



Streamwater patterns in geochemically contrasting monolithologic spruce catchments

Pavel Kram and Jakub Hruska

Czech Geological Survey, Klarov 3, 118 21 Prague 1, Czech Republic (pavel.kram@geology.cz/+420 251818748)

Three small catchments (22-55 ha), each underlain by geochemically contrasting silicate rock types, were studied concurrently in the Slavkov Forest, western Czech Republic in the 2000s. The objective of this research was to compare and contrast hydrochemical patterns in sites with contrasting lithologies that can serve as examples of differing catchment sensitivity to anthropogenic acidification. The area experienced marked declines of sulfate concentrations mainly due to decreases in emissions of sulfur dioxide from fossil fuel burning and associated decreases in acidic atmospheric deposition. Catchments are situated 5-7 km apart in the region which was not glaciated. The catchments have similar altitude, area, topography, mean annual air temperature (5-6 C), atmospheric deposition fluxes, and vegetation cover (Norway spruce, *Picea abies*). Prevailing soil is Podzol at Lysina, Cambisol at Na Zelenem, and Stagnosol at Pluhuv Bor. Median discharge in the time of water sampling was 11 L/s/km² at Lysina, 10 L/s/km² at Na Zeleném, and 5 L/s/km² at Pluhuv Bor. Lysina catchment, on base-poor leucogranite, contained low concentrations of Mg (0.4 mg/L), very low pH (4.2), negative alkalinity (-60 ueq/L) and very high concentrations of toxic metals like inorganic monomeric Al (0.3 mg/L), Be (0.7 ug/L), and Hg. The opposite end-member of catchment sensitivity to acidification, Pluhuv Bor underlain by Mg-rich serpentinite, contained high streamwater concentrations of Mg (18 mg/L), exhibited the highest pH (7.6), alkalinity (+940 ueq/L) and Ni (0.1 mg/L) concentrations. Streamwater in the Na Zelenem catchment, on amphibolite, contained an intermediate amount of Mg (3 mg/L) and an elevated amount of Ca (6 mg/L) and exhibited the most balanced hydrochemical conditions with respect to base cations. Alkalinity values below the critical value for aquatic biota of +50 ueq/L was violated only in 6% of samples at Na Zelenem. Prevailing streamwater ions were Ca-Na-SO₄-Org at Lysina, Ca-Mg-Na-SO₄-HCO₃ at Na Zelenem, and Mg-HCO₃-SO₄-Org at Pluhuv Bor. Negative relationships of chemical constituents with the instantaneous discharge were observed for elements significantly influenced by weathering (Mg, Ca, Sr, Na, K, Si, bicarbonate). In contrast, constituents generated mostly in shallow soils during wet conditions exhibited a positive relationships with discharge (H⁺, dissolved organic C, dissolved organic N, nitrate, Al). Median ratios of streamwater Ca/Mg were extremely different: 0.1 (Pluhuv Bor), 2.1 (Na Zelenem) and 4.4 (Lysina). Similarly K/Mg ratio were 0.01 at Pluhuv Bor, 0.2 at Na Zelenem and 1.3 at Lysina. The MAGIC model simulated past and present streamwater and soil chemistry using a lumped representation of physical and chemical properties of the catchments. Contrasting streamwater compositions of the studied catchments were generated mainly by different chemical weathering rates of base cations (0.7-2.4 keq/ha/yr).

This contribution was supported by the European Commission (FP7 SoilTrEC 244118).