

The bearing of the geochemistry of calc-alkaline rocks from Santorini and Christiani Islands.

by

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RECK [1936] had assumed that Christiani Islands, 25 km SW of Santorini, Santorini and the submerged Kolombos volcanoe, 8 km NE of Santorini, are connected by the same tectonic line which runs perpendicular to the Aegean island arc. Only single descriptions were available for Christiani rocks and no information is known for Kolombos. According to the subduction model volcanic rocks of the three occurrences should all belong to a calc-alkaline series with a more or less continuously developing chemistry.

Chemical major and trace element determinations on more than 50 lavas from Christiani and the nearby Askania proved them to be mostly andesites with only narrow variations of most trace elements. A rather constant K/Rb ratio (275 ± 30) points to a homogeneous source for all lava flows. During the rise of the magmas they have been contaminated by varying amounts of mantle material which has been admixed up to 9 % to the original melt. Consequently increasing concentrations of Ni, Cr, and Mg which are closely correlated to each other have been found.

Rare earth distribution resembles closely to the patterns described by TAYLOR [1969] for andesites but sometimes the light rare earths are more enriched. Only small if any negative Eu anomaly has been observed.

Within a soil sequence which forms a platform about 50 m above sea level on Christiani autochthonous rhyolitic pumice layers up to 4 m thick have been found. Just below the large pumice band xenoliths of granite, leucogranite, phyllite and scarns have been collected, which document penetration of such rocks in the underground by early eruptions of the volcanoe-clastic material. Trace element comparison of granites and pumice prohibit the latter to be derived from melting or resorption of these granites. Although intermediate calc-alkaline rocks are missing the pumice can be related to the calc-alkaline series. Scarn minerals (andradite) prove the existence of limestone in deeper zones.

On top of Christiani pumice from Santorini has been found which fits perfectly to the trace element patterns from the upper pumice of Santorini. Christiani pumice differs in Sr, Zr, Ba, Y, Sc and REE concentrations.

Due to the stratigraphical situation Christiani pumice must be older than the Santorini event, but no absolute age can be given at present.

Santorini rocks show a wider spread of chemistry in the volcanics but rhyolitic rocks have not been met. Admixture of mantle material was witnessed by high Ni, Cr, and Mg concentrations. The rare earth patterns show distinct enrichments of lighter REE and more frequent negative Eu anomalies.

If K_2O versus SiO_2 plots are compared to focal depths of earth quakes i.e. the subduction depth of the underthrust African or Eastern Mediterranean plate a correlation to K_2O concentration (normalized to 60 % SiO_2) was postulated by HATHERTON & DICKINSON [1969]. For Christiani from about 30 samples a regression line was calculated which gave 1,68 % K_2O when normalized to 60 % SiO_2 . This procedure gave for 90 Santorini samples 1,84 % K_2O and for the two Kolombos lavas 2,0 % K_2O .

Comparison with investigations by HATHERTON & DICKINSON [1969] would place the depth of the Benioff zone at 135 km under Christiani, 145 km below Santorini and about 160 km under the Kolombos volcano. These data fit the geophysically measured depths of earth quakes satisfactorily.

The geochemical data obtained so far support the picture for the formation of alkaline rocks given by GREEN & RINGWOOD [1968] and RINGWOOD [1974]. Christiani, Santorini, and Kolombos, seem to be genetically related.

Details on the petrology and geochemistry of the Christiani investigations will be published elsewhere (PUCHELT, MURAD and HUBBERTEN 1975).

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Intervention

E. Zarudzki. — Was the age of the pumice from the Pre-Santorini eruption and found on Christiani, determined?

Réponse. — The pumice found on Christiani is not dated yet. It is definitely older than the last pumice eruption from Santorini. We hope to get further information from the 1975 field work.