Geochemical and isotopic signatures of Cambro-Ordovician volcanism and plutonism in the Notre Dame Subzone, Newfoundland Appalachians; magmatic evolution of the Laurentian margin of Iapetus

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Early Paleozoic volcanics in the Notre Dame Subzone (NDS) are widely interpreted to have formed in intra-oceanic arcs and back-arc basins and been accreted to the Laurentian margin during the middle Ordovician Taconic Orogeny. However, new geochronologic and Nd isotopic data from western Notre Dame Bay show that the Cambrian intra-oceanic Lushs Bight Group is cut by ~490 Ma high-Mg dykes that have εNd of +2 to -3, indicating a substantial involvement of continental lithosphere in their petrogenesis. Therefore, the oldest arc sequences in the NOS may have been emplaced upon continental lithosphere prior to ~500 Ma.

Geochemical and Nd isotopic signatures in Early Ordovician (ca. 488-478 Ma) ophiolitic rocks indicate derivation from depleted mantle sources (εNd > +6). However, the youngest NDS calc-alkaline arc rocks of the Buchans-Robert’s Arm volcanic belt (ca. 474 Ma) have εNd = +5 to -3. Both geochemical and isotopic data for these rocks suggest a role for continental lithosphere in their petrogenesis.

Involvement of continental lithosphere in the petrogenesis of Early Paleozoic rocks in the NDS is not accounted for in current tectonic models. Credible tectonic models must consider: (i) late Cambrian emplacement of island arc sequences over continental crust, (ii) early Ordovician ophiolite generation largely from uncontaminated mantle, and (iii) close spatial and temporal juxtaposition depleted oceanic mantle derived rocks and continentally-contaminated calc-alkaline rocks. Revision of our current tectonic models and potentially a radical re-thinking of the evolution of the Laurentian margin, is required.