

## **The Origin of the Ogunquit Dike Swarm**

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Ogunquit, Maine has beautiful rock exposures along the Marginal Way, a paved pathway that overlooks the ocean. The accessibility of these outcrops makes this area especially scientifically interesting. The Marginal Way overlooks an outcrop that features light and dark rocks. The dark rocks crisscross both the light rocks and other dark rocks. We can determine a relative age of each of the bodies of rocks based on cross-cutting relationship. The idea of cross-cutting relationships is that younger rocks cross-cut older rocks. The Marginal Way is a cherished location for the local population of Ogunquit as well as the tourists that frequent the path. The two goals of this project were to learn the origin of the dark rocks and to communicate the findings in a way that is accessible and understandable to those who frequent the Marginal Way. This body of rocks has been studied in the past, but there is still quite a bit of debate surrounding the origin of these rocks. There are three hypotheses to how the dark rocks got to the Marginal Way. They could have come from a large magmatic province (201-200 million years ago) that preceded the opening of the Atlantic Ocean, a series of volcanism that was active around the time of the splitting of Pangaea (250-200 million years ago), or they could have been formed by a hotspot (225 to 170 million years ago) (Dorais et al., 2005; McHone et al., 2014; Merle et al., 2012).

Our scientific goal was to narrow down the existing timeline for when these rocks originated as well as match them with a potential geological event that produced them. Another goal of this project was to communicate what we find with the public, we accomplished this by developing a website that explains a few sites along the Marginal Way clearly and in depth to a level that is reasonable for a visitor with no previous experience with geology.

We visited the Marginal Way a few times to meet with our community partners, seek out possible sample locations as well as locations we could include on our website, and finally to gather samples for analysis with the permission of the Marginal Way community committee. After gathering samples, we prepared them into thin sections of the rock samples. A thin section is a small slide of glass that has an extremely thin layer of the rock sample glued onto it so that light may pass through. We then prepared them for data collection with the SEM (Scanning Electron Microscope). Using the SEM, we gathered chemical composition data both for individual mineral grains and bulk rock chemical composition. We compared the data we compiled to existing data for geologic events such as volcanoes that formed from the splitting of Pangaea, the creation and spreading of the Atlantic Ocean, and the possible existence of a hot spot like the one that is creating the Hawaiian chain of islands.

Our current data suggests that most these dark rocks are from the Coastal New England series, a suite of volcanoes that formed during the splitting of Pangaea. This suggests that the Coastal New England series preceded the large magmatic province. However, the data that we have collected so far has shown that the dark rocks have been chemically altered by a hydrothermal fluid. This required us to correlate several datasets to determine the original chemistry of the rocks. As mentioned above, all samples but one yielded data that suggested they were from the Coastal New England series. We took a sample from the dark rock with the largest width as well as being the youngest in the area. The data from this sample suggests that this dark rock was formed from a different geologic event, most likely the large magmatic province that preceded the splitting of Pangaea. The Marginal Way is a premier location for study because it features more than one important geologic event and is easily accessible.

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#### References:

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