How can earthquake records be extended beyond the historical record? The case example of the trench sediment of the starved subduction margin of Ecuador

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Résumé

The extension of the catalogue of ancient earthquakes beyond the historical period is one of the major objectives in subduction margin paleoseismology as it will improve prediction models of future earthquakes. The record of earthquakes in the form of gravity flows in subduction trenches is particularly complete on sediment-rich margins but presumably incomplete and difficult to interpret on starved, tectonically eroding margins.
We studied the Ecuadorian margin, in a zone under supplied with sediments, between the Esmeraldas Canyon in the north, the Guayaquil Canyon in the south and bordered by a coastal range in the east that blocks the direct inflow from the Andes. We have studied in detail four c.10m-long cores collected in the trench during the AMADEUS in 2005 and ATACAMES campaigns in 2012 (R/V L'Atalante).

The cores contain four types of gravity events interbedded with hemipelagites: classical turbidites, volcaniclastic turbidites, amalgamated turbidites, homogenite-turbidite (Hm-Tu) pairs and mega beds (debrites and Hm-Tu assemblages). The nature of the benthic foraminifera contained in the turbidites indicates that the sediments originate only from the continental slope. The gravity events observed in the cores, dated by d14C measurements in the hemipelagites and modelling (@chronomodel), cover the last 5000 years, while the megabeds observed on the seismic profiles extend back to 18 kyr BP. The return times of turbidites, Hm-Tu pairs and megabeds, although heterogeneous, are on average 150 years, 580 years and 2000 years respectively.
The isolation of the trench from continental source of sediments, the foraminiferal content and the presence of amalgamated, Hm-Tu and megabeds - recognized on other margins as being the result of seismic shakings - indicate that these beds are likely to be the result of co-seismic destabilization of the continental slope. The c. 580 yr return time of Hm-Tu events is similar to that observed for earthquakes equivalent to the 1906 Mw8.8 earthquake at the mouth of the Esmeraldas Canyon and to that modeled by the calculation of strain accumulation rate deficit in the same area. This shows that starved margins, due to their isolation from continental sources subject to climate change, can offer good paleoseismological chronicles.

Mots-Clés: Paléosismologie, Séismes, Fosse, Subduction, Turbidites, Amérique du Sud, Equateur

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