

Using big datasets to trace tectonic boundaries in the western Grenville Province.

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The Allochthonous Boundary Thrust (ABT) defines a regional tectonic boundary that separates the Allochthonous Belt (AB) from the Parautochthonous Belt (PB) in the Mesoproterozoic Grenville Province in Canada. The AB consists of an assemblage of exotic rocks accreted to Laurentia, some of which were thrust over the PB during the initial Ottawan (1090-1020 Ma) deformation phase. The PB represents the extension of the Superior Province and Laurentian cover sequences, subsequently reworked during the second Rigolet (1010-960 Ma) orogenic phase. However, the first-order architecture of the Grenville Province and location of the ABT are poorly constrained in western Québec.

Several distinctive suites of mafic dykes intruded the Laurentian basement prior to orogenesis and should also be present in the PB. Other mafic suites are unique to the AB. Consequently, the boundary (ABT) between the PB and the AB should also be revealed by differences in the types of mafic rocks they contain. In this study, we examine the trace element signatures of deformed mafic bodies in a transect that should cross the AB/PB transition. We compare our data to Laurentian dyke and AB mafic suite populations extracted from online geochemical databases and the published literature, in order to determine which suites are correlative to our unknown mafic samples.

We considered: (1) the slope and profile of normalized multi-element spider diagrams; (2) immobile element and REE enrichment, (3) HFSE anomalies, (4) depth of source melting inferred from Gd/Yb, and (5) the paleo-tectonic settings of the different mafic datasets; in order to identify the most likely correlatives of the unknown mafic rocks.

Unexpectedly, our results point to a clear AB affiliation for many mafic bodies located within the migmatitic PB gneisses (confirmed by U-Pb geochronology), specifically to the Mesoproterozoic Renzy Terrane, which structurally overlies the PB in the study area. This implies that part of the AB was dismembered and incorporated into the PB during the Rigolet deformation and possibly explains why the orogen scale ABT was not previously identified in the area.