Minsoc Report for Bursary awarded to Matt Gleeson, Department of Earth Sciences, University of Cambridge.

Project title: Field sampling of magmatic cumulates found on Floreana Island, Galápagos

I am extremely grateful to the Mineralogical Society of Gt Britain and Ireland for awarding me a junior travel bursary in 2017. This award enabled me to participate in a joint UK-Ecuador field expedition to the Galápagos Archipelago. Other members of the expedition team were: Dr Sally Gibson (PhD supervisor) and Dr Michael Stock from the University of Cambridge and Dr Benjamin Bernard and Antonio Antonio Proaño Altamirano from Instituto Geofisico Escuela Politechnica Nacional, Quito. Fieldwork was undertaken in collaboration with the Charles Darwin Foundation and the Galápagos National Park Authorities in Puerto Ayora (Santa Cruz, Galápagos).

The Galápagos is one of the most volcanically active areas in the world, with active volcanism covering an area roughly twice the size of that in Hawaii. The Archipelago consists of 8 major islands and numerous smaller islets and seamounts. The most volcanically active (Isabela and Fernandina) are found in the western archipelago, above the centre of an upwelling mantle plume, but, many of the eastern islands have had Holocene eruptions. The four-week field expedition in June 2017 covered two research projects, one focussing on the evolution of Galápagos volcanic systems from crystalline nodules found on the southern island of Floreana, and the second (led by Dr Stock) investigating magmatic processes at highly active volcanoes in the western Archipelago.

Figure 1 *– searching for xenoliths nodules on the northern cones of Floreana.*

My fieldwork focused on the island of Floreana. Previous studies have shown that this is distinct from other volcanic islands in the Galápagos because: (i) It is covered by a high proportion of explosively-emplaced scoria cones and pyroclastic deposits; (ii) abundant cumulate xenoliths, varying in composition from gabbros to wehrlite, pyroxenites and dunites, are found almost ubiquitously across the island; and (iii) Floreana basalts have highly radiogenic Sr and Pb isotope signatures. The range of isotopic compositions for the cumulate xenoliths indicates that while many are similar to the host magmas, others are more characteristic of western Galápagos volcanoes, and hence appear to give an insight into the evolution of magmatic processes beneath Floreana as the island moved away from the centre of plume upwelling.

The main goal of the fieldwork on Floreana was to collect a large representative suite of cumulate xenoliths. The fieldwork proved to be logistically quite difficult. While the island does not possess the rugged terrain of sharp blocky a'a lava flows seen on Isabela, often loose scoria rubble made navigating the volcanic cones and lavas difficult. Moreover, dense vegetation covers the island making much of it impenetrable. We travelled around the coast of Floreana by boat for four days, landing at various points each day and making our way inland where possible. Without the boat and its experienced crew, navigating around Floreana's coast would have been near impossible. As well as the fascinating geology of Isla Floreana we also witnessed a large variety of wildlife including marine iguanas, sea lions, flamingos, blue footed boobies and many more. The diversity of wildlife was outstanding.

We collected numerous samples of xenoliths, lavas and tephra from volcanic cones on the north and west of Floreana. Systematic in-situ micro-analysis of these samples for major- and trace-elements by EPMA and LA-ICP-MS at the University of Cambridge and volatile-elements at the University of Edinburgh NERC ion probe facility is now being undertaken to establish how magmatic processes change beneath Galápagos volcanoes as they move eastwards, away from the centre of mantle plume upwelling.