

**Supplemental material.** Available metals [ $\mu\text{g/g}$  soil] of mobile (F1) and specifically adsorbed fraction (F2) from control soil (C) and heavy metal contaminated soils M1 and M2 measured by ESI ICP-MS or ESI ICP-OES.

|                                 | M1     |                   |                      | C            |        |                      | M2    |       |                      |
|---------------------------------|--------|-------------------|----------------------|--------------|--------|----------------------|-------|-------|----------------------|
|                                 | M1 F1  | M1 F2             | $\Sigma\text{F1+F2}$ | C F1         | C F2   | $\Sigma\text{F1+F2}$ | M2 F1 | M2 F2 | $\Sigma\text{F1+F2}$ |
| Al                              | 20.2   | 0.9               | 21                   | 3.02         | 31 ± 9 | 34                   | 1.8   | 14.2  | 16                   |
| Ca                              | 348    | 13.9              | 360                  | 7011         | 5067   | 12078                | 2033  | 399   | 2432                 |
| Cd                              | 0.04   | u.r. <sup>1</sup> | 0.04                 | 0.02 ± 0.005 | 0.2    | 0.2                  | 0.3   | 1.4   | 1.7                  |
| Co                              | 2.4    | 0.1               | 2.5                  | 0.1          | 0.3    | 0.4                  | 2.9   | 3.02  | 5.9                  |
| Cr                              | 0.03   | 0.02              | 0.05                 | 0.1          | 0.3    | 0.4                  | 0.02  | 0.09  | 0.1                  |
| Cu                              | 0.6    | 0.3               | 0.9                  | 1.1          | 0.8    | 1.9                  | 8.1   | 70.7  | 79                   |
| Fe                              | 30     | 1.6 ± 0.1         | 32                   | 4.2          | 5.1    | 9                    | u.r.  | 1.6   | 1.6                  |
| Mg <sup>2</sup>                 | 131    | 6.8               | 138                  | 98.9         | 490    | 589                  | 347   | 32.1  | 379                  |
| Mn                              | 92.4   | 4.3               | 97                   | 68.3         | 161.3  | 230                  | 220   | 99.7  | 320                  |
| Ni                              | 1.8    | 0.2               | 2                    | 0.2          | 0.3    | 0.5                  | 2.6   | 3.5   | 6                    |
| P                               | u.r.   | u.r.              | -                    | 16           | u.r.   | 16                   | u.r.  | u.r.  | -                    |
| S                               | 10 ± 5 | u.r.              | 10                   | 75           | 23.5   | 99                   | 327   | 151.6 | 479                  |
| Si                              | 14.7   | 12                | 27                   | 57           | 138    | 195                  | 47    | 46.1  | 93                   |
| Sr                              | 1.4    | 0.09              | 1.5                  | 47           | 20.1   | 67                   | 15.2  | 4.5   | 20                   |
| U                               | 0.06   | 0.7               | 0.8                  | 0.02         | 0.04   | 0.1                  | 0.2   | 171   | 171                  |
| <sup>3</sup> $\Sigma\text{REE}$ | 2.83   | 0.98              | 3.8                  | 0.095        | 0.26   | 0.3                  | 0.01  | 0.57  | 0.6                  |

<sup>1</sup>u.r.: under range; <sup>2</sup>metals included into biominerals are printed in bold; <sup>3</sup> $\Sigma\text{REE}$ , combined values for all rare earth elements; ranges of standard deviation are color coded: white, < 1 %; light grey, < 10 %; grey, >10 %; at values >20 %, the deviations are shown; (n=3)