IMPLICATIONS OF THE GRANITEVILLE XENOLITH FOR FLOW DIRECTIONS OF THE PALISADES MAGMA

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Examination of the orientation and marginal relationships of xenoliths in the Palisades intrusive sheet of New York and New Jersey suggests that one of the feeder areas for the intrusive sheet was in the vicinity of Graniteville, Staten Island. Geological relationships in Fort Lee, New Jersey, indicate that internal flow of the magma was directed northward, perhaps away from the Graniteville feeder area.

The Palisades Sill, a world-renowned mafic intrusive sheet, is continuously exposed from west of Haverstraw, New York southwestward to Staten Island, NYC. Many investigators have postulated that the Palisades magma flowed outward from fractures paralleling the NE-SW-trending Ramapo fault. To reach Fort Lee, magma from such fractures would have to flow from NW to SE. Beneath the George Washington Bridge, in Fort Lee, NJ, many large Lockatong xenoliths and screens containing contact-metamorphosed, deformed, highly laminated cyclic lacustrine sediments, are exposed. At the S end of the xenolith, hypocrystalline basalt is adjacent to metamorphosed Lockatong. Microscopic vesicles in the basalt may have been caused by fluidized pore water from the bounding sediments. Near the contact, the sandy sediments are chaotic and have "intruded" the igneous rock to form crude "sedimentary apophyses" and clastic dikes up to 20 cm long.

The microscope shows altered, contact-metamorphosed remnant clastic textures within the "clastic dikes" with subrounded feldspars, quartz, basalt, and other lithic fragments. Locally, the clastic grains are aligned parallel to the clastic-dike margins. In the same contact zone, a 40-cm-thick basaltic offshoot intrudes a Lockatong xenolith. Furthermore, the basal contact of the Palisades sheet cuts across the bedding in a ramp-like fashion toward the north. In the contact zone, tight, chevron folds with vertical, E-W-trending axial surfaces indicate differential flow from S to N not from NW to SE. Similar relationships occur at an exposure of the Palisades at Kings Bluff. Such flow to the N is consistent with evidence from the Graniteville quarry, Staten Island, where a partially fused, Lockatong xenolith is vertical and surrounded by annular fractures. All other xenoliths in the New York City area are oriented parallel to the contact of the Palisades intrusive sheet. This unique vertical xenolith implies upward flow of the magma and thus proximity to the feeder channel. If this is correct, then from Staten Island to Fort Lee, the lateral paleoflow pattern would have been from SSW to NNE. South of Staten Island, we predict NNE- to SSW-directed lateral paleoflow.

Our field data suggest that in the vicinity of New York City burial of the Palisades magma was not deep enough to allow dewatering and total compaction of the Lockatong sediments (~ 2 km?). As such, we envision wet and wild conditions at the base of the Palisades intrusive sheet during intrusion of the Palisades magma.

To Cite This Abstract: Merguerian, Charles; and Sanders, J. E., 1994f, Implications of the Graniteville xenolith for flow directions of the Palisades magma (abs.): p. 59 *in* A. I. Benimoff, ed., The Geology of Staten Island, New York, Field guide and proceedings, The Geological Association of New Jersey, XI Annual Meeting, 296 p.