ECOLE LEMANIQUE DES SCIENCES DE LA TERRE
DES UNIVERSITES DE GENEVE ET DE LAUSANNE

Master ès Sciences in Earth sciences

Landslide and ground deformation analysis of the Askja caldera (central Iceland)

Contact persons

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Context

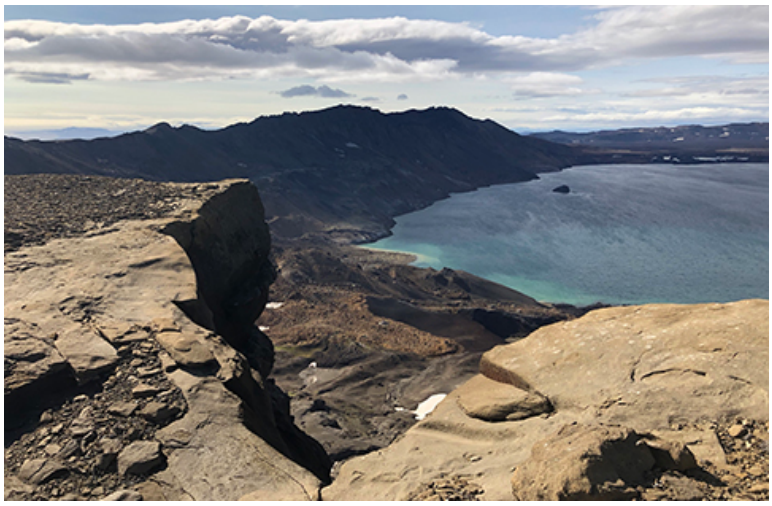
Askja caldera is one of the major volcanic landmarks in central Iceland. The Plinian eruption of 1875 was associated with a collapse of the caldera in response to the draining of a shallow magma reservoir. The collapse generated major ring faults, reactivated by dyke intrusions in the following decades. The collapse was filled by the freshwater lake of Oskjuvatn. The eastern part of the caldera has been seismically active and in 2014 was subject to the largest historical landslide in Iceland, inducing a tsunami in the lake with a run-off of up to 30 meters. Since 2014, the seismicity has not decreased and affects the northern part of the collapsed area and is aligned with the normal (ring) faults controlling the collapse structure. In addition, a new phase of rapid uplift (tens of centimeters per week!) began in August 2021 and now affects the entire caldera, suggesting possible magma recharge in the plumbing system. This project could be divided into two masters with 1) field observations at Askja and analysis of optical imagery (drone, aerial photos) and 2) analog (and numerical) modeling with models of caldera collapse, ring faults and magma injection using photogrammetry and image correlation. This project will be associated with the master project entitled “current architecture of the plumbing system of the Askja caldera”.

Aims and Methods

The project aims to study the ongoing deformation activity of the caldera and to analyse the landslide morphology and evolution.
We have already collected high resolution (~4 cm ground resolution) drone imagery in the landslide area in 2020 and 2021 and plan to repeat the measurements in the summers 2022 and 2023. This project integrates field structural observations, high-resolution drone imagery and optical image correlation to study ground deformation. Beside the field data, the student will perform analogue experiments in the laboratory to analyse and understand the deformation processes during caldera collapses and related landslide activity.

References

- *Hartley ME, Thordarson T (2012) Formation of Oskjuvatn caldera at Askja, North Iceland: mechanism of caldera collapse and implications for the lateral flow hypothesis. J Volcanol Geotherm Res 227–228:85–101. https://doi.org/10.1016/j.jvolgeores.2012.02.009*
- *De Zeeuw-van Dalfsen E, Rymer H, Sturkell E et al (2013) Geodetic data shed light on ongoing caldera subsidence at Askja, Iceland. Bull Volcanol 75(5):1–13. https://doi.org/10.1007/s00445-013-0709-2*
- *Trippanera, D., Ruch, J., Acocella, V., Thordarsson, T (2017). Interaction between central volcanoes and regional tectonics along divergent plate boundaries: Askja, Iceland, Bulletin of Volcanology 80 (1), doi10.1007/s00445-017-1179-8.*



Website

https://www.unige.ch/sciences/terre/index.php?cID=1565

Prerequiste

Indicate if the student has to take some course or module: Dynamic Earth, Geohazard and Risk