Morphology of Canal Isabela in the Galapagos Islands

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November 23, 2005

Project Summary:

Between Isabela and San Salvador Islands in the Galapagos Islands is a submarine canyon that runs beneath Canal Isabela. My proposed project focuses on this canyon. Research will take place 20-28 January 2006 on the R/V Thomas G. Thompson and I plan to investigate the processes such as currents and erosion that are affecting it by mapping the canyon and also taking three core samples in order to look at grain size distribution and types of the sediments present in the canyon. A brief study done in this area hypothesized that sediment transport from the islands was feeding the canyon and that strong undercurrents from the Equatorial Undercurrent were possibly eroding or pushing these sediments some distance back into the canyon (Christie and Fox 1990). From my swath-mapping and sediment cores of the area, I hope to determine if this hypothesis about the canyon is true and to what extent.

Introduction:

Submarine canyons exist because of land-based sediments migrating into the deep sea and form as currents and sediments carve out continental shelves by currents. Different current and sediment load levels affect the overall canyon's characteristics (Shanmugan 2003). Processes affecting the formation of the canyon that runs through Canal Isabela are thought to be similar to those causing a submarine canyon off of the Kerguelan Plateau located in the southeast Pacific. The Kerguelan Plateau and the Galapagos were both formed by volcanic processes and are a makeup of islands on top of a plateau. Both islands also are influenced by strong currents and continue to have volcanic eruptions affecting the land and sea around them. For these reasons, it is an educated assumption that the Canal Isabela's canyon behaves similar to the Kerguelan Plateau's canyon.

Dezileau et al shows how the relationship between the strong bottom currents around the Kerguelan Plateau suspends sediment flow coming from the plateau (Dezileau et al 2000) and concludes that the sediment distribution of the canyon is due to interactions between the strong AABW and ACC as well as topographic features on the Plateau. Similarly, in the Galapagos, the Equatorial Under-Current (EUC) produces strong bottom currents which affect many aspects of the islands, including plant and wildlife distribution down to marine sediments (Palacios 2002). The EUC's strength should directly influence the sediment transport of the submarine canyon northeast of Isabela (Christie and Fox 1990).

Proposed Research:

My research will take place 20-28 January 2006 on leg 2 of *R/V Thompson's* cruise in the Galapagos. During leg 1, brief mapping of the canyon will take place using the Simrad EM300 as the *Thompson* steams through Canal Isabela at 8 knots. This initial mapping will provide clues to the region's bathymetry to further guide my research on leg 2. Using the on-board EM300 bottom profiler, I will swath-map an extensive section of the canyon (Fig. 1). My swaths will be mapped with the *Thompson* traveling at 7 knots and swath-widths will be roughly 2.5 times as wide as average water depth, with approximately 10% overlap between swaths in order to get the most complete data of the area (Glickson 2005). At the mouth of the canyon I plan to take several cores to examine the properties and sizes of the sediments and look for signs of turbidites in the sediment record, which would show past turbidity currents. Jaqui Neibauer's project will also benefit from these cores as she plans to examine sediments from around the Galapagos for their dissolved oxygen content. At the start and end of my swath-mapping, a CTD cast will be taken to measure the water's salinity and temperature, which will help to calibrate the EM300 system. Several classmates, Tasha Snow, AJ LeFevre, Wendy Guo, and Tamra Dickson will also take water samples at these stations for their biological-based research. My stations can be completed at any time of day, though large portions of the mapping need to be done together in order to eliminate the possibility of errors arising from mapping small portions each time.

After taking in the raw data from the EM300 mapping, the data will then be imported into CARIS and ArcGIS, which will sort and prepare for the final step of using Feledermaus mapping-visualization software.

