3D successions of near-orthogonal progressive bulk inhomogeneous shortening resulting in multiple generations of folds in the Mount Isa Inlier

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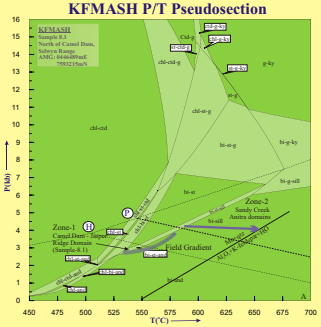
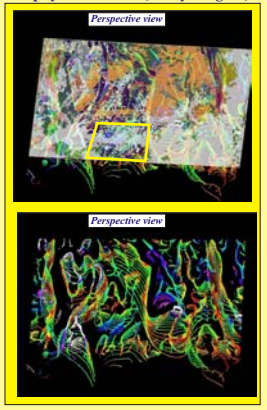
Integrated macro, meso and microstructural analyses of the Sandy Creek, Anitra and Jasper Ridge-Camel Dam domains (southern Eastern Fold Belt, Mount Isa Inlier) provide an understanding of their structural and metamorphic evolution during the Isan Orogeny. The study area lies north of the Osborne mine and south of the Selwyn mine and hosts structurally controlled Cu-Au prospects in Mesoproterozoic rocks. Therefore, interpreting structural geology of the ore deposits and the timing and controls on mineralization, it is important to establish how deformation is partitioned in the area. Six fabric generating events are recognized from field observations and microstructural analysis. The first deformation D_1 is revealed by outcrop scale north and south verging tight to isoclinal recumbent folds with almost east-west oriented fold axes. D_1 is characterized by close, tight to isoclinal, upright and overturned north-south and north-northeast trending folds with pervasive axial planar S_1 foliation parallel to S_0/S_1. Strain during D_1 was heterogeneously developed in the area and appears to be controlled by rheological contrast across the structural domains. In the Sandy Creek and parts of the Anitra domains, where pelites dominate, D_1 is prevalent and distinguished by the development of shallow dipping S_1 and accompanying east and west verging F_1 folds with pronounced north and north-northeast plunging L^1_1 intersection lineation. Mesoscopic scale S_1 crenulations are locally developed in the Camel Dam - Jasper Ridge Domain, where dense quartzitic and psammitic units dominate. Deformation during D_2 was intense and pervasive in the Camel Dam - Jasper Ridge Domain, reactivating the pre-existing S_1 foliation forming steep composite $S_{1,2}$ foliation (S_1 reactivated during D_2). However, S_1 can be observed where it has been rotated by D_2 or in low strain zones of D_2. In the Anitra and Sandy Creek domains, D_2 can be observed as small scale tight to isoclinal upright north-south trending F_2 folds overprinting either S_1 or S_0 with respective to north and north-northeast plunging L^2_2 or L^2_1 intersection lineations. Near-orthogonal shallow D_3 and steep D_4 were weak events best observed in thin sections only form the Camel Dam - Jasper Ridge Domain. Detailed matrix and porphyroblast-matrix microstructural relationship are consistent with the meso- and macroscale D_1 to D_4 structures in the area. Field structures have been correlated with 3-dimension geophysical worms, which appears to be consistent from east to west with steep lithological boundaries and consequently showing steep structural signature deep within the crust. Based on field observations and regional correlation, it is suggested that the first generation D_1 folds were produced by north-south directed compression followed by D_2 east-west shortening, producing macro- to mesoscopic scale F_2 folds with steep S_2 fabric. The east-west sub-horizontal shortening continued during D_3 and possible during D_4 with sub-vertical D_3 and D_4 events. However, due to rheological contrast and stain heterogeneity, deformation form D_3 to D_4 were unevenly distributed.

