## The German Bank pluton, offshore SW Nova Scotia: age, geochemistry, and regional significance for the Alleghanian orogeny

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Permian plutonism is widespread in the US Appalachians, but has not previously been recognized in Canada. The German Bank pluton, offshore southwestern Nova Scotia, was previously sampled by short boreholes. Two rock types were distinguished: (1) a magnetite-bearing granite with no equivalent on land; and (2) an ilmenite-bearing granite similar to the ca. 363 Ma Seal Island granite. Previous $^{40}Ar/^{39}Ar$ dating of biotite from magnetite granite gave a total-gas age of 254 ± 7 Ma. In this study, U-Pb ID-TIMS dating of chemically-abraded zircons from a borehole sample of magnetite granite gave an intrusion age of 300.0 ± 0.4 Ma, at the Carboniferous–Permian boundary. Additionally, electron-microprobe dating of monazite yielded an age of 308 ± 13 Ma.

Other evidence of Alleghanian tectonism is widespread on the Scotian Shelf. Previously published whole-rock K-Ar ages on Meguma Group metasedimentary rocks from the Naskapi N-30, Argo F-30, and Wyandot E-53 wells are 300 ± 19 Ma, 302 ± 19, and 302 ± 10 Ma, respectively, and a previously published $^{40}Ar/^{39}Ar$ plateau age on biotite from the Mohawk B-93 well is 321 ± 1.6 Ma. The significance of the Alleghanian orogeny on the Scotian Shelf may thus be greater than previously appreciated.

To extend the lithological range of samples from the German Bank pluton, additional granite samples have been obtained from winnowed thin glacial till overlying an extensive area of bedrock outcrop of granite imaged by multibeam bathymetry. Geochemical analysis shows that the German Bank magnetite-bearing granite is a high Sr-Ba granitoid, with both trace elements steadily decreasing with increasing $SiO_2$. Such granitoids are characteristic of settings involving shoshonitic volcanism.

We suggest that the Sr-Ba granitoid plutonism at German Bank resulted from melting of lower crust and/or lithospheric mantle by a rising asthenospheric diapir related to slab detachment or tear following the final stages of closure of the Rheic Ocean. Such slab detachment has been previously suggested as the origin of the similar Permian granites in the southern US Appalachians. For the US Appalachians, subduction was to the southeast, so that plutons have Nd isotope compositions influenced by Grenvillian crust. Late Paleozoic plutonism in the Canadian Appalachians was dominated by northwestward subduction of the Rheic ocean, also prevailing in Europe, so that Saharan crust was thrust under the Meguma terrane, resulting in the more strongly negative Nd isotopes of the German Bank pluton. The boundary between these two subduction domains would have been characterized by the lateral margin of the sub-




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ducted lithosphere (a slab tear) and was thus a favoured site of asthenospheric upwelling. Such upwelling may later have been responsible for the mid-Triassic alkalic dykes of the Central New England province, also found in SW Nova Scotia.