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Bahía de Banderas, México: evidence of on going submarine erosion induced by faulting

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Introduction

Bahía de Banderas is located on the Pacific margin of the central-western portion of Mexico; the length (E-W) of the bay is approximately 60 km, and its width (N-S) is 33 km. The first depth contour representation of the bay was probably that of Fisher (1961); however, until the decade of the 1990s the depth soundings in the bay were restricted to a few individual, scattered soundings plus a line with sparse soundings. These data did not allow for a detailed description of the submarine topography of the canyon. Such a description became necessary in view of the recent connection of Banderas canyon with the NW tectonic limit of the Jalisco Block (Alvarez, 2002), which apparently continues inland into Valle de Banderas and beyond according to Johnson and Harrison (1990), where several geophysical studies are presently being carried out in order to validate this assertion. The overall geologic structure corresponds to a graben.

Submarine topography

Two oceanographic campaigns, one in 2001 and the second in 2004, have been carried out to add around 250 km-line of sounding data, which include the bay and the continental shelf up to the Middle America Trench (MAT). In the first campaign we collected around 120 km of continuous sounding data obtained onboard the B/O El Puma, which added to the 60 km of sparse soundings of Argos R/V and 70 individual, scattered soundings. With these data a 3-D topographic model of the bay's floor was obtained with a nominal resolution of 465 m (0.25 nm). In the most recent campaign we added another 120 km of sounding data, this time collecting them on the northern, shallower portion of the bay and offshore, reaching to the vicinity of the MAT. A

new, integrated 3-D model of the bay including all available data for the region and its offshore vicinity is presented herein.

Faulting and erosion

Two major faults are inferred from the model, which extend in the E-W direction from the MAT to the eastern shore of the bay, and may continue inland into Banderas valley, where their surface expression is masked by the rapid sediment contribution of Ameca and Mascota rivers. This sedimentation process affects the eastern shore of the bay, where the rivers traversing Banderas valley discharge. The southern shore has steeply dipping walls above and below sea level, which jointly constitute cliffs over 2000 m in height. The northern shore of the bay is a rather flat platform, 90-190 m deep, on top of which three small islands outcrop, the Marietas Islands, located close to Punta Mita, the northern tip of the bay. Cross-sections of the canyon (e.g., Alvarez, 2002, Fig. 3a) in the N-S direction show that the platform ends abruptly at many places followed by the topography of the bottom of the canyon, which evokes bookshelf faulting. The offshore 3-D model suggests the existence of Las Marietas fault, one of the two major faults just south of the above islands, which appears to be eroding away the northern portion of the bay's floor, where several submarine landslides can be inferred. Hydrothermal activity has been reported between Las Marietas fault and the northern shore of the bay (Núñez-Cornú et al., 2000); however, it is not clear at present whether there is a link between this fault and such an activity. The other major fault, the Banderas fault, runs south of, and sub parallel to Las Marietas fault along the deepest section of the canyon. Couch et al., (1991) reported a platform about half way down the slope seaward of the canyon, which they interpreted as a slumped or subsided portion of the continental margin subsequently infilled and covered with sediments transported down the canyon. Thus, it appears that erosional processes and subsequent removal of detritus from the Banderas canyon have been acting for several million years, judging for the accumulation of detritus down the slope of the continental platform, before reaching the MAT. The present results suggest that successive, parallel faulting in the E-W direction may be responsible for the northward widening of the canyon.

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