4 INTERPRETATION RESULTS

The primary result of this study consists of the information contained within the integrated airborne geophysical and Landsat 4 TM interpretation and the explanation within this report. The interpretation is provided as a series of 'factual' hardcopy maps at an approximate 1:100,000 scale (enclosures 1, 2 and 3) and a simple 'structural synthesis' at an approximate 1:250,000 scale (enclosures 4) folded at the back of this report.

The interpretation layers (*.shp files) and selected imagery are included as a geographic information system (GIS) project (ArcView™ format) on the accompanying CD (Appendix I).

4.1 LITHO-STRUCTURAL DOMAINS

The structural and litho-magnetic variations within the area appear to be controlled by several major zones of structural displacement, either as shears and/ or thrusts with minor displacement along zones of normal faulting. These major structural zones divide the area into at least five major domains (Figure 4.1 and enclosure 4).

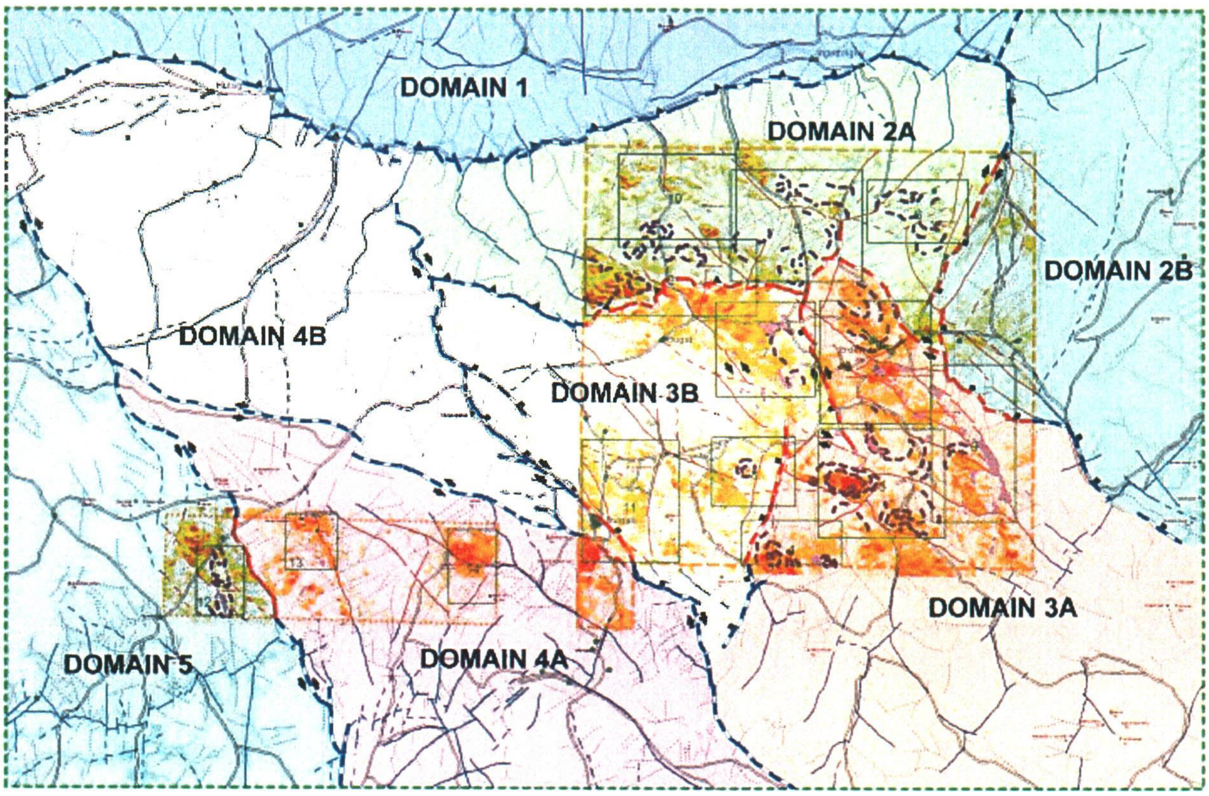

Figure 4.1: Division of the project area into five possible structural and litho-magnetic domains.

