Trace and rare earth elements of Sphagnum mosses from the Upper Harz Mountains (Germany)

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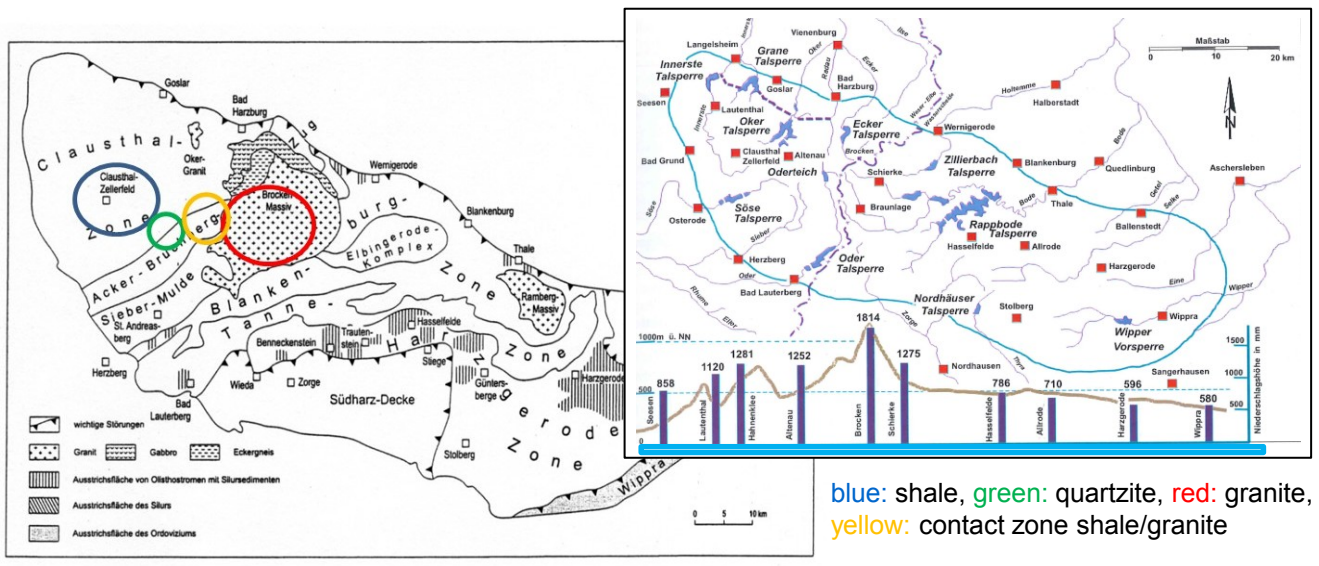
Peat bog ***Goethemoor*** and Mount ***Brocken*** (1142 m)

Study Area

Geology & sampling areas (Bachmann et al. 2008)
Elevation & precipitation (Tonn 2002)



blue: shale, green: quartzite, red: granite,
yellow: contact zone shale/granite

Herbarium

Introduction & Methods

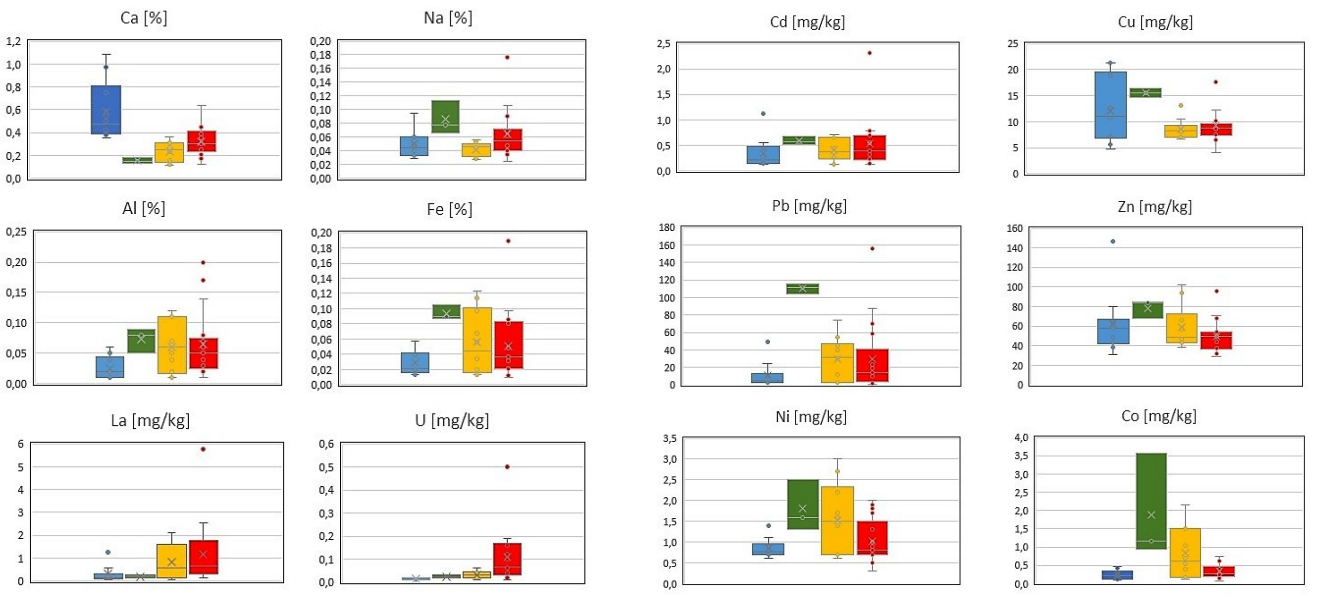
Trace elements concentrations of Sphagnum mosses are used for the estimation of atmospheric deposition (e.g., Anicic et al., 2009; Wojtun et al., 2013). But rock-water-plant interactions cannot be excluded as a second potential source of trace elements in Sphagnum mosses (e.g., Halbach et al., 1980).

