Corrigendum

Corrigendum to "Metal scarcity and sustainability, analyzing the necessity to reduce the extraction of scarce metals" [Resour. Conserv. Recycl. 93 (December) (2014) 1–8]

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The authors regret to inform the readers on an error in their article. The error concerns the boron figures in Table 2, Table 5 and Table 6. For boron, Table 2 of the publication erroneously states a 2010 extraction of 1267 * 1000 tons of boron. This should be 834 * 1000 tons of boron.

The adapted figure can be underpinned as follows.

- World production (excluding USA) in 2010 is 4080 * 1000 tons of boron concentrate (all forms)
- 90% of this amount consists of 4 ores: borax (36.5% B_2O_3), kernite (51.0% B_2O_3), calcium borate colemanite (50.8% B_2O_3) and sodium-calcium borate ulexite (43% B_2O_3).
- The content of B_2O_3 in tradable boron oxide ores produced in the USA is about 50%. We shall assume that this is similar worldwide.
- From 2005 on, USGS does not provide production figures of boron in the USA. However, on the basis of de data between 1975 and 2005 and the difference between global production in 2005 (including the USA) and global production in 2006 (excluding the USA), the production of boron (all tradable forms) in the USA in 2010 is estimated at about 1300 * 1000 tons. So the world production of boron (all tradable forms) in 2010 can be estimated at (4080 + 1300) * 1000 tons or 5380 * 1000 tons. About 50% of this is boron oxide (B_2O_3) or 2690 * 1000 tons. This matches with 834 * 1000 tons of boron (B).

The error affects the boron data in Tables 2, 5 and 6.
The corrected boron figures are included in the below tables.

Table 2
Remaining lifetime (after 2050) for exploitation of metals until depletion.

Metal	Extraction in 2010 (*1000 ton) (a)	Yearly extraction in 2050. yearly growth 3% (*1000 tons) (b)	Approximate total extraction between 2010 and 2050 (*1000 tons) (c)	Extractable Global Resources according to UNEP (2011a) (million tons) (d)	Remaining available resources in 2050 (million tons) (e)	Remaining years after 2050 until depletion (f)
B	834	2727	65,000	600	535	200

Table 5
Necessary extraction reduction rates to obtain sustainable extraction rates for 17 scarce metals. Points of departure are a sustainability period of 1000 years and EGRs of 0.01% of the amount in the top 1 km of the earth's crust.

	Extractable Global Resources (million tons)	(a) Sustainable per capita extraction rate (9 billion people, depletion in 1000 years) (g/cap/year)	(b) Present consumption of primary resources in industrial countries (b) (g/cap/year)	(c) Present world consumption of primary resources (c) (g/cap/year)	(d) Necessary extraction reduction for industrial countries (d) (%)	(e) Necessary extraction reduction for average world citizen (e) (%)
Boron	600	66.7	595	119	89%	44%

Table 6
Sensitivity of necessary extraction rate reduction for varying assumptions.

	Necessary extraction reduction for industrial countries (1000 years, 0.01%, top 1 km of earth's crust) (%)	Necessary extraction reduction for industrial countries (1000 years, 0.05%, top 1 km of earth's crust) (%)	Necessary extraction reduction for industrial countries (200 years, 0.01%, top 1 km of earth's crust) (%)	Necessary extraction reduction for industrial countries (500 years, 0.02%, top 3 km of earth's crust) (%)
Boron	89%	44%	44%	−34%

The authors would like to apologise for any inconvenience caused.