Due to the limited data available to this study and the lack of detailed litho-magnetic control, it is not possible to develop a definitive structural synthesis. However, it is possible to infer several different structural scenarios and their relative timing.

The approximate E-W trending boundary that separates domain 1 from domains 2 and 4 is interpreted as part of the Vitim Suture Zone (VSZ). Two possibilities for the cause of the curvilinear character observed along structural strike (Figure 4.2) are:

A. 'Early' strike-slip displacement, along approximate E - W trending faults, result in the formation of a series of anastomosing shear zones that envelop competent litho-structural, ellipsoidal bodies. Due to the major strike-slip displacement, minor faults that trend perpendicular to the major structural boundary (approximate N - S) are likely to be relatively late extensional structures. This major ductile to brittle structure (VSZ) is deformed by later cross-cutting NW, N and NE trending structures. During continuing compression or transpression, these 'late' structures juxtapose rigid competent bodies, possibly granites (430000mE 5460000mN) against the 'early' E-W trending structure, causing the earlier structure to wrap around the granites.

B. Early major NW (separating domains 3 and 4), and 'later' minor N or NE (separating domains 2A, 2B, 3A and 3B) trending faults possibly control both strike-slip and normal displacement of basement blocks. Regional compression post-basement block movement, could result in differential thrust displacement along the VSZ due to ramping over basement topography. The result could be the curvilinear character of the VSZ boundary.

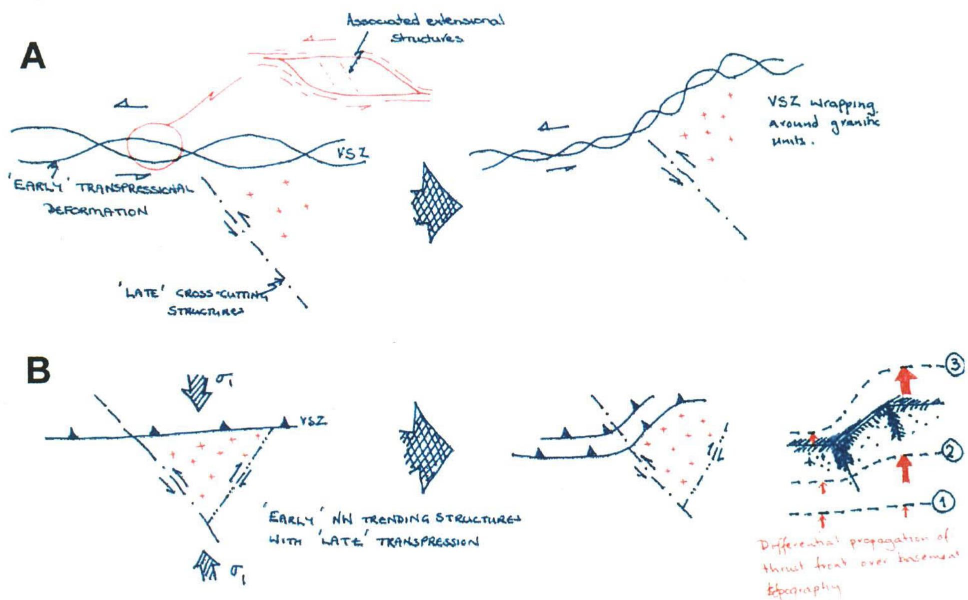

Figure 4.2: Schematic models for the development of the apparent curvilinear character along the Vitim Suture Zone.

The litho-magnetic components that form domains 2 and 3 appear to be similar. Both domains contain multiple intrusive or zoned igneous units (domains 2A and 3A), superimposed by Triassic to Jurassic volcanic and sedimentary units (domains 2B and 3B). Although the litho-magnetic characteristics of these two domains are similar, they are separated, as they appear to exhibit significantly different structural trends.

Structures within domain 2A exhibit an approximate E-W trend as shown by linear magnetic units and the elongate axes of elliptical intrusive bodies. This dominant structural trend is sub-parallel to the VSZ and suggests possible N – S compression. It is therefore possible that structures such as thrusts are active in this area (section 4.2.2 and section 4.2.5).

