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FIELD MAPPING, CAPE SMITH BELT

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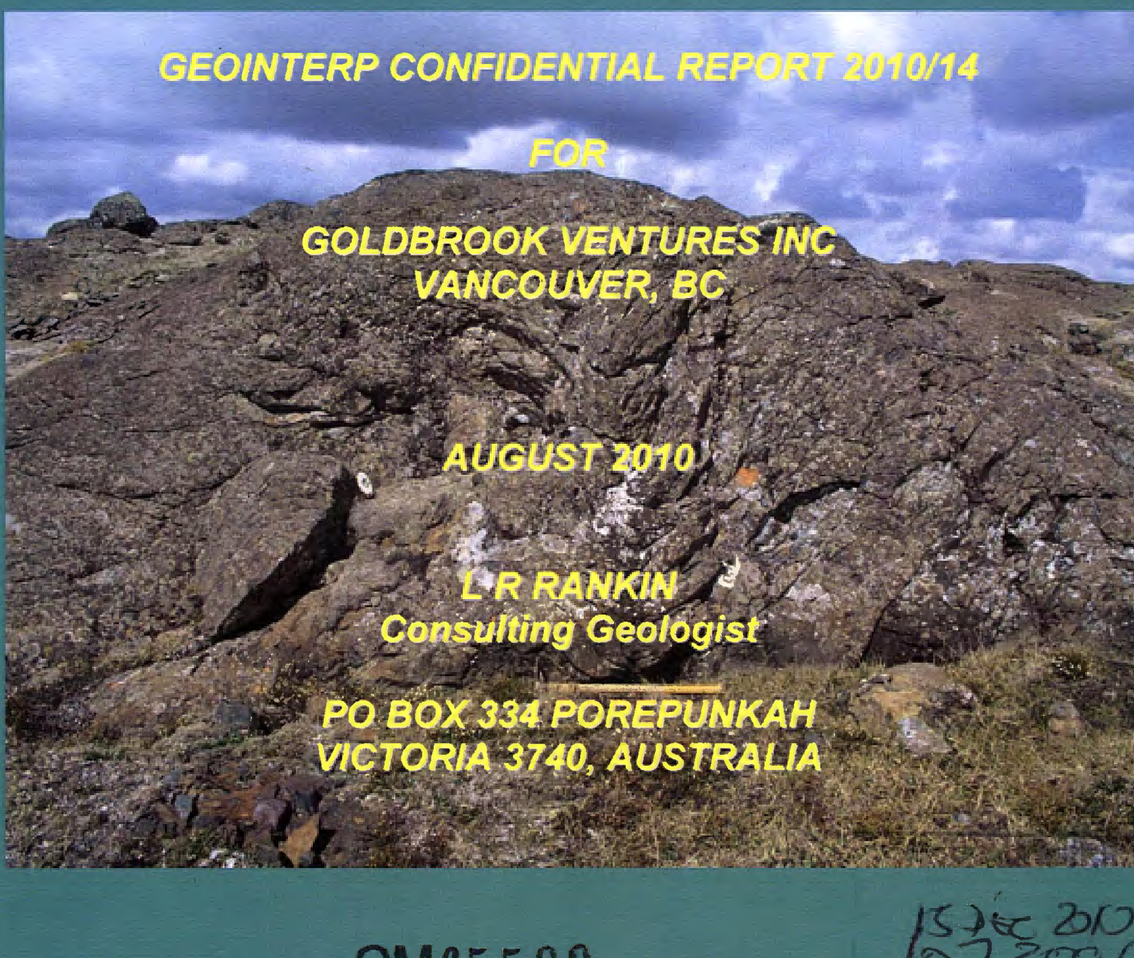
FIELD MAPPING – GOLDBROOK Ni PROJECT, CAPE SMITH BELT NORTHERN QUEBEC, CANADA



GEOINTERP CONFIDENTIAL REPORT 2010/14

FOR

GOLDBROOK VENTURES INC
VANCOUVER, BC

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The Consultant has compiled this report and accompanying maps from data supplied by Goldbrook Ventures Inc., and from field data collected by The Consultant. Whilst every effort has been made to carry out the work as diligently as possible, The Consultant accepts no responsibility for technical or business decisions arising from this report and accompanying data.

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August 2010

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1. EXECUTIVE SUMMARY

A series of both regional and detailed structural mapping traverses were undertaken within the Goldbrook Ventures Inc exploration tenements, across key sectors of the Cape Smith Belt hosting ultramafic sills. A series of geological maps and sections were compiled to highlight the structural framework of the various intrusive complexes.

Regional tectonic framework

The thrust belt geometry of the Cape Smith Belt (in particular the Chukotat / Raglan & Povugnituk Fm districts) is dominated by a 2-phase (at least) thrust history.

a) SSE-verging thrusting, forming an imbricate thrust stack of moderate to steeply-dipping thrust sheets; there is a quasi-regular spacing of 7-10kms between 1st order thrusts across the belt.
b) SSW-vergent thrusting; this juxtaposed the (higher metamorphic grade) Ireland – Borneo – Nancy thrust sheet against the earlier SSE-verging thrust sheets (including the Raglan trend).

Shallow - dipping to subhorizontal thrust sheets are common, and locally conceal the steeper imbricate thrust stacks. The timing of these thrusts is mixed – they probably formed during both primary thrust episodes.

The subtle ENE-trending zones of strike –limited and mineralised intrusives in the Ungava district represent sills within the steeper imbricate thrust sheets, exposed in erosional windows within the overlying shallow thrust sheets.

Field relationships and deformational fabrics within the sills show no evidence for multiple intrusive emplacement of ultramafic sills; all of the ultramafic units mapped to date can be interpreted as emplaced within the volcano-sedimentary basin sequences prior to major basin inversion / deformation.

Prospect – scale geometry

West Belanger District

a) Echo – Bravo – Cecilia trend

The main Echo 1, Bravo and Cecilia sill complexes represent a single moderate to steeply-N-dipping thrust sheet and stacked sill complex. The current base of the intrusives at Bravo and Echo represent a discordant intrusive contact, with the sills ramping upward through the sediments to the west.

Detailed mapping has highlighted a series of possible intrusive embayments within the Echo / Bravo & Cecilia sills (in particular within a central peridotite – dominated sill). The embayments have a quasi-regular spacing of ~400m.

The main sills are exposed as a strike- extensive erosional window within a shallow - to moderately-dipping thrust sheet; the Echo-west, -2 & -3 sills all lie along this upper thrust sheet.

The main mineralised sill in the Cecilia / Delta area is segmented and displaced by a series of NW-trending strike – slip to thrust faults associated with a 2nd – order SE-verging shallow thrust sheet.

b) Juliet – Riverview – Core - Lima prospects

The main Cecilia sills (moderate N-dipping) are partially concealed in the west by a series of relatively flat – lying to shallow dipping gabbro – to peridotite sills lying within a very broadly-folded thrust sheet. The Lima prospect in the south of the area represents a synformal- folded klippe of this thin, shallow-dipping thrust sheet.

A small flat-lying thrust sheet of ultramafic sill / black shale and pillow basalt overlying the gently-folded sills at the Core prospect represents an isolated klippe of Chukotat Gp / Raglan Fm (southern extension of the Cross Lake thrust sheet).

c) Mid - North district

This comprises a series of shallow to moderately – dipping, broadly folded thrust sheets. The thrust sheets include variably – magnetic ultramafic sills (pyroxenite to dunite). Irregular exposures of the units are due to interaction of irregular topography with shallow-dipping units. Some of the shallow thrust sheets appear bounded to the north by a moderate – dipping thrust sheet plus sills extending SW from the CLS prospect; to the SW, the CLS trend appears overlain by other shallow thrust sheets.

d) CLS prospect

This comprises a strike – extensive, moderate N-dipping peridotite to dunite sill. It is dextrally offset in the NE of the area, and is then discordantly overlain by the shallow- to moderate N-dipping thrust sheet associated within the Cross Lake synform and sills.

The CLS sill is interpreted as a thrust sheet of the Raglan Fm (overlain by Chukotat Gp basalt).

e) Big Circle prospect

This comprises a NE-trending peridotite to dunite sill overlain by a sub-horizontal thrust sheet of pillow basalt and shale (western klippe of the synformal-folded Cross Lake thrust sheet).
The Big Circle sill appears either dextrally offset (similar to the nearby CLS sill), or folded by a Z-vergent kink. The sill is interpreted to extend to the SW (with some localised thrust dislocation), becoming part of the main West Raglan trend (Chukotat Gp / Raglan Fm contact).

East Belanger / Wakeham Bay district

a) Ireland prospect

The Ireland prospect comprises at least 2 thrust sheets, with thrust repetition of 2 primary sills. The thrust sheets form the frontal thrust zone of the SSW-verging 2nd - thrust episode. The sills are therefore interpreted to not be a simplex strike continuation of the Raglan / Donaldson mineralised sills to the west. The sills are overlain to the north by a series of steep to shallow dipping Chukotat Gp basalt within an imbricate thrust stack.

b) Ellsemere prospect

This comprises a WNW-trending belt of Chukotat basalt with occasional nonmagnetic to weakly magnetic pyroxenite to ol-pyroxenite sills. The sills are typically narrow and strike – limited. The sequence forms an imbricate thrust stack (thrust sheets steep to subhorizontal), with a possible broad synformal fold overprinting the thrust belt. To the north, the thrust stack is bounded by a thrust sheet of deformed Archaean granite gneiss.

The prospect is considered to have low potential for mineralisation.

c) Borneo prospect

The Borneo prospect comprises several thrust sheets, with an overall synformal geometry (WNW- to W- trending). A strike extensive, linear sill in the south is interpreted as the lowest thrust sheet, extending towards the linear Ireland sills to the west. This sill is coarse-grained, and interpreted as emplaced at significant depth compared to the majority of the sills throughout the Belanger area.

The synformal-folded overlying thrust sheet includes mega-pillow basalts (proximal to source?) and strike-limited, narrow sills. The sills are truncated / overlain to the west by a secondary folded thrust sheet of basalt.

The thrust sheets are overlain in the east by the broadly synformal thrust sheet associated to the east with the Nancy sills.

d) Nancy prospect

The main Nancy prospect comprises a broad synform of variable – thickness ultramafic sills within meta-volcanic / metasedimentary host. The host rocks are generally garnet-amphibolite metamorphic grade, in comparison to the majority of the region (chlorite grade). This indicates the Nancy thrust sheet(s) originated from a deeper part of the deformation belt.

The thrust sheet has moderate to shallow dips (suggested by the erosional truncation of sills along the NW edge of the area (see magnetic image, Figure).

e) Nancy East-2 prospect

This comprises a subvertical, strike limited peridotite sill north of the eastern end of the Nancy synform. The base of the sill lies on the northern margin (sill is slightly overturned at surface, with an 85°N dip). The sill probably underlies the Nancy synform thrust sheet.

f) Nancy East prospect(s)

This series of prospects comprises a series of overlapping, thin and shallow – dipping to subhorizontal thrust sheets; these overly the Nancy East-2 and Nancy synform structures.

The irregular geometry of the sills evident in the magnetic data is due to the interaction of significantly incised topography with the shallow dipping thrust sheets. The thin ultramafic sills within the thrust sheets have variable dips, indicating an early thrust / fold phase prior to development of the subhorizontal thrusts. Lateral ramp faults parallel to the movement direction are common.

The bulk of sulphide mineralisation in this area is due to formational sulphide within the metabasalts and sediments (with remobilisation during thrusting likely). Minor sulphide mineralisation (with elevated Ni) associated with the sills occurs at the southern basal margin of the Lands End peridotite sill.

The annular magnetic structure within the primary NNE-trending ultramafic complex is due to an erosional window within an upper magnetic peridotite thrust sheet, exposing a weaker magnetic sill in the underlying thrust sheet. The lower sill complex has a maximum thickness of roughly 60m; the upper sill complex has a maximum thickness of roughly 120m.

A series of recommendations made include:

a) Each sill complex to be drilled to be mapped in detail prior to selection of drill site and orientation. This should include detailed structural mapping of both the sill and the footwall / hangingwall volcano-sedimentary sequences (to aid delineation of location & true orientation of basal zones and possible embayments within the sills).

b) Continue detailed structural mapping of the thrust belt geology along regional traverses throughout the Goldbrook tenements. This is particularly important in zones of complex geometry associated with multiple shallow-dipping thrust sheets (e.g. – the Mid North district).

c) Ensure mapping includes capture of primary structural data. In particular, recognition and recording of So (bedding, igneous layering), thrust / fault surface orientations, and S1 cleavage / foliation data. Where possible, younging and structural facing criteria should be recorded.

d) Volcanic and sedimentary facies should be recorded consistently. In particular, scale of pillows in basalts, presence of significant fragmentals etc should be noted (attempt to delineate zones proximal to original volcanic / intrusive sources).

e) Continued training of field geologists in structural mapping and structural logging of core. Possible training in detailed geological interpretation of magnetic data.

f) Particular mapping emphasis should be placed in broad corridors associated with inferred early (& deep-seated) NW- transfer fault zones.

g) A series of detailed structural geology maps (plus sections) of the Goldbrook tenements (plus surrounding areas) should be compiled before the next field season. This should incorporate all data from the current and previous field campaigns. The maps should integrate:
   i) Field mapping data (lithology / structure etc);

ii) Hyperspectral and other remotely-sensed data;
iii) 3-D stereoscopic air-photo interpretation
iv) Airborne and ground magnetic & EM interpretation
v) Litho-geochemical data

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August 2010

2. INTRODUCTION

2.1. Preamble

Goldbrook Ventures Inc is currently exploring for primary massive NiS deposits within the Cape Smith Belt of the Ungava Peninsula (northern Quebec); the company currently holds approximately ...kms^2 of exploration tenement throughout the belt. Exploration at present is concentrated on prospects in the west Belanger district (including the Bravo, Echo, and Cecilia trend), and the eastern Belanger (or Wakeham) district (including the Ireland, Borneo and Nancy trend) – see Figure 1, Figure 2.

The Consultant was contracted by Goldbrook Ventures Inc. to review the regional and prospect scale structural setting of ultramafic sills in both the prospects of current activity, and areas of perceived potential. This follows on from geological mapping and structural interpretation conducted by The Consultant in 2005 during j/v exploration along the western Belanger trend between Goldbrook Ventures Inc. and Anglo American Exploration Canada (see Rankin, 2005).

2.2. Aims & Strategy

The aims of the project were:

a) Outline the intrusive morphology and structural setting of prospective ultramafic sills in high-priority prospects;

b) Highlight potential drill targets within these prospects;

c) Review the regional setting of the sill complexes, including delineation of the sills into Chukotat / Raglan Fm - related sills and Povugnituk Fm – hosted sills;

d) Delineate steeper thrust – ramp and imbricate thrust stack belts from locally overlying shallow-angle thrust sheets;

e) Provide on-site advice and training in structural geological concepts within the belt and field mapping techniques for the field geologists.

The following strategy was conducted to achieve the above aims:

a) Detailed N-S mapping traverses at roughly 200m spacing were conducted over the Echo – Bravo and Cecilia sill complexes. Mapping concentrated on detailed delineation of lithological distribution within the sills, orientation of layering within the sills, orientation of intrusive and tectonic contacts with the footwall and hangingwall volcano-sedimentary sequences, and bedding within the footwall / hangingwall sequences. This led to delineation of possible intrusive embayments both at the base and within the sill complexes.

b) Prospect to semi-regional mapping traverses were conducted over many of the other prospects to both define the extent and orientation of ultramafic sills within the prospects, and outline their possible structural setting and association within the complex thrust stacking evident in the area.

c) Mapping was conducted with at least one other field geologist each day. Training in the field included:

   i. Recognition of bedding vs. cleavage in strongly deformed sediments & volcanics;
   ii. Younging criteria
   iii. The concepts of structural facing, and inverted vs. overturned stratigraphy within thrust / nappe terranes.
   iv. The use of stereonet analysis in the field and for structural solutions in drill core
   v. Structural logging of drill core

d) Both detailed and regional geological maps and sections were compiled from the field mapping (with integration of the existing regional and detailed aeromagnetic and ground magnetic data). In localised areas, the excellent hyperspectral imagery processed by D. Rogge (Univ. of Alberta) was also integrated into the mapping. Maps were compiled on Letter – sized plots of the magnetic data at various scales, scanned and geographically – registered as Geotiffs; unfortunately the A0-plotter at Belanger camp was inoperable for the majority of the author's time in the camp – limiting the ability to compile regional maps.

e) Structural data were analysed in plan map, cross section and stereonet forms.

f) All results and interpretive concepts were subsequently compiled (this report).

Field observations were entered daily in a copy of the Goldbrook field data Access database, and merged every few days with the master copy database.

GPS waypoints and tracks were downloaded daily and provided at the end of the project to the Belanger GIS manager.

All maps and sections compiled were provided as Geotiffs and placed in the main database. All field photographs were also placed within the main database.

2.3. Conventions

The following conventions were used for the project.

Geographic Data

▪ Magnetic Inclination	+80°
▪ Magnetic Declination	-26°
▪ Map Projection	NAD83 UTM 18N

Geophysical & Geological Data

A relatively comprehensive copy of the 2010 geological and geophysical database was provided to the author by P Smerchanski. Additional magnetic grid files (Geosoft .grd format)for several of the prospects were obtained from Richard Yee (geophysicist). Hyperspectral imagery was obtained from D. Rogge (remote sensing consultant) as .ecw files. Geological map files were available in ArcMap, MapInfo and Manifold formats.

The author utilised the following software:

a) MapInfo 12 / Discover 11 for GIS querying, geophysical image processing and integration of geological maps & geophysical / remotely-sensed data.

b) Global Mapper 11 for geographical registration of scanned maps and export as Geotiff files.

c) GEOrient 9.9.4. for stereonet compilation and manipulation.

d) GEOcalculator 4.9.3. for structural measurement calculations.

e) Garmin MapSource 6.12.4. for downloading of GPS data & export as .gdb & .txt files.

f) Access & Excel 2007 for database manipulation.

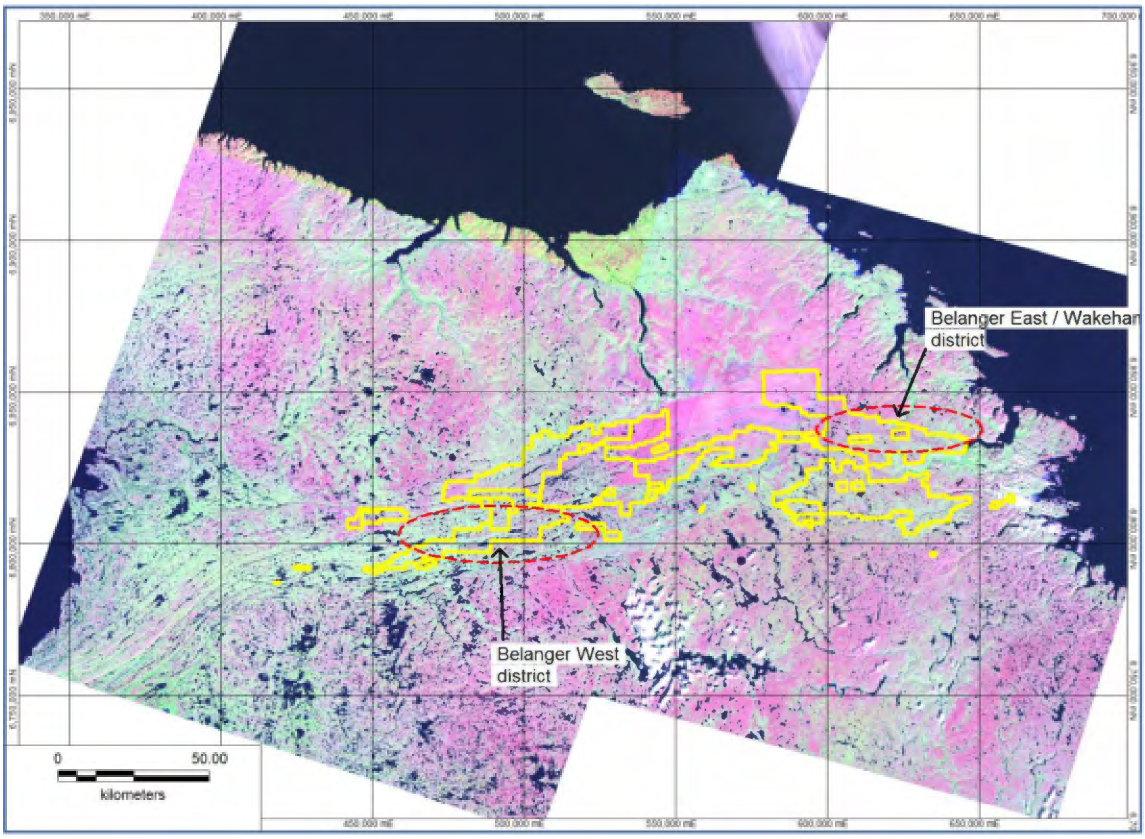


Figure 1 Location of Goldbrook Ventures Inc Raglan project exploration tenements (Cape Smith Belt, Ungava Peninsula). The 2 main areas of investigation by the author (West and East Belanger districts) are highlighted.

