# How fast do volcanic arcs establish steady-state?

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Within their average life time of 20-100 million years, volcanic arcs efficiently process solid Earth materials and create continental crust. But how long does it take for an arc/trench system to become fully operational after initiation, and how are the overall mass balances affected? There is clear evidence of time-progressive, unidirectional arc evolution from the comprehensive rock record of the intraoceanic Izu-Bonin arc (Pacific NW). Volcanism in the Izu-Bonin arc commenced 50 million years ago in the middle Eocene with voluminous boninitic magmas that are extremely depleted in high-field-strength and rare earth elements. Boninitic magmas became gradually replaced by isotopically distinctive, tholeiitic low-K and medium-K magmas from moderately depleted subarc mantle sources. Since 18 million years ago, the Neogene Izu arc has been in “steady-state”, whereby the systematic across-arc increase in K reflects steady processing of slab and mantle sources across the subduction interface.

In order to constrain the time frame within which steady state was established after arc initiation, we focus on the phase of the late Eocene to late Oligocene arc evolution. Currently available data suggest the occurrence of low-K and medium-K tholeiitic lava series during that period. It is not clear, however, whether these series are arranged in different spatial zones analogous to the Neogene, and would thus indicate steady-state by analogy. Alternatively, they might follow a time-progressive trend, reflecting secular changes in the source compositions, or in the processing of the slab and mantle. In order to distinguish among these possibilities, we performed new major, trace element and isotopic analyses of fallout tephra from ODP Site 782A. The tephra, which are low- to medium-K and basaltic andesite to rhyolite, provides a pristine as well as a highly temporally resolved rock record (<1 Ma) of the late Eocene to late Oligocene period. Closing the substantial temporal gaps in the lava record, the tephra will provide essential information with respect to the quantification of the elemental fluxes over the life time of the Izu Bonin arc.