Structures in domain 2B exhibit an approximate NE – SW trend shown by strong elongation of sub-parallel magnetic horizons. These magnetic signatures are likely to represent tight to isoclinally folded volcanic sediments or elongate intrusive bodies or dykes. A strong compressional component perpendicular to strike would be necessary to create such a strong fabric. It is possible that NW directed movement of a further domain to the E of the current study area is the cause.

The dominant structures in domain 3A exhibit an approximate NW trend shown by the elongate axes of zoned or multiple intrusive bodies. These structures appear to show a combination of strike-slip and compression. Due to the litho-magnetic components in this domain early structures are likely to have been ductile shear zones while late structures are possibly thrusts. The competent to incompetent character of successive intrusive bodies in conjunction with deformation possibly results in a combination of pinch and swell structures between anastomosing shear zones and adds to the apparent complexity of the domain (section 4.2.1). Minor faults of varying orientation are recorded throughout the domain. Many of these minor structures are perpendicular to the main NW strike or to the boundaries of competent igneous units. We therefore can assume that many of these faults are simple accommodation structures possibly with an extensional component.

Structures in domain 3B can possibly be divided into those that represent shallow volcano-sedimentary units and those that represent deeper gneissic and igneous basement units (Figure 4.3). The sedimentary units exhibit an approximate N - S trend shown by curvilinear open folded sub-parallel magnetic horizons (folded volcanic sediments or elongate intrusive bodies or dykes). The fold orientation would be consistent with an approximate N - S compression perpendicular to the E - W trending VSZ and the domain 2A to 3B boundary.

Apparently 'deep' basement structures however, appear to have a NW – SE trend similar to domain 3A. Variations in the magnetic intensity shown by broad wavelength response may indicate a combination of sedimentary and igneous units from domain 3A continue below the domain 3B basin to the NW. Major structures may also act as a ramp at the boundary between domain 2A and 3B to create the differential thrust propagation resulting in the curvilinear trend of the major litho-magnetic unit (section 4.2.2).

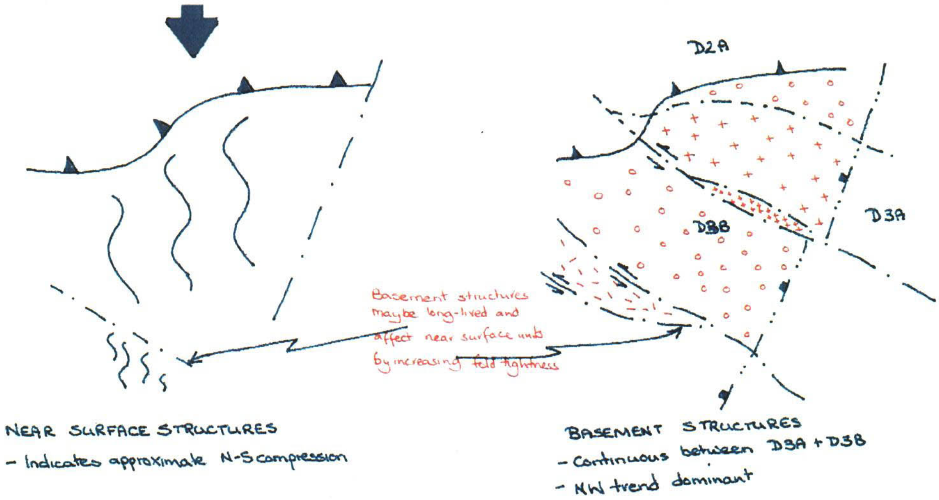

Figure 4.3: Schematic representation of the major structural components that appear to affect domain 3B.

The litho-magnetic sub-division of domains 2 and 3 appears to occur across an approximate NE – SW trending fault (Figure 4.4). From the available data and magnetic signatures it is possible to infer at least a normal displacement component along this structure, with down-throw to the E in domain 2 and to the W in domain 3. As the NE extension of this structure appears to coincide and affect the VSZ its significance and timing in the development of the area is uncertain. This fault may represent:

A. 'Late' virtually in-situ block faulting, to create a series of basins. The displacement of the VSZ along strike to the NE could relate to a major NW trending structure outside of the current study area.