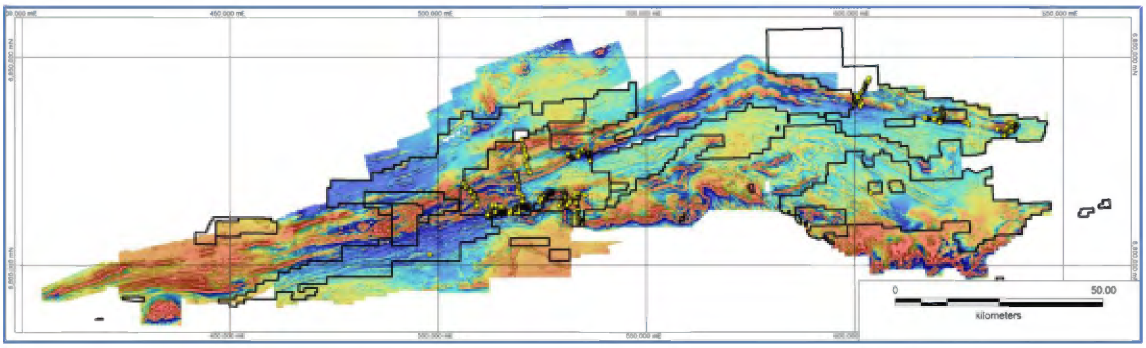


Figure 2 Location of Goldbrook Ventures Inc Raglan project exploration tenements superimposed on regional magnetic data. Yellow dots represent author's field locations.

3. STRUCTURAL GEOLOGY

3.1. Regional thrust belt

The generally – accepted structural / stratigraphic model for the Cape Smith Belt indicates:

a) The belt comprises an S-vergent imbricate thrust belt. Original work by St Onge *et al.* (1988, 1999) suggested the belt was allocthonous, and thrust onto the northern Superior Province, with >200kms of thrust movement.

b) The 2 main stratigraphic sequences in the southern half of the belt are the Povugnituk Gp sediments (+ komatiitic basalts), and the younger Chukotat Fm basalt sequence (with associated Raglan Fm komatiitic volcanics and sills).

Previous work by the author (Rankin, 2005) has noted that the Chukotat Fm north of the Povugnituk Fm belt is thrust to the south over the Povugnituk Fm. This raises the question as to the detailed stratigraphic / timing relationships between the 2 major formations. If the Chukotat Fm is younger than the Povugnituk Fm, then thrusting of the former over the latter has involved a significant out-of-sequence thrust.

If, however, the 2 formations were roughly contemporaneous, with interfingering of a carbonate / clastic shelf in the south with a mafic volcanic basin in the north, then simple imbricate thrust stacking along the margins of the basin could explain two salient points:

a) Thrusting of the supposedly younger sequence over the older (with possible imbricate repetitions), and;

b) Syn – basin / pre-deformation emplacement of mafic – ultramafic sills within both sequences (marginal volcanic basin growth faults proximal to major inter-fingering of the formations would act as a principal feeder system).

Previous geological mapping of the belt has not sufficiently recognised or delineated the presence of both steep and shallow / horizontal thrust sheets within the area. Mapping by the author has indicated the presence of numerous subhorizontal (and broadly undulating) thrust sheets overriding a series of moderate to steeply N- dipping imbricate thrust sheets. Significant errors in correlation of units and sequences throughout the belt are possible if the detailed thrust geometry of the belt is not taken into account.

The main sill complexes throughout the area are typically only broadly folded, with only localised zones of tighter folding (particularly associated with possible ramp – antiform style folds). Tight to isoclinals folding of the sills (previously invoked by several workers to explain near symmetrical lithological zonation of the major sills) is not evident. The bulk of compressive strain that was not accommodated by thrusting has been taken up by the sediments and volcanics, with significant zones of pervasive cleavage development and small- to moderate scale tight folding. The most significant zones of fold / cleavage development within the volcano-sedimentary pile appear to occur within the subdomains of broadly shallow-dipping sequences.

As stated previously (Rankin, 2005), the often subtle bedding within the volcanic and sedimentary sequences is often obscured by a well-developed S1 fold axial – planar cleavage. It is essential that bedding vs. cleavage be recognised within these outcrops, rather than assume that bedding is parallel to the cleavage.

The geometry of younging / S0 & S1 orientations in outcrop indicate that the regional sequence currently mapped by the author is facing up; i.e., there are no subdomains of inverted stratigraphy related to significant nappe development during thrusting.

A regional map outlining the main thrust sheet distribution based on mapping traverses and interpretation of the magnetic data is currently being compiled. A preliminary version of this for the West Belanger district is highlighted in Figure 3.

The relationship of the Ireland – Borneo – thrust / sill trend ("IBN trend") to the main raglan mineralised sill trend has been variously interpreted as:

a) Discordant and not directly related / connected (Falconbridge / Xstrata model – Peck / Smerchanski pers Comm.), and;

b) Directly related (along – strike extension), with only minor strike slip fault dislocation (Peck, pers comm. ,plus earlier interpretations by the author – see Rankin, 2005).

A review of the geophysical data, plus new data from mapping indicates the IBN trend represent a separate thrust sheet from the Raglan trend, with the thrust originating in the NE and verging to the SW (Figure 4 Figure 5). It therefore cuts and overlies the ENE-trending Raglan belt; the kink-like folds along the ENE end of the Raglan belt sills is now interpreted as caused by this SW-vergent thrust event. The (on average) higher metamorphic grade of the IBN trend (garnet-amphibolite), and possible deeper emplacement history of the sills (from coarser grainsize in sills along the IBN) suggest the IBN sills, whilst being the same stratigraphic level as the Raglan sills (base of Chukotat Gp basalt), represent a deeper, and more north-easterly part of the volcanic basin. This new interpretation does not diminish the potential for mineralisation in these sills, but does suggest that any potential mineralisation will be related to a different feeder source.

The deformation of the belt is therefore now subdivided into:

a) D1 – SSE – vergent thrusting (Figure 6). Initial imbricate stacking, with common moderate to steep thrust ramps developed. A major series of 1st order thrust ramps were developed throughout the belt with roughly 7 – 10km spacing. This was followed by a series of overlying, more flat – lying thrust sheets. The subtle ENE trends of variably magnetic (and strike- length variable) intrusives in the Ungava district (including the Mesamax deposit) are interpreted as significant ENE-trending D1 thrust ramp zones, exposed within erosional windows within overlying shallow dipping thrust sheets.

b) D2 – SSW- to SW- vergent thrusting, associated with major impingement of the north-eastern Archaean basement block (Figure 7). Development of initial moderate to steep imbricate thrust ramps quickly followed by a series of SSW-vergent thin, flat – lying thrusts (eg – Nancy East area). The D2 event was asslo associated with compression obliquely across the belt and development of WNW- to NW- trending folds.

NW-trending transfer structures

The Cape Smith Belt is influenced by a series of broadly NW-trending structural corridors, evident as subtle boundaries to subdomains of differing structural character along the belt (Figure 80. The structural corridors are interpreted as deep-seated basement / basin transfer fault zones; these may have acted as significant feeder structures during emplacement of the thick volcanic pile and subsequent ultramafic sills. Sills proximal to these broad structural corridors would have had greater potential for emplacement of significant massive sulphides.

Although there has been significant dissection and thrusting of the sills subsequent to emplacement, it is possible that the sills within the early (D1) SSE-vergent thrust stack may have been transported roughly parallel to these structures; this means that sills that were originally proximal to or coincident with the NW basin transfer faults are likely to still be roughly proximal to the structures (but dislocated from their original feeder zone).

Zones proximal to the NW structural corridors (on a regional scale) therefore may have significantly greater potential for mineralisation than sills distal to the structures.

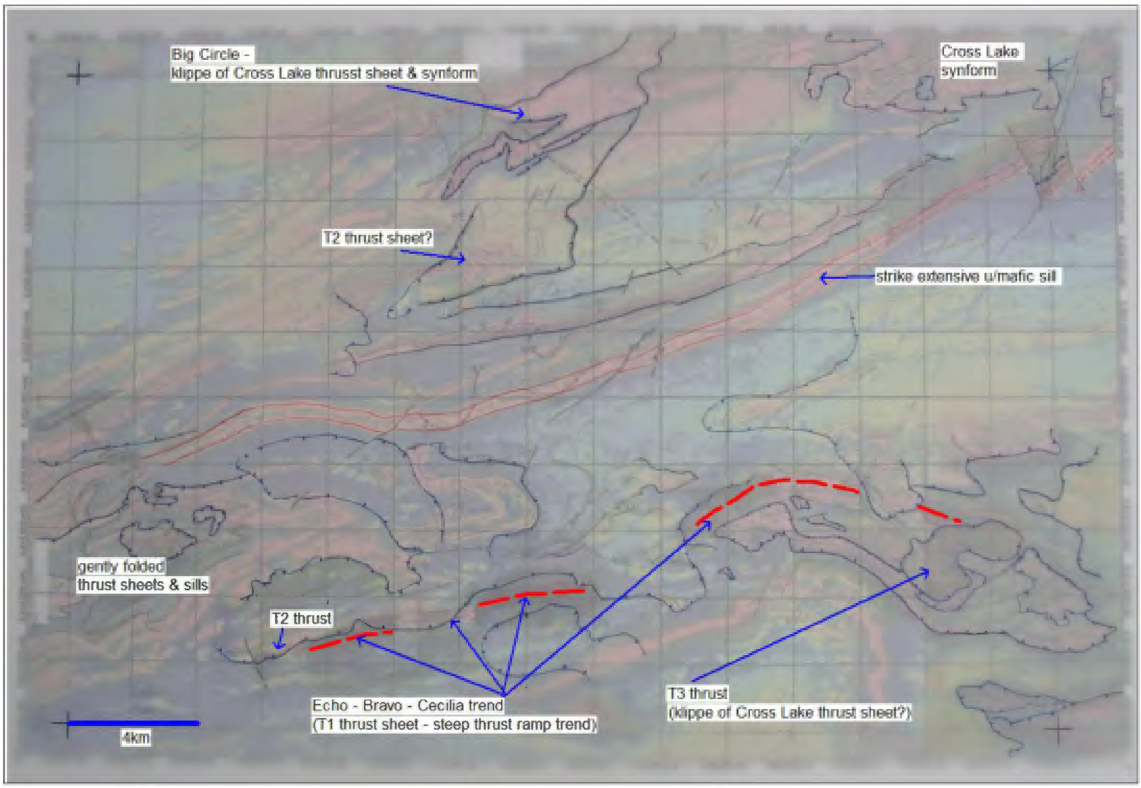


Figure 3 Distribution of both steep (ramp) and low-angle (flat) thrust sheets within the Belanger - Nuvalik area - preliminary interpretation only. The Echo-1 – Bravo – Cecilia sill complex represents an early moderate to steeply dipping thrust ramp exposed in a regional erosional window within an overlying series of sub-horizontal thrust sheets.

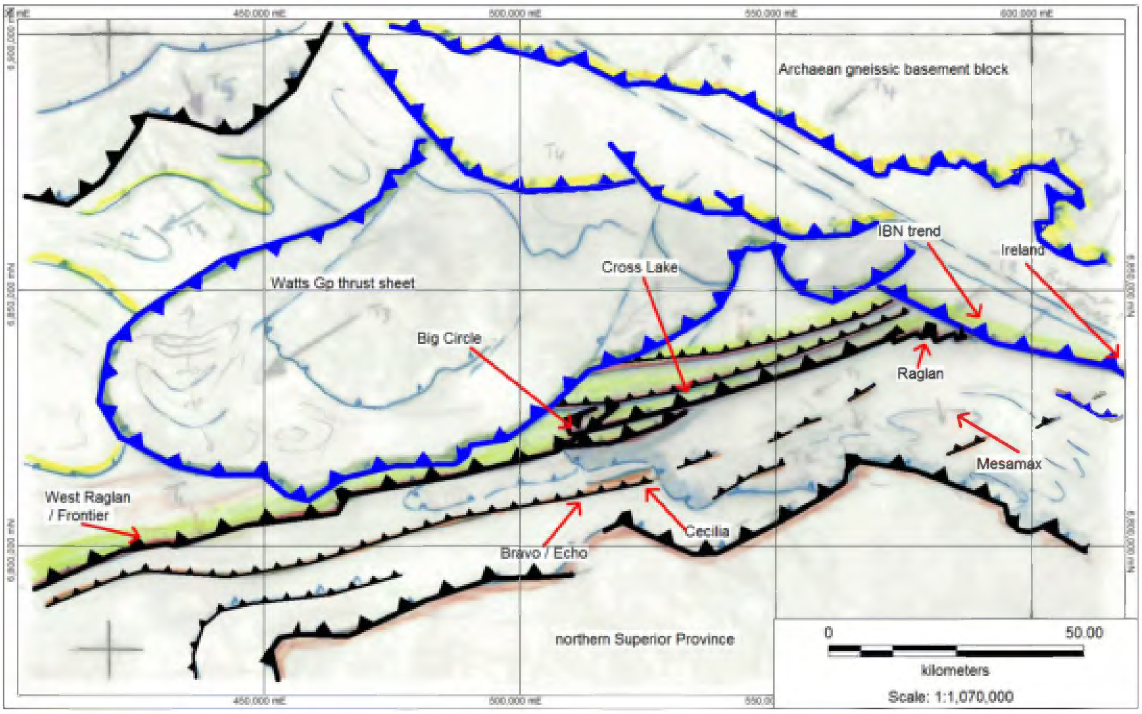


Figure 4 Regional-scale interpretation of SSE and SW-vergent thrust systems.

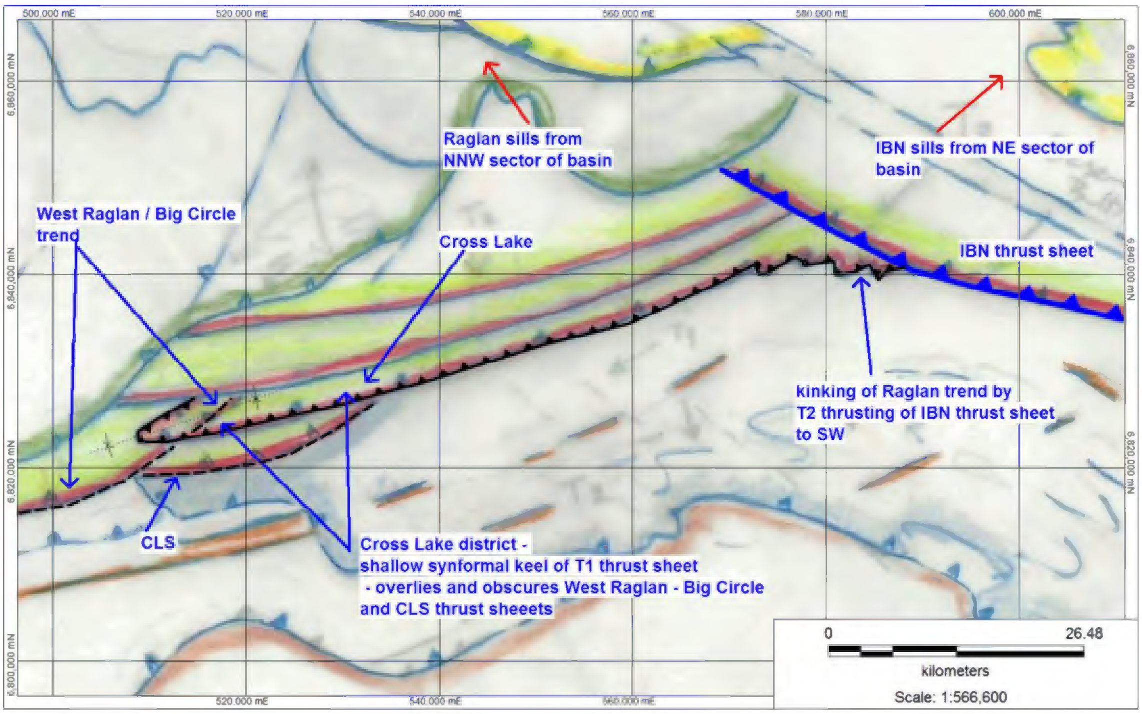


Figure 5 Detailed view of regional thrust belt framework for the Raglan / IBN thrust / sill trends. Note that the Raglan, West Raglan - Big Circle, CLS and IBN sills all represent the same stratigraphic position (base of Chukotat Gp), but originate from different areas of the volcanic basin.

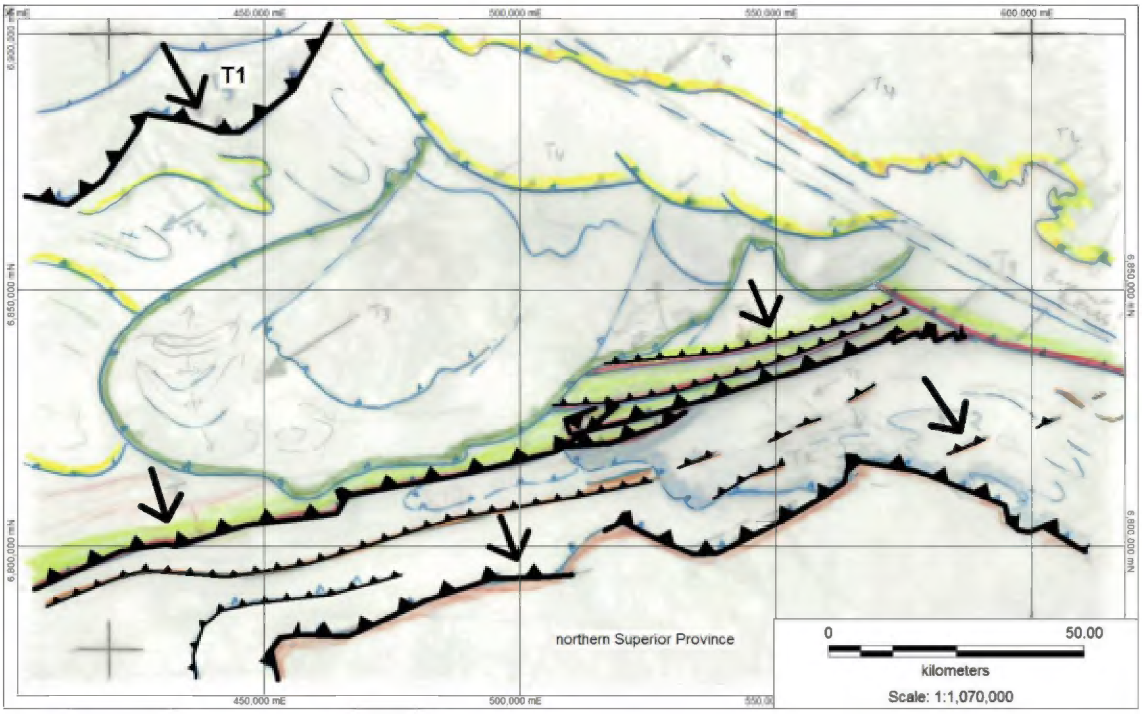


Figure 6 D1 deformation - SSE-vergent thrusting. Note continuation of ESE-trending imbricate thrust ramps in eastern part of the belt.

