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Seismic Stratigraphy, Sediments, and Basin History of Tonga Forearc Basin, Late Eocene to Pleistocene

Four seismic reflectors (A, B, C, V) define primarily unconformity-bounded sedimentary sequences. Basement (V) is a block-faulted surface, apparently of Eocene volcanics. Above this, an upper Eocene sequence (CV) mainly buries the fault topography, pinching out locally on fault-block and volcanic highs along the eastern side of the basin. This sequence includes volcaniclastics and, on paleohighs, shallow-water limestones. Overlying this is a widespread upper Oligocene–lower Miocene sequence (BC), which also thins and pinches out locally against the high eastern side of the basin. Volcaniclastics are common, but limestones may occur locally. Seismic interpretations indicate little faulting during deposition of this sequence; prominent lenticular bodies could be either sills or reefs. Sequence AB, of middle and late Miocene to early Pliocene age, is composed of volcanopelagics deposited when the Lau arc was active, adjacent to the Tonga platform. No volcanic centers are seen in this sequence in the forearc, but shallow intrusions are common. Major tensional faulting developed toward the end of this depositional cycle. The uppermost sequence (SBA), of late Pliocene to Pleistocene age, also comprises volcanopelagic sediments. The volcanics are derived from the nearby Tofua arc, which developed with the opening of the Lau back-arc basin. Doming and tensional faulting in the late Pliocene-Pleistocene raised parts of the Tonga forearc basin, allowing wide reef platforms to develop.

Dredge samples were used to supplement the age control from wells, on Tongatapu and outcrops on 'Eua. All dredged rocks consist of two components in varying proportions: biogenic ooze and volcanic ash. Many samples indicate downslope reworking and mixing as gravity flows. Gravity flows have carried carbonate well below the present carbonate compensation depth. Much of the platform is mantled with recent pumice. Diagenetic effects include common alteration of glass to smectites and zeolites, precipitation of zeolites and clays in cavities, minor growth of secondary carbonate, and rarely, prehnite alteration and carbonate veining. Cretaceous rocks dredged from the lower trench slope—calcareous and siliceous oozes and silica-rich tuffs—are exotic. They are inferred to have been transferred from the Pacific plate, with volcanic and mafic igneous rocks, by offscraping from the downgoing Louisville Ridge.