

PHD POSITION

Volcanism and tectonics of the Comoros archipelago: a link with northern Madagascar and the East-African Rift System?

Keywords: Comoros archipelago, hotspot volcanism, lithospheric deformation, regional tectonics, plate boundary, Lwandle plate, Somalia plate, East-African Rift System, geochronology, isotopic geochemistry

Supervision: Laurent Michon, professor (50%); Vincent Famin, associate professor HDR (50%)

Collaborations: Xavier Quidelleur (GEOPS, Paris Saclay), François Nauret (LMV, Clermont-Ferrand)

Location: Position based in Saint-Denis, Laboratoire Géosciences Réunion (LGSR), university of Réunion Island. LGSR is member of the Institut de Physique du Globe de Paris (IPGP)

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Summary

The Comoros archipelago is the subject of a longstanding controversy about the origin of its volcanism, alternatively interpreted as a hotspot or as due to lithospheric deformation. This controversy is part of a broader debate about the nature of hotspots in general, and whether they are deeply rooted at the base of the lower mantle, or more shallowly in the asthenosphere. On the one hand, the hotspot interpretation of the Comoros is based on the He-Sr-Nd-Os-Pb isotopic signature of some lavas in the archipelago, and also on the erosion of the islands that suggests a progression of volcanism toward the west. On the other hand, the presence of a regional seismicity, connecting the Comoros archipelago with the East-African Rift System to the west and with the Madagascar grabens to the east, suggests that its volcanism might be related to lithospheric deformation. Is the volcanism of the Comoros related to a hotspot, to an intraplate deformation zone? Does it represent the northern boundary between the Lwandle and Somalia plates? Is the Comorian volcanism related in time and origin with the East-African Rift System and/or with the volcanism of northern Madagascar? A better geological knowledge of the Comorian region is necessary to answer any of those questions.

The volcanic and seismic crisis that Mayotte undergoes since May 2018 reactivates the debate about the origin of the Comoros archipelago. The PhD thesis will study three aspects of the Comorian volcanism and its geodynamic framework. (1) The tectonics of the archipelago, through a survey of deformation structures observed in the field or by remote sensing, and their relationship with submarine structures identified by ongoing and future offshore campaigns. The objective of this first task is to determine if the deformation observed in Mayotte can be found in Anjouan, Grande Comore and northern Madagascar, and if all these structures are consistent with a regional kinematics. (2) The timing of volcanism relative to tectonics in the archipelago, with the use of K-Ar geochronology. The goal of this second task is to determine if volcanic building follows a synchronous pattern or an age progression along the archipelago, and/or if the timing of volcanism can be related to that of the East-African Rift System or of northern Madagascar. (3) The source of magmatism, through a geochemical study of the Sr-Nd-Pb isotopic evolution of volcanism through time, and its comparison with the magmatism of the East-African Rift System and northern Madagascar. The idea is to highlight isotopic similarities and differences among these magmatic provinces, in order to better understand the origin of volcanism.

The PhD thesis is funded by the French national program ANR COYOTES involving several French laboratories. A strong collaboration is expected among teams as other PhD students will work on the Comoros geodynamics with complementary methods. The beginning of the PhD will benefit from field surveys and sampling campaigns already collected in Mayotte, Anjouan and Mohéli in 2018 and 2019.

The successful candidate will participate in the offshore campaign SISMAORE (the goal of which is to study the nature and structure of the lithosphere in the Comoros) at the end of 2020 or the beginning of 2021, and will study volcanism samples dredged during this campaign. Candidates will be selected in priority based on their combined proficiency in structural geology, geochronology, and/or volcanic petro-geochemistry, as well as on their excellent writing skills in English. Applicants must have a pronounced taste for teamwork in the field, at sea and in the geochemistry laboratory. The PhD position will be based in Saint-Denis at the university of La Réunion Island, but will include frequent travels to the laboratories GEOPS (Paris-Saclay) for geochronology and LMV (Clermont-Ferrand) for Pb-isotopic analyses.

Deadline for applications: 2020, June 1st, 12:00 AM France local time.

Conference-call interviews of pre-selected candidates on June 8th – 12th (supervision team), then on June 29th – 30th, 2020 (doctoral school STEP'UP).

Beginning of the position: October 1st, 2020.

Applications must include a CV or resume, a letter of intention, two letters of referees, and the master thesis in .pdf format. Full applications should be sent to laurent.michon@univ-reunion.fr and vincent.famin@univ-reunion.fr.