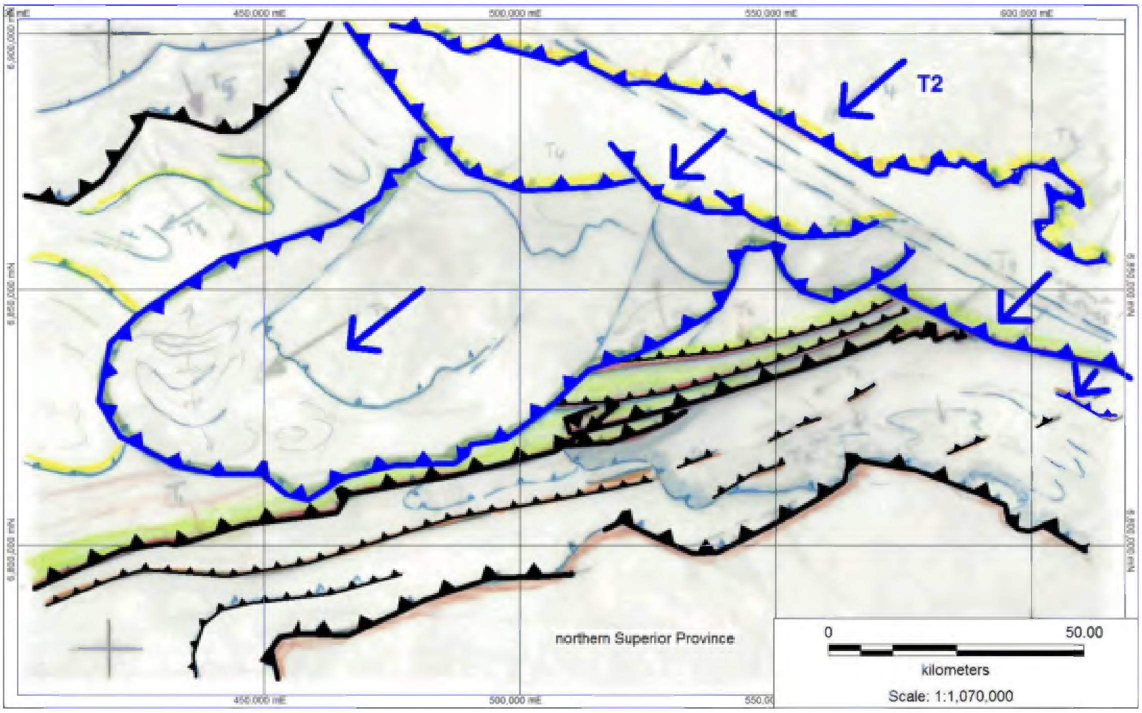


Figure 7 D2 deformation - SW-vergent thrusting associated with SW convergence of NE Archaean basement block. Thrust sheets commonly higher metamorphic grade than D1 thrust sheets.

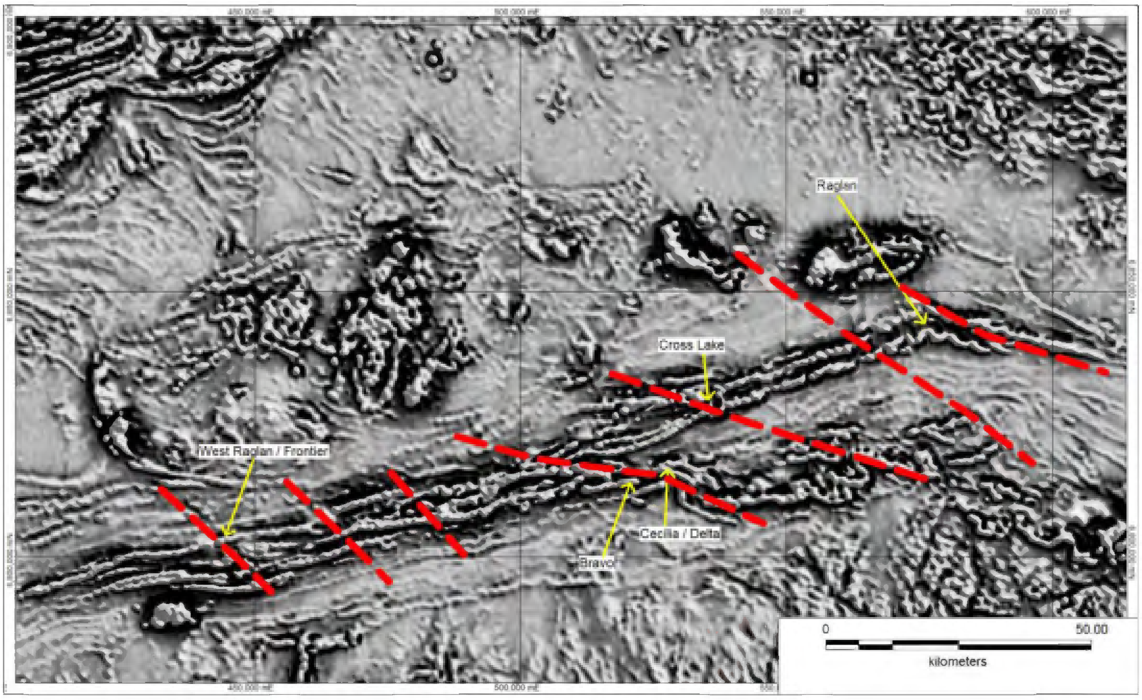


Figure 8 NW structural corridors with a 15-20km spacing. These are interpreted as deep-seated basin / basement transfer fault zones (potential feeder structures for volcanics & sills).Sills proximal to these structures may have been originally proximal to the same potential feeder structure, but further to the NW. They may therefore represent regional corridors of increased potential for mineralisation.

3.2. West Belanger district- structure at specific prospects

3.2.1. Bravo prospect

Morphology and structural setting

The prospect comprises several sills with variable magnetic response, and variable strike length, generally striking 070° (average) - Figure 9.

The sills were previously considered to form a synform, closing to the east (from both magnetic data and layering trends taken from scattered columnar joint measurements – P Smerchanski, Pers Comm.). An easterly plunge for the syncline was inferred from a broadening of magnetic anomalies to the east in one sector of the prospect; note that this is internally inconsistent with an east closure for the synform.

Detailed mapping of the Bravo sill complex by the author and others indicates:

a) The sill complex has an overall trend of ~080°. The sills that comprise the complex have a general trend of 070° – 090°. The previously reported steep southern dip on the northern sill margin in an existing exploration trench (NE sector) is not supported by both the general columnar joint measurements, and by recent drilling intersections.

b) Very localised and rapid changes from steep N-dipping to steep S-dipping layering within the sills was only observed in one location (low confidence measurement); if the measurement is correct, it most probably reflects a localised kink within the steep thrust ramp structure (represented by the overall sill orientation). Localised intersection of the irregular topographic surface with a shallow to moderate – dipping kink plane would produce rapid variations in dip.

c) The base of the sill is discordant to the primary bedding within the footwall sediment / volcanic sequence; the footwall sequence varies along strike, with both black shales and intercalated basalt / carbonate sequences in contact with the base of sill. The internal layering evident in the sill is however parallel to the strike of the footwall sediments (Figure 10). This suggests that emplacement of the sill was associated with a ramping upward through the volcano-sedimentary pile (ramping upward to the west). This would suggest that the original feeder source for the sill complex lies in the east (structurally – lower sector of the complex). Similar ramping of the sills was evident at the Getty and Sylvie sills (Rankin, 2005).

d) The dip of the base of sill varies along strike; the typical dip is ~60 – 70°, but locally decreases to 30 – 40° in the central sector. The slightly shallower dip on the base suggests that in its original ("horizontal") orientation, the sill was thickening to the south. The significantly shallower dips in the central sector may indicate the presence of a significant embayment in the sill base.

e) The sill complex comprises 3 main subdomains of stacked sills (Figure 10):

i) Sill A – this comprises a roughly 200m thick sequence with rapidly – changing lithology (a series of thin horizons ranging from gabbro to peridotite). The complexity of layering is greater in the west of the complex, with a thicker peridotite / ol-pyroxenite sequence dominating the east. A significant near-90° bend along the layering in the east of the complex (from both mapping and magnetic data) may represent a significant primary embayment within the lower sills.

ii) Sill B - this comprises a relatively homogenous peridotite sill, ranging in thickness from roughly 100 to 250m thick. The contact between this sill and the lower sill is locally marked by minor outcrops of hornfelsed basalt & shale. Sill B appears to be discordant to the underlying Sill A, and forms several asymmetric embayments, with a ramping to the west geometry. These embayments have roughly 400 m spacing along strike (Figure 11). The most significant embayment in the west is associated with a significant cluster of mineralisation. A magnetic low zone within the uppers level of the peridotite may represent an embayment near the top of this sill.

iii) Sill C – this comprises a relatively strike – continuous ol-pyroxenite to pyroxenite sill (pyroxenite dominating in the west). Sill C also appears to be locally discordant to Sill B, with similar asymmetric embayments on 400m spacing evident. The most significant embayment (in the centre of its strike extent) is roughly coincident with the magnetic low embayment of Sill B, and is coincident with a significant cluster of know mineralisation occurrences.

iv) Contact between the upper surface of the sill complex with the hangingwall sediments was not directly observed.

f) The broader magnetic highs east of the outcropping sill indicate continuation of the complex at depth. Some NW-SE normal block faulting may occur at this end. In addition, the NE corner of the complex is interpreted to be overlain by a shallow - to moderate N-dipping thrust sheet (T2) of sediments; strongly M-folded sediments roughly along strike from exposed sill complex to the west probably lie within the overlying thrust sheet. This thrust sheet is interpreted to extend along the northern flank of the entire Cecilia – Bravo – Echo trend.

g) The overlying shallow- dipping thrust sheet also includes a broad – folded nonmagnetic gabbro – pyroxenite sill immediately north of the Bravo sills.

h) The western end of the Bravo Sill appears truncated by an inferred NW-trending block fault (SW-down). The minor sill complex to the SW of the Bravo sill is interpreted as a separate sill (note marginal pyroxenite phase wrapping around the eastern end of the sill). A significant magnetic embayment (associated with a possible embayment of ol-pyroxenite into the underlying peridotite) occurs at the western limit of the ground magnetic data. This minor sill may lie within the overlying T2 thrust sheet.

i) The Kill Zone sill complex (SE of the main Bravo Sill) also dips 70-80° NNW (to vertical). This may represent either a second (structurally – lower) sill, emplaced below the Bravo Sill, or an original south-eastern extension of the Bravo Sill, offset by inferred normal block faulting (displacement on the order of 600m vertical). The latter interpretation is supported by the coincidence of a magnetic low embayment within a thick peridotite, overlain by a relatively continuous ol-pyroxenite (c/f central sector of Sill B/ Sill C geometry in Bravo Sill).

j) The western end of the Kill Zone sill abuts with a sequence of shallow – dipping shales and basalts. The shales proximal to the sill appear to dip towards the sill. This volcano-sedimentary sequence is interpreted as a broadly folded continuation of the shallow – dipping thrust sheet seen north of the Bravo Sill. The Charlie magnetic anomaly SW of the Kill zone sill is interpreted as part of the sill concealed by the shallow thrust sheet.

A section through the Bravo sills at the NE end of the body (associated with mineralisation in trench) is shown in Figure 13. Initial drilling in this area drilled down-dip (to the north). Subsequent drilling failed to intersect continuity of this mineralised zone; it is interpreted here as a very strike- and dip- limited pod of mineralisation (the most significant portion may have been eroded out).

Figure 12 highlights the orientation of layering within the sills, plus So bedding within hangingwall and footwall sequences.

Primary intrusive embayments and magnetic data

The general geometry of the broadly 400m spaced intrusive embayments defined by mapping has some expression in the ground magnetic data. It should be noted however, that there are significant variations in magnetic susceptibility within any 1 lithology, and significant overlap in magnetic susceptibility ranges between lithologies. This makes delineation of primary embayments difficult / ambiguous.

It was noted by the author that some early targeting of magnetically – defined "embayments" along the northern margin of the Bravo sill was based on a series of magnetic lows along the margin spaced at 100m intervals. These magnetic variations are dominantly the effect of both line spacing of the magnetic data and subsequent gridding and FFT filtering of the data.

It is recommended that subsequent detailed ground magnetic data be acquired at 25m spacing; this should significantly reduce the undersampling responsible for the artefact "embayments".

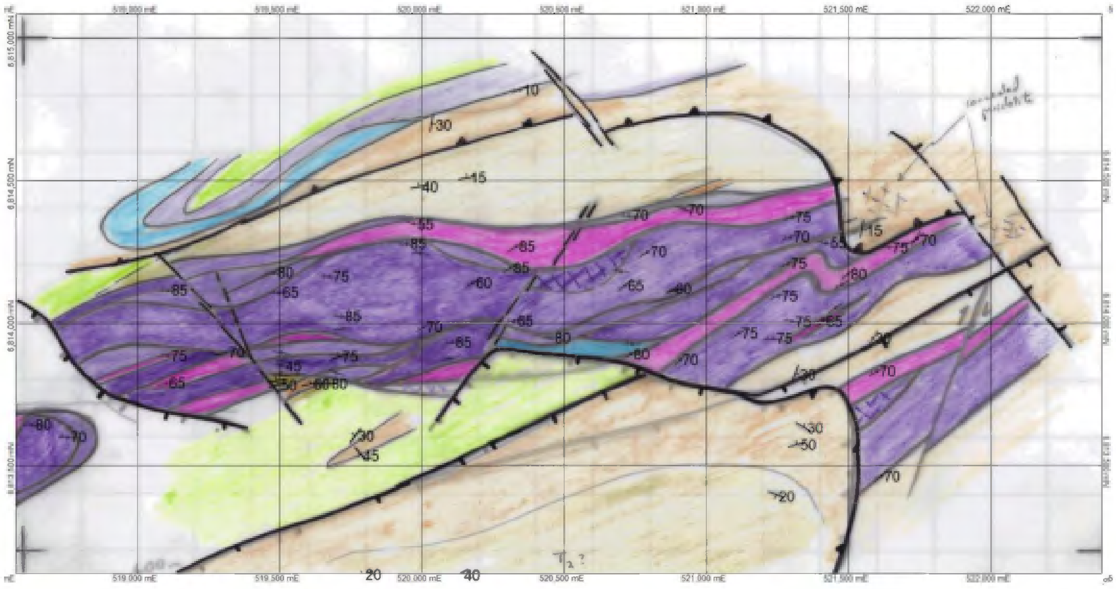


Figure 9 Bravo sill complex - mapped geology. The presence of the NE-trending block fault between Bravo and Kill Zone is conjectural at this stage.

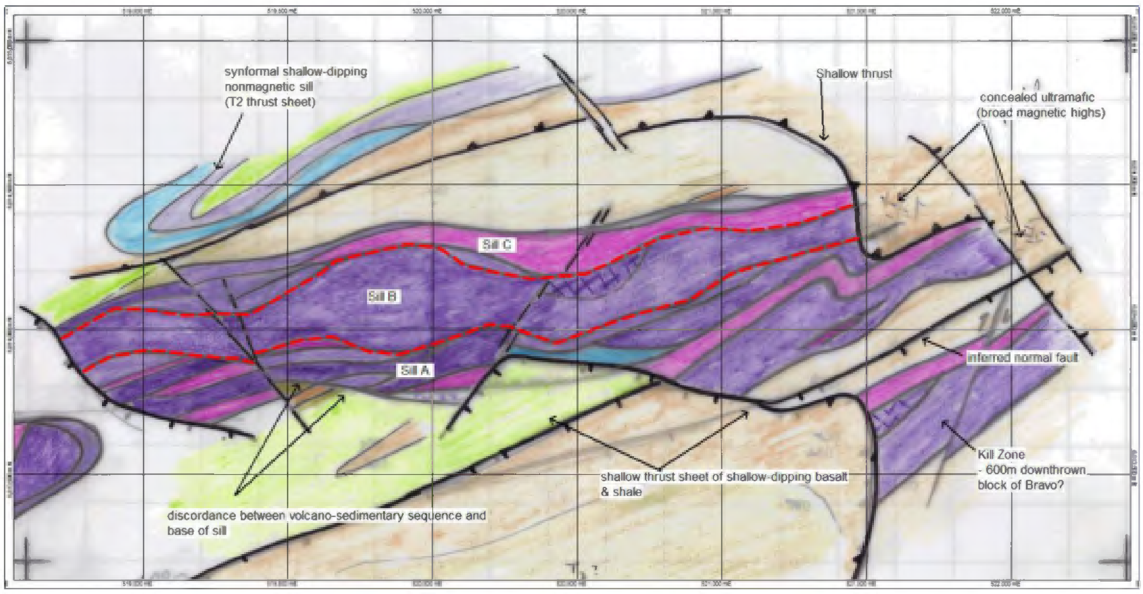


Figure 10 Bravo sill complex - delineation of principal sill subdomains and contact geometry.

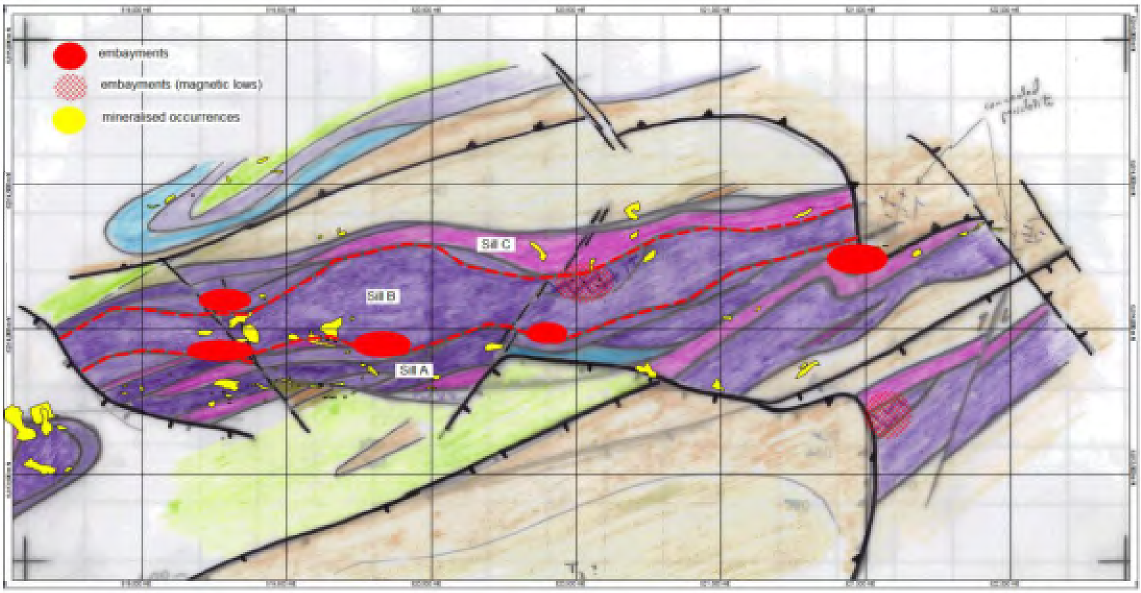
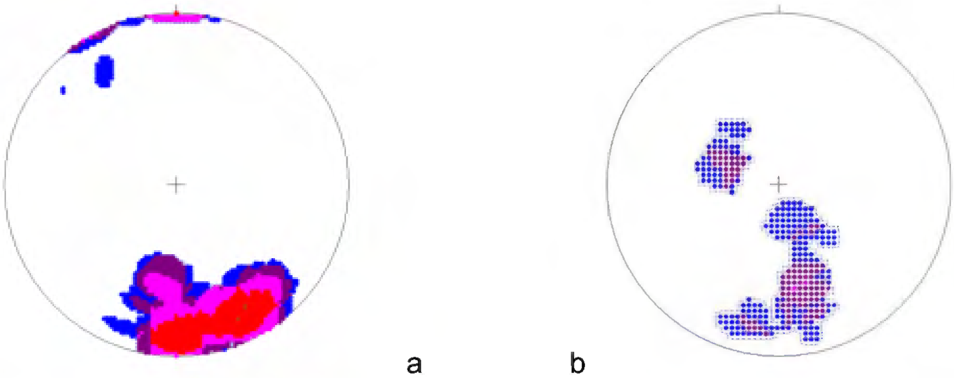


Figure 11 Delineation of possible significant embayments within the Bravo sill complex (from mapping and magnetic data). Significant mineralised occurrences are coincident with several of the embayments.



a b

No. of Data = 62
Mean Principal Orientation =
72/345
Mean Resultant dir'n = 68-348
Mean Resultant length = 0.86
(Variance = 0.14)
Calculated. girdle: 34/226
Calculated beta axis: 56-046

No. of Data = 22
Mean Principal Orientation =
34/357
Mean Resultant dir'n = 29-360
Mean Resultant length = 0.77
(Variance = 0.23)
Calculated. girdle: 86/261
Calculated beta axis: 4-081

Figure 12 Stereonet projections - poles to bedding / primary layering - Bravo sills and surrounding volcanics / sediments.

