

# Chemical and Petrographic changes in Ocean Island Basalts Associated with Hydrothermal Alteration

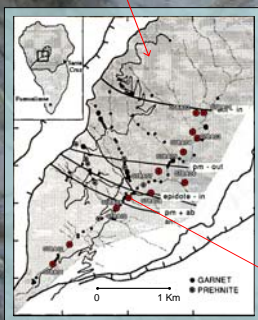
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## Geologic Setting

The island of La Palma is the westernmost and youngest island in the Canary Archipelago. The island is situated on Jurassic oceanic crust and consists of several overlapping basaltic volcanoes of Pliocene to Recent age. In the Barranco de Las Angustias, on the western side of the island, a combination of 3km of uplift and deep erosion has exposed a section through the early seamount phase of the island. All layers of the old seamount, from seafloor sediment to plutons in the magmatic core, are exposed. From seafloor to core, the rocks become increasingly metamorphosed from zeolite through greenschist facies.



Maps are from NASA World Wind 1.4



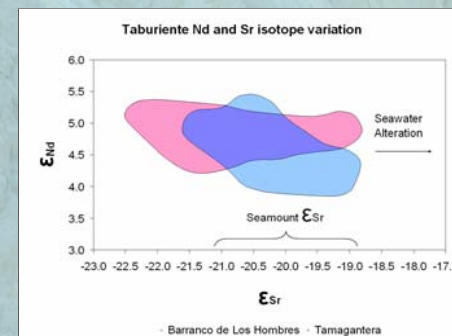
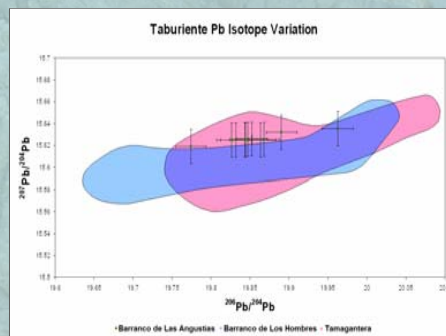
## Samples

A total of 14 samples were collected at intervals ranging from 100 to 900 meters apart over a transect that covered slightly over 3.1 km. All the samples are either pillow basalts or fragments thereof. Care was taken to avoid taking weathered samples.

Geologic map of the Barranco de Las Angustias. Red Circles denote sample localities. Base map from Schiffman & Staudigel, 1994.



Typical sample locality in the Barranco de Las Angustias showing tilted basalt pillows cut by later dikes.



## Isotopic Trends

The Barranco de Los Hombres and Tamagantara both expose the subaerial shield lavas from Taburiente. These lavas had no exchange with seawater so should preserve the isotopic signature of their source region in the mantle. In contrast, the submarine lavas from the seamount stage exposed in the Barranco de Las Angustias are expected to show the influence of seawater alteration. Surprisingly, both the Pb and Sr isotopes are virtually identical to those measured from the subaerial flows. The seamount Nd isotope analyses are in progress. There is no correlation between isotopic ratio and depth of burial.

Barranco de Los Hombres and Tamagantara data from Guetschow & Nelson

## Petrographic Trends

In spite of dramatic mineralogic changes through the section, there are no corresponding changes in isotopic ratios. The samples analyzed range from slightly altered zeolite facies through greenschist facies and spilite. Even the least altered samples show evidence of alteration such as infillings of calcite and devitrification of glass. The most altered samples have very few primary minerals remaining.



Augite-rich basalt from high up in the section      Epidote surrounded by chlorite      Relict clinopyroxene(?) from deep in the section

Increasing metamorphic grade

Field of view appx. 4mm across, crossed nicols

## Conclusions

- There is virtually no change in the isotope ratios of Taburiente through time.
- All samples show mineralogic changes associated with hydration at low pressure and temperature.
- Surprisingly, there is no isotopic evidence for seawater being involved in these changes, despite the lavas being erupted below sea level.