



Mineralogical Analysis of Indian Rock, a Large Glacial Erratic in Rocky Point, NY



HOFSTRA
UNIVERSITY

Annalisa Zovich

Sanford H. Calhoun High School, Merrick NY
annzovich@bmchsd.org

Dr. J Bret Bennington

Hofstra University, Hempstead, NY
j.b.bennington@hofstra.edu

Abstract

Indian Rock is a glacial erratic found in Rocky Point, New York (Figures 1 and 2). It is located along Sam's Path on private property and has yet to have any major studies completed on it. Little is known about the history, chemical composition, or classification of the boulder. The rock is approximately 12 x 40 meters. It is well weathered over most of its surface, but has visible feldspar pegmatitic zones within a more foliated groundmass (Figure 4). Samples of unweathered rock were obtained and examined under magnification. Petrographic thin sections were prepared and the mineral composition and texture of the rock were observed with a petrographic microscope. Visual observation reveals dark crystals of biotite mica, pink crystals of potassium feldspar, and clear crystals of quartz and albite. After geochemical and petrologic analysis, the composition was confirmed to be those four minerals, which would mean the boulder is most likely a meta-quartz monzonite, as many glacial erratics found along the north shore of eastern Long Island appear to be. This is a common rock type of the Avalonian Terrain of eastern New England, although the large size and angularity of the erratic suggests that its origin was closer to its present location, from similar crystalline bedrock beneath Long Island Sound.

Methods

Petrographic thin sections were created from hand samples (Figure 3) in order to confirm the mineral composition of the rock as seen by the naked eye. Once completed, thin sections were observed under a petrographic microscope for analysis under cross polarized and plane polarized light. Under the microscope, different minerals have different optical properties (extinction angles, color interference, twinning) so identification of each mineral is possible. X-Ray Diffraction (XRD) was also used to confirm the chemical composition of the rock. The X-Ray Diffraction machine beams X rays through the sample, and is able to detect the reflected X- Rays from the atomic crystal lattice of each mineral. The rock was pulverized into a very fine powder that was then compacted and prepared into a mount which was placed into the XRD machine, and the final graph was printed for analysis.



Figure 1. First author and Indian Rock



Figure 2. Location of Indian Rock erratic



Figure 4. Pegmatitic zone within gneissic foliation

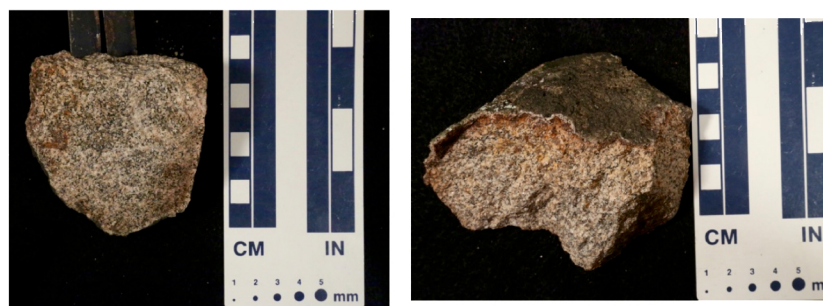


Figure 3. Hand samples used to prepare thin sections

Results

Analysis of both the petrographic thin sections and XRD clearly showed that there was biotite, plagioclase feldspar, potassium feldspar, and quartz present in the sample (Figure 5). This led to the classification of the rock as a meta-quartz monzonite.

Discussion

Within the thin section, there was obvious crystal inter growth and evidence of recrystallization, clearly showing that the rock is metamorphic in nature. Tartan twinning was found indicating the presence of potassium feldspar and pleochroic twinning confirmed the presence of albite in the sample. The XRD graph showed matching maxima that corresponded to a composition of the same minerals: biotite mica, albite, potassium feldspar, and quartz (Figure 6). The XRD also showed that the rock had a surprisingly high content of quartz, which was not expected. After searching through the USGS database of rock formations, the rock matches up with the Middletown Formation in Connecticut, which would make sense because many of the glacial erratics found on Long Island are from Connecticut and were originally from the New England area. As for future work, the rock should definitely be radioactively dated using U-238 in order to confirm the age of the rock and confirm the parent rock formation.

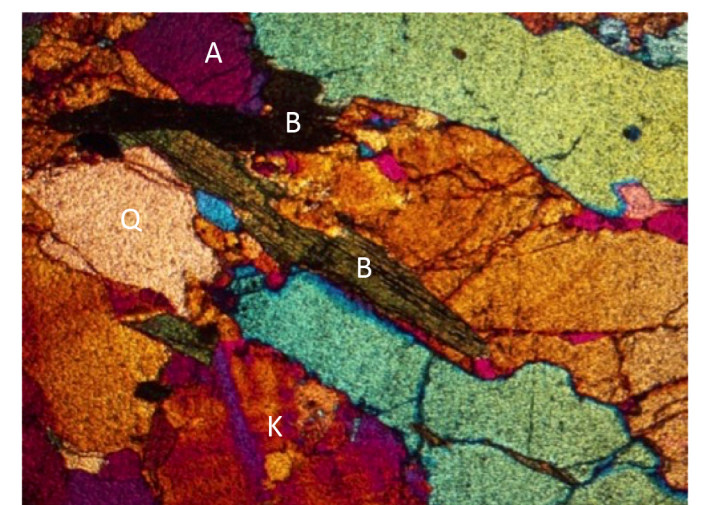
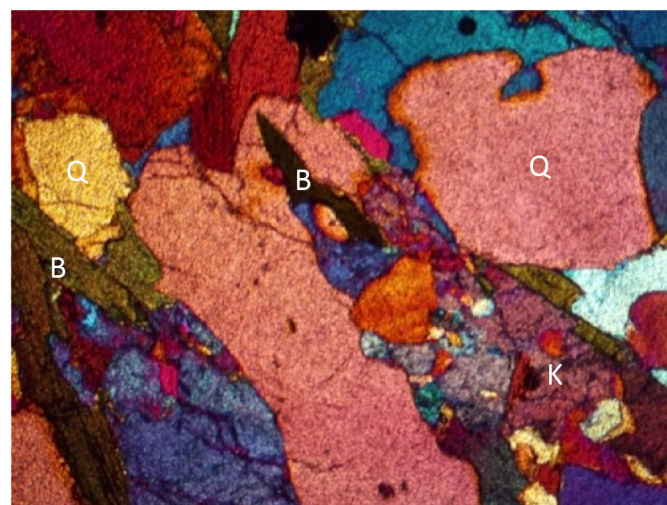


