

A quantitative field based study of basalt/basaltic glass weathering and its role in carbon fixation

S. R. GISLASON¹, M.I. KARDJILOV², G. GISLADOTTIR²,
E. S. EIRIKSDOTTIR,¹ B. SIGFUSSON¹, S. ELEFSEN³,
A. SNORRASON³ D. WOLFF-BOENISCH¹, E. OELKERS⁴
AND P. TORSANDER⁵

¹Science Institute, University of Iceland, Reykjavík, Iceland
(sigrg@raunvis.hi.is, ese@raunvis.hi.is, bergusi@hi.is,
boenisch@hi.is)

²Department of Geology and Geography, University of
Iceland, Reykjavík, Iceland; (marin@hi.is, ggisla@hi.is)

³National Energy Authority, Grensasvegi 9, 108 Reykjavik,
Iceland (asn@os.is, soe@os.is)

⁴Géochimie: Transferts et Mécanismes, CNRS/URM 5563--
Université Paul Sabatier, 38 rue des Trente-six Ponts,
31400 Toulouse, France, (oelkers@lmtg.ups-tlse.fr)

⁵Department of Geology and Geochemistry, Stockholm
University, S-106 91 Stockholm, Sweden

The goal of this study is the quantification of basalt/basaltic glass weathering rates and its effects on CO₂ cycling and climate. The motivation for studying basalt/basaltic glass is that due to its rapid weathering rate and widespread presence on the ocean floor and in volcanic terrains it plays a significant role in the global cycling of a large number of elements and CO₂ fixation. Moreover the role of rock weathering is especially enhanced at the end of glacial epochs, when large quantities of ground rock formed beneath glaciers become exposed to the surface environment. This study focuses on chemical and mass transport in several rivers in NE- Iceland. These rivers were chosen because they 1) drain almost exclusively basalt/basaltic glass catchments, 2) experience limited but variable biological activity, 3) drain catchments of variable glacier cover and 4) are unpolluted. The total water fluxes, total organic and inorganic dissolved and suspended load mass, and the flux of elements due to sorption onto suspended load were monitored continuously over a three year period. GIS modelling was used to assess the relative importance of climate, runoff, rock age, relief, glacier and vegetative cover on these fluxes. Overall, chemical denudation rates are dominated by runoff, rock age, aqueous F concentration and sometimes weathering of sulphides. The mechanical denudation of rocks ranges from 10 to 5000 t/km²/y; it is dominated by the glaciers, and is 20 to 10,000 times higher than that of organic matter. To assess the relative carbon fixation efficiency of the various processes, the annual carbon fixation of terrestrial vegetation was estimated using above ground yield measurements of the various plant communities and below ground vegetation ratios. Carbon fixation by chemical weathering is found to be greater than the organic carbon mechanical denudation rate, which itself is significantly greater than carbon fixation by terrestrial vegetation.

Atmospheric Mercury Deposition Rates in Ombrogenic Bogs from Southern Ontario

N. GIVELET¹ AND W. SHOTYK²

¹ Institute of Geological Sciences, University of Berne,
Switzerland. (givelet@geo.unibe.ch)

² Institute of Environmental Geochemistry, University of
Heidelberg, Germany. (shotyk@ugc.uni-heidelberg.de)

To quantify the effects of human activity on atmospheric deposition of mercury in the east Canadian environment, an improved understanding of the natural concentrations, fluxes and sources of Hg is required.

Methods

Peat cores representing up to 8,000 years of organic peat accumulation were collected from three different ombrogenic peat deposits in Southern Ontario. Mercury was analysed by AAS using the protocol developed by Roos-Barracough et al. 2002. Peat profiles were dated using ²¹⁰Pb, ¹³⁷Cs and ¹⁴C.

Results

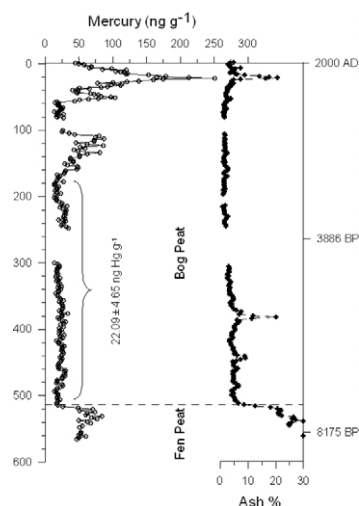


Fig. 1. Mercury concentration and ash content from Luther bog. Mean background Hg concentration in ombrogenic peat.

Discussion

Analysis of the Luther peat core show low and quite stable Hg concentrations, 14-32 ng g⁻¹, for most of the profile. The estimated average natural background deposition rate for Hg is about 0.7 µg Hg m⁻² yr⁻¹ (range of 0.5-1.5 µg Hg m⁻² yr⁻¹). For the upper layers (last 50 years), the accumulation rate is in a range of 4-32 µg Hg m⁻² yr⁻¹.

Conclusion

This study suggests that the atmospheric deposition rate in the upper layers of the 3 ombrogenic peat cores are 8-10 times greater than the pre-anthropogenic rate.

Reference

Roos-Barracough et al. (2002) *Sci. Tot. Envir.* (In press)