The sills show 2 main populations at 72/335 and 75/360 (dip / dip dir). This suggests either a kink along the sill complex, or a change in orientation between the stacked sills (across section).

The sediments show a similar dominantly steep N-dipping orientation. Two populations of shallow / moderate N- and SE dips are related to sequences within the shallow overlying T2 thrust sheet, plus the moderate N-dipping base of sill near the central sector of the complex.

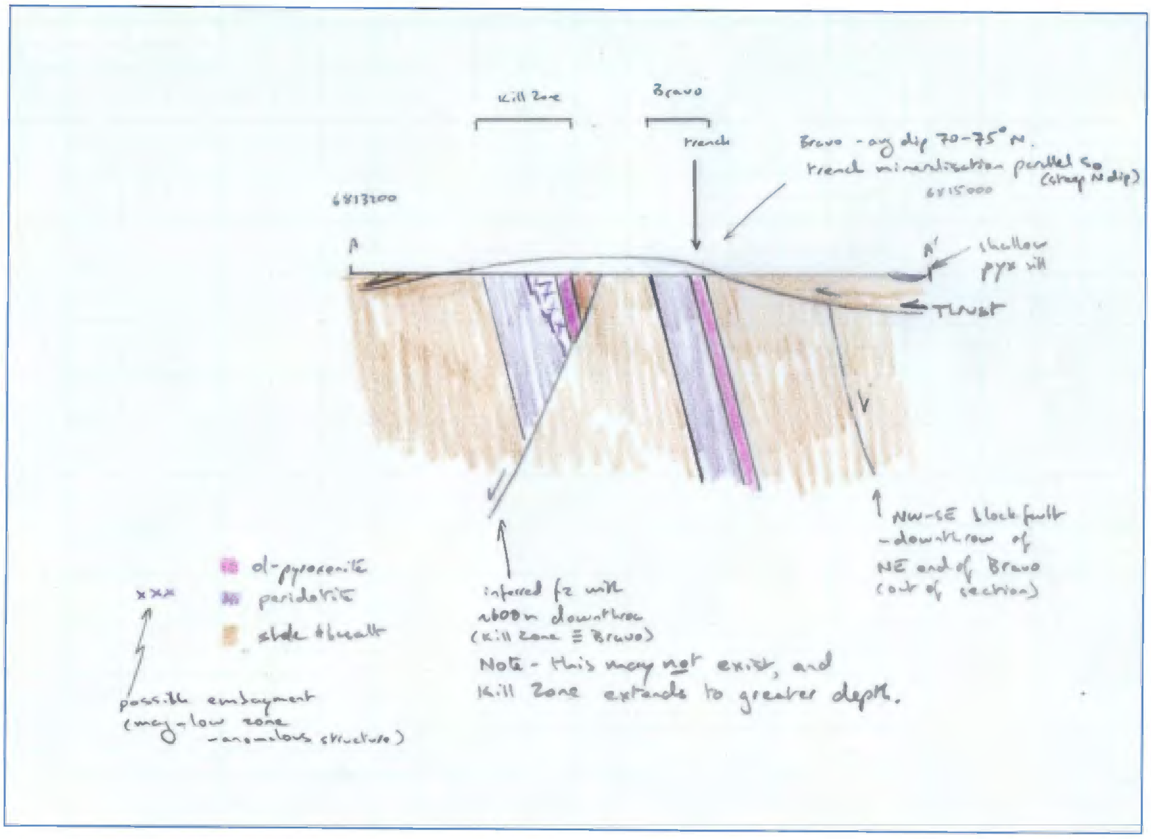


Figure 13 Section 521850 – Bravo. The interpretation of the Kill zone sill as a downthrown block of the Bravo sill is tentative at this stage.

3.2.1. Echo prospect

The Echo prospect comprises sills within 2 separate thrust sheets (Figure 14, Figure 15). Stereonet proections of layering within the sills (plus So bedding of hangingwall and footwall sequences) are shown in Figure 18.

a) Echo 1 (Thrust Sheet 1) – this comprises the main 070° trending ridge of intercalated / stacked pyroxenite to peridotite sills. The sill complex has marked similarities to the Bravo sill complex, with 3 principal sill stacks evident:

   i) Sill A – intercalated pyroxenite – ol-pyroxenite layers within a basal sill. The igneous layering is roughly 20° discordant to the basal sill / footwall sediment intrusive contact, suggesting that the sill was intruded oblique to the sedimentary pile and ramping upward to the west (source of sill to east).

   ii) Sill B – a variable – thickness peridotite sill (with ol-pyroxenite top) that appears slightly oblique to the igneous layering of Sill A. There are 3 or 4 quasi – regular spaced embayments in the base of the sill, spaced at roughly 300-400m (c/f similar spacing in the central sill of Bravo) - Figure 16.

   iii) Sill C – This is a second dominantly peridotite sill, overlying and slightly oblique to Sill B.

   Echo 1 has an average dip of 70 – 75° to N / NNW. It lies along a significant thrust ramp of the lower thrust sheet of the Belanger area. The sill complex thins towards the west, and is separate from the Echo West sill. To the ENE, the Echo 1 sill complex is overlain by a discordant ESE- to E- trending shallow thrust; a broad magnetic high between the end of Echo 1 and the Echo 2 sills to the north is interpreted as the continuation of Echo 1 beneath a thrust wedge of sediments.

b) Echo 2,3 & Echo West (Thrust Sheet 2)

   This comprises 3 separate ridges of outcropping ultramafics; all 3 lie along (or immediately above) the T2 thrust surface. The thrust varies from sub-horizontal in the Echo West area, to moderate (40°) N-dip at Echo 2& 3.

   Echo 2 and Echo West sills are subvertical to steep (80°) N-dipping. These 2 segments are interpreted as possible steep ramp antiform limbs; this is supported by evidence of ramp – antiform folding of sediments to the north of the Echo complex.

   Echo 3 dips roughly 40° N / NNW, with footwall sediments wrapping around the eastern end of the sill base (exposure in cliff) – see Figure 17. This segment is interpreted as a normal thrust flat section of the T2 thrust. The difference in geometry of the three sill segments along the T2 thrust suggest the thrust moved with differential displacement; 2 possible lateral ramp structures have been highlighted bracketing the Echo 3 body.

If the ramp antiform geometry for Echo West and Echo-2 is correct, this would imply the base of sill lies on the *northern* side of these 2 bodies; this remains ambiguous at this stage.

The footwall sequence to the main Echo 1 complex (within T1 thrust sheet) comprises a series of moderate to steeply dipping shale overlying pillow basalts to the south. A narrow pyroxenite sill lies within the pillow basalts.

A fine-grained dolerite dyke trending NW is evident in the magnetic data in the west of the area; this was locally exposed intersecting basalts in the area south of Echo West. The dyke is considered late -stage (post D1 thrust / fold deformation).

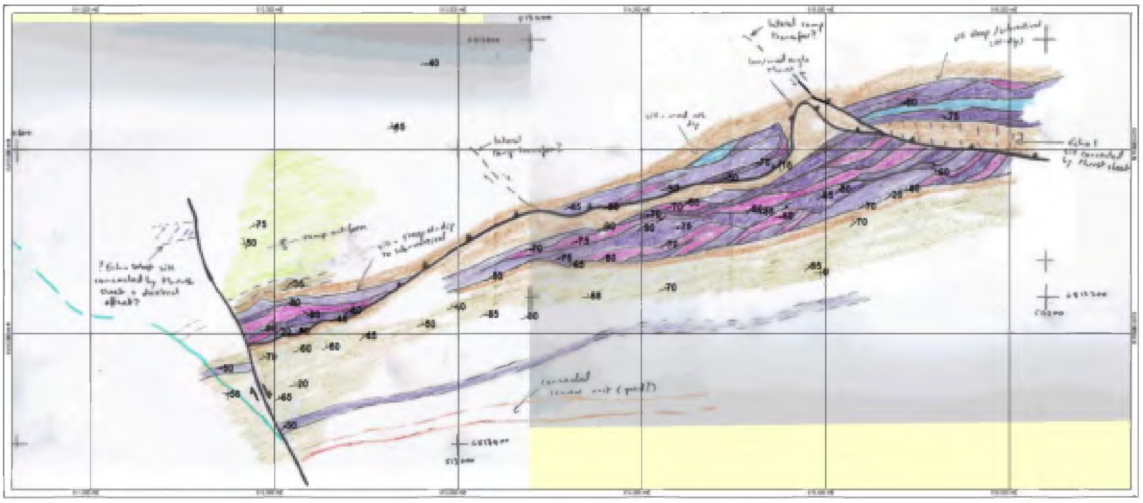


Figure 14 Echo - Echo West - surface geology. The Echo 1 sill complex lies within the steep N-dipping ramp of the T1 thrust stack. Echo 2, 3 & Echo West lie along the leading edge of the shallow - to moderate N-dipping T2 thrust sheet.

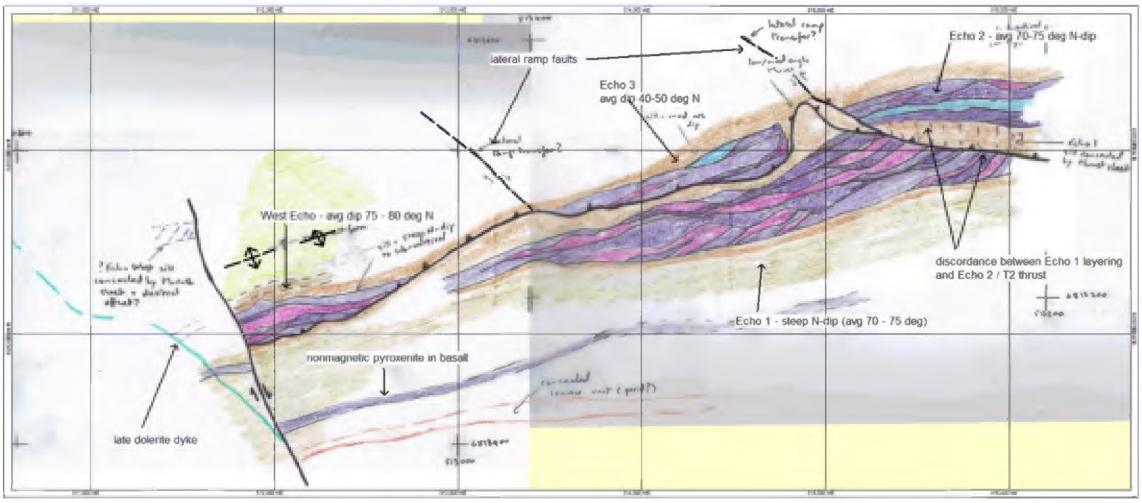


Figure 15 Principal structural elements of the Echo sill complex.

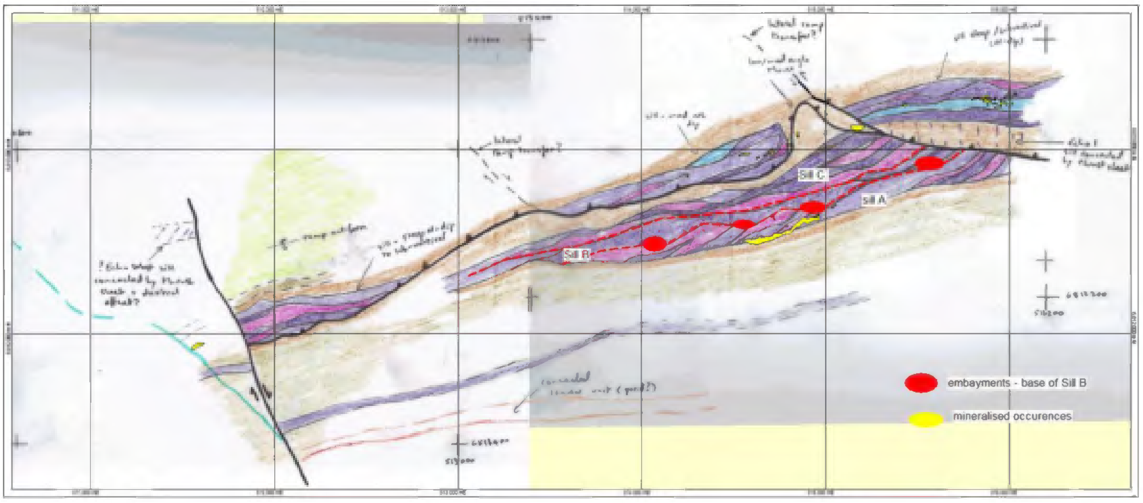


Figure 16 Delineation of sill subdomains within Echo 1, and identification of possible quasi-regular embayments along the base of Sill - B.

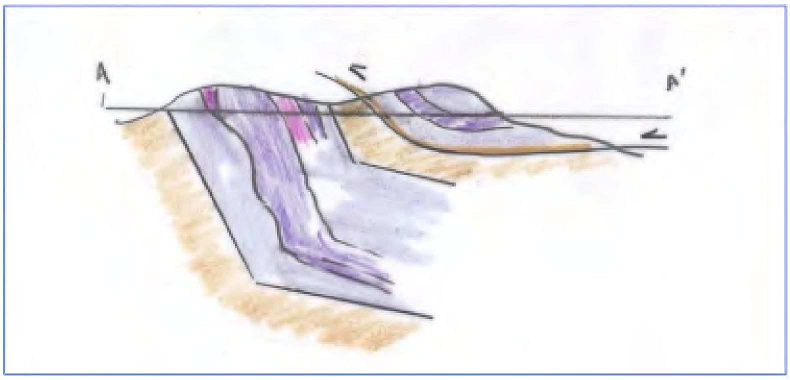
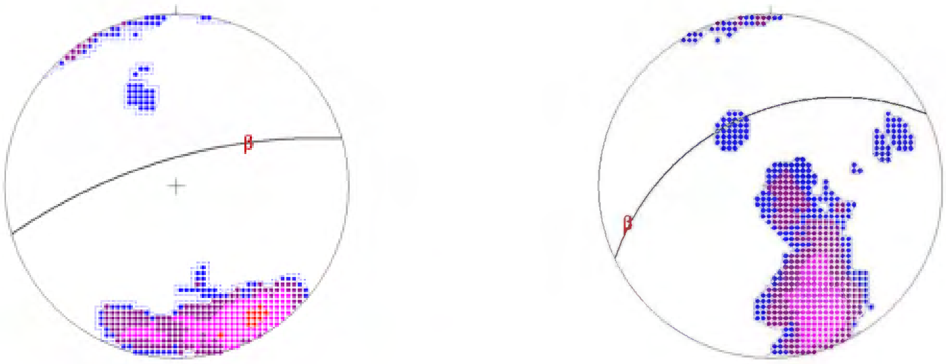


Figure 17 Schematic section through Echo 1 & Echo 3 (N-S section – north to rhs). Interpretation of thrust ramp / flat bend along the Echo-1 sill is tentative at this stage.



No. of Data = 34
Mean Principal Orientation = 77/344
Mean Resultant dir'n = 68-345
Mean Resultant length = 0.79
(Variance = 0.21)
Calculated. girdle: 41/238
Calculated beta axis: 49-058

No. of Data = 46
Mean Principal Orientation = 55/335
Mean Resultant dir'n = 45-329
Mean Resultant length = 0.77
(Variance = 0.23)
Calculated. girdle: 75/076
Calculated beta axis: 15-256

Figure 18 Stereonet plots of poles to a) primary layering in sills, and b) bedding in volcanics and sediments - Echo district.

The sills show 2 main populations of steep N-dip, either indicating lateral kinks along the strike length of the sills or a change in orientation between the sills from S to N (from base to top).

The surrounding volcanics and sediments show a general N-dipping sequence, but with some south dipping units. The overall distribution reflects a combination of the steeply-dipping T1 thrust sheet, and the more shallow, gently folded T2 thrust sheet.

3.2.3. Cecilia prospect

The Cecilia prospect lies ENE of Bravo, and comprises a thick sequence of stacked peridotite – dunite to gabbro - leuco gabbro sills (Figure 19 Figure 20).

The primary sill complex in the north of the area trends roughly 060 in the west, to 075 in the east. The change in strike is relatively abrupt (kink-like) on a regional scale, and is associated with changes in sill thickness and embayment geometry within the sill stack.

The sill complex has an average dip of 40 – 60° NNW to NW (stereonet projections of layering within sills and So of footwall / hangingwall sequences are shown in Figure 21).

The primary sill complex comprises (base to top):

a) A basal pyroxenite to thin peridotite; the peridotite exhibits at least 2 significant kink-like bends (the western of these is associated with variable thickening of the sill). The far-west of the sill is complicated by a possible embayment oat thin overlying pyroxenite – ol-pyroxenite sill into thee basal sill. The base of the sill is in contact with a footwall of hornfelsed siliceous siltstone / shale.

b) A thick gabbro to leuco gabbro sill;

c) A thick peridotite to dunite sill. This appears thicker in the east; to the west, the sill has several basal embayment, with a quasi-regular spacing of 300 – 400m;

d) A second thick gabbro – leuco gabbro sill. This includes a relatively thin ol-pyroxenite to peridotite sill extending from the east to roughly central across the body. This thin sill has several significant embayments / bends along its strike length (evident in both mapping and the hyperspectral data). The sill disappears in a zone poor outcrop & boulder fields; it is interpreted here as truncating along the upper surface of the underlying peridotite – dunite sill. The thin ultramafic layer is locally mineralised, and may be the source of mineralised boulders found within a wash-out boulder field immediately north of thee Cecilia sills;

e) A complex stack of intercalated pyroxenite to peridotite sills, with localised embayments, forming the upper part of the complex. A thin lens of shale is incorporated into this part of the sill complex.

The upper contact of the sill complex with the hangingwall shale is locally exposed. The uppermost ultramafics are strongly altered (talc – tremolite alteration), with shear – related moderate – N- dipping foliations and flat tensile fractures developed. These fabrics are interpreted as developed by S-vergent thrusting of the overlying T2 thrust sheet; this thrust is interpreted as possibly locally cutting the upper sill contact in the east of the area, and lying immediately north in the west. Possible ramp antiform fold geometry in the hangingwall sediments was noted.

The T2 thrust ramps across the SW end of the Cecilia sills, with S-vergent transport of folded sediments and volcaniclastics. Shales within this sequence locally have high-strain fabrics. Several outcrops of folded sediments in this are exhibit SE-dipping fold axial planes; these are interpreted as originally upright F1 folds, tilted during imbricate thrusting associated with the T2 thrust sheet.

Immediately south of the principal Cecilia sill complex is a second stacked sill dipping roughly 50° NNW. The sill grades from ol-pyroxenite (base) through gabbro to peridotite (top). This sill is currently interpreted as lying within the T1 thrust sheet; however, the regional mapping and magnetic data suggests that sills lying immediately south lie within a shallow – dipping to subhorizontal thrust sheet overlying T1 (T2 or another thrust sheet?) – see next section.

