XI. CHEMICAL COMPOSITION OF SURFACE SEDIMENTS FROM THE GH77-1 AREA

Komi Kato, Tomoyuki Moritani, and Seizo Nakao

Introduction

Chemical analysis for the surface sediments obtained during the GH77–1 cruise was carried out to provide the data for evaluating the distribution of major and some minor elements in the ocean floor sediments of the Central Pacific Basin, and for examining sources of the materials. This study also aims at establishing the analytical methods for the deep sea sediments, and here we report mainly the methods tried, and the obtained analytical data, not touching so much the problem of source of the sediments, the discussion of which is left elsewhere in future examination.

Methods

Preparation of samples

Sediments containing sea water were stirred and dispersed in distilled water, were separated from water in the centrifuge, and the water was decanted. This cleansing process was repeated four or five times until no chloride ion was admitted. Then the sediments were dried, ground under the size of 200 mesh (74μ), and contained in a desiccator as the sample for analysis.

Moisture ($-H_2O$)

The sample was dried at 105–110°C, and the content was obtained from the loss in weight.

Bound water ($+H_2O$) *and carbon dioxide* (CO_2)

The sample was heated at 1,000°C, and the generated moisture and carbon dioxide were absorbed into anhydrous magnesium perchlorate and soda asbestos respectively. Then the contents were determined as increases in weight. However, the value of $+H_2O$ was obtained, in addition, by subtracting the value of $-H_2O$ from the whole moisture.

Silicon dioxide (SiO_2)

The sample was fused with sodium carbonate and boric acid, was dissolved with hydrochloric acid, and the SiO_2 was coagulated with the polymer coagulant. The precipitate, after filtration, washing, heating and weighing, was treated with hydrofluoric acid, and the main SiO_2 was determined. The subordinate SiO_2 content escaped into the filtrate solution was determined by molybdenum blue absorptometry. The total SiO_2 was obtained by summing up them.

Titanium dioxide (TiO_2)

On an aliquot of the above-said SiO_2 filtrate, the TiO_2 content was determined by diantipyrylmethane absorptometry at 390 nm absorbance.

Aluminuum oxide (Al_2O_3)

On an aliquot of the above-said SiO_2 filtrate, the Al_2O_3 content was determined by EDTA-Zinc titration method.

Table XI-1 Chemical composition of the surface sediments

No.	Sample no.		Sediment type	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	FeO (%)	MnO (%)
1	703A	G404	Deep sea clay	55.23	0.68	14.41	7.83	0.00	0.64
2	704	G375	Deep sea clay	55.25	0.63	13.91	7.50	0.00	0.61
3	705	G376	Siliceous clay	54.46	0.59	13.93	7.48	0.00	0.70
4	706	G377	〃 〃	51.85	0.56	12.63	6.50	0.00	0.66
5	711	G382	〃 〃	58.03	0.59	13.77	5.80	0.00	0.10
6	714	G385	〃 〃	42.71	0.47	10.76	5.23	0.00	0.48
7	715	G396	Calcareous ooze	0.73	0.01	1.07	0.09	0.00	0.03
8	717	G386	〃 〃	2.83	0.03	1.24	0.27	0.00	0.03
9	718	G387	Deep sea clay	54.95	0.67	14.84	7.73	0.00	0.72
10	720	G389	Siliceous clay	52.85	0.64	15.95	7.87	0.00	0.64
11	721	G390	Calcareous-siliceous clay	11.77	0.19	3.92	2.00	0.00	0.48
12	725	G394	Deep sea clay	56.82	0.59	13.95	7.11	0.00	0.92
13	726	G398	Siliceous clay	57.83	0.57	13.57	6.86	0.00	0.61
14	727	G397	Deep sea clay	54.28	0.62	13.21	7.63	0.00	1.03
15	738	G402	〃 〃 〃	54.56	0.70	15.59	7.88	0.00	0.72
16	728	P 97	〃 〃 〃	58.35	0.55	13.08	6.46	0.00	0.76
17	730	P 99	〃 〃 〃	56.53	0.64	14.64	7.45	0.00	0.72
18	732	P 101	Siliceous ooze	61.41	0.61	13.03	6.56	0.00	0.51

Ferric oxide (Fe_2O_3), manganese oxide (MnO), magnesium oxide (MgO), calcium oxide (CaO), sodium oxide (Na_2O), and potassium oxide (K_2O)

The sample was treated and evaporated to dryness with perchloride acid, nitric acid and hydrofluoric acid, and the residue was dissolved with hydrochloric acid and lanthanum chloride solution was added as the interference inhibitor. On this solution each component was determined by atomic absorption method respectively.

