Structural synthesis of the north-eastern portion of the Superior Province (phase 1 of 3)

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Between 1998 and 2003, twenty mapping projects were carried out at the scale of 1:250 000 in the north-eastern portion of Quebec's Superior Province (NESP). These surveys cover an isolated region of about 300 000 km^2 located north of the 55th parallel and are represented by 32 NTS sheets (23M, 24D, 24E/F, 24L, 24M; 25C/D/E/F; 33O, 33P; 34A, 34B/C, 34F/G, 34H, 34I, 34J, 34K/L, 34M/N, 34O, 34P, 35A/H, 35B/G, 35C/F).

The structural synthesis is part of a three-year plan (2003-2006) within the Far North Project. Its first aim is to document and analyse the deformation history of an important part of the Archean crust in the Superior Province. Its second is to establish a structural evolution model which takes into account the distribution of emplacement ages of the different rock assemblages of the NESP (ages vary from 3.8 to 2.0 Ga).

NESP Archean deformation pattern:

At the scale of the NESP, the deformation is reflected by the various aeromagnetic signatures representing different structural domains. These domains which are delimited by ductile shear zones are characterised by elliptic and folded structures. Domains with aeromagnetic signatures of low contrast represent greenstone belts forming linear structures within tonalite-trondhjemite suites and showing complex fold structures (interference patterns). High contrast aeromagnetic signatures represent domains which contain granite-granodiorite, enderbite-opdalite-charnockite, clinopyroxene tonalite-diorite, gabbro-pyroxenite or diatexite suites reflected by dome and basin structures. Ductile shear zones are erratically distributed throughout the NESP, forming an anastomosed network of intense deformation zones grading longitudinally and laterally into weaker deformation domains.

NESP Archean structural evolution:

Volcano-plutonic rocks of the NESP are affected by four ductile deformation phases (D1 - D4). The Early Archean Nuvvuagittuq greenstone belt (3.8-3.6 Ga) preserves a S1 foliation and early Paleoarchean P1 isoclinal folds, which were refolded by isoclinal to open E-W folds (P2). All these rocks are associated with a steeply to moderately dipping L1/L2 linear fabric. The D2 deformation phase is contemporaneous with the emplacement of Meso- to Neoarchean greenstone belts and tonalite-trondhjemite plutonic suites (2.88-2.76 Ga). The D2 deformation is characterized by a planar fabric which is preserved in an E-W to WNW-ESE trend and associated to a steeply dipping linear fabric. The Late Archean greenstone belts (2.76-2.70 Ga) are contemporaneous with the emplacement of granite-granodiorite, enderbite-opdalite-charnockite, clinopyroxene tonalite-diorite, gabbro-pyroxenite or diatexite plutonic suites. This emplacement is synchronous with the D3 deformation phase and the regional peak of metamorphism. The D3 deformation is characterized by a regional NW-SE to N-S trending S3 foliation, which is subparallel to the regional P3 folds and contain a steeply to weakly dipping L3 linear fabric. Mylonitic shear zones (S3), with dextral strike slip kinematic indicators, are NNW-SSE to N-S trending. The geometrical relationship between shear zones, folds and subvertical plutonic fabrics seems compatible with an emplacement model under a transpression/transtension regime, implying a N-S to NNE-SSW trending compression. The D3 fabrics superimposed on the D1/D2 fabrics produced fold interference patterns in the Paleo- to Mesoarchean units. The late-D3 to D4 deformation phases (2.685-2.64 Ga) are associated with the formation of oblique shear zones which controlled the emplacement of late diatexite, granite and syenite-carbonatite intrusions.

Forthcoming work:

In 2004-2005, a structural compilation map at the scale of 1:750 000 in ArcGIS format and covering the 32 NTS sheets of the Far North Project is scheduled for publishing. All data are included in the structural databank available in SIGEOM. The data set contains more than 26 000 planar and 2 000 linear measurements which will be compiled in stereographic projections and interpreted (project phase 2 of 3). Finally, in 2005-2006, a structural evolution model will be proposed and linked to the emplacement age distribution of the different volcanic and plutonic units, to the evolution of metamorphism, as well as to the different known types and episodes of mineralization (project phase 3 of 3).

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