Bathymetric analysis of the northwestern Channel Islands Slope

Angela M. Dapremont and Leslie R. Sautter
Department of Geology and Environmental Geosciences, College of Charleston

Abstract
The Channel Islands are a series of land masses situated between the Patagonian Escarpment and the coast of southern California. Five of the eight islands make up the Channel Islands National Park which spans fewer than 400 square miles. All of the islands are considered to be located in a region known as the California Borderlands. This broader area is a continental shelf that is separated from the continental shelf by the islands. The Borderlands area is known to be seismically active, with numerous offshore faults, as well as basins and ridges that trend in a northwest-southeast direction. The islands themselves contain varying topographic and geologic features including steep mountains and marine terraces, and several are prone to landslides, as well as coastal erosion. Bathymetric data were obtained in 2011 from the NOAA Ship Okeanos Explorer with a Kongsberg EM 302 multibeam echosounder, and processed using CARIS HIPS and SIPS 7.1 software. This bathymetric investigation focused on the northwest geographic region of the Channel Islands in order to provide a more accurate characterization of specific features present. BASE surface generation (depth range of 200 to 2000 m) revealed the presence of old and young features, as well as slumping and material transport pathways.

Background
The Continental Borderland region of southern California consists of a variety of physiographic features; among which are basins, canyons, and continental slopes (Homa and Normark, 2009). The latter refers to one portion of the overall continental margin of the Borderlands located seaward of the continental shelf (Kennish, 2001). The Channel Islands slopes are of bathymetric interest due to the variability observed in their characteristics. This portion of the continental margin plays a significant role in sediment movement and transportation from the mainland to the deep ocean floor (Field, 1980).

Results
The BASE surface was separated into three areas designated Santa Barbara Slope, San Miguel Slope, and Santa Rosa Slope. In order to examine specific features unique to each region of the Northwestern Channel Islands slope (Fig. 1). The latter two regions are presented here.

The San Miguel region was characterized by a broad slope leading to a flat bottom. Feature 2 resembled a pathway of material transport. The shallow San Miguel slope consisted of a larger depth range as well as a greater amount of variability observed in their characteristics. This portion of the slope contained several shallowly incised canyons.

Discussion
The incised and straight canyons of Feature 3 may be the result of tectonically induced faulting. The submarine canyon of Feature 1 (Fig. 4) appears to have formed by a variety of erosion. Due to the absence of numerous dips and a more continuous, smooth transition from higher to lower depth of Feature 1, it is most likely younger than Feature 3.

Slumping was observed at San Miguel Slope Feature 2 at an approximate depth of 1400 m (Fig. 3).

Digital Profiles

Fig. 5. 3D view (right) of San Miguel Slope, Feature 4 (VE=5.0x), showing locations of Profiles A and B (left). Feature resembled a pathway of material transport.

Fig. 6. 3D view (left) of San Miguel Slope, Feature 4 and Santa Rosa Slope (Feature 5). This portion of the slope contained several shallowly incised canyons.