INAA of trace elements in marine sediment (SD-M-2/TM, Reference Material)

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Abstract

Determination by instrumental neutron activation analysis method of concentration of 41 elements in Mediterranean deep-sea sediment as "total" sample analysis as well as of 24 elements in partial digested sample has been performed.

Introduction

Trace elements analysis of marine sediments is an important problem from geochemical and environmental pollution studies point a view. This paper represent our contribution to the intercomparison run organized by the Marine Environment Laboratory of IAEA on trace element measurements of deep-sea sediment, as reference material, 121 laboratories from 51 countries have participated in this exercise and reported results for 62 elements, this intercomparison appears to be the widest one. The sediment sample was collected in July 1987 in the Mediterranean sea at a depth of 1240 meters.

Experimental

The samples and standards have been irradiated for long and short time in VVR-S reactor at 10^{11} - $3 \cdot 10^{12} n \cdot cm^{-2} s^{-1}$ flux. The measurements of gamma spectra have been made using a high resolution HPGe detector connected to the multichannel analyzer. Besides the "total" sample investigation, the analysis of simple partial extraction with IM hydrochloric acid has been performed in order to evaluate the effectiveness of different procedures for sample digestion.

Results and discussion

Our concentration values representing the arithmetic means of three separate determinations with the corresponding standard deviations are shown in Tables 1, 2 for total sample analysis (41 elements) and in Tables 3, 4 for partial digested sample (24 elements). A very hard and careful analysis for so many elements has been carried out in our laboratory. It is therefore a great satisfaction to have now the opportunity to pointed out the good or very good quality of our results on this valuable and convenient reference material for the future analyses.

Table 2.- Noncertified values of elemental concentrations in the marine sediment (SD-M-2/TM, reference material)

Element	Range of submitted means	Our values	Number of participated laborat.
Au (ppb)	6 - 110	6 ± 2	2
Cl (%)	1.560 - 1.566	1.566 ± 0.026	2
Dy (ppm)	1.68 - 3.83	2.97 ± 0.21	4
I (ppm)	34.7 - 77.0	34.7 ± 2.1	2
In (ppm)	0.133 - 69.50	0.133 ± 0.025	2
Mo (ppm)	2.70 - 3.43	3.43 ± 0.06	2
W (ppm)	1.7 - 2.4	2.4 ± 0.1	2

Table 3.- Elemental concentrations in partial digested marine sediment (SD-M-2/TM/P)

Element	Concentration	Confidence interval	Range of accepted results	Our values
Al (%)	0.32	0.204 - 0.408	0.18 - 0.56	0.344 ± 0.036
Ba (ppm)	35.9	27.3 - 41.7	27.3 - 41.7	37 ± 8
Ca (%)	12.3	10.6 - 13.9	10.6 - 13.9	13.9 ± 0.6
Co (ppm)	7.10	6.36 - 8.57	3.75 - 18.9	6.57 ± 0.64
Cr (ppm)	9.92	9.10 - 12.0	2.95 - 26.07	9.17 ± 0.46
Eu (ppm)	0.365	-	0.27 - 0.57	0.57 ± 0.06
Fe (%)	0.5136	0.430 - 0.618	0.085- 1.210	0.705 ± 0.041
K (%)	0.1565	-	0.1384- 0.1655	0.1655 ± 0.0119
La (ppm)	5.95	2.90 - 10.30	2.90 - 10.30	6.4 ± 0.5
Mn (ppm)	1003	960 - 1040	582 - 1430	946 ± 161
Na (%)	1.03	1.00 - 1.09	1.00 - 1.09	1.05 ± 0.02
Rb (ppm)	7.05	-	2.4 - 9.6	5.8 ± 0.5
Sb (ppb)	170	80 - 400	80 - 400	80 ± 3
Sr (ppm)	490	440 - 525	435 - 586	493 ± 9
V (ppm)	15.70	13.8 - 18.6	12.0 - 22.3	13.3 ± 2.3
Zn (ppm)	25.0	23.4 - 30.3	4.6 - 55.5	22.0 ± 4.4

Table 4.- Range of elemental concentrations in partial digested marine sediment (SD-M-2/TM/P)

Element	Range of submitted lab. means	Our values	Number of participated laboratories
Ce (ppm)	5.6 - 36.3	16.3 ± 1.3	5
Lu (ppm)	0.03 - 0.08	0.08 ± 0.01	3
Sc (ppm)	0.48 - 1.39	0.87 ± 0.03	6
Sm (ppm)	1.0 - 2.2	2.2 ± 0.2	4
Tb (ppm)	0.19 - 0.36	0.23 ± 0.02	3
Th (ppm)	0.23 - 0.42	0.42 ± 0.05	3
Yb (ppm)	0.35 - 0.74	0.74 ± 0.09	4
Zr (ppm)	-	27.7 ± 3.2	1