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Post-magmatic tectonic deformation of the outer Izu-Bonin-Mariana forearc system: initial results of IODP Expedition 352

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IODP Expedition 352 was designed to drill through the entire volcanic sequence of the Bonin forearc. Four sites were drilled, two on the outer fore arc and two on the upper trench slope. Site survey seismic data, combined with borehole data, indicate that tectonic deformation in the outer IBM fore arc is mainly post-magmatic. Post-magmatic extension resulted in the formation of asymmetric sedimentary basins such as, for example, the half-grabens at sites 352-U1439 and 352-U1442 located on the upper trench slope. Along their eastern margins these basins are bounded by west-dipping normal faults. Sedimentation was mainly syn-tectonic. The lowermost sequence of the sedimentary units was tilted eastward by $\sim$20°. These tilted bedding planes were subsequently covered by sub-horizontally deposited sedimentary beds. Based on biostratigraphic constraints, the minimum age of the oldest sediments is $\sim$ 35 Ma; the timing of the sedimentary unconformities lies between $\sim$ 27 and 32 Ma.
At sites 352-U1440 and 352-U1441, located on the outer forearc, post-magmatic deformation resulted mainly in strike-slip faults possibly bounding the sedimentary basins. The sedimentary units within these basins were not significantly affected by post-sedimentary tectonic tilting. Biostratigraphic ages indicate that the minimum age of the basement-cover contact lies between $\sim$29.5 and 32 Ma.
Overall, the post-magmatic tectonic structures observed during Expedition 352 reveal a multiphase tectonic evolution of the outer IBM fore arc. At sites 352-U1439 and 352-U1442, shear with dominant reverse to oblique reverse displacement was localized along distinct subhorizontal cataclastic shear zones as well as steeply dipping slickensides and shear fractures. These structures, forming within a contractional tectonic regime, were either re-activated as or cross-cut by normal-faults as well as strike-slip faults. Extension was also accommodated by steeply dipping to subvertical mineralized veins and extensional fractures. Faults observed at sites 352-U1440 and 352-U1441 show mainly strike-slip. The sediments overlying the igneous basement, of maximum Late Eocene to Recent age, document ash and aeolian input, together with mass wasting of the fault-bounded sediment ponds.