B. Development of laterally 'early' semi-continuous arc and basin formation parallel to the VSZ. The basin could then be truncated by 'late' strike-slip displacement, that also affects the VSZ to the NE

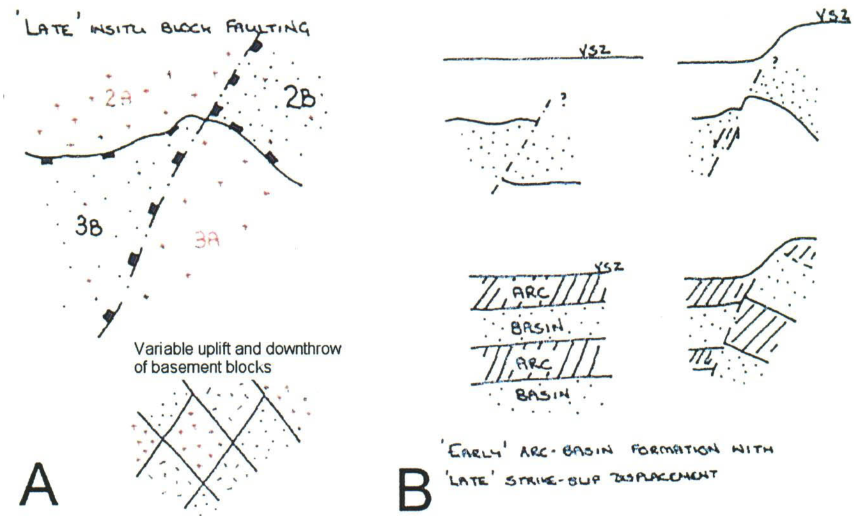

Figure 4.4: Schematic representation for the development of the major structural components that appear to affect at least domains 2 and 3.

From the remote sensing data it is possible to infer a sub-division of domain 4 into 4A and 4B (Figure 4.5). From the geophysical data, domain 4A appears to consist of a dominantly N - S trending sequence of litho-magnetic units. In the east the units appear to represent zoned intrusive bodies, while in the west they appear to relate to a series of volcano-sedimentary units and even surficial Quaternary deposits (very high magnetic response 334000mE 5410000mN) within a large folded 'synform'. Unfortunately there is no geophysical data to accurately constrain the litho-structural characteristics of domain 4B. However, it is possible to infer a series of sub-circular structures that further sub-divide domain 4B. These structures may represent a series of 'early' thrusts as domain 4B propagates to the NW, and/ or may represent a series of 'late' normal faults if the apparent compressional regime is relaxed. Domain 4 is separated from the domains to the E by a major, broad NW trending high strain zone (395000mE 540000mN).

