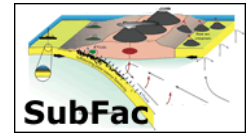


Magma generation in the early Mariana arc system revisited



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These grants were used to study Eocene- to Miocene-aged volcanic rocks exposed on the Mariana forearc islands of Guam, Saipan, and Rota. In addition, because of the opportunity for Reagan to participate in the Shinkai 6500 dive cruise YK04-05 of the RV Yokosuka, Eocene volcanic rocks from the Bonin Ridge and the escarpment leading to the Bonin Trough also were studied. The USA-Japan collaboration begun during the YK04-05 cruise has continued after the grant through two additional Shinkai 6500/Yokosuka dive cruises to the southeast of Guam to map out the distribution of volcanic rocks in the Mariana forearc. The first cruise was in 2006 (YK06-12), and the second (YK08-08) in middle July, 2008. Based on the observations to date, the overall evolution of volcanism along the entire length of the IBM system appears to be the following (see Fig.). The tholeiitic basalts and related intrusive rocks are the oldest igneous rocks in the forearc. We hypothesize that these are the first volcanic rocks to erupt after subduction begins, and result from mantle upwelling to fill the space left by the catastrophic initial sinking of the Pacific Plate. We further hypothesize that continued melting of this now-shallow harzburgitic mantle residue due to the introduction of a robust flux of water-rich fluid from the subducting slab resulted in the genesis boninites. Beginning with the 45-46 Ma rhyolites on Saipan and 41-42 Ma arc tholeiites on Guam, lavas with relatively normal arc signatures started being generated. These lavas have compositions suggesting that pressures and other conditions of melting were relatively normal along the arc front by the late Eocene. The emergency response of MARGINS to the 2003 eruption of Anathan allowed us to study the timescales of genesis and differentiation for this andesite. We produced a comprehensive U-series data set (²³⁸U-²³⁴U-²³⁰Th-²²⁶Ra-²¹⁰Pb-²¹⁰Po and (²³⁰Th)/(²³²Th)) for the andesite that suggested a differentiation time period between 100 and a few thousand years.

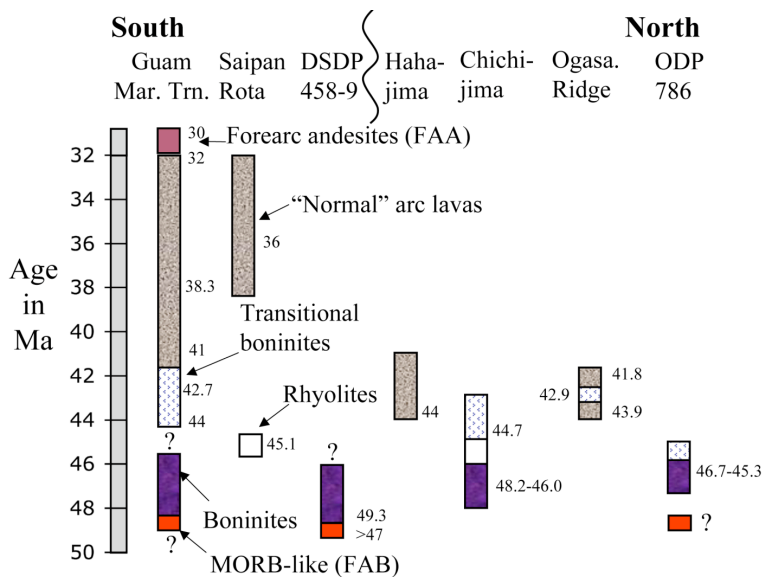


Figure: Ages and compositions of protoarc and first arc lavas after Ishizuka et al. (2006). Ages from; Meijer et al. (1983); Ishizuka et al. (2006); Cosca et al. (1998)*; Reagan et al. (2008); M. Reagan and M. Heizler (unpublished data); O. Ishizuka (unpublished data).

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*References listed in appendix A.

