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Title: THE WALKER LANE STRIKE-SLIP FAULT SYSTEM: AN INCIPIENT TRANSFORM FAULT ALONG THE EVOLVING PACIFIC - NORTH AMERICAN PLATE BOUNDARY

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Abstract: Since ~30 Ma, western North America has been evolving from an Andean type margin to a transform boundary. Transform growth has been marked by progressive retreat of magmatic arcs, collapse of orogenic highlands, and periodic inland steps of the transform. In the western Great Basin, a system of dextral faults, known as the Walker Lane (WL) in the north and eastern California shear zone in the south (ECSZ), currently accommodates ~20% of the Pacific-North America dextral motion.

Although initiation of strike-slip faulting is generally poorly constrained, the evolution of the WL-ECSZ appears to be intimately tied to plate boundary processes. We speculate that the NW-trending Las Vegas Valley shear zone in southern Nevada marks the earliest manifestation of the WL-ECSZ, as it lies directly inboard of where the San Andreas fault system (SAF) initially organized into a through-going structure. In the late Miocene (~6-10 Ma), however, dextral shear became focused farther west in the western Great Basin in response to the east jump of the southern part of the transform to the Gulf of California. This placed the western Great Basin in a favorable position to accommodate plate motion, avoiding a bottleneck in the Big Bend of the SAF. The WL terminates in the Cascade arc in NE California near the latitude of the Mendocino triple junction (MTJ) and north end of the SAF. This implies that the WL is migrating NW in concert with N-ward migration of the MTJ. Continued N-ward migration of the MTJ puts it on a collision course with the NW-propagating WL off the southern Oregon coast in ~8 Ma. This collision may herald a bold inland jump of the plate boundary to the WL-ECSZ.

At present, however, the WL-ECSZ is not a typical transform fault, as it consists of a diffuse belt of disconnected dextral faults, with relatively short strike lengths (<100-200 km). Slip rates and cumulative offsets decrease NW-ward in the WL as dextral shear is transferred to NW-directed extension in the Great Basin. The northern Walker Lane in NW Nevada and NE California is the least evolved and possibly youngest part of the

WL-ECSZ and thus offers insight into the initiation and maturation of strike-slip fault systems. Offset segments of Oligocene paleovalleys suggest only 20-30 km of cumulative slip since ~9.3 Ma on four left-stepping dextral faults in the northern WL. We interpret the left-stepping faults as macroscopic Riedel shears above a nascent lithospheric transform. The strike-slip faults end in arrays of ~N-striking normal faults as dextral shear diffuses into extension. Coeval extension and dextral shear have induced slight counterclockwise block rotations, which may ultimately rotate Riedel shears toward the main shear zone at depth. This process may eventually facilitate hard linkage between Riedel shears and ultimately produce a through-going strike-slip fault. This process may be common in developing intracontinental transform faults.