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Stress-Strain Modeling as Part of a Mineral Systems Approach to IOCG Exploration and Target Generation: A Case Study from the Mt. Woods Inlier, Gawler Craton, South Australia

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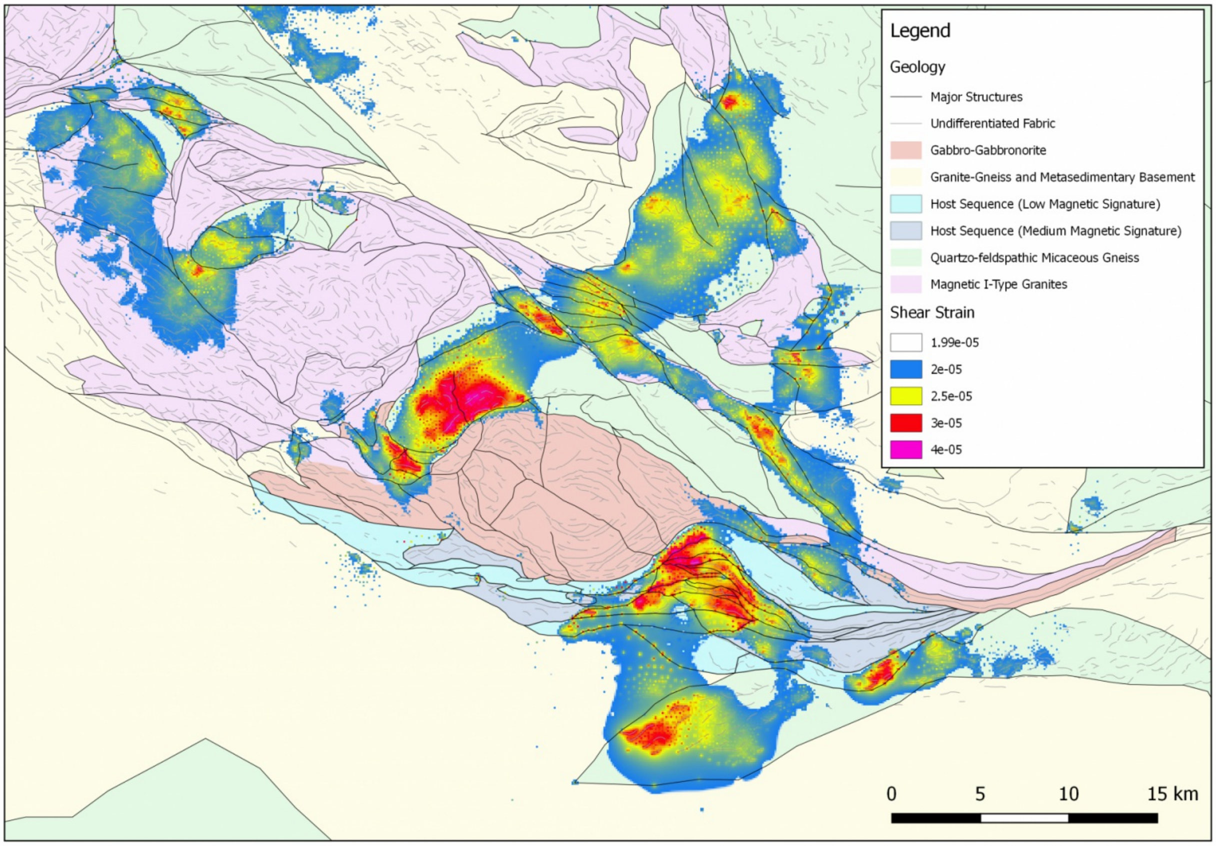
Hydrothermal IOCG deposits contain numerous phases of hydrothermal brecciation, cataclastic milling, pervasive replacement, multistage alteration assemblages, and polymetallic (Fe, Cu, Au, Ba, F, U, Ce, and La) mineralization. Orebodies typically comprise breccias or stockworks, with sharp boundaries and steep or vertical pipe-like or columnar geometries that show spatial relationships to deep-seated structures or their intersections.

Structural reinterpretation of publicly available high-resolution geophysical and drill hole data over the Mt Woods Inlier, Gawler Craton, South Australia, allows for the application of finite element analysis to simulate the relative distribution and magnitude of stress-strain conditions during a geologically brief NNW-SSE-oriented extensional event (ca. 1595-1590 Ma), coincident with IOCG-hydrothermal fluid flow and mineralization in the region.

Structural and lithological reinterpretation of the Mounts Woods Inlier area encompassing Prominent Hill was undertaken and used as input into the finite element analysis. Differential stress and shear strain maps across the modeled terrane highlight regions that were predisposed to strain localization, extensional failure, and fluid throughput during the simulated mineralization event. The role of stress risers, or markedly more competent units, is exemplified by a large, sigmoidal-shaped mafic-ultramafic body surrounded by steeply dipping, alternating host units to the N and NW of the Prominent Hill area.

Stress-strain maps are integrated with other data sets and interpretation layers, one of which is a proposed structural-geometrical relationship that is apparent in many world-class IOCG-deposits, including Prominent Hill, Olympic Dam, Sossego, Salobo, Cristalino, and Candelaria. These occur at the steeply plunging, pipe-like intersection of a conjugate-extensional system of faults, shears and/or contacts, wherein the obtuse angle may have been bisected by the maximum principal extensional axis (viz., σ_3) during mineralization. Several other layers were also used for the generation of targets, such as distance from major shear zones, angular tolerances of geometrically favourable fabrics and/or structures, favourable host lithologies, and proximity to tectonostratigraphic contacts of markedly contrasting competency. The result is an integrated targeting index and heat map for IOCG prospectively within the Mount Woods Inlier.



Legend
Geology
Major Structures
Undifferentiated Fabric
Gabbro-Gabbronorite
Granite-Gneiss and Metasedimentary Basement
Host Sequence (Low Magnetic Signature)
Host Sequence (Medium Magnetic Signature)
Quartzo-feldspathic Micaceous Gneiss
Magnetic I-Type Granites
Shear Strain
1.99e-05
2e-05
2.5e-05
3e-05
4e-05
0
5
10
15 km