Geophysical Research Abstracts
Vol. 18, EGU2016-12755, 2016
EGU General Assembly 2016

Morphological modifications of the Kerguelen Islands (South Indian Ocean) in response to Neogene climate change: evidence from ^{40}Ar/^{39}Ar and (U-Th)/He thermochronology

Floriane Ahadi (1), Guillaume Delpech (1), Cécile Gautheron (1), Sébastien Nomade (2), Rosella Pinna-jamme (1), Léandre Ponthus (3), and Damien Guillaume (3)

(1) GEOPS, Université Paris Sud 11, 91405 Orsay, France (floriane.ahadi@u-psud.fr), (2) LCSE-IPSL, CEA-CNRS-UVSQ, 91198 Gif-sur-Yvette, France, (3) GET, Université Paul Sabatier Toulouse 3, 31400 Toulouse, France

The processes driving erosion in geodynamic contexts in which regional tectonics is of minor importance, such as in oceanic islands, can be seen as a combination of positive/negative retroactions between climate change, isostasy or dynamic topography. The Kerguelen Islands (48-50˚S, 68.5-70.5˚E) are of particular interest to understand the impact of Cenozoïc climatic variations on the long-term geomorphological evolution of emerged reliefs at mid-latitudes. The Kerguelen Islands (6700 km^2) are the emerged part of the vast Kerguelen oceanic plateau and reach a maximum height of 1852m asl. The archipelago is mostly made up of Oligocene basaltic traps (≈25 Ma) up to 1000m asl that are cross-cut by a dense network of large and deep valleys. The impact of glacial erosion during the last Quaternary glaciations on the landscape morphology is attested by the occurrence of U-shaped valleys, abundant moraines, erratic blocs and glacial lakes, as well as remnants of glaciers. Numerous plutonic complexes of various age (25-4.5 Ma) locally intrude theses traps and cover about 15% of the main island's surface; the largest being located in the Rallier du Baty peninsula (800 km^2). This plutonic complex is mainly constituted of syenites with minor occurrence of gabbros and monzonites. The southern part of this complex has a laccolith structure with satellites plutons and formed between 13.7 and 8.0 Ma.

The cooling history of syenites from the Rallier du Baty plutonic complex was investigated in order to identify one or several denudation periods and to understand the potential role of climate change on the geomorphological evolution of the islands since the Oligocene. We conducted the first thermochronological study on the Kerguelen Islands using the biotite ^{40}Ar/^{39}Ar thermochronometer and the apatite (U-Th)/He thermochronometer (AHe). The ^{40}Ar/^{39}Ar ages range from 9.44 ± 0.13 Ma to 13.84 ± 0.07 Ma for the various parts of the southern complex. These ages are identical to high-temperature crystallisation ages (U-Pb on zircon) and suggest an extremely rapid cooling between ≈700 and ≈300˚C and that these rocks were emplaced at shallow depth. The mean AHe ages range between 4.4 ± 0.3 Ma and 7.4 ± 0.7 Ma. Theses ages agree with a model implying a rapid erosion of the upper volcanic rock pile that occurred several My after emplacement of these plutonic rocks at the Miocene-Pliocene transition. This transition coincides with a global climatic cooling which is particularly strong at these mid-latitudes. It is suggested that the morphological evolution of this part of the main island results from global climate changes at this period, with a possible contribution from positive retroaction between climate cooling and local isostatic accommodation. This study further strengthens the link between climatic variations and increase in erosion rates at mid latitudes since 6 Ma as recently demonstrated for Patagonian Andes.