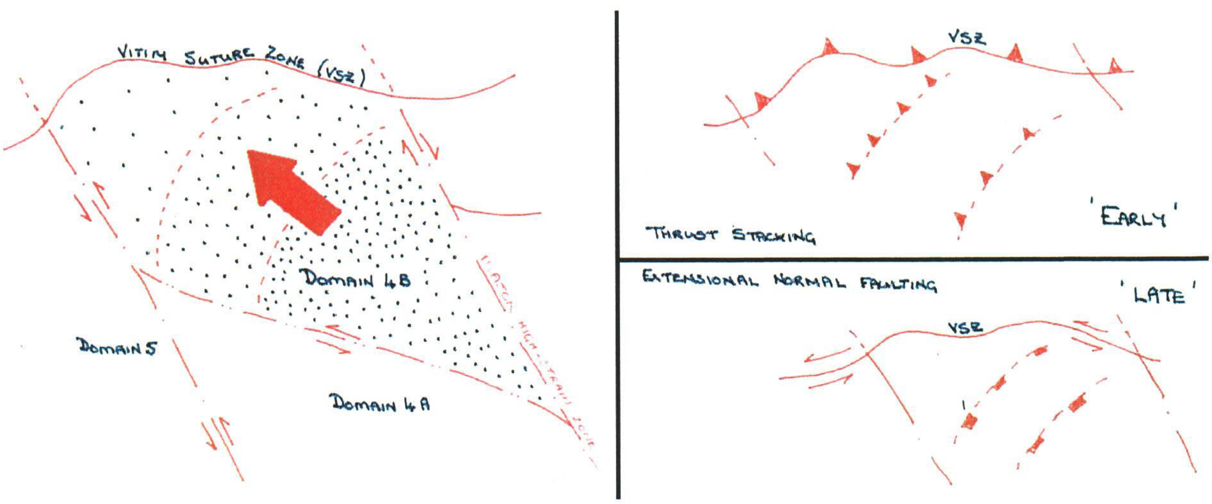

Figure 4.5: Schematic representation of the major structural components that appear to affect domain 4.

Domain 5 to the west of the study area appears to consist of N – S trending litho-magnetic units with a dominantly zoned igneous character. It appears to be separated from domain 4 by a major NW to NNW trending structural zone that possibly affects the VSZ to the north.

The structure and litho-magnetic character of the study area is complex and is unlikely to be unraveled as a single, simple coherent story. However, by using this basic structural domain breakdown, it may be possible to better understand the relative local structural evolution. If the relative timing of structural events can be determined, it is then possible to more accurately infer targets for mineral potential within these domains.

Unfortunately there is no geophysical data with which to directly control the nature of the VSZ in this study. However, the remote sensing data does enable a regional overview to be achieved and consequently structural displacements to be inferred.

The E – W and NW – SE trending structures appear to dominate the area, while the N to NE trending structures appear to be relatively minor with only local affect.

As there is an apparent NW – SE trend associated with porphyry Cu-Mo mineralisation to the S (Dejidmaa and Naito, 1998), determining the timing and significance of this trend may be significant.

4.2 PROSPECTS

Selection of the following fourteen sub-sections is due to the areas containing significant geophysical characteristics that could contribute to the structural and mineralogical understanding of the area (Figure 4.6). The areas are not described in any particular order of preference or significance.

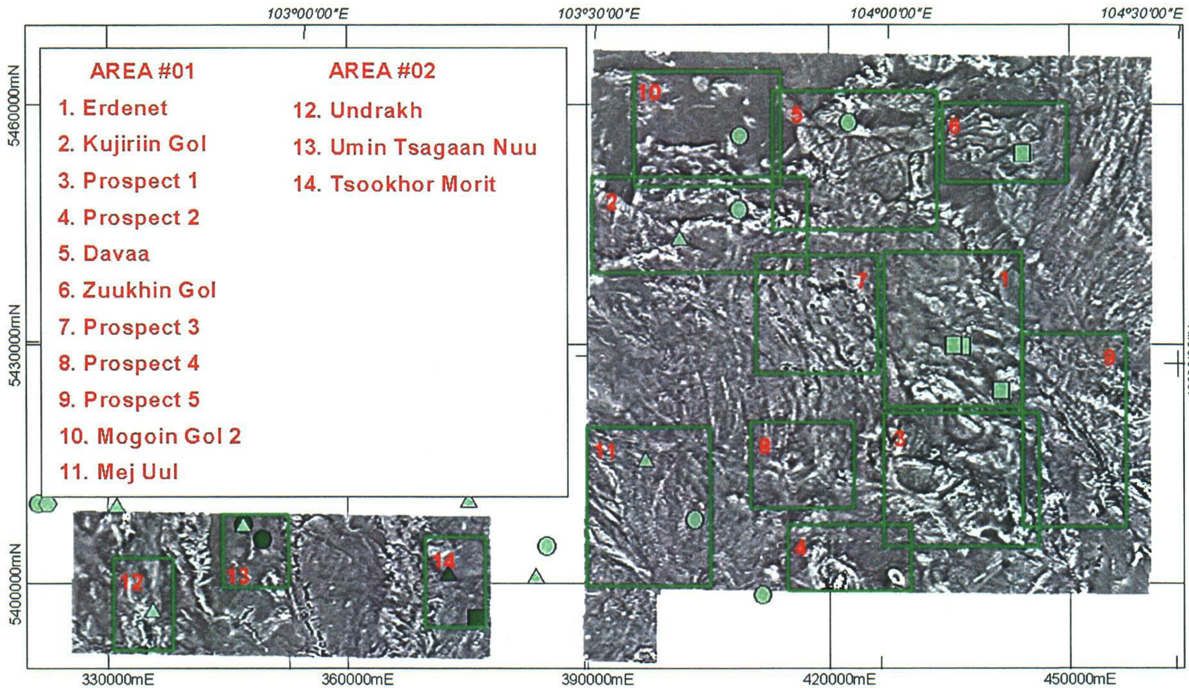

Figure 4.6: Areas that are considered to contain either structures or intrusive units that could be prospective, particularly for porphyry mineralisation.

