

2015 GSA International Distinguished Lecturer Tours Key Locations in Central and South America

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As the International Lecturer from North America, I visited 11 destinations in Ecuador, Peru, Chile, Costa Rica, Mexico, and Puerto Rico. The tour was designed to include locations where the topic of my presentation, “Following in the Footsteps of Darwin: Combining Geological and Historical Evidence to Assess Earthquakes and Tsunami Hazards,” would have direct relevance.



Lisa Ely presents her GSA International Lecture at the Universidad Católica del Perú.



Charles Darwin joined the 1831–1836 expedition on The *H.M.S. Beagle* as “a young man of promising ability, extremely fond of geology, and indeed all branches of natural history” (FitzRoy, 1839, p. 18). Darwin and the ship’s captain, Robert FitzRoy, documented coseismic land-level changes and tsunami inundation following the great Chilean earthquake of 1835 (Darwin, 1839; FitzRoy, 1839). My GSA lecture described the results of seven years of research with colleagues studying past earthquakes and tsunamis in Chile, in which we incorporated historical observations by Darwin, FitzRoy, and others into geological investigations of paleoseismic features such as tsunami deposits, microfossils, and uplifted shoreline platforms (Ely et al., 2014; Wesson et al., 2015).

The lecture tour was far from a one-way communication of research results. Many of the locations on my 2015 tour contend with potentially destructive earthquakes and volcanoes, as in Costa Rica and Chile, and institutions there are at the forefront of research into the geological processes inherent to tectonically active regions. In southern Chile, I had the opportunity to accompany researchers and students from the Universidad Austral to an Andean lake to acquire reflection-seismic profiles and extract cores of lacustrine turbidite sequences that could reflect shaking during large interplate earthquakes (Moernaut et al., 2014). At the Universidad Católica de Valparaíso, I spoke at the IV Congress of Physical Oceanography, Meteorology and Climate. The meeting included for the first time an all-day session devoted to Pacific Ocean tsunamis. This brought together researchers from a variety of fields and agencies throughout Chile to discuss the means to share their data across disciplinary and institutional boundaries.

As a professor at a regional university, I am particularly interested in the educational approaches of universities of various types and sizes. A recurring theme at many universities in Latin America is the expansion of the geology curriculum beyond the traditional emphasis on mining and natural resources to include environmental geology, natural hazards, and climate change. These new directions are largely grassroots efforts by faculty in response to regional needs and student opportunities, and they have generated a palpable influx of energy into the departments. At the Universidad Católica del Perú in Lima, the newly introduced undergraduate emphasis in geology within the major in geological engineering has attracted a crew of eager students.

The Centro de Investigación en Gestión de Riesgos y Cambio Climático at the Universidad de Ciencias y Artes de Chiapas, Mexico, was developed to investigate the management of geological hazards of direct relevance to the local region, including active volcanoes, seismicity, and flooding. Faculty members, students, and I toured field sites of student projects in fluvial and coastal processes complete with a fat alligator resting at the base of an otherwise promising stratigraphic section of flood deposits.

At every destination on this tour, I was impressed with the preparation and enthusiasm of the students. Two universities



Silvia Ramos-Hernandez of the Universidad de Ciencias y Artes de Chiapas leads a field trip to examine fluvial and coastal stratigraphy along the Pacific coast of Chiapas, Mexico.

organized symposia that featured student and faculty research. At the University of Puerto Rico Mayagüez, each undergraduate geology major completes two independent research projects, several of which were exhibited in the student poster session of the geology department's 31st Annual Symposium on Caribbean Geology.

At the Escuela Superior Politecnica del Litoral (ESPOL) in Guayaquil, Ecuador, a short course for 40 students included a day of presentations followed by a two-day field trip to investigate Holocene coastal stratigraphy and volcanic tephra. Many proudly donned field vests emblazoned with the ESPOL geology logo, sold as a fund-raiser by the student geology club. The timely importance of this type of educational program in geologic hazards was brought home by the occurrence of a devastating M_w 7.8 earthquake that struck the same section of coastal Ecuador on 16 April 2016, six months after our field excursion. Similar courses throughout this tectonically active region are developing the next generation of professionals to lead public education and preparations for future earthquakes.

The general public in Latin America is, in my experience, receptive to and interested in the earth sciences. During our fieldwork in Chile, many rural residents gave detailed testimonials of their experiences during the 1960 and 2010 tsunamis and were intrigued by our geological investigations of those events. The experiences recounted by the director of the Instituto de Geología at the Universidad Nacional Autónoma de México (UNAM), Elena Centeno, illuminated some of the roles played by the Institutes of Geology and Geography as societal resources for solving geoscience problems. These ranged from explaining the sudden disappearance of a river and local water supply into a karst sinkhole to consultation on forensic geology in legal cases.

My final stop, the EcoExploratorio science museum in Puerto Rico, has a mission to promote the spirit of exploration in everyone, which is resonant of the spirit of scientific curiosity expressed in the journals of the young Charles Darwin. Here I gave my presentation to an eclectic group of local citizens in tandem with Christa von Hillebrandt, director of the Caribbean Tsunami Warning Program, who encouraged public participation

in the annual CARIBE WAVE exercise in tsunami preparedness throughout the Caribbean. Through the persistent determination of its staff and founders, I have every reason to expect that by my next visit, the EcoExploratorio will have moved from its present quarters in a San Juan shopping mall to the modern building inspired by the DNA double helix, currently a 3D model in a display window there.

What was the highlight of this GSA lecture tour? The “modern-day Darwins” I met along the way. These young researchers and students embody the promising ability and enthusiasm for geology of the young man who set off on a voyage around the world 200 years ago and whose careful observations and thoughtful syntheses led to scientific interpretations that continue to evolve into the present day.

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