for structural elements in fault block 3. See figure 3 for location.



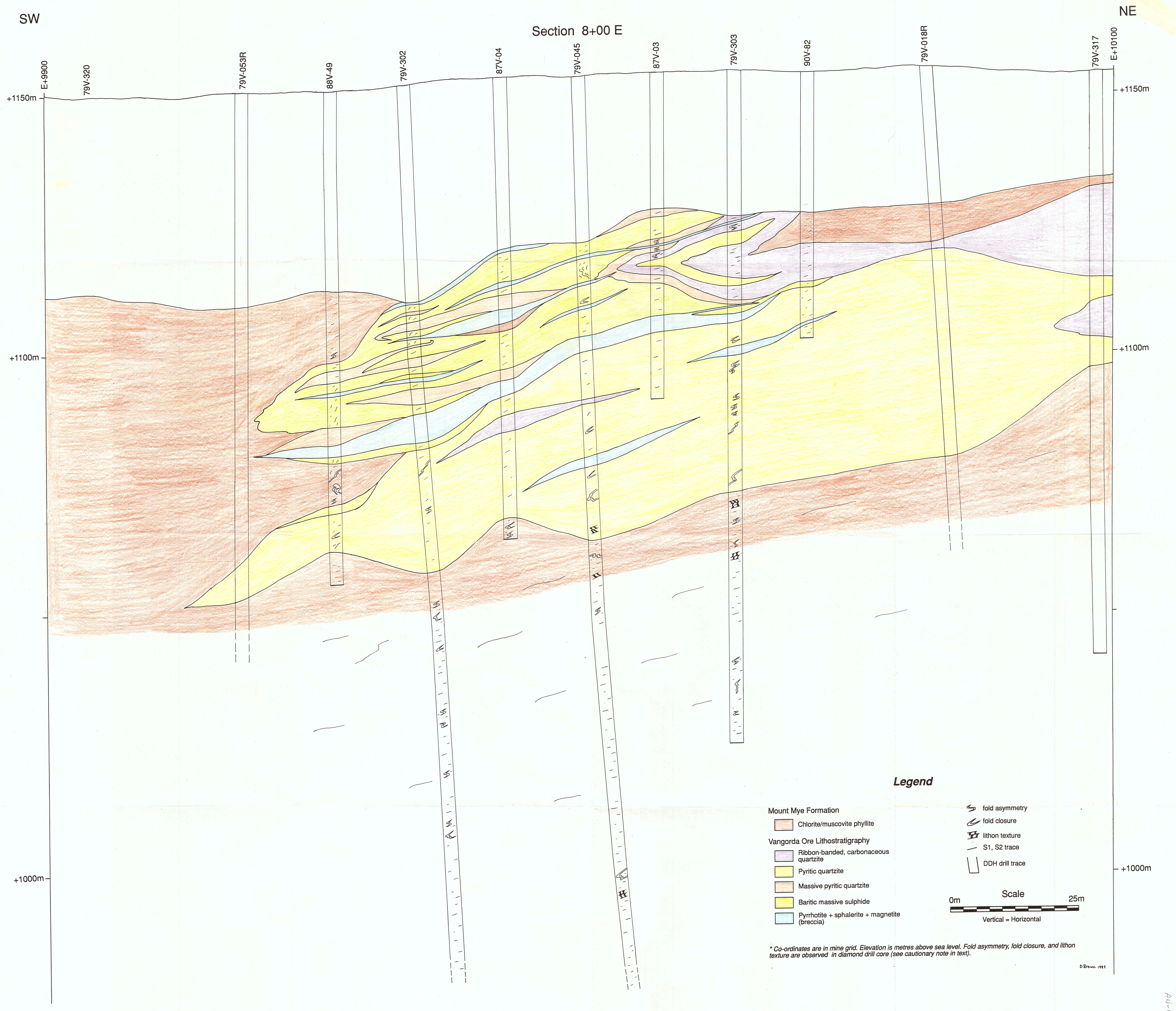
Section
4+00E
AN-VP-92-022

Section 6+00E



* *Co-ordinates are in mine grid. Elevation is metres above sea level. Fold asymmetry, fold closure, and lithon texture are observed in diamond drill core (see cautionary note in text).*

Section 6+00E
AN-VA 92-028



Section 8+00E
AU-VA-92-024


10000 E
9900 E
9800 E
9600 E
9400 E
10100 E
Cross Fault
no exposure
6902800.0 UTM N
594200.0 UTM E
6902600.0 UTM N
594400.0 UTM E
Legend
Mount Mye Formation
Chlorite/muscovite phyllite (carbonaceaous bands)
Vangorda Ore Lithostratigraphy
Ribbon-banded, carbonaceous quartzite
Pyritic quartzite
Massive pyritic quartzite
Baritic massive sulphide
Pyrrhotite + sphalerite + magnetite (breccia)
Foliation (S1, S2, S3)
Fold axis (F1, F2, F3)
S1, S2 trace (in pit wall)
Pyrite slickenside lineation
Fracture
Fracture trace (in pit wall)
Extensional Fault (> 1 m offset)
Extensional Fault (< 1 m offset)
Extensional Fault (in pit wall)
Thrust Fault (defined, assumed)
Thrust Fault (in pit wall)
Lithofacies boundary
Fold Asymmetry (in pit wall)
Fold Closure (in pit wall)
Lithon Texture (in pit wall)
Antiformal axis
Synformal axis
Scale
0m
50m
* Co-ordinates are in mine grid and UTM. Contour interval is 6 m bench toes.
N
Poles to S1 152 Data
Poles to S2 176 Data
f2 folds 98 Data
Poles to faults 108 Data
* All plots are Lambert equal area projections.