Active Deformation of the Gorda Plate: Constraining Deformation Models and Subduction Coupling With Recently Collected Multibeam Bathymetric, Sidescan, and Seismic Data

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Abstract

Preliminary analysis of new Gorda plate SeaBeam 2112 multibeam swath bathymetry and backscatter data collected by NOAA/PMEL during 1997 shows evidence of recent and active deformation of the plate and young overlying sediment cover. On a fine scale we are able to identify both sinistral and dextral strike-slip separation along reactivated spreading fabric faults. These linear ridges vary in height along strike, with the exposed highs split and offset in their long direction. Furthermore, basement fabric faults appear to be drag folded adjacent to "pseudofaults" that appear to be activated as tectonic structures. These and other previously unmapped faults present a detailed kinematic picture of the intraplate/interplate tectonics responsible for the ongoing deformation of the Gorda plate. The Gorda plate was recognized early as "unusual" due to the presence of smoothly bent magnetic anomalies (Raff \& Mason, 1961) and several

deformation models have previously been proposed to explain these features. However because of the low resolution of magnetic and Gloria sidescan data, systematic earthquake location errors, and incomplete seismic reflection coverage, no previously proposed deformation model has been consistent with all these data. The complete bathymetric and backscatter coverage of the plate, coupled with precise P-code navigation, provides a high-resolution dataset that we will use to further constrain kinematic deformation models for the Gorda plate. Locations of low magnitude (M$<$4) Gorda Plate earthquakes recorded on the U.S. Navy's SOSUS hydrophone array will be combined with available moment-tensor solutions of large earthquakes (M$>$4) estimated by land-based seismic networks to examine the contemporary strain patterns in relation to identifiable active faulting. Our preliminary analysis suggests that the Gorda plate is deforming in a manner similar to a flexural-slip fold, with slip along spreading fabric faults accommodating a large buckle in the horizontal plane. This model is similar to that of Stoddard (1987) in kinematic style. The overall flexural slip deformation is complicated by other structures cross-cutting the spreading fabric faults. Using information derived from kinematic modelling of the Gorda plate, a numerical deformation model will be constructed to place Gorda deformation in the larger Cascadia stress field. Understanding Gorda plate deformation will not only provide an example of non-rigid plate tectonics, and the evolution, and destruction of a microplate associated with ridge and subduction processes, but is additionally important for determining whether the Gorda/Cascadia region will act as an independent segment during a Cascadia megathrust event.

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