

Final Report: Senior Research Stay

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subject: Sensitive landscapes

Research Title: Modeling of biological induced weathering of mafic and ultramafic rocks in cold environments: processes, effected to landscape stability and sensitivity (example of North Eurasia, Russia)

Dates of Stay / Duration: November 2016, 1 month

The primary contact person is Prof. Dr. Anna Gorbushina, Dept. of Biology, Chemistry, Pharmacy & Dept. of Geosciences, Freie Universität Berlin. Based on the postulate that mineral weathering is a sum of Earth-forming processes that start to play a role at the scale of a single mineral grain but finally express their effects at the landscape scale, the rock weathering induced by biofilm was investigated in the laboratory experiment. The rock samples of mafic and ultramafic rocks from the lithic contact of soil profiles developed in cold environment of Central Siberia and the Polar Urals (Russia) were collected to be a subject of experiment: *in vitro* weathering with the help of a laboratory model biofilm. This biofilm combining one heterotroph and one phototroph component is genetically modifiable and has been recently developed (Gorbushina AA, Broughton WJ. Microbiology of the atmosphere-rock interface: how biological interactions and physical stresses modulate a sophisticated microbial ecosystem. Annu Rev Microbiol 2009; 63: 431-50.).

As a result of the experiment new data of biotic and abiotic interaction were disclosed, which can be extrapolated to landscape scale to estimate landscape stability based on rock senility to weathering. Thus, it was the great opportunity to join that scientific environment, which provided me with the unique opportunity to work out the results on the base of the above mentioned experiment. The most challenging aspect of the research stay was some unpredictability of experiment results and ability to use the results of the laboratory experiment for extrapolation of the landscape stability study in general.

Open seminar and discussion of the result of the experiment allowed us to work out plans for future collaboration in the framework of studying the landscape stability and sensitivity not only in the research projects but also in the teaching process. This can provide me with the outstanding opportunity to modify the lectures using the obtained data concerning biotic and abiotic interactions, which effect to the processes of fine earth formation from hard rocks and are absolutely essential for life on Earth.

Collaboration and intercommunications between professors, specialists and lecturers from different countries create the special scientific infrastructure, which allows to grow up the new generation of young scientists. They potentially could use common scientific language and share scientific results.

The research stay in FUB has been extending my knowledge concerning sustainable development in the micro-scale of biology weathering affected by microbial dominated ecosystems termed “biofilms”, which form at interfaces of solid materials with gas or liquid phases and represent a unique structure capable of multiple impacts on substrate and element cycles (*Burford, EP., Fomina, M, Gadd GM* 2003. Fungal involvement in bioweathering and biotransformation of rocks and minerals. *Mineralogical Magazine* 67: 1127-1155; *Gorbushina AA*. Life on the rocks. *Environ Microbiol* 2007; 9: 1613-31). Based on the obtained results and findings new projects are being planned. For instance an application for the annual project granted by St. Petersburg State University will be submitted. The goal of this research project is to provide an input for understanding the ratio of recent fine earth to that inherited from ancient epochs in the pedosphere based on studies of rock weathering in soil environments in cold regions, which make the bridge for understanding of the processes active in the critical zone of high latitudes, including polar ones.