Abby Lodge
Submarine Morphology

The morphology and structure of oceanic islands in hot spot archipelagos provide insights into how these oceanic islands grow and evolve. I found it interesting that scientists can use $^{3}He/^{4}He$ ratios to help determine that the leading edge of hot spot volcanism currently lies under the westernmost island of Fernandina. Yet despite the unique geological and biological characteristics of the Galapagos Islands and their location near the first discovered mid-ocean ridge hydrothermal vents, the submarine geology of the islands has remained relatively unexplored until recently. This article does provide detailed interpretation of submarine volcanic features in the western Galapagos and better understanding of the processes responsible for their formation. However, I found this article overly verbose and very detailed in areas that I was personally not familiar with (e.g. the data collection section) so this made it rather dry. The authors of this article also pulled from several other articles and built upon previous work, which I believe is a good thing but can get rather confusing in a format such as this one.

Information that was presented a little clearer (yet still verbose) was in the Discussion section. In the Submarine Riff Zone subsection, it was discussed that the diffuse nature of Galapagos subaerial rift zones has been shown to differ from the well-developed nature of western Galapagos submarine rifts, likely due to greater deviatoric stresses in the submarine environment. The western and southwestern rift zones of Ecuador Volcano extend into the submarine region from northern and southern segments of its dissected caldera, with the western submarine rift zone being semi-parallel to the subaerial ‘‘Northeast’’ Rift Zone. Western Galapagos rift zones range from 5 to 20 km in length, significantly shorter than the 30–70 km submarine rift zones on the island of Hawaii. I found the comparisons to Hawaii helpful. Short rift zone length for Galapagos rifts is likely a product of lower magma supply rates, as the Galapagos Islands are about 10% as volcanically active as their Hawaiian Island counterparts.

Then in the NW Fernandina Rift Zone subsection, it was discussed that cross-axial profiles reveal a well-developed, symmetrical rift axis at the shallow end of the NW rift, becoming progressively more irregular at its distal end, reinforcing evidence for recent volcanism focused at the nearshore portion of the NW Fernandina rift zone.

The Volcanic Cones subsection discussed the submarine slopes of the Galapagos Islands are dotted with volcanic cones, both lining rift zones and lava terraces and in regions in which volcanic activity is otherwise limited, such as Canal Isabela. Steep-sided, pointed cones are found on volcanic flanks and rift zones at water depths generally shallower than 1500 meters. These cones are said to be related to a greater expansion of magmatic gas under lower pressure, leading to piling up of fragmental material around the vent. Flat-topped volcanic cones on submarine flanks and rift zones of Hawaiian volcanoes are likely a product of long-lived effusive eruption of low volatile content lavas experiencing high confining pressures at moderate to great water depth and gentle slopes.

And finally, in the Vents and Deep Lava Flow Fields subsection, it was discussed that It has recently been proposed that the deep lava flow fields west and northwest of Fernandina and Ecuador Volcano represent initial phases of island-building volcanism that will coalesce into terraces and form a plateau upon which the next island in the Galapagos chain will grow.