The Colca River located in Central Andes in southern Peru, creating one of the deepest valleys of the Western hemisphere, just recently registered as UNESCO Geopark, is ideally suited to study crustal deformation based on landscape features. Frequent earthquakes, mass movement processes and volcanic eruptions prove current activity of local faults and the Nazca-South America subduction zone generating large and often catastrophic earthquakes. In such areas, the ongoing tectonic deformation is the main factor contributing to contrasting relief, drainage anomalies, differential tectonic uplift, variations in erosion rates, river incision, and in channel gradients. Thus, substantial information on the tectonic activity can be derived from the analysis of landscape, especially river network, which is the most sensitive element reacting to the variability of tectonic deformations.

In this project we propose to study the response of the morphology and drainage network to ongoing tectonic deformation in the Colca River catchment. Thus, the main aim is to decipher information on the deformation related to the Nazca-South America subduction zone and/or active crustal faults based on (1) mapping and dating of morphological features (i.e. river terraces, fault scarps, etc.), (2) computing incision, erosion and uplift rates in various locations in the Colca catchment, (3) calculating geomorphometric indices to derive the variations in relative tectonic activity, (4) determining the activity of crustal faults based on dating of deformed strata, and (5) chemical and isotope analyses of thermal water and gases in detected zones of active faults. Such wide spectrum of planned studies has not been performed in this part of the world. We believe that our results would help us to understand tectonic processes related to subduction zone, their relationship with faults located on the upper plate (i.e. South America plate), as well as the history and evolution of the formation of the deepest canyon on the Earth. Moreover, obtained information on past earthquakes and recurrence time in between those seismic events should help us to provide more accurate assessment of seismic hazard.

The authors of the project will use methods and experience of the Principal Investigator and co-workers achieved in similar studies conducted in other subduction zones in the world.