Subject offered for a contract starting in September 2012

SUBJECT TITTLE: Timing and implication of mass wasting processes in the history of Martinique volcanoes: Insights from Expedition IODP 340

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Second Advisor/ Supervisor:

Host lab/ Team : **Equipe de Géologie des Systèmes Volcaniques– IPGP - UMR7154**

Financing: **Doctoral contract with or without assignment**

For more information go to http://ed109.ipgp.fr, section: Offres de these (PhD offer), you must apply on the Doctoral School website

Presentation of the subject (1 or 2 pages)

Flank collapse with emplacement of voluminous and potentially tsunamigenic debris avalanches is the key recurrent process controlling the evolution of Lesser Antilles volcanoes. In the context of island arcs where small size edifices are built, most debris avalanche material is deposited offshore such that on land studies provide only a very limited part of the information necessary to study these major volcanic events of considerable potential hazard. Major submarine slope instabilities can also produce important mass transport deposits in this context. The expedition IODP 340 is taking place (3 March- 17 April 2012) offshore the Lesser Antilles volcanoes to obtain a unique record of eruptive activity and volcanoclastic sedimentation of the most active complexes of the Lesser Antilles arc, over, at least the last Ma and to drill through mass transport deposits.
The PhD is dedicated to the post-cruise research plans of this expedition. The aim of the PhD is to focus on mass transport deposits emplacement around a volcanic island to understand much better 1/the timing and emplacement processes of debris avalanches produced by flank-collapses on Martinique volcanoes as well as 2/ submarine instabilities occurring on the flanks of the island. This PhD will gain unprecedented information necessary for understanding the behavior of volcanic debris avalanche and the actual role of flank collapses in the evolution of arc volcanoes with a remarkable frequency of flank collapses (15 in the last 12 ka) higher than in other regions (e.g. Hawai: 1/ 350 ka).

1- Debris avalanche deposits emplacement and sediment deformation
Offshore debris avalanche deposits (or mass transport deposit) can be identified on bathymetry data and seismic reflection profiles where they display typical chaotic signal. Cores retrieved throughout this chaotic facies during the Expedition 340 revealed the presence of important deformed marine sediments.

Understanding whether debris avalanche emplacement can be related to deformation of marine sediments or sediment failure is crucial for including realistic parameters in numerical simulations of flow processes. Combined seismic reflection profiles, logging data and core analysis will allow to: 1/ document the internal facies architecture and stratigraphy of mass transport deposits, 2/ evaluate the overburden removal of the underlying substrate and 3/ test the degree to which a given mass transport deposit volume results from volcanic debris avalanche emplacement and/or subsequent marine sediment deformation.

2- History of Martinique volcanoes and Timing of flank-collapse events

An important objective is to place each flank failure examined within the local volcanic history, and to provide accurate ages of events. The ages of events will improve quantification of the return periods, which is important for hazards assessment. Marine sediments preserve tephra layers and consequently provide a good record of the eruptions. Analysis of the cores through sediments offshore Montagne Pelée volcano combined with onshore record will provide the most complete history of the volcano, as a reference. The study of the sediments which cover the mass transport deposits will be used to date deposits around Martinique and to replace them into the long-term (2 Ma) eruptive histories of these islands. We will particularly focus on the influence of flank-collapse events on the evolution and eruptive processes of volcanoes.

3- Seismic stratigraphy and long-term evolution of the island

The regional seismic stratigraphy of the submarine flanks of Martinique will be constrained with temporal data from core analysis and will provide new constraints on the overall evolution of Martinique edification including deposition of material resulting from mass-wasting events.

The PhD student will have collaborations with a Post-doctoral researcher focusing on geomechanic analysis of marine sediments underlying mass transport deposits, with international researchers from the Expedition 340 and in particular with our UK colleagues. Cutting-edge results from this PhD research will significantly improve our understanding of the eruptive history of one of the Caribbean volcanoes which show an exceptional number of edifice collapses.

Academic training and specific skills

Academic training in the area of geology and geophysics