

Geodynamic evolution of the Central Peru (~10-14°S) Andes range

Supervisor: Prof. Massimiliano Zattin (Univ. Padova)

Co-supervisors: Prof. Cécile Gautheron (Univ. Paris Sud), Prof. Laurence Audin (Univ. Grenoble)

State of the art

The Andes are a major topographic mountain range, elongated for 2000 km along the active subduction zone in South America. The topography building along the Pacific border began in the Late Mesozoic although the actual relief and the formation of the large Altiplano plateau occurred more recently (Oligocene-Miocene). However, most of literature agrees on the existence of some relationships between growth of the chain and changes in the subduction angle and crustal shortening eastward migration. Changes in kinematics of the subduction zone are clearly testified by temporal and spatial evolution of volcanic and plutonic bodies emplacement. In Peru, ore and copper deposits have been emplaced during time associated to slab flattening and crustal shortening.

In Central Peru (10-14°S), the relief formation and migration of the Andean tectonic activity during Cenozoic remains unresolved. Although some recent data have been obtained along the easternmost Subandean belt, the timing of thrust-related exhumation and Cenozoic sedimentation remains poorly constrained along the nearby Altiplano, Western and Eastern Cordillera from Lima to Huancayo. Here, some porphyry-style and copper-bearing deposits are described along major inherited fault zones.

Near Huancayo, the structural limit between the Western Cordillera and the Altiplano is characterized by major NW-trending fault systems (high-angle reverse and strike-slip kinematics). This 10 to 50-km-wide tectonic corridor is inferred to have been active for the Mesozoic time and to have largely controlled the structures reactivation during Andean deformation.

Methodologies

This project will combine different methodologies to determine the relief construction and exhumation history from short to long term time scales. Firstly, based on field work, tectonic structures will be identified and samples will be collected along SW-NE profiles (Lima-Huancayo transect). The short term exhumation history will be reconstructed by dating surface markers with Terrestrial Cosmogenic Nuclides whereas long term evolution will be studied with low temperature thermochronology (apatite fission track and apatite and zircon (U-Th)/He). All the data will be finally integrated and modeled for thermal history and relief reconstruction in relation with the new structural mapping.

Host institutions

The thesis will be held in co-tutelle between Padova and Grenoble-Alpes Universities. However, the student will spend some time at Paris Sud University for (U-Th)/He analysis and hosted by INGEMMET (Institut Géologique Minier et Métallurgique) and IRD (Institut de Recherche pour le Développement) offices during the stay and field trips in Peru.

Funding

The expenses for field trips will be covered by IRD funds and the student will access to local logistics of the IRD office in Lima (low expense location of 4 wheel drive cars and experienced driver). The analytical costs will be covered by internal funds at Grenoble University for the cosmogenic dating (Labex opportunities; 10Be preparation at ISTERRE and CEREGE ASTER facility), by Paris Sud University for AHe dating in addition to projects submitted at French INSU proposals, and by a PRAT project and ex-60% grants for the activities at the Padova University.