Final Report

ECORD Research Grant: The petrology and geochemistry of lavas from the western Azores oceanic plateau

Felix S. Genske

GeoZentrum Nordbayern, University Erlangen-Nürnberg, Germany

CCFS, GEMOC, Macquarie University Sydney, Australia

now at:

Institut für Mineralogie, Westfälische Wilhems-Universität Münster, Germany

Aims of the study

The ECORD project funded here addresses the evolution of the westernmost part of the Azores oceanic plateau (Fig. 1), which is located in the central North Atlantic, either side of the Mid-Atlantic Ridge (MAR). Almost all published studies have focused on the eastern Azores islands and the MAR basalts, and only more recently lavas from the western Azores islands have been included to further reconcile the nature of this plateau (Genske et al., 2012; Larrea et al., 2012). This is important because the chemical composition of these lavas holds important information in terms of plume-ridge interaction, or, more generally, constraints as to whether the western plateau is related to the same mantle plume that is believed to be the source of the islands east of the ridge.

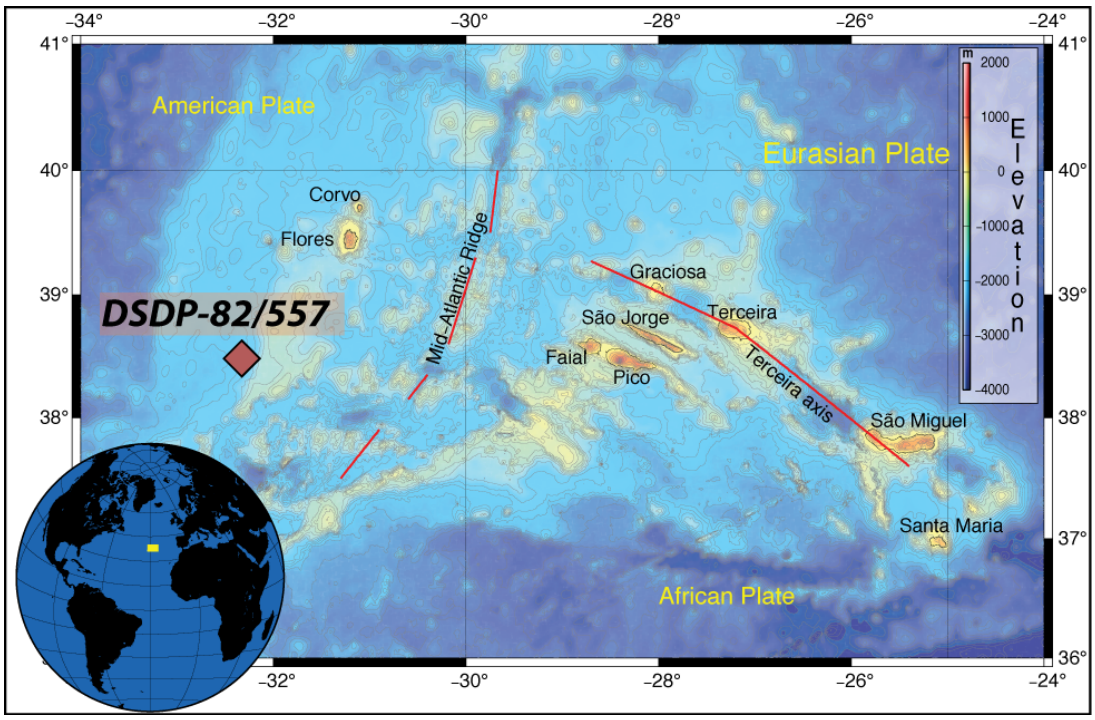

Figure 1: Bathymetric map showing the location of drill hole DSDP-82/557 on the Azores platform. Map generated using GMT.

