Geophysical Research Abstracts
Vol. 19, EGU2017-7463-1, 2017
EGU General Assembly 2017

From vein precipitates to deformation and fluid rock interaction within a SSZ: Insights from the Izu-Bonin-Mariana fore arc

Peter Micheuz, Dennis Quandt, and Walter Kurz
Institute of Earth Sciences, NAWI Graz Geocentre, University of Graz, Austria (peter.micheuz@uni-graz.at)

International Ocean Discovery Program (IODP) expeditions 352 and 351 drilled through oceanic crust of the Philippine Sea plate. The two study areas are located near the outer Izu-Bonin-Mariana (IBM) fore arc and in the Amami Sankaku Basin. The primary objective was to improve our understanding of supra-subduction zones (SSZ) and the process of subduction initiation. The recovered drill cores during IODP expedition 352 represent approximately 50 Ma old fore arc basalts (FAB) and boninites revealing an entire volcanic sequence of a SSZ. Expedition 351 drilled FAB like oceanic crust similar in age to the FABs of expedition 352.
In this study we present data on vein microstructures, geochemical data and isotopic signatures of vein precipitates to give new insights into fluid flow and precipitation processes and deformation within the Izu-Bonin fore arc.
Veins formed predominantly as a consequence of hydrofracturing resulting in the occurrence of branched vein systems and brecciated samples. Along these hydrofractures the amount of altered host rock fragments varies and locally alters the host rock completely to zeolites and carbonates. Subordinately extensional veins released after the formation of the host rocks. Cross-cutting relationships of different vein types point to multiple fracturing events subsequently filled with minerals originating from a fluid with isotopic seawater signature.
Based on vein precipitates, their morphology and their growth patterns four vein types have been defined. Major vein components are (Mg-) calcite and various zeolites determined by Raman spectra and electron microprobe analyses. Zeolites result from alteration of volcanic glass during interaction with a seawaterlike fluid.
Type I veins which are characterized by micritic infill represent neptunian dykes. They predominantly occur in the upper levels of drill cores being the result of an initial volume change subsequently to crystallization of the host rocks. Type II veins are characterized by blocky carbonates and idiomorphic to blocky zeolites. Blocky carbonates locally exhibit zonation patterns. Type III and type IV veins are both assumed to be extensional veins. Type III is characterized by syntaxial growth and elongate blocky carbonate minerals. They predominantly occur as asymmetric syntaxial veins, locally exhibiting more than one crack-seal event. Type IV veins are defined as antitaxial fibrous carbonates.
Type II veins commonly show deformation microstructures like twinning (type I/II twins), slightly curved twins, and subgrain boundaries indicative of incipient plastic deformation. Based on these observations differential stresses around 50 MPa were needed to deform vein minerals, presumably related to IBM fore arc extension due to the retreat of the subducted Pacific plate.
We acknowledge financial support by the Austrian Research Fund (P27982-N29) to W. Kurz