Tectonics of the North America/South America plate boundary

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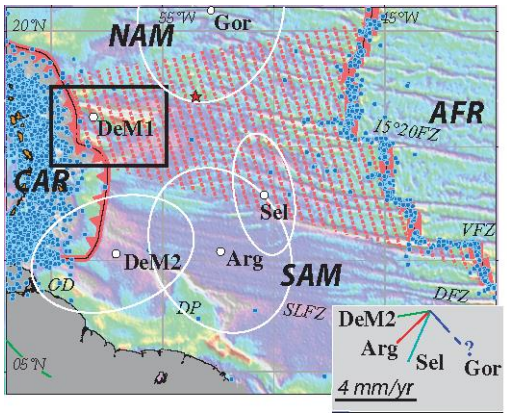

It is well known that continental plates deform internally, but oceanic plates are often thought of as rigid blocks with discrete boundaries. However, there is increasing evidence that oceanic plates also deform internally. One example is within the central western Atlantic, where there is a diffuse boundary between the North American and South American plates. Some of the relative motion is expressed in changes in the trends of Atlantic fracture zones, but some of the motion is taken up by individual areas of shortening that has formed elevated ridges on the seafloor in the central Atlantic, such as Barracuda Ridge and Tiburon Rise. This project will constrain the timing and amount of shortening that has occurred, and how it is accommodated. Potentially the ridges represent overthrusting of the oceanic crust, and thus the initiation of a new subduction zone. The ridges are also partly subducted beneath the Caribbean plate, changing regional sediment transport from south to north and possibly controlling the size and location of major earthquakes.

Methods: The student will use high-quality multichannel seismic reflection data and high-resolution sub-bottom profiler data collected in 2017 to study the timing of uplift of the ridges, and evidence at the seabed for present-day deformation. He/she will also use seismic refraction data together with gravity and magnetic data to investigate the deeper structure of Barracuda Ridge. The student will process the seismic reflection data in ProMAX, and complete a stratigraphic interpretation in Petrel linking to other published data and ODP core sites to provide timing. The seismic reflection data will be used to provide evidence for shortening from faulting and sedimentary package structure, and measure this shortening as a constraint on the relative plate motion. The deep structure of the ridges will be investigated by constructing density models constrained by the seismic reflection data and coincident seismic refraction velocity models to investigate how the crustal thickness varies, and thus how the elevation of the ridge is supported, giving additional information on regional shortening. The student will combine these results with more regional observations of gravity and magnetic anomalies to generate a new framework for the tectonics of the North and South American plate boundary.

Training: The SSCP DTP programme provides comprehensive personal and professional development training alongside extensive opportunities for students to expand their multi-disciplinary outlook through interactions with a wide network of academic, research and industrial/policy partners. Specific training will include:

- Seismic reflection processing using ProMAX software
- Seismic interpretation and use of Petrel interpretation package
- Quantitative interpretation of gravity and magnetic anomalies
- Scripting and use of GMT and ArcGIS for geographical data processing and manipulation
- Programming in relevant languages such as Python

The project would suit a numerate geoscience graduate.
If you would like further information please contact Jenny Collier (jenny.collier@imperial.ac.uk).

References:

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