# Structural Evolution of the Gold-Bearing LP Fault on the Great Bear Property, Red Lake, ON


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## PROJECT DESCRIPTION

The Great Bear property (5.0 Moz Au) is located ~25km south of the Red Lake gold camp in the NW Superior craton, within the Red Lake Greenstone Belt.
The property comprises two distinct domains, a northern felsic domain and southern mafic domain, separated by the SE-trending LP Fault (Figure 1). The LP Fault Zone is a ~500m wide high-strain zone with a penetrative, NW-striking, steeply NE-dipping foliation and transposed isoclinal folds.

## METHODOLOGY

As part of a larger study into the structural controls on gold mineralization on the Great Bear Project, the results of a study on the structural evolution of the LP Fault Zone are presented here. The study included outcrop and regional mapping, supplemented by core logging and petrography.

## STRUCTURAL OVERVIEW

The LP zone is located in the hanging wall of the fault and is characterized by gold-bearing deformed quartz veins oriented parallel and oblique to the foliation.

Two generations of structures are present within the LP Fault Zone:

1. Early generation steeply dipping penetrative NW-SE mylonitic foliation, moderate to steeply dipping tight to isoclinal folding, and moderate to steeply dipping mineral stretching lineations (Figures 2, 4, 6, and 9).
2. Later generation Z-shaped, steeply dipping, tight to isoclinal folds, steeply dipping axial planar crenulation cleavage, and dextral shear bands (Figures 2, 5, 7, and 8).

## TRANSPRESSION

Transpression = Deformation resulting from simultaneous strike-slip (or simple shear) movement and perpendicular shortening (or pure shear) with vertical lengthening along the shear plane.

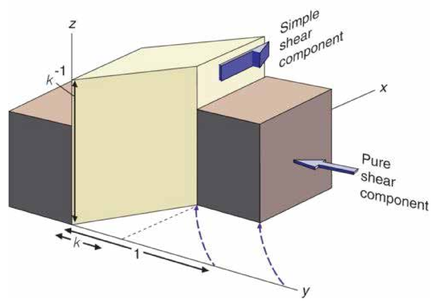



Figure 3: Simple model for transpression by Sanderson and Marchini (1984).

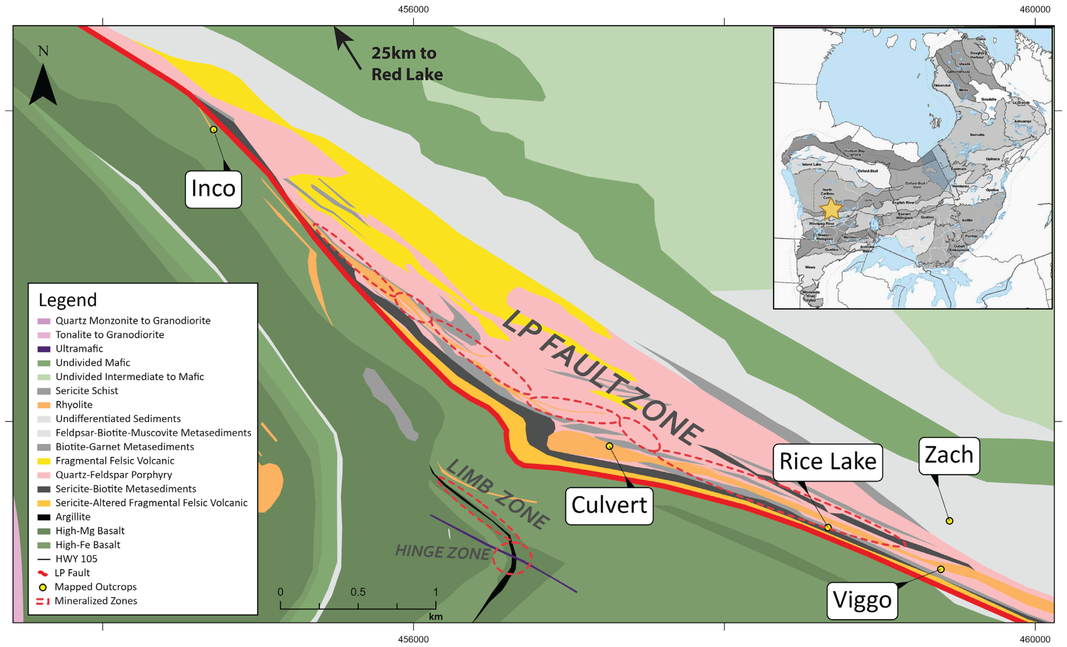
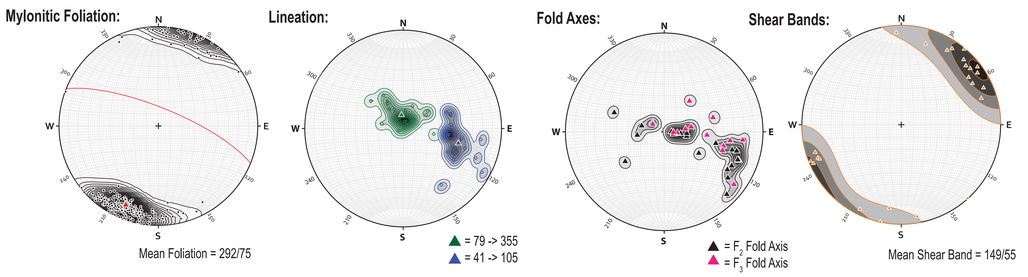



Figure 1: Geologic map of the LP Fault Zone on the Great Bear Property, including the location of mapped outcrops and mineralized zones. Scale 1:20,000. Coordinate system NAD 1983 UTM Zone 15N.
(Inset) Map of the Superior Craton modified after Montsion (2018). Great Bear Property indicated by the star.

