Sieh, K., Zachariasen, J., Bock, Y., Edwards, L., Taylor, F., Gans, P., 1994, Active tectonics of Sumatra: *GSA Abstracts with Programs* **26**, No. 7, Sept. 1994.

Abstract

Sumatra straddles a 1600-km-long portion of the boundary between the Southeast Asian, Indian and Australian plates. GPS measurements indicate that near Sumatra the SEA and Australian plates are converging NNW about 7 cm/yr. This motion is partitioned between the Sumatran subduction zone and the dextral Great Sumatran Fault (GSF). Historical seismicity of the subduction zone is dominated by two very large (M_W ~8 1/2 to 9) earthquakes in 1833 and 1861. The GSF has produced many earthquakes of up to M7 1/2. Understanding the kinematics of Sumatra is both scientifically and socially important. We are using geomorphology, stratigraphy, geodesy, and geochronology to 1) determine the dates and extent of past large subduction-zone earthquakes 2) map the GSF and ancillary structures 3) determine variations in dextral slip rate along the GSF and 4) to determine the nature of current accumulations of elastic strain adjacent to both major structures. Our GIS map of the GSF shows major irregularities in the fault that probably control some rupture initiations and terminations. Ar-Ar dates of geomorphic offsets in late Quaternary volcanic units indicate that between about 0° and 3.5° S, the GSF is slipping at about 1 cm per year. At about 2.2° N, the rate is much greater – about 28 mm per year. This variability requires major secondary structures between the Equator and about 2° N. The morphology of coral microatolls on the islands of the outer arc ridge west of Sumatra and 80 to 130 km from the trench indicate that the region is slowly submerging. We believe this to be a manifestation of elastic loading of the crust along the subduction zone in preparation for one or more great earthquakes. Although little net emergence has occurred since at least the mid-Holocene, morphologic studies and ^{14}C and U-Th dates on older corals indicates several sudden uplifts in the past few thousand years.