

Igneous Geochemistry and Its Implications for Terrane Analysis
of the Avalonian Event In Southeastern New England

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During the past four years we initiated a detailed geologic, petrographic and geochemical study of rocks within ten specific target areas, which encompass a zone broadly identified as the Avalonian Block. Although this effort is only about 30% complete at this time, the data gathered so far do allow us to give at this meeting a preliminary assessment on the nature of the Avalonian event in eastern Massachusetts and adjacent regions.

The Avalonian Block of southeastern New England is represented by two distinct crustal segments. The *southeastern segment* (known as either the Boston Platform or as the Milford-Dedham Zone), to the east of the Bloody Bluff Fault system (BBF), is dominated by igneous rocks emplaced during the Avalonian magmatic pulse. Rocks of this segment (the Avalonian terrane "proper") belong to a sequence of cogenetic caldera-type explosives and shallow intrusives formed between 580 m.y.b.p. and 630 m.y.b.p., that were largely spared from any of the post-Avalonian dynamometamorphic deformations with the exception of the late Paleozoic (Alleghanian) event, which primarily affected the southern sections. These studies were undertaken to determine the mode of origin of the cogenetic tonalite-granodiorite-granite/dacite-rhyolite associations: one preceding and one postdating the voluminous series. The data indicate that the Avalonian "proper" sequence was formed in an area of thermal anomaly which manifested itself as an intracontinental rift triggered by subduction of the Late Proterozoic mid-

ocean-ridge (back-arc rift). The igneous activity began as a bimodal alkali/transitional basalt-rhyolite series followed by a voluminous unimodal magmatic sequence formed by magma mixing of two parental magmas - one being a tholeiitic magma and the other an anatectic granitic magma derived from crustal rocks of Late Archean or Early Proterozoic lineage. Concluding the magmatic activity is a bimodal series but of apparent calc-alkaline character.

The geochemical and geologic evidence gathered on rocks of the *north-western segment* to the west of BBF (the Nashoba Block) suggests that their origin took place within a depositional basin either in epicontinental or eugeoclinal environment, but in direct association with the Avalonian continent. Widespread tholeiitic basalts (now metamorphosed to middle amphibolite facies: the Marlboro Formation) were most likely emplaced during Early Paleozoic and, if so, they may represent an Early Paleozoic arc sequence. Some of the formations within this block yield inherited zircons pointing toward a Late Archean or Early Proterozoic provenance. In contrast to the southeastern segment, this entire region was subjected to pervasive partial melting and to intrusions of calc-alkaline intermediate (diioritic) magmas during the time span between 450 m.y.b.p. and 400 m.y.b.p. As of now we believe that the north-western segment represents a separate Avalonian terrain which originated as a eugeoclinal sequence on the flanks of the Avalonian "proper" continent.