The format for this section will focus on the structural component of the area and discuss the possibility of igneous relationships. The data shown will be:

- A – TMI-RTP-1VD-greyscale
- B - Published geology at a scale of 1:100,000 or 1:50,000
- C – TMI –RTP-NW sun-illumination
- D – Ternary radiometrics
- E – Digital Elevation Model, plus clipped K radiometric values to the top 10 and 5 % (orange and red repectively.
- F – Landsat 4 TM

It should be noted that due to the limited information relating to the structural geology of the region let alone this project area, it is not possible to generate a single definitive interpretation. Close correlation with published data and geological verification is necessary to refine this work.

4.2.1 Erdenetiin Ovoo

The main geophysical characteristics of the Erdenetiin Ovoo porphyry Cu-Mo deposits are shown in Figure 4.9, a schematic representation of the geological evolution of the area is shown in Figure 4.8. Previous work has highlighted the complex structure (Figure 4.7).

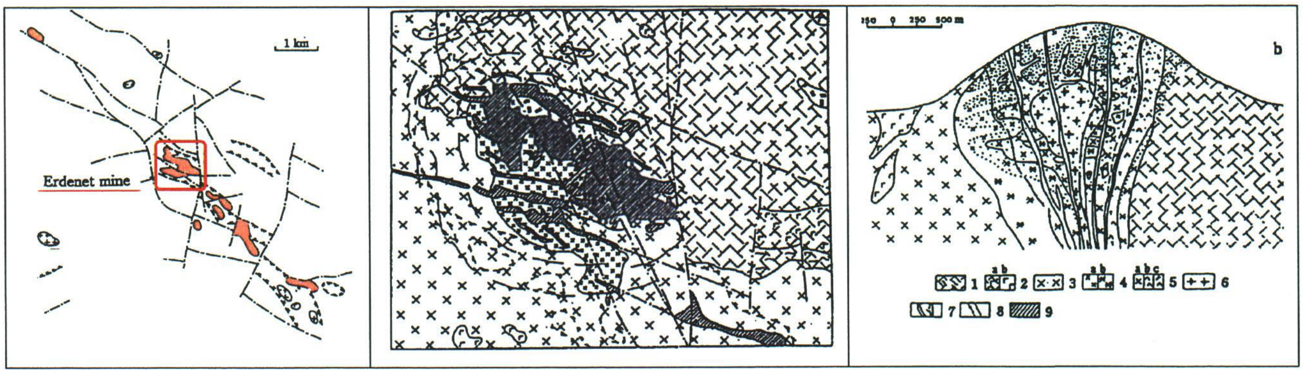

Figure 4.7: Detail around the Erdenetiin Ovoo deposit, (from Dejidmaa and Naito, 1998).

From this study, it is possible to identify a distinctive relative low magnetic intensity response associated with areas of known mineralisation. This low magnetic zone appears to have the geometry of a tight fold closure with an apparent NW axial trace. Similar apparent 'fold' closures are observed along strike of the possible fold axial trace, as shown by zoning within horizons with varying magnetic intensity.

To the N and S of the main mineralised area are large zoned granitic bodies (possibly of the Selenge Complex). Both of these 'Selenge' granites have an approximate NW strike as shown by their elongate elliptical axes. These granitic bodies are separated from the mineralised zone by major NW trending shear zones.

Throughout the area are a series of minor approximately N - S and NE - SW trending faults. These structures are almost perpendicular to the major shears with variations in strike associated with the curvilinear character of the shear zones as they wrap around the 'Selenge' granites.

