

Progress report on bedrock mapping in the Munsungun Inlier, Maine, USA, in 2018: new field, geochemical, and geochronological constraints on its tectonic history

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Bedrock mapping at 1:24 000-scale in the Munsungun Inlier of Maine has made significant progress towards understanding its geology and tectonic history. New field, geochemical, and geochronological data obtained in 2018 help to decipher the tectonic history of the Inlier. These new data confirm the existence of two separate volcanic belts formed at different times during the Ordovician – the Munsungun-Jack Mountain-Bald Mountain Volcanic belt in the east-southeast, and the Spider Lake-Mule Brook Mountain belt in the west-northwest.

The Munsungun-Jack Mountain-Bald Mountain Volcanic belt is underlain by the Munsungun Lake Formation and Round Mountain Formation. The Munsungun Lake Formation consists of cyclic layers of dominantly arc-type, calc-alkaline subaqueous basaltic (dominant), andesitic, and dacitic pyroclastic falls (dominant), ignimbrite flows (minor), and lava flows with large negative ϵNd values (-16.3 to -18). The Round Mountain Formation comprises cyclic layers of tholeiitic E-MORB-like (rifted arc) subaqueous basaltic pyroclastic falls, lava flows, and diabase sills/dikes with higher ϵNd values of 2.7-3.7 (one sample has -18.0). Two tuff samples from the belt yielded U–Pb concordia ages of 468.0 ± 2.0 Ma and 471.2 ± 4.2 Ma.

The Spider Lake-Mule Brook Mountain belt consists of subaqueous tholeiitic arc basalt/diabase and pyroclastic rocks with minor arc-type calc-alkaline rhyolite. Their ϵNd values are 3.5 to -4.8. Two tuff samples from the belt yielded U–Pb concordia ages of 454.4 ± 1.8 Ma and 456.6 ± 1.8 Ma. The respective ages suggest a minimum 14 m.y. gap between the two volcanic belts. Does it suggest arc-trench migration?

New data reveal the existence of several post-arc sedimentary formations. The Rowe Lake Formation has the youngest zircon grains, clustered at 447.0 ± 3.2 Ma, a Katian age supported by graptolite fossils. The Blind Brook Formation has detrital zircon grains clustered only at 445.2 ± 1.8 Ma, suggesting it was deposited in a restricted basin in middle Late Ordovician. The younger, post-arc sedimentary rocks were also mapped in several other locations, including one hosting the youngest zircon grains (clustered at 442.8 ± 3.2 Ma). The detrital zircon age spectra of all the samples point to a Laurentian provenance, suggesting that near the end of the Ordovician, the Munsungun arc was already accreted to the Laurentia margin and the restricted, post-arc successor basins began receiving sediments from Laurentia. The Chase Lake Formation was also recognized in the study area and its extent and lithology redefined; it is probably also post-arc and Late Ordovician.