S09-T07

Northwestern Central American Volcanic Arc: Increased contribution of enriched lithosphere to lavas along the volcanic front from Nicaragua to Guatemala and behind the volcanic front

Ken Heydolph[1], Kaj Hoernle[1,2], Paul v.d. Bogaard[1,2], Folkmar Hauff[1]
[1]Leibniz-Institut für Meereswissenschaften IFM-GEOMAR, Wischhofstr. 1-3, D-24148 Kiel, Germany
[2]Sonderforschungsbereich 574, Wischhofstr. 1-3, D-24148 Kiel, Germany

The Central American Volcanic Arc (CAVA) has been subject of intensive research over the past decades, leading to a large variety of different models for the origin of CAVA lavas with various source components. Based on a comprehensive new geochemical data set (i.e. major and trace elements and Sr-Nd-Pb-Hf-O isotope ratios) of mafic volcanic front (VF), behind the volcanic front (BVF) and back-arc (BA) lava and tephra samples from NW CAVA (Nicaragua to Guatemala), we present a new model for the NW Central American Volcanic Arc volcanism. Additional potential source component sample data from subducting Cocos Plate sediments, igneous oceanic crust and Guatemalan granitic and metamorphic continental basement further contributes to our new model.

We find systematically increasing Pb isotope ratios and decreasing Nd and Hf isotope ratios along the arc from NW Nicaragua to Guatemala. BVF lavas generally have more radiogenic Pb and less radiogenic Nd and Hf isotopic compositions than related VF lavas, similar to what is observed for trace element ratios going northwards along the VF. Combined isotope and trace element data indicate the presence of three endmembers for the volcanism in NW Central America: (1) NW Nicaraguan VF samples with very high Ba/(La, Th) and U/Th, low La/Yb, relatively radiogenic Sr, Nd and Hf but unradiogenic Pb, (2) NW Guatemalan VF and Guatemalan and Honduran BVF samples with low Ba/(La, Th) and U/Th, high La/Yb, radiogenic Sr and Pb but unradiogenic Nd and Hf, and elevated d18O, and (3) Honduran and Nicaraguan BVF samples with low Ba/(La, Th) and U/Th, high La/Yb, unradiogenic Sr but radiogenic Nd, Hf and Pb. We interpret the NW Nicaragua VF endmember to be dominated by a largely serpentinite-derived fluid flux from the subducting slab, possibly with small amounts (<1 wt. %) of sediment melts, to a depleted N-MORB type of mantle wedge, resulting in large degrees of melting of primarily peridotitic material. Based on combined Hf and Nd and Hf and Pb isotope systematics, the isotopically enriched Guatemala VF and BVF endmember cannot be explained by the addition of subducted pelagic sediments to the source. Instead this endmember could be derived from pyroxenitic cumulates in the lithospheric mantle (and possibly lower crust) that were derived from parental magmas for plutonic rocks in NW Central America, which were melted during the Quaternary subduction-related volcanism. The isotopically depleted Honduras and Caribbean BA endmember could be derived from melting of young, recycled, oceanic crust in the asthenosphere upwelling in the back-arc, based on the OIB-like major and trace element but relatively depleted isotopic compositions of these samples. Mixing between these three endmember types of magmas can explain the observed systematic geochemical variations along and across the NW Central American Arc.