Geophysical Research Abstracts
Vol. 12, EGU2010-9146, 2010
EGU General Assembly 2010

Hypsometry as an indicator of form and process in submarine basins

Dina Vachtman

The University of Manchester, Faculty of Engineering and Physical Sciences, School of Earth, Atmospheric and Environmental Sciences, Manchester, United Kingdom (dina.vachtman@manchester.ac.uk)

Hypsometry (area-elevation analysis) is a method used in subaerial geomorphology to characterise the large-scale forms of landscapes. In particular, it represents the distribution of elevation in a landscape and can reflect the dominant erosion mechanism (e.g. broad U-shaped glaciated vs. V-shaped fluvially eroded valleys) or erosional maturity (e.g. stages of headward propagation of channels into a plateaux). Multibeam sonar data, which are now widespread along main continental slopes, show submarine landscapes that appear visually remarkably similar to those of drainage systems on land, and prompt a systematic study of whether hypsometry could also be useful in submarine settings. This paper explores linkage between submarine processes and basin hypsometry through quantitative analysis of hypsometric curves forms and integrals derived from multibeam bathymetry data of 27 valleys in the USA Atlantic continental slope. Whereas some valleys have been documented clearly to have been created by large slope failures, other valleys and valley systems have remarkably fluvial-like morphologies. Their origin of the latter have been controversial, with some arguing that top-down fluvial-like erosion by turbidity currents has dominated, while others have argued that they were created by retrogressive failure initiated in the lower slope. The results of this study not only suggest that hypsometry could be a sensitive tool for separating forcing factors in submarine valley development, but we also show its strong dependence on types of channel network and topological shape of the basin, which might be due to the hypsometric curve being a sensitive indicator of the drainage network in plan view. For submarine basins dominated by fluvial-like sediment transport (turbidity currents) we find that their hypsometric curve resembles a classic Strahler ‘mature’ structure, with well pronounced head and toe, and markedly different from those of the major landslide valleys. Either these were originated by landslides and have been later strongly modified to fluvial-like valleys mostly by turbidity current erosion, or they have initially originated from turbidity current erosion, as has been investigated. We suggest that the form of the hypsometric curve is unique to a particular basin and may, among others, depict evolutionary changes in the forms of the basins.