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Spinning tectonic microplates at the transition from collision to subduction: a comparison of several western Pacific examples with Mediterranean active tectonics

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The fastest modern-day tectonic block rotations (up to 9 degrees/Myr) occur in the forearcs of convergent plate margins where a transition from collision to subduction occurs. GPS techniques allow us to accurately document the kinematics of these rotations. We have used GPS velocities, in combination with paleomagnetic rotations and the knowledge of timing of collisional and rifting events to show that rapid microplate rotations at convergent margins in Papua New Guinea, New Zealand, Marianas, Tonga and Vanuatu are associated with a transition from collision to subduction. The change from collision of a buoyant indentor (a "push") to normal subduction (a "pull") at these convergent margins exerts a torque on the upper-plate microplate, causing the microplate to spin about an axis near the collision point. In some cases, these rapid microplate rotations lead to back-arc rifting. Similar to our western Pacific examples, previous workers have suggested that the kinematics of rotation of Turkey (Anatolian plate) and back-arc rifting in Greece are due to some combination of forces associated with collision of Arabia with Eurasia, and subduction (and possible trench rollback) at the Hellenic trench. We suggest that our model for rapid microplate rotation at the transition from collision to subduction developed from the western Pacific examples is highly relevant to understanding Mediterranean active tectonics. In particular, we will highlight the striking similarities between the rotation of the South Bismarck microplate in Papua New Guinea and the tectonic rotation of Anatolia. The recognition of several western Pacific analogues for Mediterranean active tectonics may lead to new and important insights into the dominant forces behind tectonic processes in the Mediterranean region.