Geology of the Newbury Neck 1:24,000 quadrangle, coastal Maine

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In coastal Maine, east of Penobscot Bay, the Cambrian Ellsworth Schist crops out in the Ellsworth-Mascarene terrane between the northwesterly St. Croix terrane and southeasterly Avalonian terranes. Recent 1:24,000-scale mapping in the Newbury Neck quadrangle south of Ellsworth constrains lithologic and structural variations that bear on the regional tectonic evolution of coastal Maine and New Brunswick.

Ellsworth rock types include quartz-muscovite-chlorite schist, greenstone, and metarhyolite, and, at the head of Morgan Bay, impure quartzite and a conglomerate. Chlorite-rich greenschist suggests a reworked volcanogenic protolith for much of the formation. The sheet-form meta-igneous rocks consist of tuff and, locally, sills, indicated by gabbroic texture and possible chilled margins. Igneous sheets and the few clearly-bedded strata are close to flat-lying except where steepened on rare late folds. A subhorizontal lineation, best displayed by elongate quartz phenocrysts in metarhyolite, trends northwest-southeast. Thin quartz laminae and abundant quartz veins define pervasive cm-scale, strongly asymmetric, tight to isoclinal folds that verge southwest to north. The hinge lines are distributed around the gently ESE-dipping plane of the main foliation. Sigmoid quartz laminae and veins and shear bands indicate top-to-the-northwest sense of shear. Greenstone slabs in pelitic schist at the south end of Newbury Neck suggest that the main deformation was locally intense. Crenulation cleavages correspond with the minor and variably oriented late folds. The formation is chlorite-grade except in the aureole of the Blue Hill Pluton where rare, pelitic beds contain andalusite. A late northwest-trending fault is postulated in Patten Bay based on truncation of isograds and steep fractures at Weymouth Point.

West of the map area, pebbles of Ellsworth Schist at the base of the overlying Castine Volcanic rocks (Late Cambrian) indicate an angular unconformity. On Deer Island, 20 km southwest of Newbury Neck, the Ellsworth Schist partially encloses a serpentinite body, which may be an intrusion or a slice of mantle. The serpentinite-Ellsworth contact is sheared, and the serpentinite has a harzburgite protolith with elongate orthopyroxene grains. The strongly bimodal character of the Ellsworth igneous rocks points to extension, which may have exhumed mantle (tectonized harzburgite) in a setting analogous to the Iberian continental margin. The intense top-to-the-northwest deformation and low-grade metamorphism suggest a southeast-dipping convergent boundary active in Late Cambrian time along which rift and mantle rocks were juxtaposed.