To differ between these two processes Sphagnum samples of the Harz Mountains were collected at several geological units (shale, quartzite and granite) and rising elevations of the mountain range in 2017 and 2018. The samples were carefully washed to remove dust and soil particles, ground, digested with aqua regia and analysed for main components, REE and trace metals by ICP-MS.

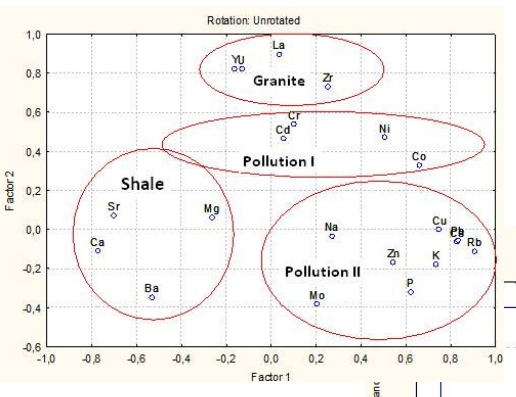
Results & Conclusions

First results and statistical analyses (cluster and factor analyses) do not allow for the clear identification of elements reflecting rock-water-plants interactions and/or atmospheric depositions. In contrast to the results of Zechmeister (1984), the rising elevation of the mountain range combined with increasing rain amounts is not reflected in the investigated samples.

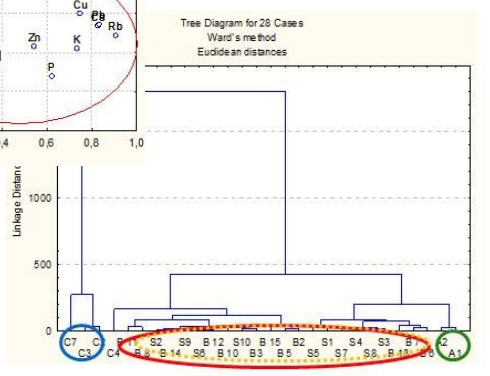
REE and U concentrations of the mosses sampled on granite are generally higher than the concentrations of samples from the other geological units. Therefore, REE and U could be tracers of the geological units where the mosses were sampled. However, local inputs of soil and rock particles to atmospheric dust can also contribute to the measured concentrations of mosses. Compared to data from Poland and samples analysed about 25 years ago, single trace metal concentrations (e.g., Fe and Pb) have decreased. Our results confirm the conclusions of Aboal et al. (2010) that atmospheric deposition cannot be accurately estimated from the concentration of metals in moss tissues. Further studies (e.g., artificial moss samples, isotope ratios) and the investigation of other study areas with different rocks and climatic conditions (e.g., sea water contribution to rain water) are needed to provide distinct tracers for atmospheric deposition and rock-water-moss interaction.

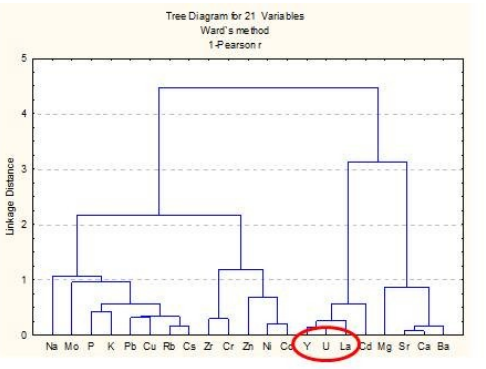


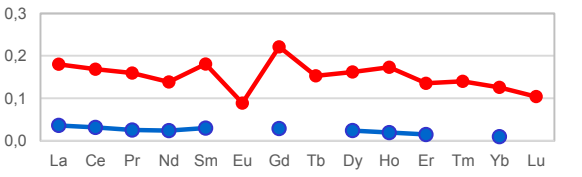
Concentrations of mosses from different geological units of the Harz Mountains (blue: shale, green: quartzite, red: granite, yellow: contact zone shale/granite)



Statistical analyses of the Sphagnum mosses from the Harz Mountains collected in 2018







REE pattern of mosses [sample/NASC]
red: granite, blue: shale

Trace metal concentrations of Sphagnum mosses (different species) from Poland and Germany collected from 1986 until 2018

	Bystrzykie Mts. (Wojtun et al., 2013) n = 50		Erzgebirge (Bozau, 1995) n = 6	Harz (Bozau, 1995) n = 2	Harz n = 40	Rhön n = 2
mg/kg	1986	2011	1992/3	1992	2017/18	2017
Cd	0.8	0.3	1.2	0.9	0.5	0.1
Co	0.3	0.4	1.5	1.3	0.6	0.2
Cr	0.9	0.3	4	2	2.5	1.8
Cu	9.0	4.7	10	16	10	10
Fe	661	290	3000	1300	500	200
Mn	50	114	76	210	136	163
Ni	2.6	1.0	6	4	1.2	0.9
Pb	65	7.0	150	140	31	1.5
Zn	71	10	80	92	57	51

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