# Rotation of crustal blocks in the Western U.S.

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## ABSTRACT

In deforming zones along active plate boundaries, fault-bounded blocks rotate about local axes, commonly vertical in strike slip domains and inclined in extensional or compressional domains. Vertical axis rotations can be measured by paleomagnetism and GPS. Along the western North American plate boundary, clockwise vertical axis rotations are characteristic. (Beck, 1976; Wells and Heller, 1988). Block rotation is a function of the relative strength of the block and its bounding faults and the shape and orientation of the rotating block in the shear couple (Lamb, 1994). Along the San Andreas fault in central California, blocks are elongate parallel to the fault and the block rotation rate (spin rate) from GPS is about 0.6°/m.y (McCaffrey, 2005). In the western Transverse Ranges where the faults are at a high angle to the San Andreas fault, the post-15 Ma rotation rates from paleomagnetism are nearly ten times larger, indicating a change in spin rate over time. The spin rates in California are similar to the rotation rate of the Pacific plate with respect to North America, indicating that blocks are rotating due to traction along their edges between the Pacific and North American plates. Onderdonk (2007) also argues that edge forces exceed basal traction for small blocks above lower viscosity mantle characteristic of western US plate boundary. In California and western Nevada, vertical axis rotations take up very little of the slip rate budget across the region (McCaffrey, 2005). However, inboard of the Cascadia subduction zone in Oregon, Pacific –North America shear is accommodated largely by rotation at up to 1°/m.y. based on both GPS and paleomagnetic rates (McCaffrey et al., 2007; Wells et al., 1998).

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