GPS and seismological constraints on active tectonics and arc-continent collision in Papua New Guinea: Implications for mechanics of microplate rotations in a plate boundary zone

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[1] The island of New Guinea is located within the deforming zone between the Pacific and Australian plates that converge obliquely at _110 mm/yr. New Guinea has been fragmented into a complex array of microplates, some of which rotate rapidly about nearby vertical axes. We present velocities from a network of 38 Global Positioning System (GPS) sites spanning much of the nation of Papua New Guinea (PNG). The GPS-derived velocities are used to explain the kinematics of major tectonic blocks in the region and the nature of strain accumulation on major faults in PNG. We simultaneously invert GPS velocities, earthquake slip vectors on faults, and transform orientations in the Woodlark Basin for the poles of rotation of the tectonic blocks and the degree of elastic strain accumulation on faults in the region. The data are best explained by six distinct tectonic blocks: the Australian, Pacific, South Bismarck, North Bismarck, and Woodlark plates and a previously unrecognized New Guinea Highlands Block. Significant portions of the Ramu-Markham Fault appear to be locked, which has implications for seismic hazard determination in the Markham Valley region. We also propose that rapid clockwise rotation of the South Bismarck plate is controlled by edge forces initiated by the collision between the Finisterre arc and the New Guinea Highlands. INDEX TERMS: 8150

Tectonophysics: Plate boundary—general (3040); 8110 Tectonophysics: Continental tectonics—general (0905); 1243 Geodesy and Gravity: Space geodetic surveys; 1206 Geodesy and Gravity: Crustal movements—interplate (8155); KEYWORDS: Papua New Guinea, GPS, microplate, tectonics, collision

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