# NSF Award Abstract - #0440143

## Distinguishing Tectonic Mechanisms of Extension and Forearc Translation near the Central American Volcanic Arc by High-Resolution Seismic Profiling in Lakes Nicaragua and Managua


**NSF Org** EAR
**Intial Amendment Date** June 7, 2005
**Latest Amendment Date** June 7, 2005
**Award Number** 0440143
**Award Instrument** Standard Grant
**Program Manager** David Fountain
EAR Division of Earth Sciences
GEO Directorate for Geosciences
**Start Date** June 15, 2005
**Expires** May 31, 2007 (Estimated)
**Awarded Amount to Date** $288850


**Investigator(s)** Kirk McIntosh kirk@ig.utexas.edu(Principal Investigator)
Paul Mann (Co-Principal Investigator)
**Sponsor** University of Texas at Austin
P.O Box 7726
Austin, TX 78713 512/471-6424


**NSF Program(s)** MARINE GEOLOGY AND GEOPHYSICS, TECTONICS
**Field Application(s)** 0000099 Other Applications NEC
**Program Reference Code(s)** OTHR,0000
**Program Element Code(s)** 1620,1572


## Abstract


Deformation at convergent tectonic plate margins frequently involves some form of boundary-parallel shearing attributed to oblique convergence. This boundary-parallel component of convergence may be absorbed by deformation in the forearc, backarc, or concentrated along the volcanic arc. Two of the major

deformation modes associated with oblique convergence are 1) crustal block rotation and 2) forearc detachment by strike-slip faulting along the volcanic arc - the forearc sliver model. The roles of forearc slivering and block rotation are not clear in the case of the Central American convergent margin. A linear zone of strike-slip earthquakes indicates right-lateral shearing along the Nicaragua depression, a prominent Quaternary morphologic and structural depression, which extends approximately 600 km from the northern Gulf of Fonseca in El Salvador and northern Nicaragua to the Caribbean coast of Costa Rica. The depression is aligned with the belt of active Central American volcanoes, which are generally within the depression or near its southwest margin. To test the two deformation hypotheses, this project exploits the existence of two very large, shallow lakes (Nicaragua and Managua), to acquire images of the lake sediments and the recent faults that deform these sediments. Using a portable seismic reflection system mounted on passenger ferries in the lakes, roughly 1000 km of high-resolution seismic data is being recorded. By mapping the active fault patterns in the lakes this project provides a way to distinguish between the proposed deformation models. The block rotation model requires a series of northeast-oriented, left-lateral faults crossing the lakes. The forearc sliver model suggests that a major northwest-oriented fault system is aligned with the active volcanic chain and that extensional basins will develop between right-stepping offsets in the chain. Thus there should be a significant difference in fault system orientation and distribution depending on the mode of deformation. In addition to testing deformation models related to oblique subduction, the longer term geologic history of the Nicaragua depression is also being investigated. Some models suggest that the depression formed largely in Plio-Pleistocene times (approximately 0 to 6 million years ago) by arc-normal extension associated with slab rollback. However, if the forearc sliver model applies here, then basin development at right-step-overs along the strike slip system may also be an important and ongoing factor in forming the Nicaragua depression. Data is being acquired near both the northeast and southwest margins of the lakes to investigate the presence and orientation of basin-forming normal faults. This project is helping with seismic hazard mitigation. Faults in and around the lakes pose a major seismic hazard for the populated areas of the Nicaragua depression; the capital city and economic hub of Managua has been completely destroyed twice in the last 70 years by earthquakes and has a rapidly growing, present-day population of over one million inhabitants. This project better defines locations of active faulting and thus helps guide seismic hazard mitigation efforts.

---

Please report errors in award information by writing to:
award-abstracts-info@nsf.gov.