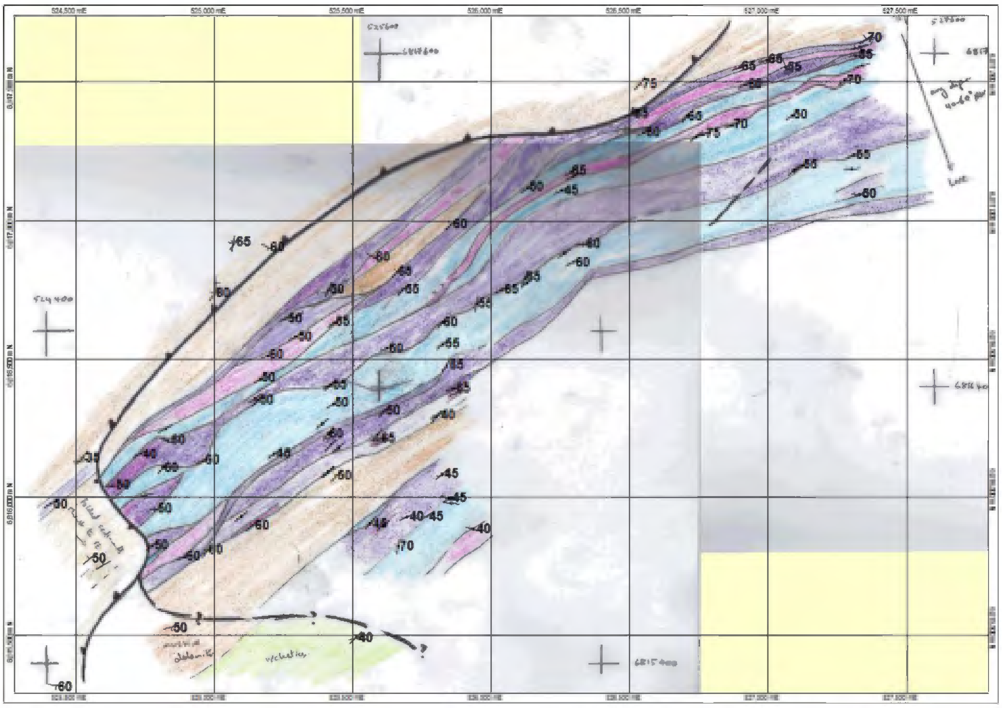


Figure 19 Cecilia (west) area. The principal sill complex dips 40 - 60 deg NW. The T2 thrust overlies the SW end of the sills.

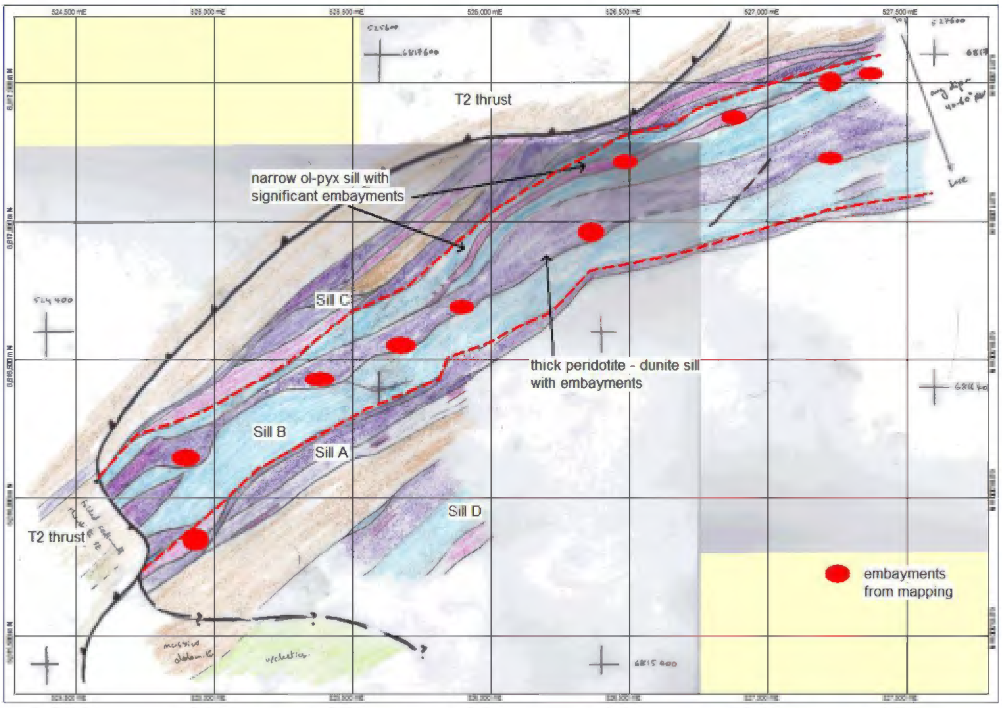
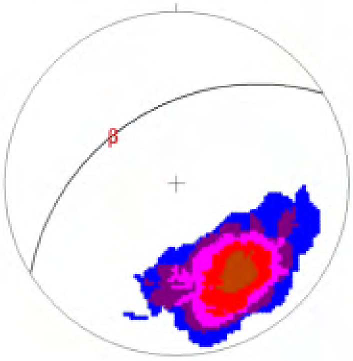
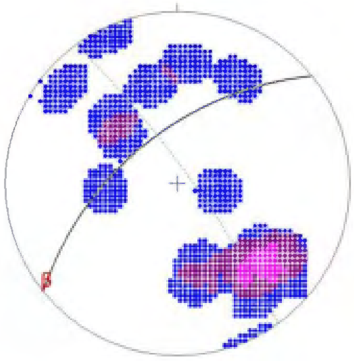


Figure 20 Location of mapped and interpreted embayments within Cecilia peridotite to ol-pyx sills.



No. of Data = 84
Mean Principal Orientation = 53/328
Mean Resultant dir'n = 52-328
Mean Resultant length = 0.92
(Variance = 0.08)
Calculated. girdle: 39/127
Calculated beta axis: 51-307



No. of Data = 20
Mean Principal Orientation = 66/321
Mean Resultant dir'n = 21-300
Mean Resultant length = 0.59
(Variance = 0.41)
Calculated. girdle: 84/054
Calculated beta axis: 6-234

Figure 21 Stereonet plots of a) primary layering within sills (from both columnar joints and intrusive phase contacts) and b) bedding of surrounding volcanics / sediments.

3.2.4. West Cecilia – Juliet – Core

The ENE-trending sills of Cecilia (West) bend to the E- / ESE- in the east of the district. West of the Xstrata tenements, the main Cecilia sill complex is partially obscured by a series of moderate to flat-lying thrust sheets (Figure 22, Figure 23). The underlying sills are also intersected / displaced into segments by at least 2 NW-trending strike – slip faults (interpreted) marginal to the overlying T2a thrust sheet. The dissected sill(s) represent the eastern extension of the mineralised Delta sill, and is a significant target.

At least 3 major overlying thrust sheets can be recognised (Figure 22, Figure 23):

a) T2a – this comprises a lobate (SE-trending) thrust sheet displacing and covering the northern Cecilia sills. The thrust sheet is roughly 1.5km wide in this area, and includes inferred broadly folded sills (from magnetics).

b) T2b – This comprises the extensive thrust sheet lying principally south of the main Cecilia sills . Irregular terminations of magnetic sill horizons within this thrust sheet indicate it is thin and shallow dipping to subhorizontal. Interference between the magnetic signatures of relatively flat-lying sill(s) at the base of the thrust sheet with the northern Cecilia complex sills gives the (incorrect) impression of a significantly folded belt. This is further complicated by interference from the magnetic signatures of the third overlying thrust sheet.
Several NE- trending narrow magnetic bodies within the broad area of shallow-dipping gabbro in the west of the T2b thrust sheet may represent either minor dykes, or concealed, broadly folded trends of shallow-dipping ultramafic sills at the base of the thrust sheet.

   An ESE-trending linear magnetic body in this region is interpreted at present as a minor dyke partially concealed by the thrust sheet.
   The T2b thrust sheet is very broadly folded in the east in a gentle synform. The thrust sheet, with variably magnetic sills in the hangingwall form another synformal thrust klippe to the south (the Lima prospect sills).
   T2a & T2b are probably parts of the same thrust sheet.

c) The T2a thrust sheet sills (peridotite overlain by gabbro) are locally overlain by a subhorizontal sheet of pillow basalts (with basal black shales and a thin peridotite sill). This is interpreted as a third flat-lying thrust sheet (T3). The basalts and shale have marked similarities to the Chukotat Formation; the thrust sheet is interpreted here as a small klippe of the regional –scale Raglan – Cross Lake thrust sheet.

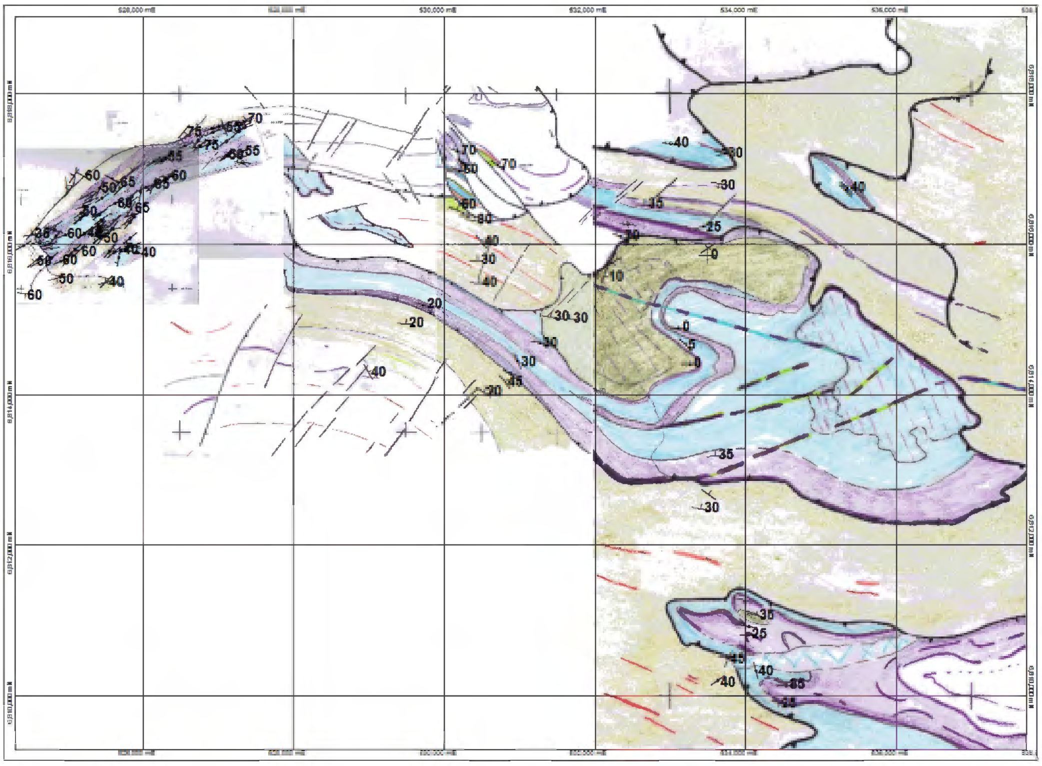


Figure 22 Regional setting of the Cecilia / Juliet and Core sill complexes. The Juliet and Core prospects comprise shallow dipping - to subhorizontal sills within the T2 thust sheet. These are locally overlaiin by the T3 thrust sheet.

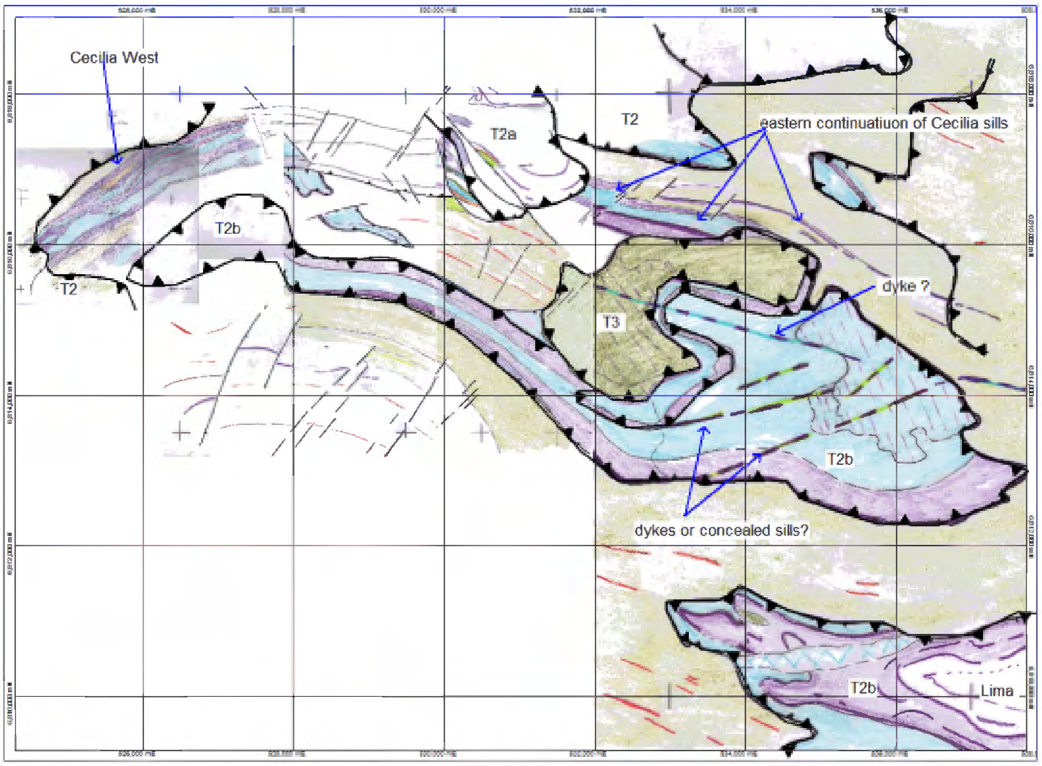
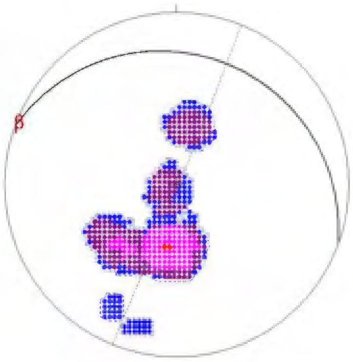
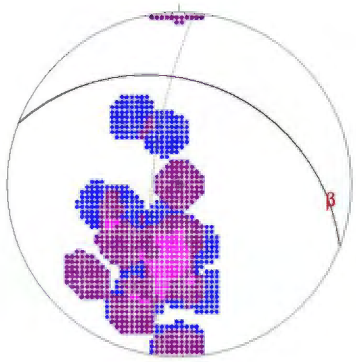


Figure 23 Distribution of the main thrust sheets within the Cecilia / Juliet / Core / Lima district.



No. of Data = 25
Mean Principal Orientation = 40/021
Mean Resultant dir'n = 38-023
Mean Resultant length = 0.85
(Variance = 0.15)
Calculated. girdle: 77/275
Calculated beta axis: 13-095



No. of Data = 29
Mean Principal Orientation = 25/020
Mean Resultant dir'n = 22-019
Mean Resultant length = 0.84
(Variance = 0.16)
Calculated. girdle: 89/112
Calculated beta axis: 1-292

Figure 24 Stereonet plots of a) primary igneous layering and b) volcanic / sedimentary bedding - Juliet / Core area. Note dominance of shallow to subhorizontal dips.

3.2.5 CLS prospect

The CLS prospect comprises principally an ENE-trending belt of moderate to steeply dipping basalts (+/_ sediments) with 2 stacked sill complexes. The main sill comprises ~200m thick sequence of peridotite / dunite (base), ol-pyroxenite and gabbro (top). This is a very strike-extensive sill, extending for at least 35km across the district with a relatively contact strike and dip.

The sill is offset by ~1200m by a splaying NNE- dextral fault zone (with complication from a conjugate NNW- sinistral fault zone). The zone of displacement is also associated with a klippe of an overlying thrust sheet of pillow basalt (interpreted T3 thrust with Chukotat Formation) - Figure 25.

The overlying basalt thrust sheet is interpreted here as an outlier of the main Cross Lake Chukotat Formation subdomain (this lies immediately north / northeast). The Cross Lake district is interpreted here as a shallow, broadly folded synform of Chukotat Formation basalt with intercalated Raglan Formation sills forming the hangingwall to a major shallow- to moderately dipping S-verging thrust sheet (the main T3 thrust sheet in this interpretation).

The current interpretation precludes a direct correlation of the ENE CLS sill as a continuation of the Cross Lake sill complex (within the same thrust subdomain); the 2 sills are separated by a significant thrust. However, it is probable that the CLS sill and basalt sequence are a separate (underlying) imbricate thrust sheet of Chukotat and Raglan Formations. This could therefore represent a significant target. Further mapping and integration of the magnetic data along this trend is required to resolve these questions.

Stereonet plots of layering within the sills and So bedding of sediments / volcanics (Figure 26highlight:

a) The consistent ~50°NW dip of the CLS sill, and;

b) The variation from moderate to subhorizontal dips within the hangingwall volcanics (combination of thrust flat and thrust ramp zones, plus subhorizontal dips of the overlying klippe of the Cross lake thrust sheet).

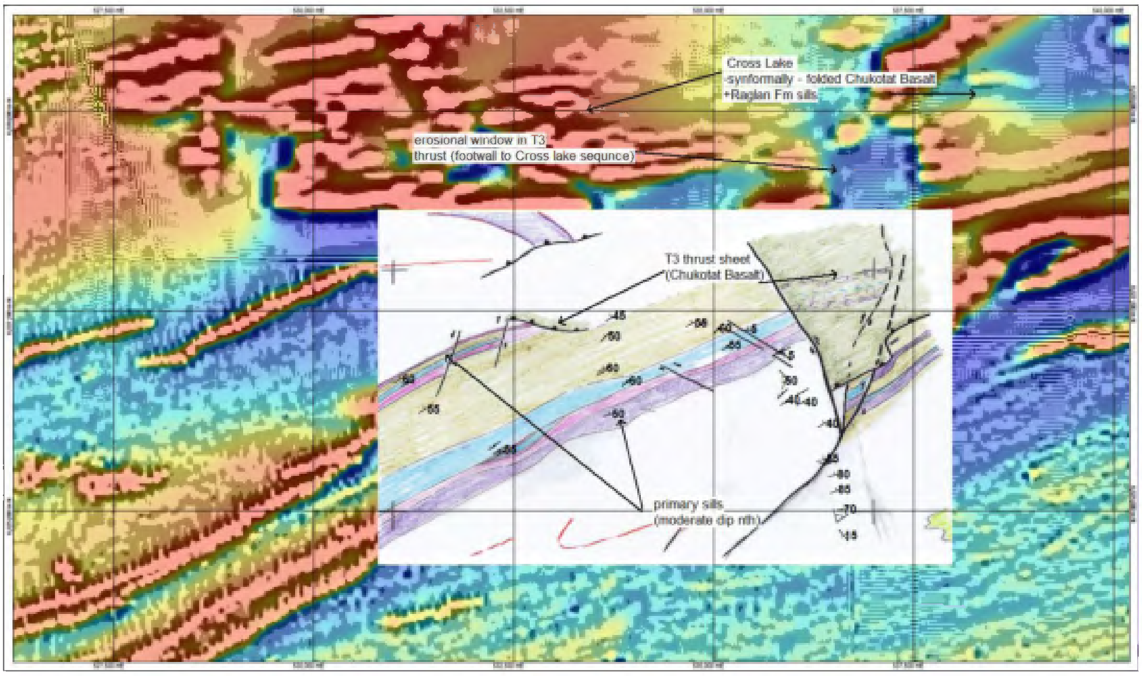


Figure 25 Structural setting of moderate NW-dipping peridotite - gabbro sill at CLS. The Cross lake complex to the NE lies within a separate shallow dipping thrust sheet (T3).

No. of Data = 13
Mean Principal Orientation = 52/325
Mean Resultant dir'n = 52-325
Mean Resultant length = 0.99
(Variance = 0.01)
Calculated. girdle: 60/208
Calculated beta axis: 30-028

No. of Data = 23
Mean Principal Orientation = 45/332
Mean Resultant dir'n = 39-331
Mean Resultant length = 0.82
(Variance = 0.18)
Calculated. girdle: 85/067
Calculated beta axis: 5-247

Figure 26 Stereonet plots of So for a) sills and b) sediments / volcanics - CLS prospect. Note – the CLS sills have a consistent dip of ~50° to NW. The sediments & volcanics exhibit asymmetric subhorizontal to steep N – dips, suggesting thrust flat / ramp geometry.

