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Structure Imposed on New Hebrides Island Arc by Subduction of d'Entrecasteaux Zone, a Major Submarine Mountain Chain

The northwest-trending New Hebrides island arc marks the juncture between the subducting Australia-India plate on the west and the overriding Pacific plate and North Fiji basin on the east. The d'Entrecasteaux zone (DEZ), which consists of two subparallel, highstanding (1-2 km) ridges, trends eastward across the India-Australia plate and collides with the central part of the arc. Recently, considerable new geologic and geophysical information—including dredged rock samples, seismic refraction and multichannel seismic reflection data, Seabeam bathymetry, and locally detailed magnetic and gravity data—has been obtained over this collision zone. Our studies use these data to investigate the structure and evolution of this collision zone. Migrated multichannel seismic data show highly varied rock structure beneath the arc's trench slope within the collision zone. The north ridge of the DEZ is apparently being subducted without much disruption of the Bougainville Spur, an enigmatic feature that may contain obducted oceanic rocks. This spur juts above the lower slope of the arc, but a recognizable subduction zone does not extend beneath it. Highly detailed Seabeam bathymetric data have recently been acquired and are being integrated into the study of lower-slope structure.

Directly east of where the DEZ and the New Hebrides arc collide, the Aoba basin lies encircled by a relatively shallow-water (0 to 2,000-m depth), arc-summit platform. This basin is overlain by water 2-3 km deep and contains 5-6 km of sedimentary rocks. Theoretical studies and interpretation of multichannel seismic data suggest that the basin may have deepened substantially during collision of the DEZ and arc. Hence, understanding the tectonic processes that attend arc-ridge collisions will not only contribute to our general understanding of the development of intra-arc basins, but also may help determine whether hydrocarbons have been generated within the Aoba basin.