Subduction tectonics of the southern Izu-Bonin Trench area: Possibility for basal erosion

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The Izu-Bonin convergent plate margin is characterized by (1) subduction of the old (Mesozoic) oceanic plate (Pacific plate) beneath an active oceanic island arc (Izu-Bonin arc), (2) several serpentinite seamounts on the fore-arc slope, (3) lack of a large volume accretionary wedge, and (4) high-Mg andesite and/or boninite emplacement during the initiation of subduction. These characteristics had been defined by previous geologic and geophysical studies in the northern Izu-Bonin arc, including several ODP legs. In contrast, the characteristics of the southern Izu-Bonin arc-trench system had not been defined well. In November 2000, three E-W lines and four N-S lines of multichannel seismic reflection profiles were collected by M/V Geco Emerald, chartered by the Metal Mining Agency of Japan (MMAJ) and the Japan National Oil Corporation (JNOC), in the southern Izu-Bonin Trench area. Seismic reflection data were acquired using a 240-channel streamer of 6000 m length and 134.4 l air gun seismic source. The seismic source was fired every 50 m, except for the line D00-1, which was fired every 100 m due to depth constraints. We processed 3 E-W lines (D00-1, 'typical' subduction of an oceanic plate; D00-2, central part of the subducting Ogasawara Plateau; D00-3, southern part of the subducting Ogasawara Plateau). Processing included f-k filtering to suppress multiple, followed by common mid-point (CMP) stacking. Post-stack time migration was applied after CMP stacking. These three seismic profiles clarify the geologic structure of the southern Izu-Bonin Trench region, including Ogasawara Plateau area. In the line D00-2, development of a thrust can be recognized in the subducted plateau, very close to the trench axis. This thrust suggests the existence of some component of compressional stress. However, many normal faults are recognized on the plateau and also in the subducted plateau, and no accretionary wedge has developed from the plateau in the line D00-2. These features suggest that the Ogasawara Plateau has been subducting beneath the landward plate, and is not accreting to the overriding plate. In contrast, several thrusts are observed in the frontal part of the landward plate, and a very small accretionary prism is also observed in D00-1. Previous geologic and geophysical studies indicate that forearc serpentinite seamounts originated from the mantle wedge; in other words, forearc serpentinite seamounts have a 'root' in the mantle wedge. However the top of the subducting plateau is located beneath a forearc serpentinite seamount (Hahajima Seamount) on the Philippine Sea plate. This suggests that no mantle wedge lies beneath the Hahajima Seamount, and that Hahajima Seamount is 'rootless'. The structural features of the Ogasawara Plateau and the landward plate imaged using high-resolution bathymetric data and seismic profiling suggest that high-relief oceanic plateaus or seamounts do not necessarily accrete to the overriding plate as ophiolites, and tectonic erosion, especially basal erosion, has been occurring simultaneously in this area.