Results

The data obtained during this project span major and trace elements as well as radiogenic isotope compositions of strontium, neodymium and hafnium that were measured on drilled basalt cores on (DSDP82-557, plus cores from a subsided island west of Flores (Ryall et al., 1983) and just off the western Azores plateau (DSDP82-556). The major elements were analyzed via XRF at the GeoZentrum Nordbayern/Germany; all other data were obtained at the Geochemical Analysis Unit (GAU) at Macquarie University, Sydney. The trace elements were determined via solution quadrupole ICP-MS, Sr and Nd isotopes were measured on a Trition TIMS and the Hf isotopes were analyzed on a Nu MC-ICP-MS. Whereas all of the on-plateau submarine basalts are similar in composition to lavas from the western Azores islands (França et al., 2006; Genske et al., 2012; Larrea et al., 2012), the drilled basalts from hole 556 resemble normal MORB crust (Fig. 2, new data are highlighted in red).

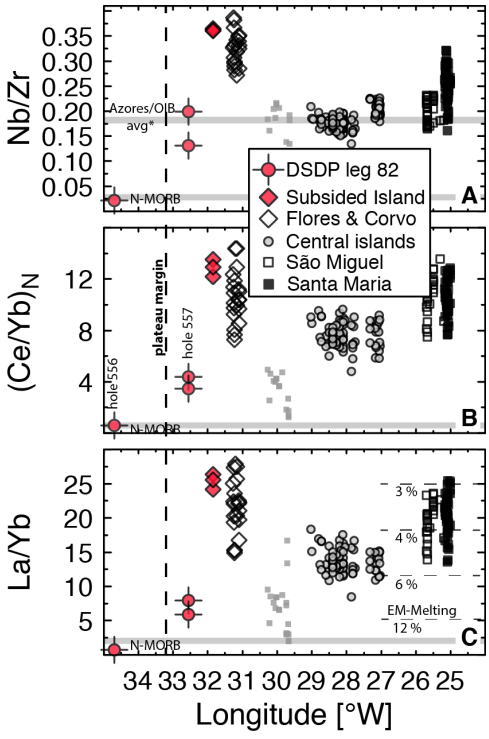

Fig. 2: Plots of a) Nb/Zr, b) primitive mantle normalised $(Ce/Yb)_N$ and c) La/Yb, atios versus longitude [°W] across the Azores archipelago. The ratios of Nb/Zr (and Ta/Hf, not shown) reveal an asymmetry with highest values and largest variation ascribed to Flores and Corvo lavas. Compositional ranges for typical N-MORB and normal OIB are shown for comparison ((Arevalo and McDonough, 2010) and (Willbold and Stracke, 2006) respectively).

The actual data will be included and presented in a paper, which is preparation and will be submitted 2013.

Preliminary discussion and findings

The preliminary findings from this study confirm the results from onboard major and trace element measurements (Bougault et al., 1985). However, the high field strength elements, namely Nb, Ta, Zr, Hf reveal distinct systematics across the entire Azores platform, which require new interpretations regarding the mantle composition and melting dynamics in the Azores region. In line with the radiogenic isotopes we conclude that the local depleted MORB mantle plays an important role for the generation of magmas that erupted during the formation of the Azores oceanic plateau.

From bathymetric constraints together with chemical differences between drill holes DSDP82-556 & 557 we also conclude that the western boundary of the chemically enriched plateau strikes roughly north-south at longitude -33 deg. W.

Budget of costs

The analytical costs for major elements of 6 samples incurred at the GeoZentrum Nordbayern amount 120,- EUR

The remaining analytical costs incurred at Macquarie University Sydney contained:

- sample separation via SelFrag (3 samples @ AUD 94 per sample) = AUD 282.00
- trace element analysis of 5 samples (@AUD 104.00 per sample) plus radiogenic isotope analyses (Sr-Nd @AUD 117.00 per sample, Hf @AUD 130.00 per sample) = AUD 2067.00 (incl. bank fees)

These have all been covered and paid by the ECORD research grant.

References

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