Phosphorous pentaoxide (P_2O_5)

The sample was decomposed with nitric acid and hydrofluoric acid, and evaporated to dryness. The residue was dissolved and acidified with nitric acid, and P_2O_5 content was determined by phospho-vanado-molybdate absorptometry at 460 nm absorbance.

Cobalt (Co), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn)

The sample was decomposed with perchloric acid and hydrofluoric acid, and eveporated to dryness. The residue was dissolved with hydrochloric acid. After adjusting the condition in similar one by adding Ca solution amounting nearly as much as the total of Al, Ca, Fe, Mg, Na, and K to the standard solution, the content of each element was determined by atomic absorption method.

Results

The results of the analysis are shown in Table XI-1. The rough examination of them indicate that the deep sea surface sediments have a consistent chemical composition as the pelagic sediment (GOLDBERG and ARRHENIUS, 1958; EL WAKEEL and RILEY, 1961; NOHARA and YOKOTA, 1978) throughout the GH77-1 area, regardless of the differences between siliceous clay or deep sea clay, and without regional differences in relation to the distribution of manganese nodules.

from GH77-1 area (Analyst: K. KATO).

MgO (%)	CaO (%)	Na_2O (%)	K_2O (%)	P_2O_5 (%)	$+H_2O$ (%)	$-H_2O$ (%)	CO_2 (%)	Co (ppm)	Cu (ppm)	Ni (ppm)	Pb (ppm)	Zn (ppm)	Total (%)
3.18	1.59	1.48	2.29	0.47	7.52	3.95	—	77	349	135	37	141	99.34
3.17	2.16	1.44	2.11	0.82	7.64	4.07	—	77	377	137	31	123	99.39
3.33	2.16	1.39	2.04	0.88	7.87	4.49	—	81	455	161	31	129	99.41
2.73	6.43	1.32	2.16	0.48	6.16	3.73	4.14	79	349	160	31	114	99.42
2.99	1.50	1.82	2.73	0.62	6.98	4.59	—	73	379	84	37	118	99.59
2.34	14.92	1.10	1.90	0.25	5.64	3.10	10.48	65	265	127	30	97	99.44
0.16	54.20	0.15	0.05	0.05	0.93	0.17	42.44	14	17	16	27	8	100.09
0.20	52.76	0.16	0.12	0.06	1.02	0.21	41.13	16	24	18	23	13	100.07
3.15	1.24	1.50	2.55	0.26	7.27	4.51	—	90	369	151	36	122	99.47
3.26	1.60	1.72	2.96	0.54	6.79	4.55	—	83	421	139	36	123	99.45
0.80	43.42	0.35	0.72	0.10	2.11	0.76	33.43	67	116	104	29	39	100.09
2.97	1.28	1.30	2.40	0.30	7.11	4.64	—	109	416	221	33	122	99.48
2.85	1.10	1.31	2.39	0.22	8.08	3.93	—	86	303	123	30	107	99.39
3.32	2.93	1.23	2.24	1.16	7.57	4.02	—	121	520	290	73	164	99.36
3.21	1.24	1.31	2.58	0.27	7.54	3.74	—	88	364	136	37	129	99.42
2.80	1.52	0.67	1.71	0.62	8.42	4.35	—	88	402	189	30	119	99.37
2.96	1.14	0.95	2.45	0.25	7.91	3.67	—	93	344	155	35	121	99.39
2.38	0.68	0.82	2.14	0.13	7.28	3.72	—	69	254	114	31	107	99.33

References

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