Plate tectonic reconstructions of the Juan Fernandez microplate: Transformation from internal shear to rigid rotation

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Side-scan sonar, swath bathymetry and magnetic anomaly data define a detailed, three-phase history of the Juan Fernandez microplate. The ~6 m.y. history is presented in a series of discrete time steps to document the growth and reorganization of propagating spreading centers and structural features, and microplate kinematic evolution. Prior to the microplate, the East Pacific Rise at the Pacific-Antarctic-Nazca triple junction was offset by a long transform fault zone; likely the fastest-slipping transform on Earth at anomaly 3A time. The microplate originated from an intra-transform setting between anomaly 3A (5.95 Ma) and anomaly 3 (5.24 Ma) time. Its early development resembled a large propagating rift system, and microplate core structures suggest the entire offset zone may have experienced deformation. Fast propagation of the East Ridge dominated microplate growth until ~2.6-1.9 Ma, when seafloor spreading became the dominant growth process. The microplate rotation rate increased three-fold (9 to 29*/m.y. average) from phase 1 (4.2-2.6 Ma) to phase 2 (2.6-1.1 Ma) of the microplate's history, then reduced four-fold (29 to 7*/m.y. average; phase 3, 1.1 Ma to Present). Phases 2 and 3 of the microplate's rotational history support the edge-driven model for microplate kinematics of Schouten and others to a good approximation. The Pacific-Nazca shear couple drove microplate rotation during phase 2, but development of the southeastern boundary enabled a transfer to the Nazca-Antarctic plate pair (phase 3). West Ridge propagation and reorganization of the southwestern boundary may have decoupled the Pacific plate from the microplate, thus facilitating the shear couple transfer. The recent continued deceleration in microplate rotation rate and westward migration of the Pacific-Antarctic ridge axis relative to the microplate may indicate that the process of microplate "death" has begun. We speculate that the Juan Fernandez microplate will accrete to the Antarctic plate, perhaps within the next million years, like the extinct Friday microplate has done, thereby accomplishing another northward migration of the Pacific-Antarctic-Nazca triple junction. Our reconstructions illustrate that the Easter and Juan Fernandez microplates are more similar than previously thought in terms of their origin, growth, rift propagation, ridge segmentation and overall tectonic evolution.