

Subduction initiation in the Aleutian arc system

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Despite its key role for plate tectonics, subduction initiation remains a poorly understood process. One way to shed light on the physical and chemical development of subduction zones is to investigate the composition of the first igneous rocks produced in this setting. In particular, the nature of the first erupted rocks is key to constrain the tectonic regime of the overriding plate, which in turn allows discrimination between different models of subduction inception. In order to investigate the initial stages of the Aleutian system, we sampled (via dredging) the lowermost submarine sequences at ten forearc and rear-arc localities during the R/V SONNE Cruise 249. We present whole-rock major and trace element concentrations, Sr-Nd-Hf-Pb isotopes as well as preliminary Ar-Ar and U-Pb zircon dating on the recovered igneous rocks.

The samples are tholeiitic and calc-alkaline and range in composition from basaltic to dacitic (and plutonic equivalents). Most of the samples show typical arc rock signatures. Based on preliminary ages, the oldest rock of this type is 47 Ma, which is similar to the oldest ages published so far in the Aleutian, also obtained on rocks with typical arc signatures. The remaining ages (n=8) range from 6 Ma to 38 Ma, suggesting that not all dredged samples are from the oldest units. These younger samples are nevertheless valuable witnesses of the pre-Quaternary compositions of the arc mantle sources, and reveal a complex evolution. No boninites were found, which could suggest their absence in the lowermost outcrops and therefore a different initiation style compared to other Pacific subduction zones. A few samples with limited slab signatures were recovered, two of which have close trace element characteristics to fore-arc basalts (FABs). Since FABs are the first volcanic rocks erupted in the subduction systems where they occur, these samples could not only provide the age of the inception but also key information about the related tectonic setting. Upcoming dating will reveal if this is the case and will, in any case, provide new constraints on the arc basement.