Abby Lodge
The Geology of the Galapagos

The Galapagos Islands are formed by a mantle plume – this is a column of hot rock that rises from deep within the earth. I was surprised to learn that there are debating theories as to how deep from within the earth these plumes come from. Some scientists believe that plumes originate from shallower depths, somewhere between the supper and lower mantle at 670 kilometers. Other scientists believe the plume comes from much deeper, about 2,900 km, around the base of the Earth's mantle. The latter theory is more widely accepted because the plumes remain fixed relative to one and other over many millions of years, then though the lithosphere remains fixed above them move thousands of kilometers in this time. As these plumes meet the surface, they cool but do not completely melt – at this point it is called magma and when the magma pools at depths between a few kilometers and ten kilometers beneath the surface it forms magma chambers.

The Galapagos Spreading Center is a mid-ocean ridge (usually located at the edges of plates moving away from one another) and is located just north of the Galapagos archipelago. A major subduction zone is located along the west coast of Central and South America, where the Nazca and Cocos Plates are subducting beneath the South American and Caribbean plates. The Galapagos Islands are located beneath the Nazca Plate, which is moving east-southeast, towards South America. I like how both articles made comparisons to other island chains and mainly Hawaii. For example, the it was stated that the Galapagos Islands are not as linear as Hawaii, but nonetheless, the islands get older to the south-southeast toward the subduction zone. The non-linear anomaly is likely due to the proximity of the plume to the ridge. The motion of the lithosphere eventually carries the volcanoes away from its source of magma – the plume – so this volcano becomes "extinct." This is how chains of sea-mounds formed – they were once islands but now are disappearing into the subduction zones.

On the islands to the west, Isabela and Fernandina, large volcanoes with an "inverted soup-bow" morphology and deep calderas can be observed. On the islands to the east, smaller shield volcanos with gentler slopes occur. These different volcanic morphologies appear to be due to the difference in lithospheric thickness and this indicates distinctly different age in the lithosphere. At 91° W is a fraction zone and just to the west of that the lithosphere is older and thicker – therefore able to support the load imposed on it by a large volcano. East of the fracture zone, the lithosphere is too young and weak to support large volcanic structures. I, again, was surprised to learn that there are different competing theories as to the unusual "inverted soup-bow" morphology. The first theory is that the morphology results from way in which eruptive vents are distributed on the volcanoes. Since there are relatively few vents on the steep upper sides of the volcanoes, the volcanoes then grow outward at the bottom and upward at the top. However, an alternative hypothesis for the morphology of Galapagos volcanos is that it reflects the pattern of disturbance of magma within the volcano. Essentially, magma intruded into the volcano inflates the central part, pushing the summit region upward and steepening the slopes on the upper flanks.

Two more characteristics that make the Galapagos volcanoes unique are, first, the large size of their calderas, especially in comparison to the size of the volcanoes. Calderas are formed

when an underlying magma chambers collapses. The second characteristic is that the mantle plume is able to produce so many simultaneous active volcanoes at one time.