KFMASH P/T Pseudosection

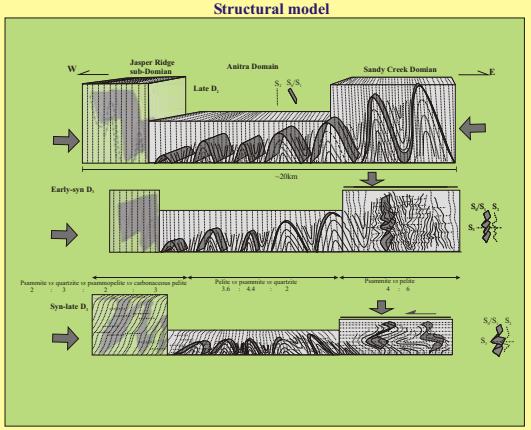


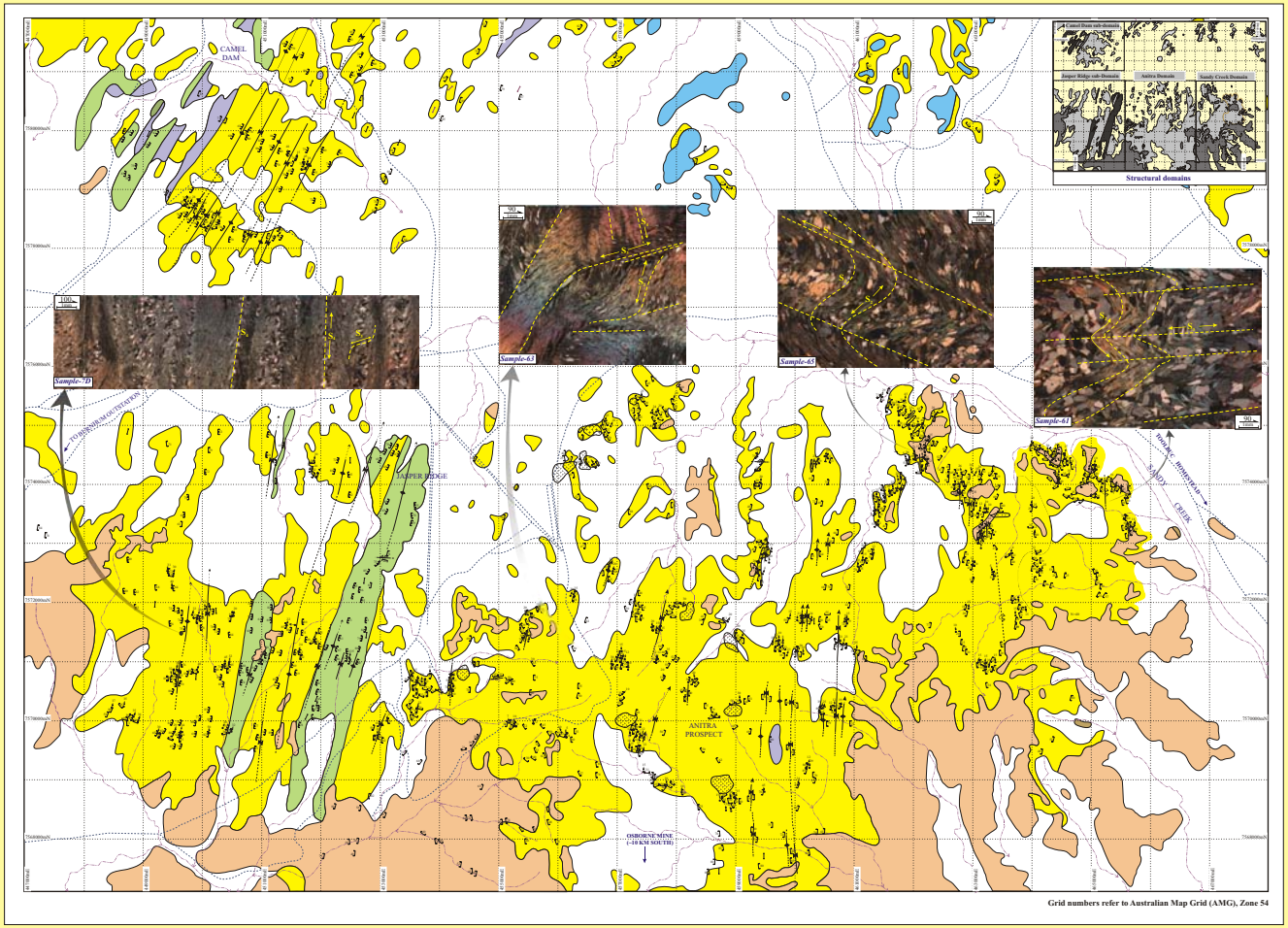
KFMASH P-T pseudosection ($mu+qtz+H_2O$ in excess) showing stable phase assemblages. The rock consists of staurolite-andalusite (replaced by muscovite) -biotite schist (Al_2O_3=15.6%, MgO=1.25%, FeO=5.57%, K_2O=3.12%; all in wt %) collected from north of the Camel Dam sub-domian. Dashed line with arrow shows possible P-T path based on the appearance and disappearance of mineral phases. Metamorphic field gradient is shown on the P-T diagram for Jasper Ridge - Camel Dam (zone-1) and Anitra and Sandy Creek domains (zone -2). Second sillimanite isograd is plotted on the diagram for zone-2 rocks. $AlSiO_5$ triple pints after (H) Holdaway (1971) and (P) Pattison (1992).

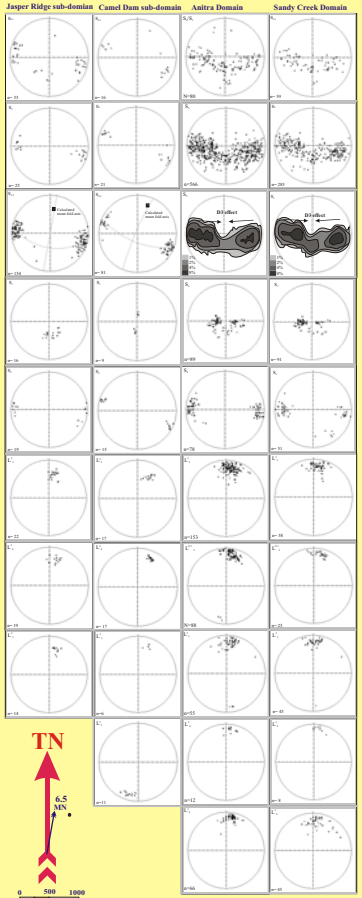
Geophysical worms (Selwyn region)



Structural model







Structural measurements

Field Photographs

D_1 structures

D_2, D_3, D_4 structures

STRATIGRAPHY

STRUCTURE SYMBOLS

Overturned/Recumbent folds

Inferred north-northeast plunging F_2 Antiform / Synform in Jasper Ridge - Camel Dam Domain