Figure 5. Photomicrographs of petrographic thin sections (Q:quartz, A:albite, B:biotite, K:potassium feldspar)

References

1. Flohr, Marta J.K. "X-Ray Powder Diffraction." United States Geological Survey, USGS, 1 May 1997, pubs.usgs.gov/info/diffraction/html/. Accessed 22 Sept. 2017.
2. USA.gov. "Geology of Connecticut." USGS Geologic Map Database, USGS, 1 Aug. 2016, ngmdb.usgs.gov/ngmdb/ngmdb_home.html. Accessed 22 Sept. 2017.

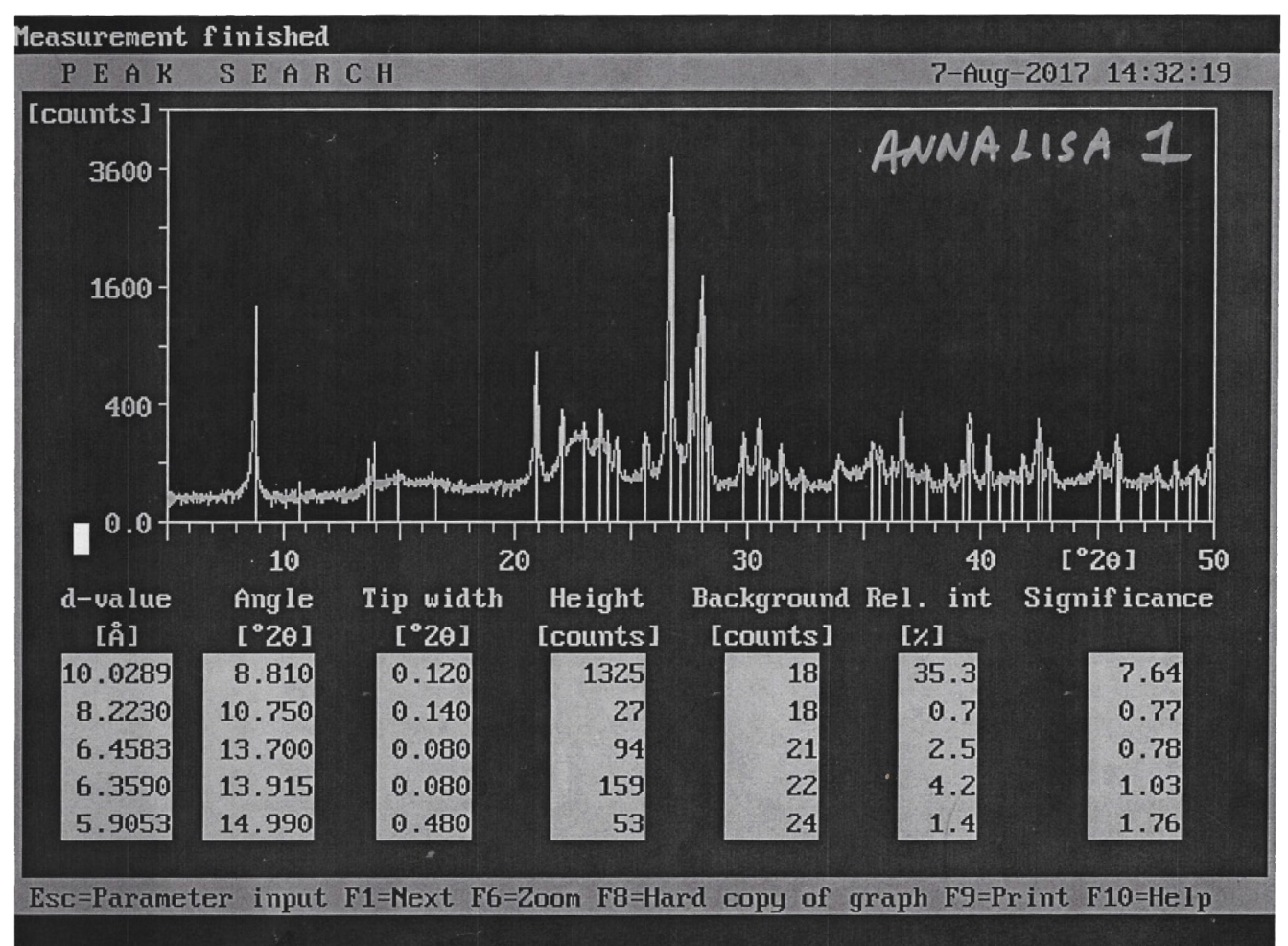


Figure 6. XRD (x-ray diffraction) spectrum for a pulverized sample from Indian Rock