

Seismogenic zone input: the upper plate contribution in Costa Rica. Structural analysis of the Osa Mélange.

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Subduction thrust systems are conveyor belts that transport surface sediments and rocks through an ever-increasing pressure-temperature-strain regime. These are unique fault systems because the thrusts exhibit an evolutionary progression from zero displacement in unconsolidated sediments to many kilometers of displacement at depth along the decollement, or megathrust. The thrust system is aseismic at shallow depths with the onset of nucleation of microseismicity at around 4 km depth. Locking of the fault is required to allow strain accumulation and earthquakes with a significant stress drop. Hence the onset of locking in the subduction thrust system is a key component of the aseismic to seismic transition. Some aspect of the incremental processes of lithification, mineral phase transformations, or fluid pressure changes is leading to the locking and onset of earthquakes with depth along subduction thrusts.

This conventional description is currently under challenge from two new observations:

- 1) the nucleation portion of a megathrust does not always overlap with its rupture area, the 2011 Tohoku EQ well demonstrated that rupture can propagate to shallow depths and displace the frontal part of the megathrust where the sediments are unconsolidated;
- 2) the material entering a subduction plate boundary and forming the wallrock of the megathrust can come from the overriding plate and be already lithified; this is the case of erosive plate boundaries as Costa Rica or Japan Trench.

This project aims at studying the upper plate material of an erosive subduction system that is ultimately input into the megathrust. Costa Rica is the best studied example of an erosive subduction margin, and is currently the focus of an international, multiplatform drilling experiment designed to reach the seismogenic portion of the plate boundary. Recent drilling has shown that the subduction erosion rate reached a record value of

$\leq 4000 \text{ km}^3/\text{Ma}/\text{km}$ of trench during the last half million years in the region where the Cocos Ridge is currently subducting. The removed portion of the forearc is (to the best of our knowledge) formed by an accretionary complex of Galapagos-produced seamounts that entered the subduction zone from the Oligocene to the Miocene. This complex, known as the Osa Mèlange, also outcrops on Osa peninsula.

Samples from the Osa Mèlange are currently available for microscopic analysis to define the structural characteristics of the rock assemblage before it enters the subduction plate interface. We would also use some samples in high velocity friction experiments that would be conducted at the INGV lab of Prof. Giulio di Toro in Rome. Additional fieldwork in Costa Rica after the preliminary evaluation of already collected samples is also planned, as are new analyses of the drillcore material to be recovered in Oct-Dec 2012.

How to Apply:

Please use the **online application system** (<http://www.rhul.ac.uk/studyhere/postgraduate/applying/home.aspx>) to submit an application for this project. Applications will require 2 letters of reference, plus a cover letter and CV- applicants are also requested to email a copy of their CV directly to the lead supervisor of this project (paola.vannuchi@rhul.ac.uk). **Please ensure you complete your application by mid-December. Suitable candidates will be invited for interviews, which will take place in February/March, and offers are made by the end of March.**

This is a PhD studentship open to UK/EC students starting in 2013.

For any queries please contact the Postgraduate Programmes Co-ordinator (email: pgadmin@es.rhul.ac.uk or tel: 01784-443581) and further information can also be found on the Department's Website (<http://www.rhul.ac.uk/earthsciences/home.aspx>).