A significant ENE trending linear feature appears to pass through the centre of the area as shown on the elevation model and Landsat data, but appears to have only a minor affect on the magnetic data. Consequently, we assign this structure to be a minor "late" feature.

The radiometric data shows a strong K response around the Erdenetiin Ovoo mine site. This is likely to be due to the major exposure of bare outcrop and fresh material exposed around the mine shown on the Landsat data. This high response should not be taken as being indicative of a radiometric mineralisation signature in the study area. The tailings dam as expected returns a very low response. The radiometric data shows good correlation and distinction of surface geological units, geomorphic features and published mapping.

Possible Explanations

- A - Published mapping and the known porphyry mineralisation precludes the possibility that mineralisation is hosted within a meta-sedimentary fold structure.
- B - The major shear zones appear to run along the edge of the magnetic low intensity zone. Magnetite destruction by hydrothermal fluids along these shears may create the low magnetite response. The apparent fold closure could be created by accumulation of fluids where the shears intersect or anastomose. However, precise positioning of the major faults and the actual number of faults within this zone is difficult to accurately define, as there is an apparent buffer zone of moderate to high magnetic signature between the low mineralised zone and the 'Selenge" granites.
- C –The relative low magnetic zone and the apparent tight fold closure could actually be the preserved section of part of a larger zoned intrusive body. The moderate to high magnetic material either side of the magnetic low mineralised zone and between the main "Selenge" granites being part of the same zoning. This zoned intrusive body is then attenuated and compressed between the two "Selenge" granites. This deformation has subsequently obscured much of the geometry of the original zoned intrusive body. A schematic of this model is shown in Figure 4.8.

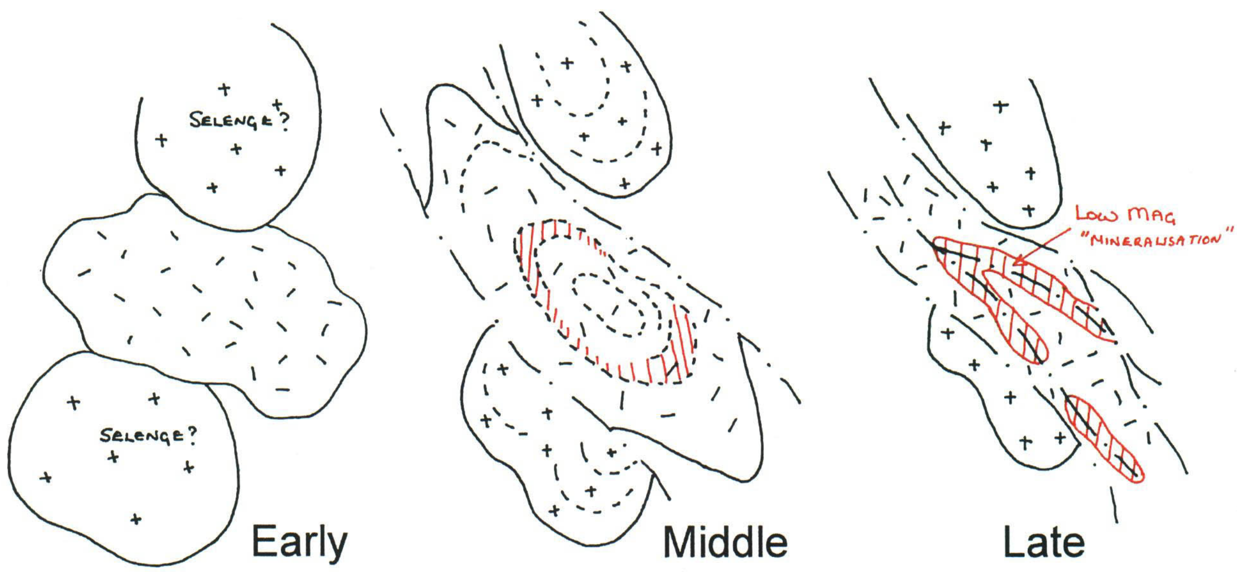

Figure 4.8: Schematic diagram for the possible evolution of the present low magnetic intensity zone associated with the Erdenetiin Ovoo porphyry deposit. Note the model requires zonation of the granitic bodies and compression between NW trending shear zones.