3.2.6 Big Circle prospect

The Big Circle prospect lies west of the Cross Lake area; the district can be subdivided into 3 principal subdomains (Figure 27):

a) South area (part of "T1" thrust stack)– this comprises a thick series of massive to pillow basalts (+/- intercalated sediments) with 2 or 3 strike – continuous ENE- trending sills. The southernmost sill complex in the mapped area corresponds to the northernmost linear sill complex in the CLS prospect area. A moderate to steeply-dipping thrust separates the 2 main sills in this area (the sills are likely thrust repetitions of the same sill). There are probably several other imbricate, moderate N-dipping thrusts in the subdomain. Note that the sequence generally dips to the north, with some folding evident. Younging is generally to the north, with consistent normal facing.

b) North area (part of "T1" thrust stack) – this area has a similar ENE structural grain to the southern district, but with only minor thin sills evident, and a subdued magnetic signature. The area is interpreted as a northern continuation of the S-vergent imbricate thrust stacking of dominantly massive to pillow basalts (Chukotat Fm?).

c) Overlying thrust sheets (T2 / T3) – the Big Circle zone can be separated into;

   A magnetic anomalous zone comprising a relatively fault – lying thrust sheet of Chukotat Fm basalt with basal black shales and an ol-pyroxenite to pyroxenite sill. The irregular shape of the magnetic sill and the locally "fuzzy" magnetic signature indicate interaction of the flat-lying thrust sheet with the variable topography (and variable thickness of basalt cover). This thrust sheet is interpreted as a very limited and thin klippe of the regional Cross Lake thrust sheet occurring to the east.

   A thicker and stronger magnetic sill to the south (and underlying the T3 thrust) – this has a z-vergent geometry (possible kink fold or dextral NE-fault offset), and a moderate NW dip. It is interpreted as coincident with a probable regional continuation of the West Raglan thrust / sill trend.

   A second relatively shallow – dipping but gently folded thrust sheet (T2) underlying the T3 thrust has been interpreted from local discordances between basalt and shale sequence. The plan-view extent of this thrust sheet is ambiguous at present (a tentative interpretation is shown here).

Stereonet plots of layering within sills and So bedding of sediments & volcanics (Figure 28) highlight the dominantly flat-lying orientation of the thrust sheets in the Big Circle area.

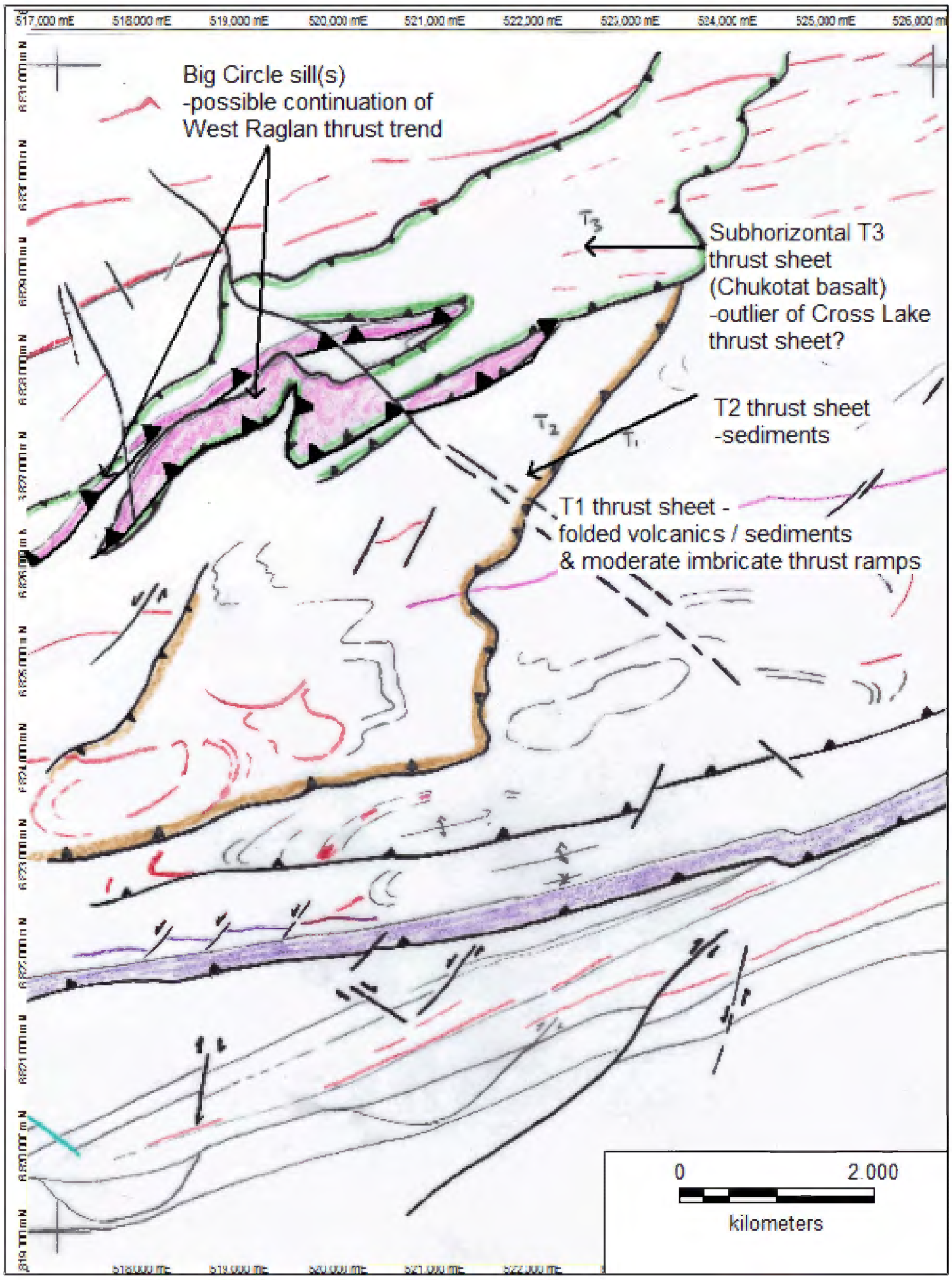
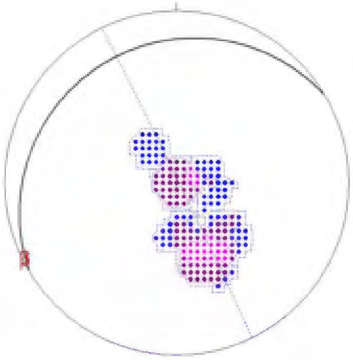
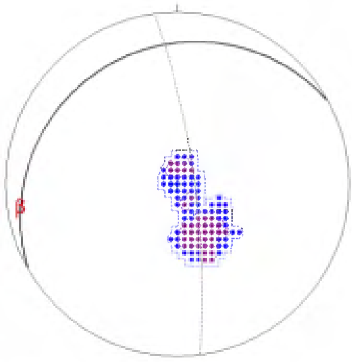


Figure 27 Principal structural elements of the Big Circle area. Moderate to steeply-dipping imbricate thrusts are overlain by at least 2 shallow-dipping thrust sheets. The big Circle magnetic sill(s) are interpreted as coincident with a probable continuation of the West Raglan thrust trend.



No. of Data = 12
Mean Principal Orientation = 21/330
Mean Resultant dir'n = 20-331
Mean Resultant length = 0.85
(Variance = 0.15)
Calculated. girdle: 82/082
Calculated beta axis: 8-262



No. of Data = 18
Mean Principal Orientation = 20/330
Mean Resultant dir'n = 19-330
Mean Resultant length = 0.92
(Variance = 0.08)
Calculated. girdle: 88/064
Calculated beta axis: 2-244

Figure 28 Stereographic plots for Big Circle area a) primary layering of sills, and b) volcanic / sedimentary bedding. Note dominance of shallow to subhorizontal dips.

3.2.7. Mid – North district

This comprises an extensive area north of the Bravo – Echo prospects, extending north towards the Big Circle / CLS districts.

The area is characterised in the magnetic data by:

a) the SW continuation of strike extensive linear magnetic sills from the CLS – Big Circle areas within a magnetically-quiet domain of thick basalts / sediments, and;

b) Further SW, the linear sills merge with a very structurally complex subdomain of folded and imbricate – thrust sills within basalts and thick sequences of Povugnituk Fm basaltic volcaniclastics and dolomites.

Only 2 limited mapping traverses were undertaken in this district at this time. Integration of the traverse data with the magnetics highlights the following points (Figure 29, Figure 30):

a) The northern sector of the Min-North district comprises the relatively linear, ENE-trending imbricate thrust stack of basalt & sills occurring in the CLS / Big Circle (south) areas; the sequences dip moderately to steeply north. Much of this area may be imbricate thrust slices of the Chukotat & Raglan Fms structurally intercalated with Povugnituk Gp sequences.

b) The southern sector comprises a series of intercalated basalt and mixed sediments / volcaniclastics, with broad to moderate folding evident. Whilst bedding at the outcrop scale is commonly steep, the intensity of small-scale folding within the units suggests that the overall form surfaces of the sequences are on average shallowly dipping, and broadly folded. Irregular discontinuities of magnetic units in the magnetic data, plus field observations of rapid and discordant changes in dips of basalts & sediments both across strike and up sequence (up-topography) indicates the presence of possibly several shallow – dipping thrust sheets.

Three possible models may explain the discontinuity between the linear magnetic units of the northern sector and the irregular / folded units of the southern sector:

a) The northern thrust stack cuts off the shallower thrust stack to the south;

b) The southern broadly folded thrusts (with associated sills) represent the southern thrust flat continuation of the northern imbricate thrusts;

c) The southern thrusts form a separate (overriding) thrust sheet truncating the (lower) steep imbricate thrusts.

At present the author favours the third model. Further reconnaissance mapping through this district will be required to solve these structural questions. This will be important in attempting to reconstruct the regional geometry of the thrust belt, and therefore to recognise potential imbricate thrust repetitions of the Chukotat / Raglan Fms in an area currently perceived as dominated by Povugnituk Fm sediments / sills.

Stereonet plots of layering within sills (Figure 31) highlights the main linear, moderately NW-dipping sills; a few measurements of so were possible form some of the flat lying sills, but in general So was poorly represented and not measured (and therefore under-represented in the diagram).

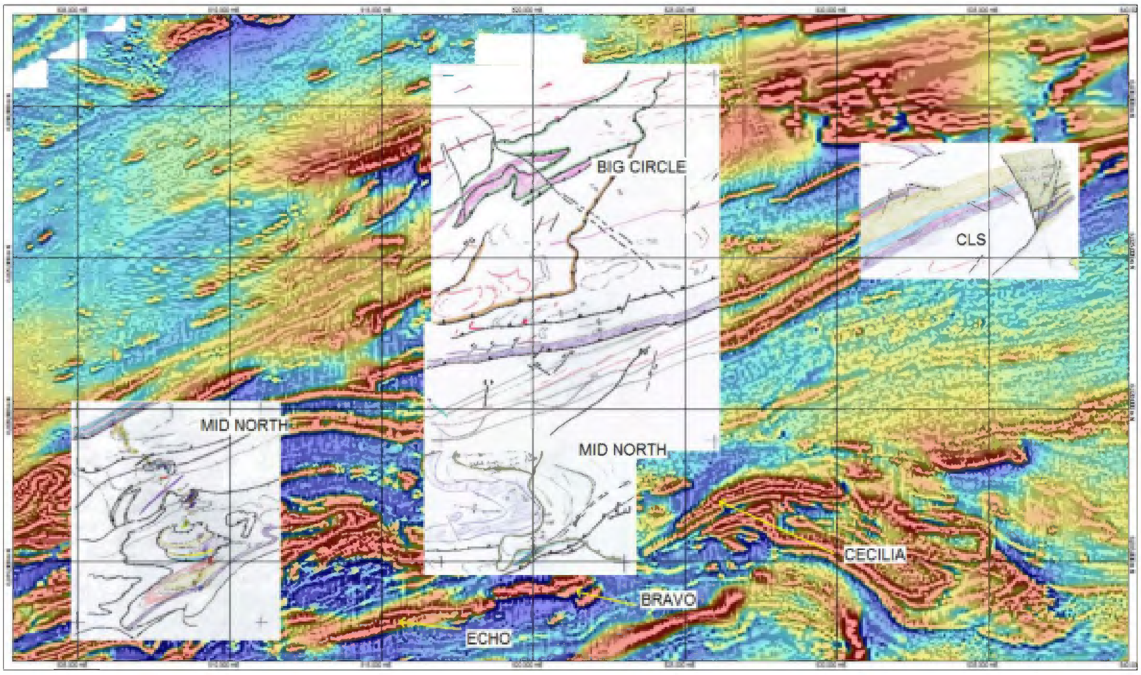


Figure 29 Preliminary geological mapping (regional traverse) across Mid North, Big Circle & CLS prospects.

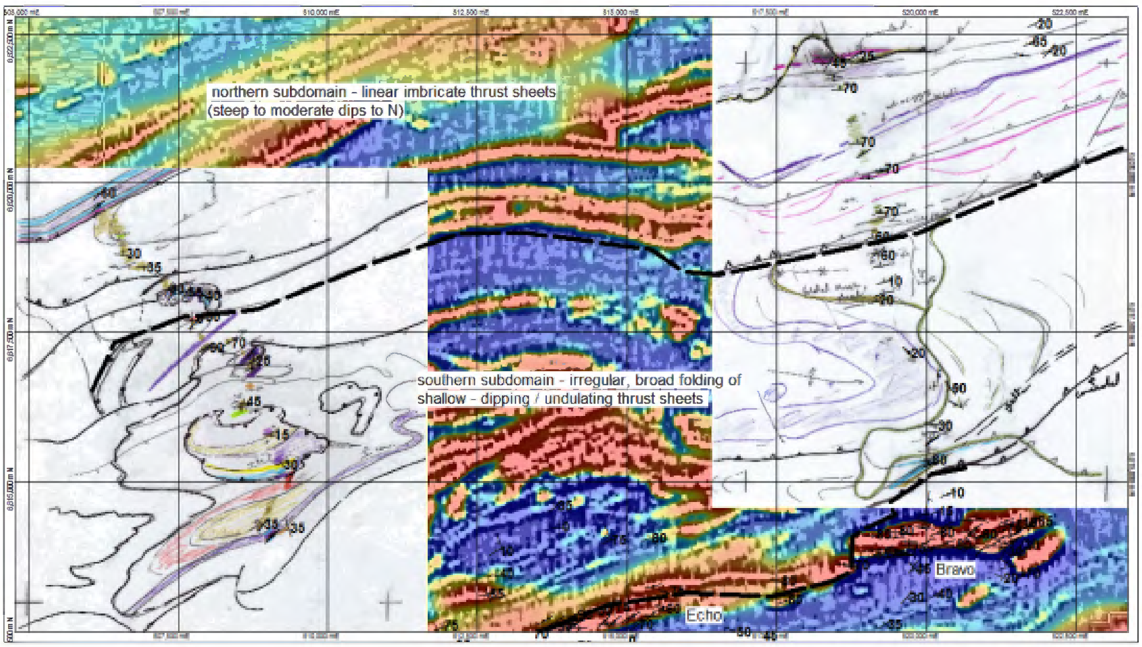
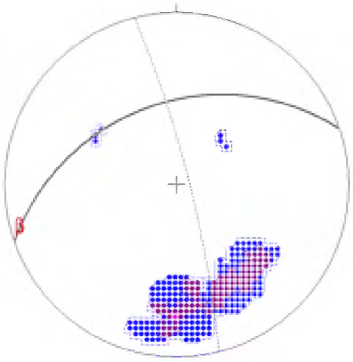


Figure 30 Mid North district - separation of northern (moderate to steep imbricate thrust sheets) and southern (folded, shallow dipping thrust sheets) subdomains.



No. of Data = 18
Mean Principal Orientation = 50/341
Mean Resultant dir'n = 38-344
Mean Resultant length = 0.76
(Variance = 0.24)
Calculated. girdle: 84/076
Calculated beta axis: 6-256

No. of Data = 37
Mean Principal Orientation = 17/324
Mean Resultant dir'n = 15-316
Mean Resultant length = 0.76
(Variance = 0.24)
Calculated. girdle: 83/076
Calculated beta axis: 7-256

Figure 31 Stereonet plots of a) primary layering (sills) and b) volcanic / sedimentary bedding (Mid North district). Note – significant folding evident in volcanics & sediments, with abundant shallow to moderate dipping beds (broad folding). The average 50° N-dip for the sills reflects significant exposure (and clear layering indicators) of the NE-trending linear sills vs. the shallow / sub-horizontal sills.

3.3. Belanger East / Wakeham district- structure at specific prospects

3.3.1. Nancy East -2

The Nancy East 2 prospect comprises a peridotite to dunite sill roughly 250m thick; the sill intruded pillow to massive basalts (with garnet-grade metamorphism locally evident). Garnet-bearing mafic schist and quartzite occur south of the sill.

The sequence trends E-W, and dipping (at surface) roughly 85°N to 90°. S1 cleavage dips steeply N (80°N), and is therefore shallower than bedding; the sequence forms a locally overturned (short) limb of an overturned fold. Pillows and vesicle trails indicate younging to the south; the sequence is facing up. The northern sill contact represents the base of sill.

Current drilling of the sill (as of Aug 10), combined with surface mapping of the location of the sill / footwall contact, indicates the upper 100m or more of the base of sill – intrusive contact dips roughly 70-75° S. This is discordant to the subvertical to very steep N-dip evident form So in the footwall and hangingwall basalt, and from columnar jointing tin the sill. A near-vertical dip is also indicated by the magnetic modelling of the sill (R. Yee, pers. Comm.). The discordance between the mapping and drilling results suggest the shallow section of the sill is discordantly ramping up across bedding to the south (pre-deformation reconstruction). The subvertical dip interpreted from magnetic modelling suggests the discordant lower-dip section of the sill may steepen to subvertical further down-dip.

The sill appears strike-limited in the magnetic data; it is probably over-thrust to the north by another moderate to steep imbricate thrust. Whilst the Nancy East-2 sill probably lies within the northern limb of the E-W synform folding the main Nancy sills, it appears to lie within an underlying thrust sheet; the main Nancy sills are interpreted as lying within a relatively thin shallow-dipping thrust sheet.

The structural framework of the Nancy and Nancy East-2 sills with respect to the .overlying thin thrust sheets of Nancy East are shown in Figure 32 & Figure 33

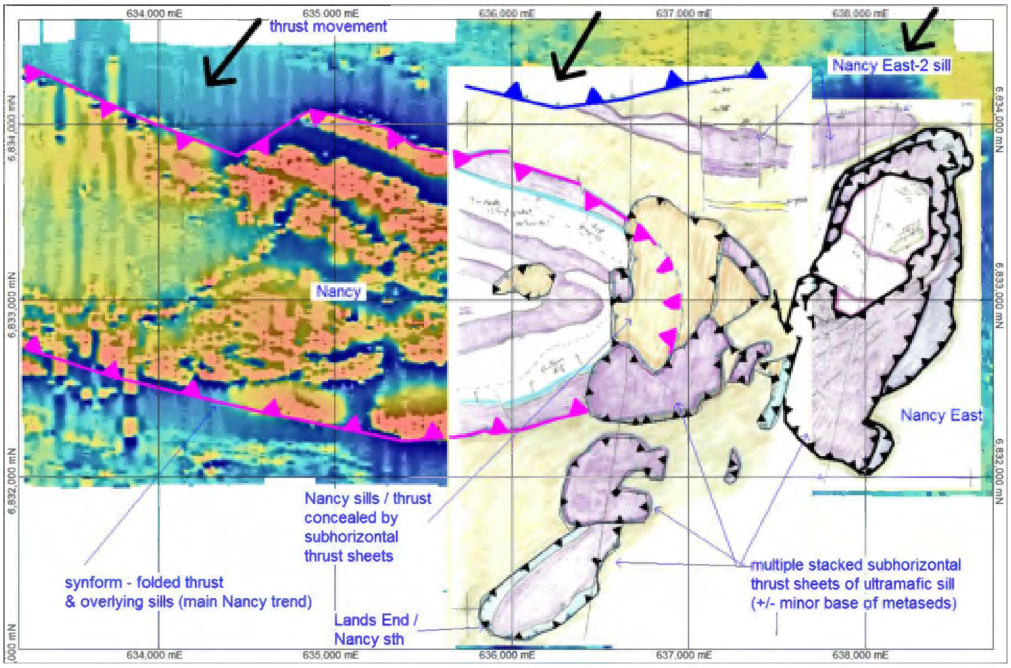


Figure 32 Nancy and Nancy East prospects. The nancy and Nancy East-2 sills are overlain in the east of the area by shallow-dipping thin thrust sheets of varibaly-magnetic sills.

