

GREENE, H. G., F. L. WONG, D. A. FALVEY, A. MACFARLANE, and
SCIENTIFIC STAFF of R/V of *S.P. Lee*, U.S. Geological Survey, Menlo
Park, CA

Basin Development and Petroleum Prospects of Central New Hebrides Arc

Tectonic processes resulting from active subduction and collision of the d'Entrecasteaux Ridge with the central New Hebrides arc have created thick sedimentary basins that could be promising targets for hydrocarbon concentration. Two extensive intra-arc basins, the Central basin of Vanuatu and the Vanikolo basin, have recently been mapped in detail and appear to have developed in the last 3 m.y. primarily from subduction and arc-polarity reversal. The Central basin of Vanuatu is being modified by the ridge-arc collision and is still accumulating sediment, whereas the Vanikolo basin has no physiographic expression and is completely filled with sediment.

Quaternary volcanism has separated the Central basin of Vanuatu into two physiographic basins (North Aoba and South Aoba basins). The Central basin is flanked on the west by five smaller insular basins associated with the islands of Malakula and Espiritu Santo. Although North and South Aoba basins lie in water depths as great as 3 km, migration paths into the shallower water basins appear to be present, and structures that could trap hydrocarbons occur. More than 5 km of sediment of Miocene and younger age were deposited in the deeper basins, whereas 2-km thick sediments of late Miocene and younger age occur near the islands. The most promising hydrocarbon basin is Malakula basin, which lies on the eastern shelf of Malakula Island, where onshore source rock analyses indicated potential gas concentrations.

North of the Central basin of Vanuatu lies the largest basin in the region, the Vanikolo basin, covering more than 14,000 km² and containing more than 6 km of probable Miocene and younger sediment. Water depths are more than 2 km in the deepest part of this basin, but much of the margins lie in water less than 1 km deep. Structures along the margins could trap hydrocarbons, especially along the western side, and are accessible to drilling. More work must be done in Vanikolo basin to assess hydrocarbon source rocks, migration, and heat flow before a comprehensive hydrocarbon evaluation can be made. However, the extent of the basin and the sediment thickness are unusual for an active island-arc setting; further study is needed before it can be discounted as a potential petroleum target.