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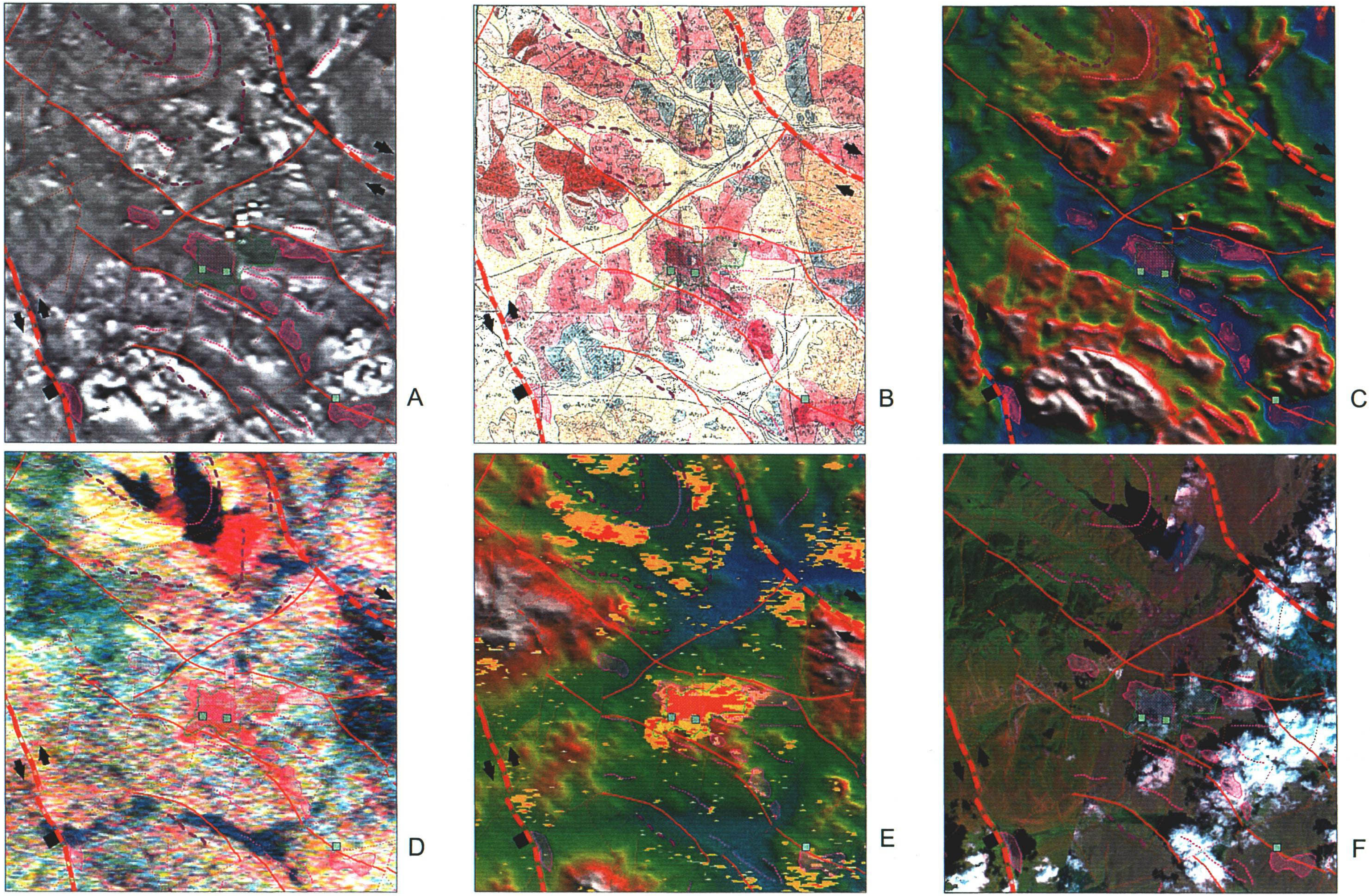

Figure 4.9: Characteristics of the Erdenet prospect area.