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**Machias Seal Island quartz monzodiorite:  
the southernmost rocks in New Brunswick**

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Machias Seal Island is located at the mouth of the Bay of Fundy, about 20 km south of Grand Manan Island and 20 km east of Machias, Maine. The island has an area of about 0.04 km<sup>2</sup>, and is barren except for a lighthouse and dwellings maintained by the government of Canada. It has the last manned lighthouse in the Maritime Provinces, and is well known among bird-watchers as a nesting site for puffins, auks, and other seabirds. Geologically, Machias Seal Island is important because of its location in an area through which it is difficult to trace terranes from the mainland of Nova Scotia and New Brunswick into the New England states. Studies in Grand Manan Island have not entirely resolved the problem, as rocks there most resemble those of the New River terrane of southern New Brunswick, suggesting that the Kingston, Brookville, Caldonia (Avalon), and Meguma terranes all lie outboard of Grand Manan Island.

Machias Seal Island consists entirely of grey, locally pink, fine- to medium-grained weakly foliated quartz monzodiorite, gradational to granodiorite. Small ovoid metadioritic xeno-

liths, generally less than 20 cm in maximum dimension, are abundant and consist of fine-grained granoblastic plagioclase, orthopyroxene, clinopyroxene, amphibole, and biotite. Two anastomosing mafic dykes, oriented approximately north-south and about 1 m in width, cut across the island. One dyke is alkalic, whereas the other is tholeiitic and may be related to Mesozoic basalt on Grand Manan Island.

Typical Machias Seal Island quartz monzodiorite contains 60% strongly zoned plagioclase, 40% amphibole and biotite, and about 20% interstitial quartz and orthoclase. The amphibole contains relict cores of orthopyroxene. The average chemical composition (6 samples) has 60.6% SiO<sub>2</sub>, with relatively high Al<sub>2</sub>O<sub>3</sub> (over 16%) and low K<sub>2</sub>O (2.8%). Overall, the chemical characteristics, including low Rb, Y, and Nb, are consistent with emplacement in a continental margin subduction zone.

A quartz monzodiorite sample yielded a preliminary U-Pb zircon age of 542.5±1.3 Ma, indicating that the pluton was emplaced close to the Precambrian-Cambrian boundary. Both the age and composition differ from those of the Three Islands Granite, which underlies the rocky shoals 14 km east of Machias Seal Island, and which has yielded a much older age of 611.1 ± 2.4 Ma. Small granitic plutons on Grand Manan Island have yielded ages more similar to the age of Machias Seal Island (ca. 547 Ma and 535 Ma), but they differ in terms of petrography and mode of occurrence. The Machias Seal Island quartz monzodiorite also differs in age from the adjacent granitoid rocks in Maine which are Silurian-Devonian and part of the Coastal Maine magmatic province. Age and compositional similarities strongly suggest correlation of Machias Seal Island quartz monzodiorite with the abundant ca. 550–525 Ma gabbroic to granitic plutons of the Brookville terrane on the mainland of southern New Brunswick.