Development of the transtensional plate boundary in the Gulf of California

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Prof. Joann Stock received her PhD in Earth Sciences from MIT in 1988 and has been a Professor of Geology and Geophysics of CalTech since 1998. She was elected as a Fellow to Geological Society of America in 2009, and a Fellow of the American Geophysical Union in 2010. Her research interests involve a wide range of tectonic problems, including global and regional plate tectonic questions, and geological and geophysical field studies related to plate boundary evolution. She has published more than 125 papers in the international journals, including Nature, Science, Geology, EPSL, and so on.

ABSTRACT: The Gulf of California contains the active boundary between the Pacific and North America plates. It is connected on the north end with the San Andreas Fault and on the south end with the East Pacific Rise. It has accommodated about 300 km of plate motion since 6 Ma, in extenaional basins offset by long transform faults. The type of new crust in the rift is different from basin to basin. It contains basins below sea level as well as a wide zone of active faulting in the surrounding Gulf Extensional Province. In the southern basins, seafloor spreading has produced new basaltic seafloor with crust about 7 km thick, with abyssal hill fabric and magnetic anomaly stripes. The northern basins contain 5 to 7 km of sediment, interpreted to be underlain by stretched continental crust with no recognizable seafloor magnetic anomalies. On the conjugate margins of the northern Gulf basins, Miocene and Pliocene rift-related volcanic rocks are reconstructed to their pre-rift geometry using field mapping, geochemistry, Ar/Ar dating and paleomagnetics. These observations show that there has not been significant subsidence of the margins yet, despite widespread normal faulting and significant rotation of blocks in the extensional province. They also show that 250 km of new crustal width formed in several parallel basins without having any seafloor spreading and without hyperextension. This model of extension may also apply other rift margins such as the Ross Sea, Antarctica.