ENVIRONMENTAL IMPACT OF ACID MINE DRAINAGE IN THE TURȚ CREEK, SATU MARE COUNTY, ROMANIA

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Our goal was to investigate the mineralogical, geochemical and biological impact of acid mine drainage connected to the activity of a polymetallic ore mine. We applied different chemical and mineralogical analytical methods on special sets of samples as follows: on-site electric conductivity and pH measurements of water in several points of the Turț Creek; polarised light optical microscopy of thin sections of rocks and their (recent, brownish–yellow) encrustation collected from the creek bed; X-ray powder diffraction of rock encrustations and non-consolidated creek sediments; scanning electron microscopy combined with EDX on thin sections; Mössbauer spectroscopy of rock encrustations; inductively coupled plasma optical emission spectroscopy (ICP-OES) of water samples with special attention on 1) solved and fine-grained (below 450 nm) solid and 2) coarser (above 450 nm), but still suspended solid components of the creek water.

The biological investigations consisted of germination tests of oat seeds with polluted and non-polluted water samples collected from the creek, and control, algal toxicology test, effects on algal biodiversity, and chlorophyll fluorescence analysis with PEA fluorometer in leaflets of germinated oat seedlings (SCHREIBER *et al.*, 2000).

The Oaş Mountains represents the north-western part of the volcanic chain of the inner part of the Romanian East Carpathians. They consist of Neogene volcanic and sedimentary rocks developed – especially the volcanics – in the north-western part of the small Oaş Basin, an Eastern extreme of the Pannonian Basin. Epithermal lead and zinc ore formation was connected to the Neogene volcanic activity in the area. In the 1970s a mine was established on such an ore deposit in the valley of the Turț Creek. In 1999, as a result of some technological problems, the mine seriously polluted the by-flowing creek, and, through that creek, also the river Tur. The pollution of the creek was repeated in the summer of 2005 (in July, August and September). We sampled the area in February and in the July–September period of 2005.

The chemical and mineralogical results evidenced the presence of poorly crystallised iron oxide/sulphate phase(s), like akagenéite, ferrihydrite or schwertmannite, enriched in metals like Cu and Zn. The acid mine drainage brings into the creek excessively high amounts of solved metals (*e.g.* Cd, Zn, Cu, Pb, Fe, Ni, Sr and Co), while the low pH of the water (<3) causes extensive leaching of silicate minerals of the bottom rock and soil, resulting in a very high solved concentration of elements like Al and Si, unusual in natural waters. The soluble salts of some of these metals accumulate in aquatic micro-organisms and cause an imbalance in the ecological equilibrium of the affected aquatic habitats.

The special niche formed by acid mine drainage also represents the habitat of several bacteria and protists. We identified *Euglena mutabilis* (Ehrenberg 1838), an acidophilic protist, an indicator species (FORRAY, 2002) for environments of low pH conditions (in our case pH 2.9), high amount of total dissolved solids (TDS; in our samples: 9772 mg/l) and high electric conductivity (in our samples: 5,000–9,000 μS/cm).

As an interesting by-product of our study we found also some macroinvertebrates not described from the Turț Creek previously (*e.g.* caddisfly *Micropterna lateralis* (Stephens 1834) (Trichoptera), from an unpolluted area).

References

FORRAY, F. (2002): Studia Univ. Babeş–Bolyai, Geologia, Special Issue, 1: 189–198.

SCHREIBER, U., BILGER, W., HORMANN, H. & NEUBAUER, C. (2000): In: RAGHAVENDRA, A. S. (ed.): Photosynthesis: a comprehensive treatise. Cambridge: Cambridge University Press, 320–339.