Interplay between internal deformation of the Gorda plate and spreading rates along the Gorda Ridge

Details

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Abstract

Recent work has shown that small tectonic plates or plate fragments act as non-rigid accommodation zones or buffers between the larger plates, absorbing deformation and allowing larger plates to act in a more rigid fashion. Although complex deformation occurring within these zones requires detailed investigation to understand them, they offer the opportunity to investigate fundamental plate forces, to which larger plates may not respond to as dramatically. Within the Gorda plate, an excellent example of a non-rigidly deforming tectonic buffer plate or diffuse oceanic plate boundary, complex internal deformation allows us to ask whether mid-ocean ridge spreading and subduction processes control internal deformation or does internal deformation provide feedback that influences spreading rates of this and other plate systems. A new structural analysis of the Gorda plate based on full-plate bathymetric coverage, augmented by seismic reflection data and earthquake locations, reveals that this region undergoes complex deformation under the influence of the

competing and interacting regional and intraplate tectonic forces. Internal deformation of the Gorda plate is accomplished through reactivation of spreading-ridge fabric faults as strike-slip faults, with an overprint of newly-formed and previously unknown second-generation faults. As the plate approaches the subduction zone, we find renewed extensional deformation. Based on these new constraints, we interpret internal deformation of the Gorda plate as a modified flexural-slip buckle, driven predominantly by the N-S compressive stress field created by the continued convergence of the plate between the non-parallel Mendocino and Blanco Fracture Zones. We further suggest a relationship between ridge spreading rates and internal Gorda deformation, in that severe deformation of the plate may be controlling spreading rates along the length of the nearby Gorda Ridge. In other words, accommodation space opening within the plate as a result of the internal deformation is filled by faster spreading along sections of the ridge, rather than opposite as we expected.

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