



## First Results on Moss Biomonitoring of Trace Elements in the Central Part of Georgia

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## Areas under investigation

The landscape within the nation's boundaries is quite varied.

Western Georgia's landscape ranges from low-land marshforests, swamps, and temperate rainforests to eternal snow and glaciers, while the eastern part of the country even contains a small segment of semi-arid plains.





## Sampling

- $\circ$  Samples were collected during the period April October.
- The sampling points were located at least 300 m from main roads (highways), villages and industries and at least 100 m away from smaller roads and houses.
- For each sampling site up to 10 sub-samples were taken in the area of 50 x 50m and combined into one collective sample.



HEAVY METALS, NITROGEN AND POPS IN EUROPEAN MOSSES: 2015 SURVEY



#### MONITORING MANUAL

International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops

> http://flap.jinr.ru/naa http://icpvegetation.ceh.ac.uk







Pleurozium schreberi (Brid.) Mitt.

5 Samples



4 samples

Hypnum cupressiforme Hedw.

12 samples

Abietinella abietina (Hedw.) M. Fleisch.

14 samples



The concentrations of 41

 elements in moss samples
 was determined by means of
 neutron activation analysis
 (NAA) using REGATA
 facility in the IBR-2 (JINR)

 The amount of Cd, Cu and Pb in the moss samples was determined using atomic absorption spectroscopy (AAS) Factor Loadings, Factor 1 vs. Factor 2 vs. Factor 3 Rotation: Varimax normalized Extraction: Principal components

1600.0



For date analysis multivariate statistics was applied. • Principal component analysis (PCA) allowed to distinguish 4 Factors associated with

different sources.

Distribution maps of factor scores over the study area

were built

• Spline interpolation





Factor 1 is loaded with Na, Al, Sc, Ti, V, Cr, Fe, Co, Ni, Th, and U.

Mainly a combination of light and heavy crust component elements in the form of soil dust.



Factor 2 contains Cl, K, Zn, Se, Br, I, and Cu.

Possibly due to some local agricultural activity



Factor 3 includes As, Sb, and W.

The village of Uravi (Ambrolaur region, Western Georgia) a mining and chemical factory functioned during the Soviet era. Arsenic has been mined and processed there for almost 60 years.



Factor 4 is represented by Ca, Cd, Pb, and Br.

### Possibly due to local anthropogenic activity



High concentration of arsenic was observed in one single location in 2016. However, all other arsenic measurements showed no anomalies.

Uravi arsenic mining sites were abandoned in 1992, approximately 100,000 tons of wastes containing arsenic were left in surface areas.

## Conclusions

- Moss biomonitoring provides a cheap and efficient method to deposition analysis for the identification of areas at risk from atmospheric deposition fluxes of heavy metals
- Considerable potential ecological risk for Arsenic still exist in the environs of the village Uravi.
- The obtained data might be used as a baseline data for the air pollution deposition and follow up any possible dynamics of the air quality in Georgia.

# Thank you for attention!