DISTRIBUTION OF ELEMENTS IN STREAM SEDIMENT

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Stream sediment is derived from the erosion and transport of soil and rock debris, and other materials within the catchment basin upstream of the sampling site. It is, thus, representative of the geochemistry of materials from the upstream drainage basin. Stream sediment was first used effectively in mineral exploration since the 1950's (Lovering *et al.* 1950, Hawkes and Bloom 1956, Boyle 1958, Webb 1958a, 1958b). Its suitability in environmental and multidisciplinary studies was recognised with the publication of the first regional geochemical atlases by the Applied Geochemistry Research Group at Imperial College of Science and Technology of the University of London (Webb *et al.* 1973, 1978). Since then many national geochemical atlases have been published in Europe using stream sediment (Plant and Ridgeway 1990, Plant *et al.* 1996, 1997). Low sample density geochemical mapping projects using stream sediment, covering large areas, were performed by Garrett and Nichol (1967), Armour-Brown and Nichol (1970), Reedman and Gould (1970), Reedman (1973), Shacklette and Boerngen (1984). An excellent review of stream sediment case studies is given by Hale and Plant (1994).

Stream sediment samples in the present FOREGS project were collected from the small catchment basin (<100 km^2), where stream water and residual soil were taken (Salminen *et al.* 2005a). Generally, recent active stream sediment from the stream bed was sampled, except in some dry streams in Mediterranean countries, where old stream sediment was collected.

It is noted that the description below refers to the new stream sediment maps in this volume, including the results from Sweden, and not to the maps in Part 1 of the Geochemical Atlas of Europe (Salminen *et al.* 2005).

In the description of element distribution in stream sediment, as for soil, the following definitions were adopted with reference to the coloured maps and the histograms in Part 1 of the Geochemical Atlas of Europe (Salminen *et al.* 2005):

- ***Low values*** group the three lowest shades of blue in the colour scale, corresponding to the range from the minimum value up to the 25th percentile, defined as "*very low*" and "*low background*" concentrations in Part 1 (Tarvainen *et al.* 2005, p.97), and
- ***High values*** group the three highest shades of red in the colour scale, corresponding to the range of values from the 75th percentile up to the maximum, defined as "*high*", "*very high*" and "*highly anomalous*" concentrations in Part 1 (Tarvainen *et al.* 2005, p.97).

Correlation coefficients were calculated with Pearson's product-moment linear correlation method (Table in electronic format on website) after deletion of outliers and subsequent pairwise deletion of absent data. For a given element (or oxide), outliers were defined here as values exceeding by a factor of 1.5 other nearby results, when all analytical results are ranked. They are generally visible on the histogram accompanying each map in Part 1 of the Geochemical Atlas. A maximum of four outliers were removed in this work for the calculation of linear correlation coefficients. A list of outliers is given for stream sediment (Table 5).

Throughout the text the following notation is used for the correlation coefficients:

- *Very strong correlation*: >0.8;
- *Strong correlation*: between 0.6 and 0.8;
- *Good correlation*: between 0.4 and 0.6, and
- *Weak correlation*: between 0.3 and 0.4.

Because of the large number of samples, even the so-called weak correlations are significant at the 0.01 confidence level.

For a discussion on the merits of correlation coefficients in this large dataset, the reader is referred to the introduction to the distribution of elements in soil.

Table 5. Outliers of the stream sediment data. Criterion: an outlier has a value exceeding by factor of 1.5 other nearby results, when all analytical results are ranked. A maximum of four outliers were removed for the calculation of linear correlation coefficients.

