Public Abstract

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Title:Analysis of Quaternary Faults and Associated Deformation of Sedimentary Basin Fill: Inner Continental Borderland of Southern California

Numerous faults are found offshore southern California including: Newport-Inglewood, San Mateo-Carlsbad, Coronado Bank fault system, and the Descanso. These faults are of interest to researchers and the public since they are located near the densely populated cities of Long Beach and San Diego as well as the towns and cities in between. In recent years, a large amount of seismic reflection data was made available to the public by the petroleum industry in cooperation with the U.S. Geological Survey. Seismic reflection data (acoustic â€œprofilesâ€•) are used to image faults and geologic material at and below the seafloor. Given the closely-spaced intersecting profiles, three dimensional grids of faults and layers within the sedimentary rocks were created.

This study carefully analyzed seismic reflection data to accomplish the following tasks: 1) produced a stratigraphic age model correlated to petroleum test wells and scientific coreholes 2) reated depth-converted grids of the three-dimensional geometry of stratigraphic layers,and 3) determined if individual faults are geometrically continuous at depth 4) determined the geometric relationships between different fault strands at depth. 5) took the results from the first four items to calculate slip rates and slip directions for a prominent fault..

Results of this study are different than other recently published maps and papers in important ways, including sediment age, fault geometry or even existence, fault continuity, and fault slip type. This study produced a stratigraphic age model that is between several and more than 10 times older than certain previous models. If the kinematic modeling had used the young age model, calculated slip rates would have been 10 times too high. Individual fault strands were mapped as continuous for 50 to 100 km stretches; and these individual faults are connected to others by intersections at depth or by motions through a map-view extensional double bend or â€œstep-overâ€•, forming regional fault systems. The upper edge of the San Mateo-Carlsbad fault underlies the base of the continental slope, and it dips towards the mainland. Displacement since 1.8 million years ago on its southern part has been horizontal right-lateral strike-slip, ~700m, or a rate of ~.44 mm/yr. The pattern of the vertical component of deformation through fault bends is similar for a horizon dated at about 600,000 years, suggesting that the type of slip modeled since 1.8 million years ago has continued more recently. Farther south, fault strands were interpreted as close as 5 km to the San Diego coast but dipping away from land. These faults are missing from the California state fault map and from publications Three-dimensional geometry of faults farther offshore of San Diego is much more detailed than from previous studies; these faults dip towards the mainland. The slip type and slip rates for the last few tens or hundreds of thousand years are unknown and require additional study with additional data. This study also documents that deposition and preservation of sediment over the last 1.8 million years has shifted from one place to another, with large age gaps across layers within the sedimentary rocks (unconformities).