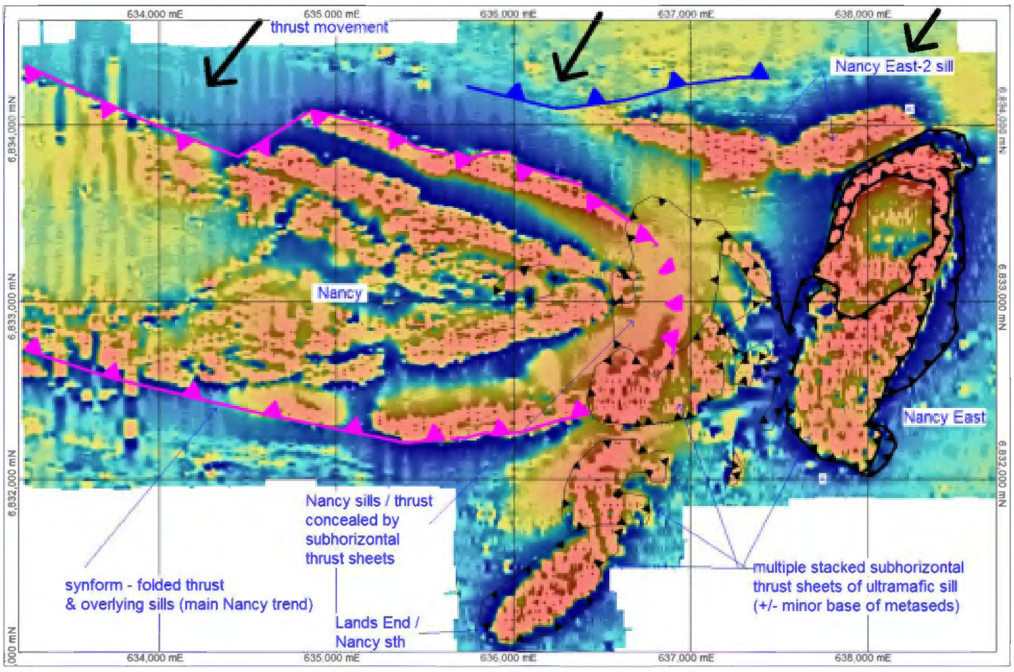


Figure 33 Structural framework of the Nancy & Nancy East thrust sheets superimposed on ground magnetic data.

3.3.2. Nancy East A – (including the magnetic annulus area)

The NNE-trending Nancy East A magnetic complex comprises a series of (at least) 2 low-angle thrust sheets with relatively thin sequences of sub-horizontal to variably-folded and variably – magnetic ultramafic sills (Figure 34, Figure 35).

The thrust sheets are described here from structural base to top (see N-S section outlining thrust sheets A-C - Figure 36).

a) Thrust Sheet A

This comprises the lowermost sequence of variably – folded metasediments and mafic metavolcanics. These are typically steep, and folded about E-W to ENE-trending F1 fold axial trends.

The sequence includes amphibolitic mafic schist (fine-grained metabasalt), pillow metabasalt, garnet-bearing quartzite and qtz – fsp – biot – ga schist (+/_ migmatitic horizons).

The easternmost continuation of the magnetic Nancy East 2 peridotite sill (subvertical to 80°N dip) lies immediately north of (and structurally below) the main Nancy East –A magnetic complex.

b) Thrust Sheet B

This is the lowest thrust sheet of the main NNE-trending Nancy East complex. The thrust sheet comprises a subhorizontal to very broadly folded sill, grading from nonmagnetic pyroxenite at the base to a thin peridotite, and then an upper sequence of ol-pyroxenite (grading to peridotite). The ol-pyroxenite and peridotite are only weakly magnetic (k= 1 – 7 x10^{-3}SI). The northern end of the thrust sheet dips moderately to the south (structurally overlies the Nancy 2 sill).

The peridotite – ol-pyroxenite phase of the sill forms the magnetically-low section of the obvious magnetic annulus - this is an erosional window within the overlying Thrust Sheet C peridotite.

Minor ESE- to E-W folding is evident in the northern sector of the sheet, then grading to the south into a relatively shallow S-dipping sheep (0- 20°).

The sill is on the order of 60-80m thick (based on waypoint elevations of topographically – highest outcrop to outcropping base of sill.

c) Thrust Sheet C

This comprises the main NNE-trending strongly magnetic
Sheet of peridotite structurally overlying the weaker magnetic ol-pyroxenite sill. There is a distinct colour difference between the 2 sills (Thrust sheet B sill ol-pyroxenite has a brown / buff – coloured weathering; the Thrust Sheet C peridotite has a greenish weathering (greater serpentinite component).

The annular structure at the north end of the complex is formed by a topographic high ridge of peridotite surrounding the topographically-subdued erosional window into Thrust Sheet B.

At the north end of the thrust sheet, the peridotite exhibits local tight (kink-like) folding (ESE-trending synform). In the central / southern sectors of the sheet, the peridotite ranges from 30 -80° dips (S- to SE – dips). The strong variability in dips suggest the sill forms a series of irregular dome & basin(?) folds – possibly as transported thrust ramp folds. Steep dips near the western margin of the thrust sheet may be related to steep lateral ramp faults within the thrust sheet.

The sill is on the order of 40 – 60m thick (from waypoint elevations).

d) Thrust Sheet D

The peridotite of Thrust Sheet C is overlain on the southern half of its western margin by a moderately W-dipping sheet of coarse-grained gabbro (+/- minor basalt to the west). The gabbro dips roughly 50° W , with the footwall peridotite dipping up to 80°W at the contact.

The gabbro is overlain to the west by metabasalt, garnet-bearing mica schist and quartzite. The metasediments near the top of the thrust sheet locally exhibit S-verging small-scale nappe folds and imbricate S-verging high-angle listric thrust faults.

e) Thrust Sheet E

This comprises a flat-lying to broadly folded upper thrust sheet of peridotite. The thrust dips roughly 30° W adjacent to the Nancy East A magnetic complex, and extends to the west to form the main Nancy East / South complex. The upper peridotite has a moderate (discordant) dip on the thrust.

The sills of the Nancy East - A complex have limited thickness, and little or no mineralisation within outcrop or local ultramafic boulders. The Surtsey & Emperor prospect gossans in the south of the complex comprise localised formational sulphide within the underlying metabasalts (and shales). The sulphides may have undergone remobilisation during the thrust event.

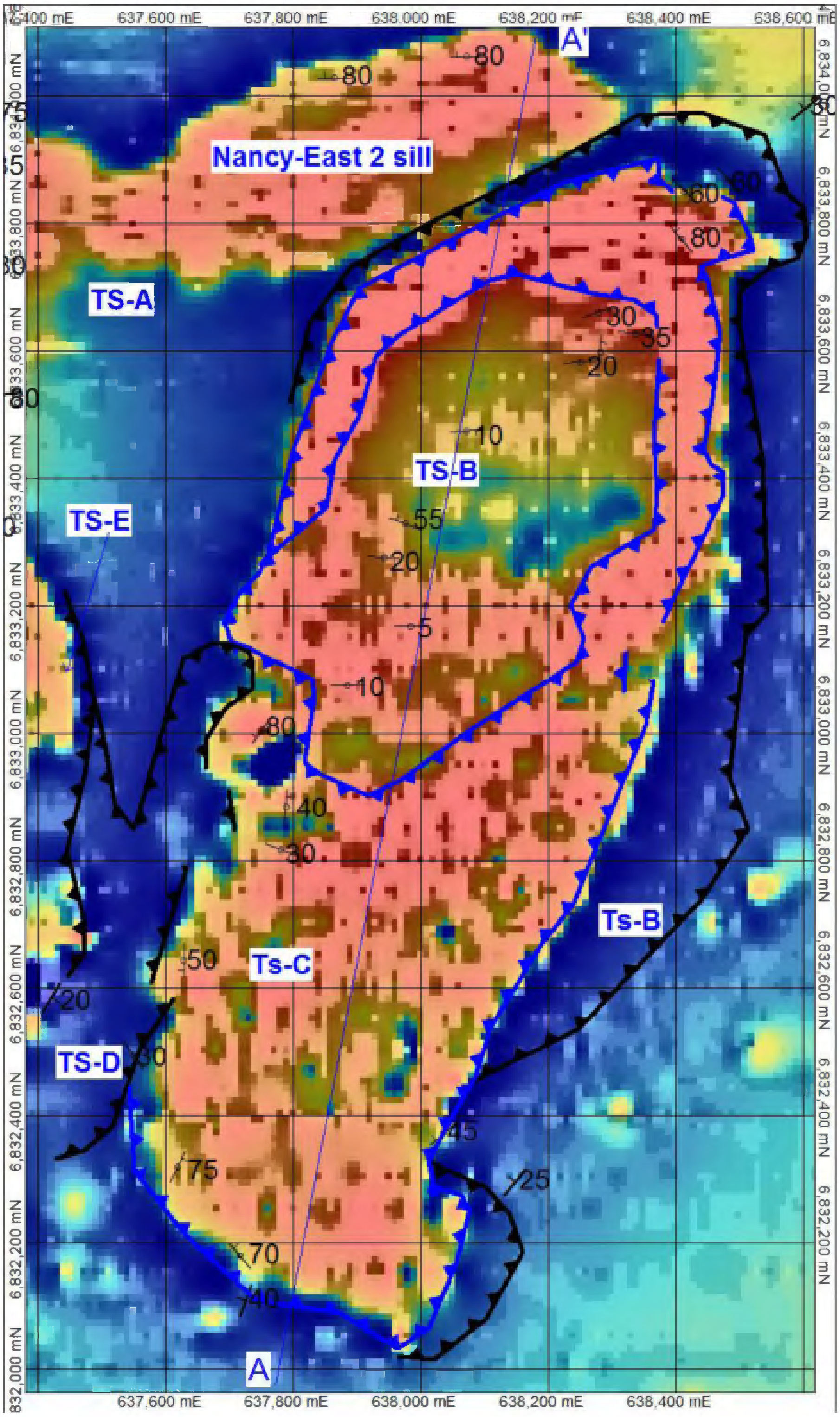


Figure 34 Principal thrusts and thrust sheets of the Nancy East-A prospect, superimposed on ground magnetic data.

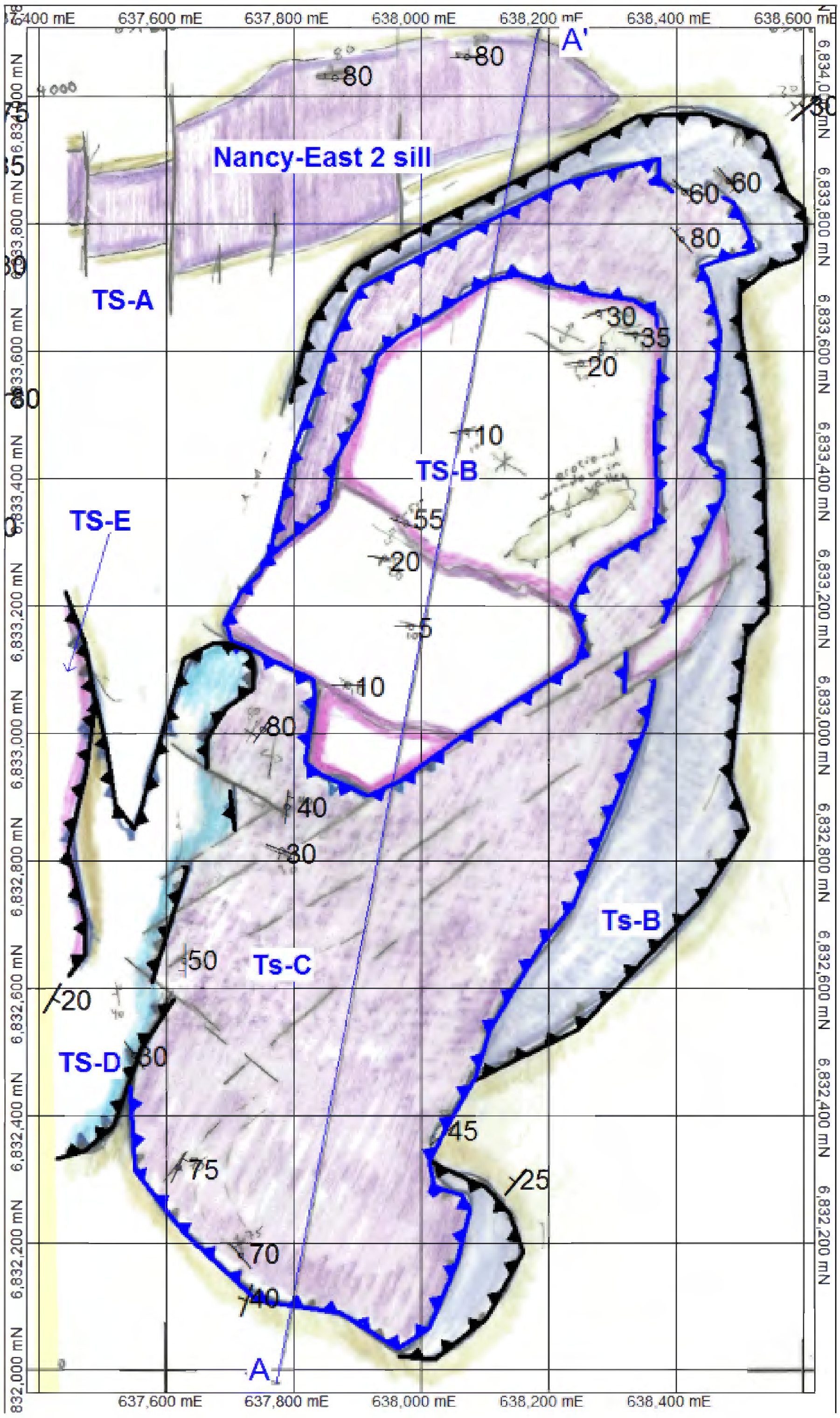


Figure 35 Map of Nancy East-A thrust sheets. Note - minor thrust sheets in west (Ts-D, Ts-E) are shown as approximate boundaries only at this stage.

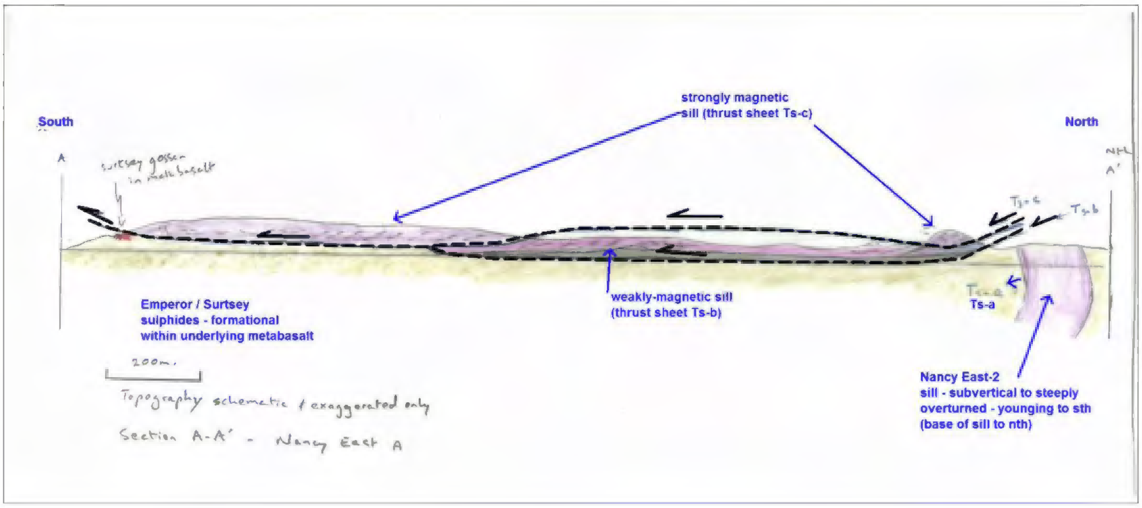


Figure 36 N-S section across Nancy East-A prospect, highlighting stacking of thin, subhorizontal thrust sheets of variably-magnetic ultramafic sills.

3.3.3. Nancy East - B / Lands End prospects

This comprises a NNE – trending corridor of irregular, variably-magnetic subdomains overprinting the eastern closure of the main Nancy synform; these represent a series of overlapping sub-horizontal to shallow – dipping thrust sheets with relatively thin, variably magnetic sills (with occasional footwall metasediments / metavolcanics). These thrust sheets are the western continuation of the subhorizontal thrust sheet stack in the Nancy East – A area immediately to the east (see Figure 32, Figure 33).

The thrust sheets structurally overly the subvertical imbricate thrusts and sills of the Nancy East-2 prospect, and the synformal-folded main Nancy sills.

The limited areal extent of each thrust sheet and accompanying sill(s) is due to both:

a) Interaction of the subhorizontal sequences with significant incised topography, and;
b) The common occurrence of moderate-angle lateral-ramp faults (NNE- to N-trending), with ramping of the thrust sheets above the current topographic level.

The shallow thrust sheets are interpreted to verge to the SSW, and were developed in response to the D2 SSW-vergent thrusting of the northern Archaean basement terrane (this lies roughly 5kms to the NNE of Nancy).

Whilst the thrusts in this area are typically subhorizontal to shallow – dipping, the overlying sills exhibit variable dips, ranging from horizontal to 70° (from columnar joints). These dips are in part due to localised folding of the sills associated with the local lateral ramp geometry, and in part represent an early phase of thrust / fold deformation of the sills prior to intersection and displacement along the subhorizontal thrusts.

The Lands End sill is associated with minor sulphide mineralisation (+ elevated Ni) along its southern basal margin (sulphide mineralisation straddles the lower pyroxenite / footwall basalt contact). A single drillhole to test this mineralisation has been proposed.

3.3.4. Borneo prospect

The Borneo prospect lies along the regional WNW trend of sills that also includes the Ireland prospect to the west, and the Nancy prospects to the east.

Thrust sheets

The area comprises a series of variably magnetic (and variable – thickness) sills within 3 main thrust sheets. A fourth subsidiary thrust sheet comprises pillow basalt, with little or no ultramafic sill component. These are described from structural base to top (Figure 37, Figure 38). Stereonet plots of layering within the sills, plus So of hangingwall / footwall volcanics (Chukotat Gp) are highlighted in Figure 39.

a) Thrust sheet A

This comprises the southern sector of the prospect; it includes a broadly – folded series of massive to pillow metabasalt (pillows <1m), overlain by a roughly 250 – 300m thick sill (grading from a thin gabbro (+/- pyroxenite) at the base through a thick, strongly magnetic peridotite and moderately magnetic ol-pyroxenite to an upper gabbro. The sill complex has a consistent E-W strike, and dips roughly 50°N. All of the units within the sill locally exhibit compositional banding. The ultramafic sills are typically coarse – grained relative to the Nancy sills, suggesting a deeper emplacement history. The sill extends for >15kms; it is truncated to the east by the overlying folded thrust sheet of the Nancy sills, and is covered by thick till to the west, but appears to extend towards (and is equivalent to) the Ireland sills.

A localised thickening of the sill at roughly 620200E / 6834750N is associated with a localised change in strike: it is interpreted as a localised embayment in the base of sill, (possibly accentuated by minor normal faulting).