After processing my data I hope to determine several things. With the exception of brief EM120 mapping by the DRIFT 4 cruise as their ship steamed through the channel (Kurz et al 2001), this canyon has not been studied; therefore any data from this research will be useful. I hope to quantitatively show that the EUC's strength is preventing sediment from drifting too far into the abysmal plain and that sediments from land, probably volcanic in nature, are being transported into the canyon. Conclusions will be determined from features present on the EM300-produced map. Processes such as turbidity currents and mud flows and their magnitude will cause the seafloor to look different. If the EUC is significantly affecting the flow of these sediment-driven currents, features will also show on the final map. Another way I hope to have definite results is by taking core samples in parts of the canyon. The deposition of the sediment (or lack of) will tell of the long-term environment of the canyon (Davies 2005, Ogston 2005). Because I cannot take sediment samples away from the Galapagos, my investigation of the cores will be confined to quantitative observations of the sediment sizes and distributions I take while on the cruise. More sophisticated testing such as isotope-dating done in many similar studies (Dezileau et al. 2000, Shanmugan 2003) will not be possible.

Fig. 1 EM120 survey data from DRIFT-4 cruise (Kurz et al. 2001)

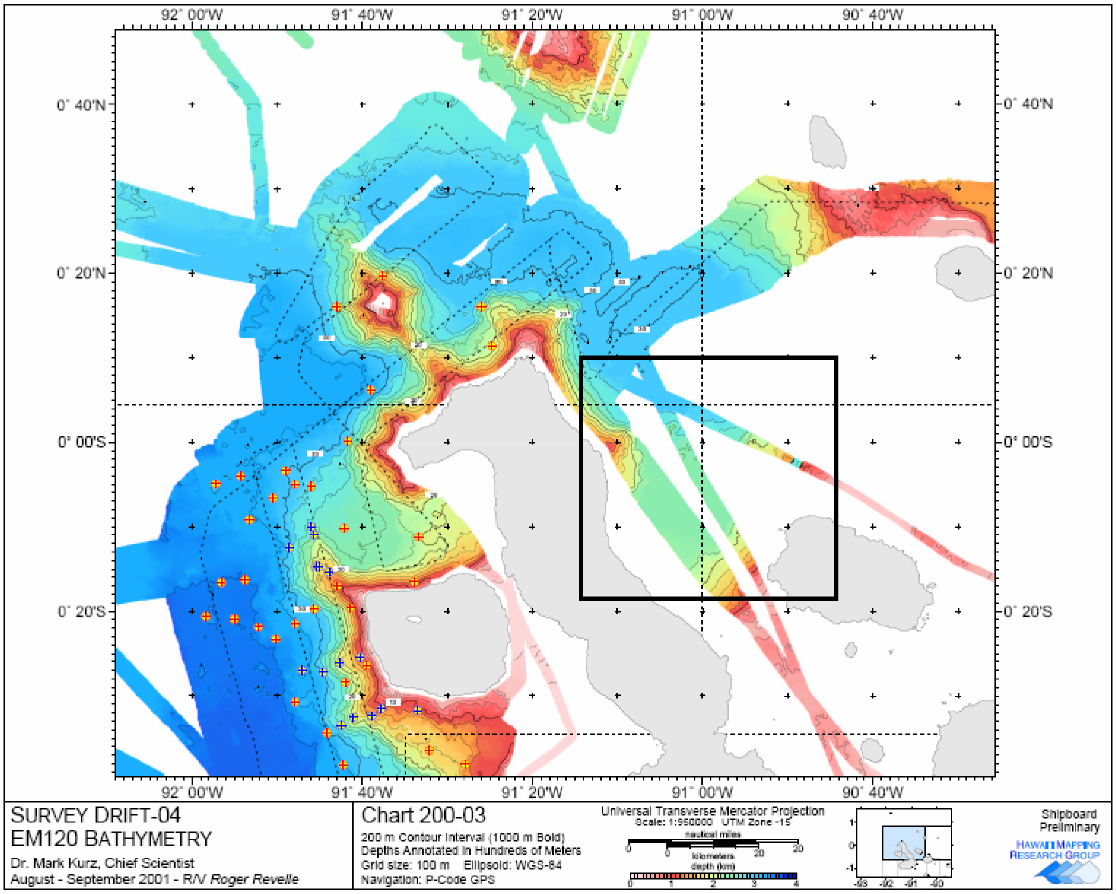

Fig. 2 Showing proposed tracks for leg 2 of this cruise. The black box shows the area and EM300 survey lines I propose for my research.