Figure 2: Stereonets



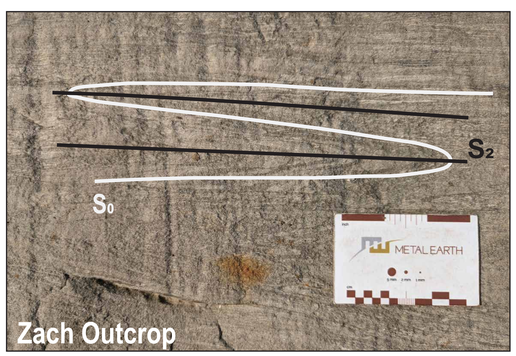




Figure 4: Early generation of tight to isoclinal folds defined by folded bedding in metasedimentary rocks.


Figure 5: Asymmetric Z-shaped folds in banded iron formation. The folds formed as drag folds during dextral shearing.

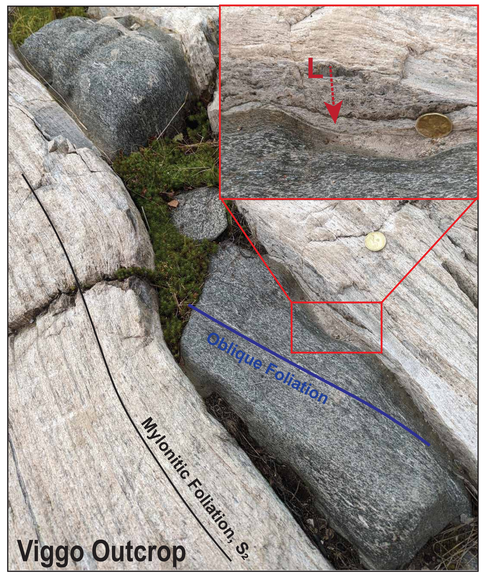



Figure 6: Mylonitic foliation in strongly deformed quartz-phenocrystic porphyry (light grey on photograph). The development of an oblique foliation in mafic dykes (centre of photograph) was coeval with the development of the mylonitic foliation in the porphyry and indicates dextral transcurrent shear.
(Inset) A single set of steeply plunging stretching lineations is noted associated with both the steeply dipping oblique and main foliations.

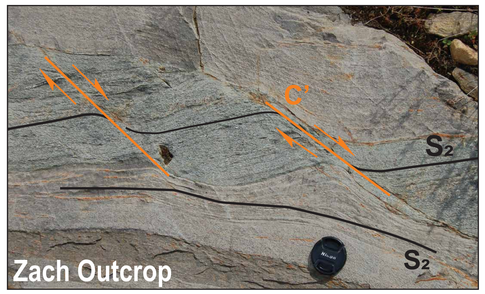



Figure 7: Boudinaged and dextrally backrotated mafic dyke hosted within strongly foliated metasedimentary rocks.

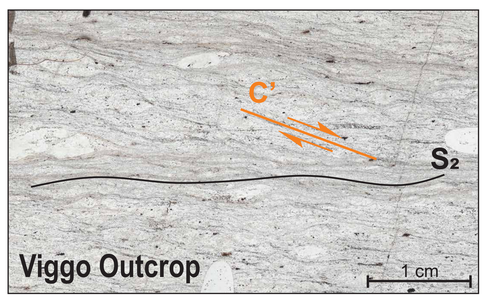
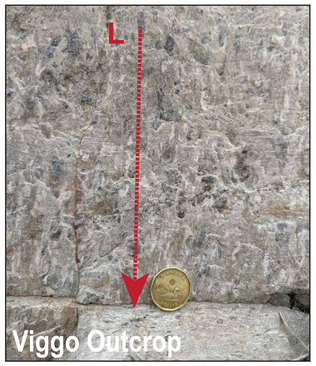



Figure 8: Photomicrograph of dextral asymmetric strain shadows on quartz phenocrysts and development of shear bands (C'). Oriented looking down at the horizontal plane. (PPL)

Figure 9 (Right): Steeply plunging mineral stretching lineations defined by elongated feldspars and quartz phenocrysts in a quartz-feldspar porphyry.

Figure 10 (Below): Visible gold hosted on the margin of a quartz stringer hosted in foliated, ablitized felsic volcanic.




## INTERPRETATION

Several lines of evidence suggests that the LP Fault is a dextral transpression zone:
(1) coeval oblique foliation in competent units that are parallel to the mylonitic foliation in surrounding rock (Figure 6),
(2) steeply plunging stretching lineations along this coeval oblique (anticlockwise) foliation (Figure 6),
(3) dextral asymmetrical strain shadows on the horizontal surface around vertically stretched quartz phenocrysts (Figure 8),
(4) rotation of the F2 and F3 fold axes into the single stretching lineation

Gold mineralization was likely emplaced during this major regional dextral tranpressional event.

## REFERENCES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Sanderson, D. J., & Marchini, W. R. D. (1984). Transpression. Journal of Structural Geology, 6(5), 449–458. https://doi.org/10.1016/0191-8141(84)90058-0


## ACKNOWLEDGEMENTS


Special thanks to Emily Gorner, Dana Cipelleti, and the rest of the Kinross team for always providing access to data and facilitating everything I needed while on site. Additionally, a huge thank you to the Kinross Survey team for all their assistance in the field. This research was funded through an NSERC Alliance grant awards to Stefanie Brueckner, Bruno Lafrance, and Doug Tinkham.

MERC Publication Number: **MERC-2023-20**