Two minor E-W sills evident in the magnetic data in the north of the district may be either a synformal fold limb repeat of the sill, or a second moderate – dipping imbricate thrust sheet.

b) Thrust Sheet B

This comprises a slightly discordant WNW-trending, synformal – folded thrust sheet of ultramafic sills. The thrust sheet and sills are interpreted as the WNW extension off the Nancy synform structure. The discordant nature of the thrust sheets A & B are evident in the magnetic data; the contact between the 2 thrust sheets was not directly observed in the field, although significant textural differences between the 2 sill complexes adjacent to each other in the SE of the prospect were evident,

c) Thrust Sheet C

This comprises the main E-closing synform of intercalated pillow basalt and pyroxenite to peridotite sills evident in the central and western part of the prospect. The pillow basalts include mega-pillow complexes (pillows up to 3-4m), suggesting a proximal source.

The sills are relatively thin compared to the Thrust Sheet A sill. The 2 limbs of the synform dip roughly 40° (on average). The sills appear strike – limited in the magnetic data, and in outcrop. At least one of the sills grades along strike from magnetic ol-pyroxenite to nonmagnetic pyroxenite. At roughly 620300E, the sills are truncated by an overlying subsidiary thrust sheet of pillow basalt (Thrust Sheet D – see below). Weak, broad magnetic anomalies in the area of this overlying thrust sheet (including the broader magnetic anomaly targeted as [art of the main Borneo prospect in the NW) are interpreted to reflect the strike – continuation of at least one of the folded sills to the west beneath a thin cover of pillow basalt. The wider separation between the north and sth magnetic units in this area compared to the exposed sills to the east suggest there is a minor normal fault (west block down) roughly coincident with the eastern limit of the overlying Thrust Sheet D.

d) Thrust Sheet D

This comprises an secondary thin thrust sheet of pillow basalt overlying the Thrust Sheet C sills and volcanics in the west of the prospect. The thrust sheet has been interpreted from the localised presence of structurally-anomalous dips in the pillow basalts, and the concealment of magnetic sills in the west of the prospect. The eastern limit of the thrust sheet is interpreted as due to lateral ramping of the thrust upward to the east (coincident with the inferred location of a N-S normal fault in the underlying Thrust sheet).

Thrust sheets C & D are folded in the same synformal structure.

Regional fold trends

The synformal trends of the main Borneo and Nancy complexes are regionally near-coincident, but in detail discordant (by 20 – 30°). This suggests the thrust sheets were undergoing initial weak folding during thrust stacking, with further accentuating of the synformal folding after thrusting stopped.

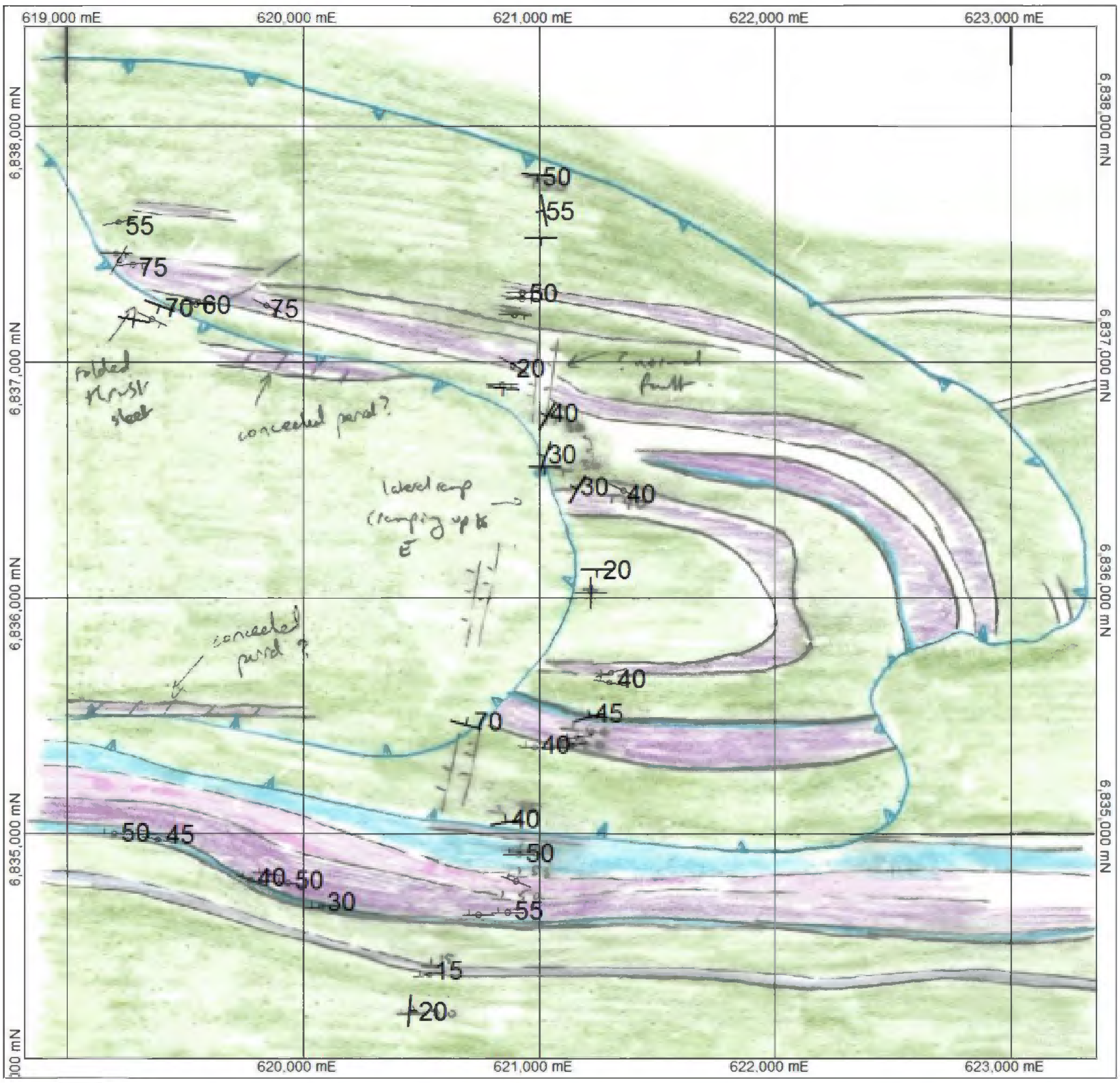


Figure 37 Map of Borneo prospect. The strike-extensive Borneo Sth sill is structurally overlain by a synform-folded thrust sheet of thinner, strike length variable sills intercalated with mega-pillow basalt. These sills are overlain to the west by a subsidiary folded thrust sheet of pillow basalt (thrust sheet ramps upward to the east).

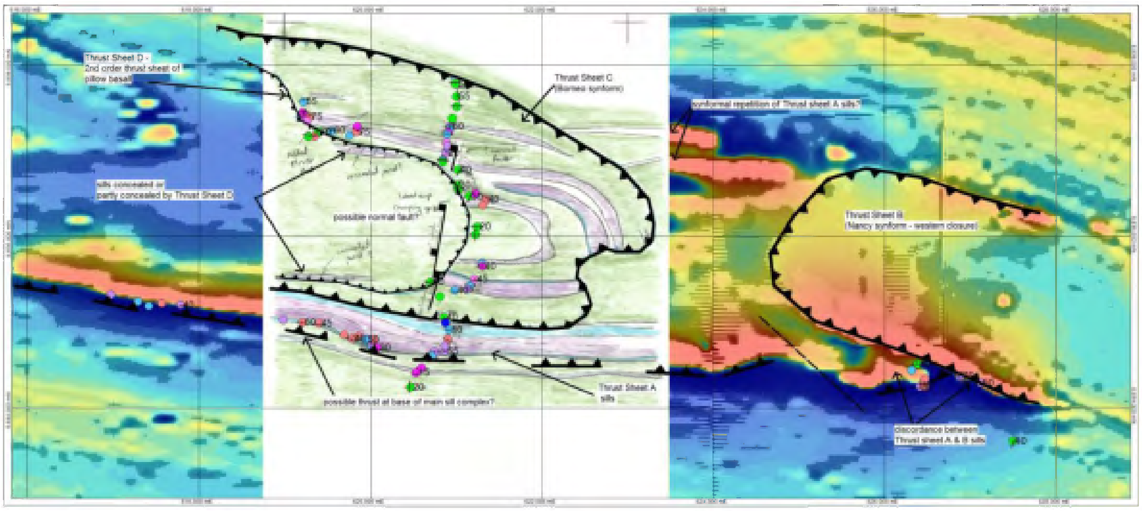
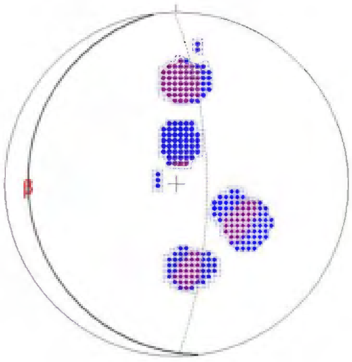
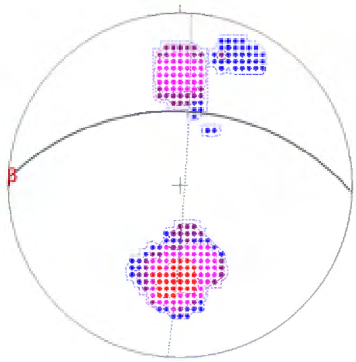


Figure 38 Regional view of strike - extensive Borneo Sth sill, discordantly overlain by th western end of the synformal-folded Nancy thrust sheet. It is ambiguous whether the Nancy synform thrust sheet and the central Borneo thrust sheet are the same (separated by an erosional window), or are at different structural levels.



a



b

No. of Data = 18
Mean Principal Orientation = 15/263
Mean Resultant dir'n = 14-251
Mean Resultant length = 0.73
(Variance = 0.27)
Calculated. girdle: 76/089
Calculated beta axis: 14-269

No. of Data = 37
Mean Principal Orientation = 55/002
Mean Resultant dir'n = 8-007
Mean Resultant length = 0.64
(Variance = 0.36)
Calculated. girdle: 88/094
Calculated beta axis: 2-274

Figure 39 Stereonet plots of a) layering within sills and b) So of hangingwall / footwall volcanics.

3.3.5. Ireland Prospect

The Ireland prospect comprises 3 or 4 sills trending WNW, and intercalated with Chukotat Gp pillow basalt.

The sills are thrust to the SSW (D2 thrust event) along a major WNE-trending thrust front ; to the west, this thrust overrides the main raglan – Donaldson thrust and mineralised sill trend.

The Ireland sills most probably represent simple thrust repetition of 2 primary sills (Figure 40).

To the north of the main sills there are 2 or 3 subsidiary, arcuate & imbricate thrusts, producing structural repetition of a thin nonmagnetic to weakly magnetic pyroxenite sill with pillow basalt hangingwall.

The entire Ireland prospect sequence dips steeply to moderately N / NNE, with consistent younging to the north.

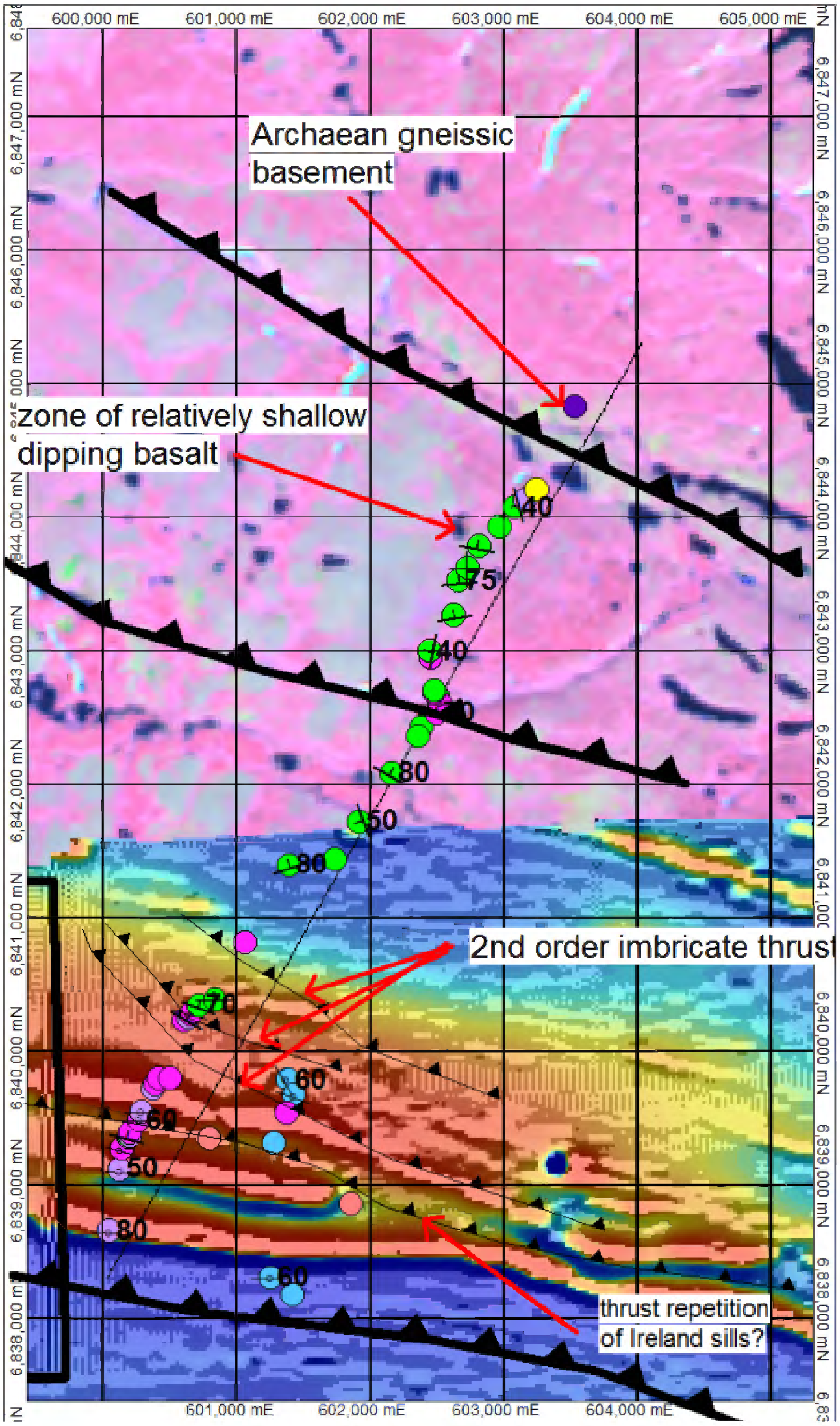


Figure 40 Regional traverse through Ireland (sth) and Ellsemere (nth) prospects. The Ireland sills probably represent thrust repetition of 2 main sills. The Ellsemere prospect comprises an imbricate thrust stack of pillow basalt with occasional thin, nonmagnetic pyroxenite sills.

3.3.6. Ellsemere Prospect

This comprises a relatively monotonous sequence of pillow basalt (Chukotat Gp); the sequence varies from subhorizontal to moderate NNE- dips, and represents a series of imbricate thrust sheets (Figure 40). Occasional W-dipping exposures indicate broad folding of the basalt. Thin and typically strongly foliated pyroxenite sills occur occasionally; these have significant variability in strike extent (some appear to be only 100m strike length).

Fine-grained basalt to volcaniclastic units have locally deformed to chlorite schist; this is particularly evident at the northern limit of the basalt (thrust contact with Archaean granite gneiss to the north).

In the north of the area, the S1 cleavage within the basalt, plus S1 (?) foliation within the Archaean granite gneiss dips steeply to the south; in the southern sector of the prospect, s1 dips steeply north. This may indicate some local thrusting of the Chukotat basalt to the north over the Archaean gneisses, rather than S-vergent thrusting of the gneiss over the basalt.

5. SUMMARY & RECOMMENDATIONS

5.1 Summary & Conclusions

The southern sector of the Cape Smith belt comprises a series of thrust sheets developed during 2 principal thrust episodes:

a) D1 – SSE- to SE – vergent thrusting, with initial imbricate stacking of common moderate to steeply N-dipping thrust ramps, followed by a series of shallow – to flat lying thrust sheets. The imbricate thrust ramps are exposed in erosional windows in the overlying shallow thrust sheets.

b) D2 – SSW- to SW- vergent thrusting. This included the over-thrusting of the higher metamorphic grade IBN sills and metavolcanics over the eastern end of the Raglan – Donaldson mineralised sills / thrust sheet. Imbricate thrust stacking was rapidly followed by a series of shallow to flat-lying thin thrust sheets (well exposed in thee Nancy east area).

The Chukotat Gp / Raglan Fm is interpreted here as contemporaneous with the Povugnituk Gp and associated sills; the prior lack of recognition of the complex nature of the thrust belt suggests a comprehensive review of previous stratigraphic and geochronological relationships is required in this belt. A detailed review of the litho-geochemical signature of both the intrusives and the volcanics will greatly aid a reassessment of the belt.

Field evidence suggests there is only 1 main episode of ultramafic sill emplacement; these were emplaced during volcanic / sedimentary basin development. Apparent conflicts in orientation etc between intrusives from both field observations and magnetic data are due to interaction of multiple thrust sheets with varying orientation.

The separation of the Raglan trend form the IBN trend into distinct thrust regimes does not in itself diminish prospectivity within the IBN trend.

The Raglan – Cross lake, IBN, West Raglan – Big Circle and CLS trends all represent thrust sheets with the same stratigraphic sequence (Raglan Fm sills at the base of the Chukotat Gp basalt.

The Cecilia – Bravo – Echo complex represents a sill complex emplaced within probable Povugnituk volcanics and sediments. The known mineralisation at Delta (Xstrata property west of Cecilia) demonstrates the potential for mineralisation within these sills.

The Cecilia / Juliette prospects are considered the highest priority for the rest of the 2010 drilling season. A review of all data for Echo / Bravo should be undertaken to highlight targets of opportunity for the 2011 drill season.

5.2. Recommendations

- Ground magnetic data should be acquired at 25m spacing – more detailed data is required to remove as much as possible the under-sampling artefacts that have been previously interpreted as regular embayments in sill margins.

- Each sill complex to be drilled to be mapped in detail prior to selection of drill site and orientation. This should include detailed structural mapping of both the sill and the footwall / hangingwall volcano-sedimentary sequences (to aid delineation of location & true orientation of basal zones and possible embayments within the sills).

- Continue detailed structural mapping of the thrust belt geology along regional traverses throughout the Goldbrook tenements. This is particularly important in zones of complex geometry associated with multiple shallow-dipping thrust sheets (e.g. – the Mid North district).

- Ensure mapping includes capture of primary structural data. In particular, recognition and recording of So (bedding, igneous layering), thrust / fault surface orientations, and S1 cleavage / foliation data. Where possible, younging and structural facing criteria should be recorded.

- Volcanic and sedimentary facies should be recorded consistently. In particular, scale of pillows in basalts, presence of significant fragmentals etc should be noted (attempt to delineate zones proximal to original volcanic / intrusive sources).

- Continued training of field geologists in structural mapping and structural logging of core. Possible training in detailed geological interpretation of magnetic data.

- Particular mapping emphasis should be placed in broad corridors associated with inferred early (& deep-seated) NW- transfer fault zones.

- The detailed LIDAR topographic data should be available as a Geosoft (or other format) .grd grid file to allow easy plotting of topographic sections. This will greatly aid compilation of detailed cross-sections, allowing higher-confidence reconstruction of thrust sheets and correlation of sill segments between thrusts.

- A series of detailed structural geology maps (plus sections) of the Goldbrook tenements (plus surrounding areas) should be compiled before the next field season. This should incorporate all data from the current and previous field campaigns. The maps should integrate:
    i) Field mapping data (lithology / structure etc);
    ii) Hyperspectral and other remotely-sensed data;
    iii) 3-D stereoscopic air-photo interpretation
    iv) Airborne and ground magnetic & EM interpretation
    v) Litho-geochemical data

- The Manifold software is considered inadequate for the scale of the database and GIS querying required for such a major program. It is recommended that this be replaced by either ArcMap or MapInfo software.

- One copy for each camp of appropriate software for structural calculations and stereonet plotting should be obtained. GEOcalculator and GEOrient (Holcombe & Associates software) is recommended as it is very easy to use and inexpensive.

Leigh Rankin MAIG
Consultant Geologist
Director, Rankin Consultancy PL t/a Geointerp

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