A detailed study of magmatic processes in development of part of the Fogo Batholith, Newfoundland, Canada

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The geology of Fogo Island, located in north-central Newfoundland, is dominated by a Silurian−Devonian batholith that contains rocks ranging from mafic to felsic in composition. Past work has focused on mapping the different gabbroic and granitic units represented on the island, studies of their chemistry, along with the nature of intrusion of plutonic rocks into the surrounding metasedimentary host rocks of the Fogo Harbour Formation. Our research focuses on spectacular mafic enclave swarms and dykes seen at Wild Cove, on the northeast coast near the town of Tilting. The enclaves are generally gabbroic to dioritic in composition and display mingling relationships with the diorite-granodiorite rocks that host them. Our hypothesis, based on the cuspate texture of the enclaves and the intruding/back-intruding nature of contacts between units, is that multiple felsic and mafic magmas co-existed as crystal-rich "mushes" within the chamber at the time of mingling.

Due to the lack of a base-map at an appropriate scale for this detailed study, aerial imagery specialists CloudBreaker™ were hired to conduct remote drone photography over Wild Cove. A total of 735 high-resolution photos were combined to create an ortho-rectified, GPS-located, photo mosaic base-map of the region. Careful hand-drawn maps were made of particular areas of interest where complex mingling relationships occur between units. Over the course of this investigation, these maps are being thoroughly examined to ascertain the nature and time-frame of magma mingling between the various hosts and intruding units. As an example, at one location evidence is preserved of complex mingling between mush units involving the intrusion of diorite dykes into diorite and granite mushes. The dykes were later pulled apart and subsequently back-intruded by liquid from the host mush. Field relationships such as this yield apparent contradictory evidence for the sequence of intrusion. This research may have implications for magma mingling processes in plutonic rocks seen elsewhere, such as the Vinalhaven intrusion in Maine, as well as provide new ideas for the understanding of the construction of composite intrusive suites.

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