Sample	Country	Element	Unit	Value	Next value	Factor
N32W02S5	France	As	mg kg^{-1}	241	122	1.98
N27E05S1	Italy	Ba	mg kg^{-1}	5 000		
N37W02S4	UK	Ba	mg kg^{-1}	3 606	2 383	1.51
N27E05S1	Italy	Cd	mg kg^{-1}	43.1		
N26E14S3	Greece	Cd	mg kg^{-1}	15.8		
N34E07S1CZ	Czech	Cd	mg kg^{-1}	13.8		
N34E07S4	Czech	Cd	mg kg^{-1}	11.5	4.30	2.68
N34E04S1	Germany	Co	mg kg^{-1}	216.0	106	2.04
N26E14S5	Greece	Cr	mg kg^{-1}	3 324		
N26E14S2	Greece	Cr	mg kg^{-1}	2 786		
N31E05S1	Italy	Cr	mg kg^{-1}	2 200.00	1 267	1.74
N31E06S3	Italy	Cu	mg kg^{-1}	877		
N33E11S2	Slovakia	Cu	mg kg^{-1}	304		
N26E14S3	Greece	Cu	mg kg^{-1}	220	108	2.04
N30E02S3	France	Dy	mg kg^{-1}	78.2	51.9	1.50
N30E02S3	France	Er	mg kg^{-1}	46.0	26.3	1.75
N36E05S1	Germany	Hf	mg kg^{-1}	174	116	1.51
N27E05S1	Italy	Hg	mg kg^{-1}	13.6	1.29	10.57
N30E02S3	France	Ho	mg kg^{-1}	16.6	9.46	1.76
N30E02S3	France	Lu	mg kg^{-1}	6.04	3.65	1.65
N37W03S1	UK	MnO	%	2.37	0.99	2.39
N44E06S1	Sweden	Mo	mg kg^{-1}	117		

Table 5. Continued.

Sample	Country	Element	Unit	Value	Next value	Factor
N45E07S3	Sweden	Mo	mg kg^{-1}	82.3		
N40E03S4	Norway	Mo	mg kg^{-1}	42.6		
N42E05S4	Sweden	Mo	mg kg^{-1}	27.9	17.0	1.64
N19W10S1	Spain	Nb	mg kg^{-1}	281		
N31E01S5	France	Nb	mg kg^{-1}	127		
N40E04S4	Norway	Nb	mg kg^{-1}	122	62.0	1.97
N26E14S2	Greece	Ni	mg kg^{-1}	1 406		
N31E05S1	Italy	Ni	mg kg^{-1}	1 033		
N27E12S1	Greece	Ni	mg kg^{-1}	908		
N30E05S4	Italy	Ni	mg kg^{-1}	680	415	1.64
N35E01S2	UK	P_2O_5	%	2.47		
N35E08S3	Poland	P_2O_5	%	2.42	1.23	1.97
N27E05S1	Italy	Pb	mg kg^{-1}	5 758		
N26E14S3	Greece	Pb	mg kg^{-1}	1 484		
N37W04S5	Ireland	Pb	mg kg^{-1}	694		
N42E10S1	Finland	Pb	mg kg^{-1}	681	421	1.62
N35E01S1	UK	S	mg kg^{-1}	33 495		
N32W02S5	France	S	mg kg^{-1}	17 294	10 505	1.65
N37W04S5	Ireland	Sb	mg kg^{-1}	34.1	16.8	2.03
N28W05S1	Portugal	Sn	mg kg^{-1}	188		
N34W02S3	UK	Sn	mg kg^{-1}	175	115	1.52
N28W05S1	Portugal	Ta	mg kg^{-1}	58.4		
N19W10S1	Spain	Ta	mg kg^{-1}	20.2	9.17	2.20
N31E01S5	France	TiO_2	%	4.99	3.15	1.58
N26E14S3	Greece	Tl	mg kg^{-1}	7.90		
N31E07S1	Italy	Tl	mg kg^{-1}	5.62	2.89	1.94
N30E02S3	France	Tm	mg kg^{-1}	6.43	3.65	1.76
N46E08S4	Finland	TOC	%	34.5	21.8	1.58
N41E06S2	Sweden	U	mg kg^{-1}	98.0	59.0	1.66
N30E02S3	France	Y	mg kg^{-1}	425	257	1.66
N30E02S3	France	Yb	mg kg^{-1}	42.8	23.9	1.79
N27E05S1	Italy	Zn	mg kg^{-1}	13 866		
N26E14S3	Greece	Zn	mg kg^{-1}	10 000		
N34E07S4	Czech	Zn	mg kg^{-1}	1 513	916	1.65
N36E05S1	Germany	Zr	mg kg^{-1}	9 942	4 865	2.04

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