

Europlanet TNA Report

PROJECT LEADER

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| Date of TNA visit: | August 22 nd – September 10 th 2010 |
| Host laboratory: | Space Research Institute (IKI), Moscow |

Project Title –

New geochronological constraints of polyphasic Mutnovsky and Gorely volcanoes : contribution to the history and volumetric extrusion rate of Kamchatkan volcanism

- Report on the outcomes of the TNA visit (approx 1 page)

2010 TNA1 Kamchatka fieldwork August 22nd – September 10th
Report

Mutnovsky and Gorely volcanoes, which presently show important geothermal activity, are built on a volcanic plateau made of previous volcanic deposits of other older volcanoes. The interesting and unusual characteristic of these two volcanoes is that they are very close, by a distance of only 15 km. They are therefore qualified of being a “pair of volcanoes”. This feature can be found in other places of Kamchatka (and on Earth such as in Ecuador, in the Andes) and is due to the angle of subduction of the oceanic plate under Kamchatka, which allows the melting of the mantle under Kamchatka at two different depths for the same latitude, which hence makes two distinct volcanic centres on the surface.

The particularity of Gorely volcano is that it is built inside a circular depression named “caldera” which was formed by a cataclysmic eruption, for which available ages obtained by ¹⁴C and Ar-Ar dating - 30-40 ka and 360 ka respectively -, are obviously contradictory and make the understanding of the story of Gorely volcano quite confusing. The aim of our past expedition and subsequent labwork is thus to assess accurately the timing of the initiation and of the lifetime stages of Gorely and Mutnovsky volcanoes up to Holocene activity, by providing exhaustive K-Ar dating on the whole area.

This huge explosion destroyed the volcanic edifice and enhanced its collapse on itself, together with the collapse of the magmatic chamber underneath. The volcanic deposit due to this explosion is named ignimbrite and offers four distinct layers, which were more likely emplaced shortly after each other. We could sample the latest ignimbrite deposit in three different locations out of the depression caldera and on its rims. We also sampled two of the earliest ignimbrite deposits by climbing down to Opasny canyon guided by professor Vladimir Leonov. By dating the several ignimbrite deposits with the K-Ar technique, we wish to provide new concordant ages for this eruption, together with a complete time sequence of the different phases of this cataclysmic explosive event.

During our expedition we also sought to sample other volcanic formations that predated the formation of the caldera, hence which are located outside and especially along N-S fault systems east of Gorely volcano. For this purpose, six sites have been sampled.

Caldera formations enhance a decrease of pressure in the magma chamber or at least in shallow magma reservoirs, which enables the ascent of magma towards the surface and its exits through faults systems inside or on the rims of the caldera. We could identify and sample early post-caldera rocks such as a lava flow originating from a dacitic dome located inside the caldera south of the present Gorely edifice, two other sites on the caldera rims, and one early lava of the present Gorely edifice. Dating these lavas will provide a closer bracket of the caldera event, and may tell us more about the timing of the succession of events happening during the formation of a caldera. We are also hoping to learn more about the timing of the building of the subsequent Gorely edifice inside the caldera.

Mutnovsky volcano is supposed to be younger than Gorely volcano and to have been emplaced after the formation of the caldera of Gorely. We sampled basal lava flows of Mutnovsky volcano which are located underneath the latest layer of the ignimbrite of Gorely caldera. We also sampled two lavas from Mutnovsky 1 which may be in fact part of a separate volcanic edifice along the N-S fault system, that would have been emplaced before the present Mutnovsky, hence maybe before the caldera formation.

For constraining the present Mutnovsky, we could sample a basal lava flow, hence earlier to Mutnovsky 3, together with large pumice deposits supposed to have been emplaced during the initial eruption of the present Mutnovsky 3. As a similar level of pumices has been recently identified in two submarine cores in the Pacific ocean, the dating of this pumices will thus be vitally important for the submarine and ^{14}C research, as reservoir correction is not available for the northern Pacific. Two other sites on top of Mutnovsky 3 have also been sampled for constraining the more recent stages of this volcano.

Mutnovsky 2 and Mutnovsky 4, as well as Gorely 1 are far reach areas that would request two days of hike or the assistance of a four-wheel drive car and the setting of an extra camp during several days; this may be the goal of another later fieldwork expedition, together with complementary sampling sites at Gorely's.

Agnes Samper and Pierre Lahitte, September 18th , 2010.

Please include:

- Publications arising/planned (include conference abstracts etc)

As we are currently waiting for the samples to be sent to our respective laboratories in Canada and France, our wish to attend the JKASP conference in

Petropavlosk-Kamchatski in Kamchatka (Russia) in August 2011 might be delayed to the EGU in 2012 in Vienna (Austria).

- **Host approval** The host is required to approve the report agreeing it is an accurate account of the research performed.