

THE TIMING OF THE EMPLACEMENT OF THE TOURMALINE-BEARING TWO-MICA GRANITES: U-Pb MONAZITE DATING

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The Manhattan Prong, which trends northeastward across southeastern New York comprises an area of Proterozoic to Paleozoic metamorphic rocks that have been repeatedly metamorphosed at grades that range from greenschist to granulite facies. Early high- pressure granulite mineral assemblages and later extreme high temperature (~900°C) and pressure (~9 kilobars) assemblages are recorded in the Taconian metamorphism of the rocks of the northeastern Manhattan Prong by Brock (1993). However, the extent of the early high-pressure granulite metamorphism is poorly constrained because the evidence is obliterated by later phases of Taconian metamorphism and by younger, post-Taconian deformation, granite intrusion, and remetamorphism. Mineral assemblages in the central and eastern portions of the Prong now reflect upper- and middle-amphibolite facies grade but the age of this metamorphism is not always clear. Post-Taconian, two-mica granites are associated with D6 deformation throughout the Manhattan Prong (Brock, 1993). They occur as small dikes (six inches to six feet wide) or as irregular shaped bodies up to a few tens of feet in diameter. Contacts between the two-mica granites and host rocks are generally sharp, and in places are pneumatolytic (Coarse grains grow inward from the contacts). Host rocks near the granites are retrograded from granulite and sillimanite+ k-feldspar grade or higher to staurolite+kyanite+muscovite grade and this retrogression was evidently largely controlled by granite-derived fluids (Brock, 1993).

The age of two-mica granites had previously been interpreted as Mississippian on the basis of three separate Rb-Sr isochron age determinations, and on K-Ar cooling ages of 350Ma from muscovite in the host rocks (Brock, Brueckner & Brock, 1985). New U-Pb analyses of monazites separated from two-mica granites from three localities: Goldens Bridge, Katonah and Manhattan yield Late Devonian Ages (387±6.4 Ma, 380±2.6 Ma and 378.0±6.6 Ma respectively), and the host rocks record a slow cooling rate of ~ 11°C/Ma. This cooling rate is far slower than would be expected for such small granites and is probably the cooling rate for the larger volume of rock that was subjected to hydrothermally-driven remetamorphism. Results of this study permit the remetamorphism and associated intrusion of two-mica granites in the Manhattan Prong to be interpreted as part of the widespread Acadian Orogeny instead of an independent Mississippian event. The implication is that the Acadian igneous activity is more widespread in this region than was previously recognized. In addition, the associated remetamorphism (and rehydration) are also more pervasive and more extensive than is generally recognized. This makes it even more difficult to map the original extent of the high-grade Taconian metamorphism.

References

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