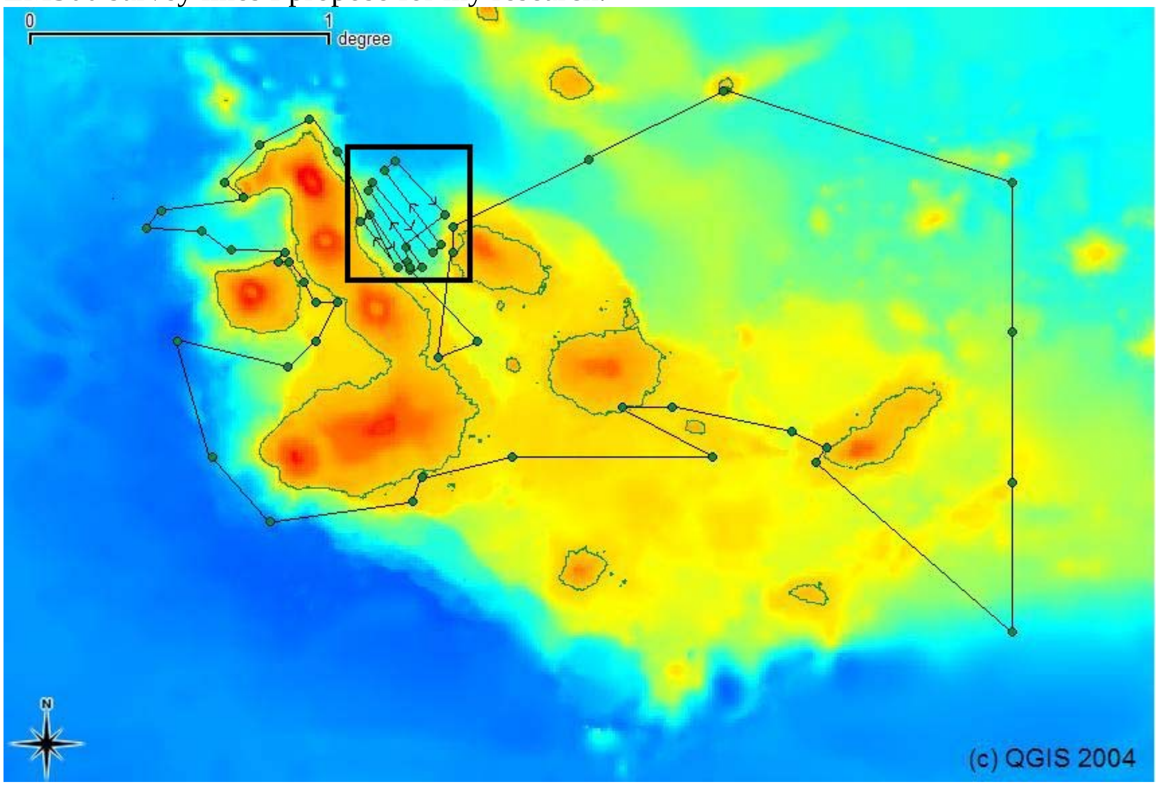

Table 1: The proposed budget for my research

Equipment/Supplies	Origin	Cost ($)	Days Required	Total Cost ($)	Effective Cost ($)
R/V Thomas G. Thompson	School of Oceanography	18,000/day	2	36,000	0
Shipboard Equipment		(included)	2	0	0
Simrad EM300 mapping					
3.5 kHz sub bottom profiling system					
CTD rosette					
Sampling Gear	Pooled Equipment				
Spade box corer		45/day	2	90	90
Extra sample boxes					
Cradle for supporting the samples/other core accessories					
Computer Programs	School of Oceanography	?		?	?
CARIS processing software					
ArcGIS processing software					
Fledermaus visualization software					
			totals	36,090.00	90.00

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