

STSM of COST Action ES1306

Object: Scientific Report for the STSM Proposal “Connectivity of the rivers Eystri-Rangá and Ytri-Rangá located within the the Rangárvellir watershed in southern Iceland”

COST STSM Reference Number: COST-STSM-ES1306-34336

Hosting Institution: HASKOLINN REYKJAVIK – REYKJAVIK UNIVERSITY

Period: 17/07/2016 to 31/07/2016

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Host: David Christian – Finger, HASKOLINN REYKJAVIK – REYKJAVIK UNIVERSITY

Purpose of the visit

This mobility is aimed at develop of cooperation between research groups of HASKOLINN and Belgrade Universities in the scientific area of physicochemical interaction of elements in the water – soil/sediments systems and developing methods for connectivity paths of sediments and their origin in watersheds using specific elements and groups of elements (and their specific ratios) as tracers.

Work carried out during the STSM visit

Visit to HASKOLINN University was in three steps:

1. Initial meeting at HASKOLINN University with Prof. David Christian – Finger and their collaboration to data collection about Eystri-Rangá and Ytri-Rangá watershed.
2. Move to Gunnarsholt and stay at the Soil Conservation Service of Iceland for collection of waters, soil and sediments samples of Eystri-Rangá and Ytri-Rangá watershed. Colleague Guðmundur Halldórsson provide me exceptional hospitality, enabled field work with all necessary field-tools for sampling, introduced me to all collaborators in the Centre, provide me all relevant data and personally escorted fieldwork. We took samples of water and sediments of Eystri-Rangá and Ytri-Rangá and also samples of soil, in the vicinity of the sampling waters and sediments at each sampling point, in order to compare contents of elements in surrounding soil with their contents in water and sediments. Samples of water, soil and sediments were taken along the whole rivers flows from its sources to its mouths.
3. After the end of sampling activities I returned to Reykjavik and continued visiting of HASKOLINN University. With Prof. Þórunn Pétursdóttir and Prof. David Christian – Finger we spoke about collected data and samples as well as methods that we will apply in this research. Also we considered another possibilities for continue this research because of watershed on Iceland could be accepted as field-test for developing of methods for this model.

Collected samples of water, soil and sediments have transported to laboratory of University of Belgrade where they prepared for further analysis.

Description of main results

We finished analyzes of waters samples. We analyzed 63 elements (major and trace elements), main ions and conductivities of investigated water.

Applying of ICP/OES and ICP/MS techniques we analyzed the following elements: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Ce, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Hg, Ho, In, Ir, K, La, Li, Lu, Mg, Mn, Mo, Na, Nd, Ni, Os, P, Pb, Pd, Pr, Pt, Rb, Re, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Tb, Th, Ti, Tl, Tm, U, V, W, Y, Yb and Zn. In the examined waters were not quantified in any of the sample following elements: Ag, Ba, Bi, Cd, Cu, Eu, In, Ni, Pb, Pt, Rh, Sn, Th, Tl, Tm and Zn. In samples of both rivers are dominating $Na > Ca > Si > S > Mg > K$, in the same order but their contents in Estri-ranga are about two to three time lower (depending of elements) and also content of S is significantly lower.

Applying of ion chromatographic technique we analyzed F^- , Cl^- , Br^- , J^- , NO_3^- , SO_4^{2-} and PO_4^{3-} . In none of any sample has been found J^- and PO_4^{3-} . Contents of anions in Estri-ranga are lower from two to four times in general that their contents in Ytri-ranga.

Applying of conductometrics method we measured conductivities in water samples and this parameter shows three to four time lower values in Estri-ranga compare to values in Ytri-ranga.

We analyzed contents of trace elements in both rivers: some of them contained only in water of one river (for example Al detected only in samples of middle of Estri-ranga or B detected just in Ytri-ranga) and we try to find all specific tracers for each river on the one hand and determine the specific ratios of major and trace elements for both rivers on the other.

Sequential extraction of major and trace elements has been done using the optimized procedure proposed by European Community Bureau of reference (BCR) in the next fractions:

- Step 1: fraction soluble in acid - metals that are exchangeable or associated with carbonates (extraction of elements with solution of acetic acid)
- Step 2: reducible fraction- metals associated with oxides of Fe and Mn (extraction of elements with acid hydroxyl ammonium chloride solution)
- Step 3: oxidizable fraction - metals associated with organic matter and sulfides (extraction of elements with H_2O_2 solution and ammonium acetate solution)
- Step 4: residual fraction—metals strongly associated with the crystalline structure of minerals (extraction of elements with 3:1, v/v, HCl to HNO_3 solution).

Till now by ICP/OES extracts in all steps have been analyzed on next elements: Al, As, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, P, Pb, S, Sb, Si, Sr, V, and Zn. Processing of the results is in progress.

In additional we did elemental analyses (N, C, H and S) of soil and sediments and we found the maximum contents of N in sediment and soils are about 0.1%, for C are about

1 – 2%, for H are about 1% and for C are about 0.1%. The contents of these elements are slightly higher in surrounding soils than in sediment.

Description about how the results contribute to the Action aims

The main contribution of this STSM to COST Action ES1306 is in joint collaboration on connectivity. This mission was relatively short, but has established strong partnership between two institutions among the participants of COST Action ES1306. For relatively low budget we successfully organized research which can help us to develop the method for unique model for study of hydrological and sediment connectivity using chemical tracers, specific ratios of chemical constituents in the water and sediments, multivariate statistical models, geo-accumulation indices etc. This work is within the scope of COST Action ES1306 and related to WG2 (data), WG3 (models) and WG4 (indices).

Expected publications from the STSM

The obtained results of this STSM are going to prepare for publication in prestigious international scientific Journals. Also we will present the first results on EGU2017 within Soil System Science (SSS) Disciplinary Session in SSS9 (Soil, Environment and Ecosystem Interactions) where together Prof. David Christian Finger and me proposed Session No.SSS9.16/HS* Physicochemical interaction in water - soil/sediment systems which will also presented on PICO session.

Dragana Djordjevic