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

Master ès Sciences in Earth sciences

## Earthquake-volcano interactions at oblique subduction margins

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**Context**

*Earthquake-volcano interactions have first been described by Charles Darwin during "The voyage of the Beagle" (Darwin, 1840). Yet, little is known about physical processes driving seismically-promoted volcanic unrests. Northern Sumatra features a complex geodynamic setting characterised by the oblique subduction of the Austalian and Burma plates beneath the Sunda plate. The high-angle convergence occurs at about 5.7 cm/yr promoting strain partitioning in the upper plate. This results in a regional-scale onshore right-lateral and deep-reaching strike-slip fault system named Great Sumatran Fault upon which the volcanic arc develops. In 2005 the Mw 8.6 Nias earthquake struck offshore Sumatra (Hughes et al., 2010). Mount Sinabung sits upon the segment of the Great Sumatran Fault facing the region affected the most by the main slip of the Mw 8.6 Nias earthquake. Mount Sinabung began to inflate 2 yrs after the megathrust earthquake and ultimately erupted in 2010. Interestingly, no Holocene eruptions were reported for this system (Chaussard and Amelung, 2012).*
*This study proposes that the Mw 8.6 Nias earthquake may have reactivated the Great Sumatran Fault ultimately promoting volcanic unrest at Mount Sinabung. This study will combine petrological studies, earthquake observations and coulomb stress changes to investigate a possible causative link between the Mw 8.6 Nias earthquake earthquake and the unrest of Mount Sinabung. Samples have been collected at the onset of the eruption in 2010 and will be collected in the framework of the study to investigate the evolution of the system. Mount Sinabung is still active to date.*

**Objectives and Methods**

*Methods:*

- *Electron microprobe*
- *LA-ICP-MS*
- *Coulomb stress change*
- *Earthquake catalogues*

*Objectives:*

- *Petrography and petrology of the magmas erupted in 2010*
- *Assess and compare the evolution of the magmas erupted over the last decade*
- *Diffusion chronometry to determine if the reactivation of the system occurred at the time of the Nias earthquake*
- *Question whether Mount Sinabung's unrest may have been promoted by the 2005 Mw 8.6 Nias earthquake.*

**Literature**

Darwin, C., 1840. On the connection of certain volcanic phenomena in South America, and on the formation of mountain chains and volcanoes, as the effect of the same power by which continents are elevated. Trans. Geol. Soc. London.
Chaussard, E., Amelung, F., 2012. Precursory inflation of shallow magma reservoirs at west Sunda volcanoes detected by InSAR. Geophys. Res. Lett. 39, n/a-n/a. doi:10.1029/2012GL053817
Hughes, K.L.H., Masterlark, T., Mooney, W.D., 2010. Poroelastic stress-triggering of the 2005 M8.7 Nias earthquake by the 2004 M9.2 Sumatra?Andaman earthquake. Earth Planet. Sci. Lett. 293, 289–299. doi:10.1016/j.epsl.2010.02.043

**WEB sites**

https://earthquake.usgs.gov/earthquakes/eventpage/official20050328160936530_30/executive
https://volcano.si.edu/volcano.cfm?vn=261080

**Choice of orientation : (supprimer les orientations qui ne conviendraient pas)**

2) Geochemistry, Alpine tectonics, Ore Deposits / **3**) Geological Risks