Table 2. Multiple element contamination at Haneş (partly after Grawunder et al., in press). Soil samples were taken around the water bodies, not from the mine tailings (n.d. = not determined).

Parameter	Mine Drainage Water $[\mu g \times l^{-1}]$	Water from Basins $[\mu g \times l^{-1}]$	Soil $[mg \times kg^{-1}]$
Arsenic	289 ± 300	3.3 ± 4.7	440 ± 268 (0.6% bio-available)
Cadmium	206 ± 107	Not detected	2.6 ± 1.3 (18.7% bio-available)
Cobalt	206 ± 126	0.1 ± 0.1	12.1 ± 5.4 (8.6% bio-available)
Copper	270 ± 106	1.6 ± 1.1	151 ± 32 (10.7% bio-available)
Lead	54.9 ± 19.3	0.3 ± 0.1	886 ± 650 (7.8% bio-available)
Manganese	190,170 ± 128,230	240 ± 310	2.374 ± 1.343 (0.8% bio-available)
Nickel	390 ± 166	Not detected	21.8 ± 5.9 (10.0% bio-available)
Zinc	107,533 ± 78,318	29.1 ± 1.2	1,472 ± 1,539 (23.1% bio-available)
Sulphate	3,786 ± 2,215	20.0 ± 24.9	n. d.
pH	2.9 – 3.0	7.6 – 7.8	3.9 – 6.3

Table 3. Contamination of the mine waste of the Aurul Plant, Baia Mare (n.d. = not determined).

Element	Pond A (water) $[\mu g \times l^{-1}]$	Pond B (water) $[\mu g \times l^{-1}]$	Pond C (water) $[\mu g \times l^{-1}]$	Mine Tailing (soil) $[mg \times kg^{-1}]$	Pipeline (soil) $[mg \times kg^{-1}]$
Arsenic	12±10	1±2	22±14	478±309 (1.2% bio-available)	1,267±1,430 (0.6% bio-available)
Cadmium	Not detected	Not detected	Not detected	1.4±1.2 (29.4% bio-available)	7.6±5.4 (15.7% bio-available)
Copper	464±49	74±17	42±6	335±139 (10.0% bio-available)	349±174 (9.9% bio-available)
Lead	198±14	96±16	175±20	2,188±1,947 (9.0% bio-available)	2,352±1,067 (7.2% bio-available)
Manganese	28,400±392	53,000±2,470	1,726±108	417±291 (10.6% bio-available)	1,768±1,566 (3.9% bio-available)
Zinc	8,560±74	9,810±59	48±59	1,700±2,35 (23.3% bioavailable)	1,092±1,111 (23.1% bioavailable)
Cyanide	n.d.	n.d.	n.d.	0.1±0.2	n.d.
pH	3.8	4.9–5.4	2.9	2.8–3.6	2.6–6.3

However, several specimens of *Rana ridibunda* were observed in a pond (Pond A) next to the base of the heap (47°28.610' N, 23°28.764' E, 188 m a.s.l.) that is influenced by runoff water from the spoil heap. This observation was repeated on 26 July 2012 and 03–04 July 2013, each time during sunny weather. The vegetation surrounding the pond consisted of *Phragmites australis* (Poaceae) and *Equisetum fluvatile* (Equisetaceae), both of which are well known to be resistant to heavy metal contamination.

On 03 July 2013, more than 20 freshly metamorphosed specimens of *Bufo viridis* and about ten specimens of *Rana ridibunda*, one of them an albino, were observed in another pond (Pond B) in the centre of a mine tailing (47°37.973' N, 23°27.684' E, 185 m a.s.l.) in sunny weather. The vegetation was dominated by *P. australis* and *E. fluvatile* as well. A third pond in the centre of another mine tailing (Pond C) lacked amphibians during all three visits from 2010 to 2013. Remarkably, Pond C exhibited significantly lower concentrations of several heavy metals than either Pond A and B, but its pH was highly significantly lower (2.9 vs. 3.8 and 5.2). Data on the water chemistry of these ponds are shown in Tab. 3.

On 15 June 2010, several small ponds and puddles filled with rainwater were found on the side of a road paralleling

Table 4. Concentrations of selected metals at the Gyögyösoroszi zinc-lead mine. Data after Földessy et al. (2005) (n.d. = not determined).

Parameter	Acid mine drainage $[mg \times l^{-1}]$	Neutralised mine drainage $[mg \times l^{-1}]$	Lime sludge $[mg \times kg^{-1}]$	Flotation tailings $[mg \times kg^{-1}]$
Arsenic	236	n.d.	n.d.	325
Cadmium	n.d.	< 0.02	102	17
Lead	< 25.0	< 0.05	146	1,212
Zinc	17.5	17	29,000	2,898

the pipeline that contaminates the soil below. At least three of these were inhabited by one or two apparently healthy *Bombina variegata* each (47°38.966' N, 23°29.434' E, 177 m a.s.l.). This observation could not be repeated in 2012 and 2013 due to drier weather conditions,.

Gyögyösoroszi Mine

The Gyögyösoroszi zinc-lead mine is located in the Matra Mountains in northeastern Hungary (Heves province, 47°51.929' N, 19°52.376' E, 400 m a.s.l.). From 1952 through 1986, up to 150,000 t of low-grade mesothermal and epithermal ores were excavated here every year. Since 1979, the acid mine drainage produced by the mine is neutralised by the addition of lime. Thus, the surroundings of the mine are affected by (1) acid mine drainage before neutralisation, (2) mine drainage after neutralisation, (3) lime sludge as the by-product of neutralisation, and (4) flotation tailings. All these contain increased concentrations of heavy metals as shown in Tab. 4 (Földessy et al. 2005). Recently, extensive measures have been undertaken to immobilise or extract the metals by the company, Mecsek-Öko Zrt/Pécs (pers. comm. E. Mühlmann).

In spite of the contamination still present, numerous subadult specimens of *Bufo viridis* were observed on spoil heap material next to the entrance of the mine on 24 July 2012, in the late evening of a sunny day (Figure 3). The animals appeared on the excavated material at dusk; highly contaminated areas without vegetation were not avoided, but no animals were found on mud soaked with acid mine drainage.

Smolník River

At the mining villages of Smolník and Smolnícka Huta (Slovakian Ore Mountains, Košický Kraj, Slovakia), the Smolník River shows signs of heavy metal pollution, and

Figure 3. Subadult specimen of *Bufo viridis* perched on mine waste without vegetation at the Gyögyösoroszi mine.