



Tectonic evolution of the outer Izu-Bonin forearc subsequent to Pacific Plate subduction initiation

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International Ocean Discovery Program (IODP) Expedition 352 sites U1439 and U1442 obtained very good overall recovery of the sedimentary-volcanoclastic sequence that allow the reconstruction of the IBM forearc tectonic evolution using shipboard data and seismic reflection images. The oldest recorded biostratigraphic ages of the sediment cover (Late Eocene to Early Oligocene) imply a hiatus of up to 15 million years between the formation of the igneous basement around 52 to 47 Ma and the onset of pelagic sedimentation.

At the fore arc upslope sites (U1439, U1442) extension resulted in the formation of asymmetric, fault-bound basins. Displacement along confining normal faults is in the range of 310 meters, resulting in stretching by ~16%-19% at strain rates in the range of 1.58×10^{-16} to 4.62×10^{-16} . Downslope site U1440 is characterized by symmetric graben structures bound by conjugate normal faults. Displacement along these faults is ~ 660 m to 770 m, resulting in extension in the range of ~4 at strain rates of 9.66×10^{-15} to 3.31×10^{-15} . Incipient roll-back of the Pacific Plate triggered upper plate extension that was accommodated by normal faulting with initial syntectonic sedimentation from Late Eocene to Early Oligocene times onwards. This was followed by waning displacement with slow-rift to post-rift sediment deposition during the transition from rifting along the margins to spreading at the center of the Shikoku–Parece-Vela basin system.

Increasing extension from upslope to downslope sites is explained by roll-over of the fore-arc towards the retreating trench, and by rheological weakening of downslope forearc crust due to fluid-assisted metasomatism. Towards the West Philippine Basin spreading center, extension was assisted by magmatism, resulting in lithospheric hyperextension around 26-27 Ma with related spreading of the Shikoku and Parece Vela basins, so that parts of the IBM arc and rear arc, as well as the West Philippine back arc basin, sheared off from the IBM forearc.