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Chemical Studies of the Shallow-water Deposits. (3) On the Chemical Constituents of the Shallow-water Deposits along the Sea-Coasts of Korea[1]

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Since the discovery of the fertilizing effect of the shallow-water deposits, we have collected many deposits along the sea-coasts of Korea and Japan and have made experiments for a long time in order to elucidate the principal causes of the fertilizing effect and to make a map of the distribution of the chemical constituents of these deposits. In this papar, the analytical results on ten kinds of samples from the sea-coast of the Korean Straits and a part of the east sea-coast are described, some of them being compared with those of muds from the west sea-coast of Korea and the western sea-coast of the Korean Straits which were reported in the previous paper. It is found that the N and Na_2O+K_2O contents of the muds reported in this paper are appreciably lower.

INTRODUCTION

M. Ishibashi, one of the authors, extended formerly his researches from the deep-sea deposits to the shallow-water deposits in order to determine the chemical constituents and at the same time to investigate the adsorption mechanism of peculiar elements in sea-water.

He supposed that if the deposits should be rich in radioactive elements such as Ra and minor or rare elements by adsorbing from sea-water, they should have the fertilizing effect. His hypothesis was verified by a test which was carried out in a large scale at the experimental field for the rice crop of Chōsen-fuji-kōgyō Co., Ltd., by employing a shallow-water deposit from the west sea-coast of Korea as a sort of earth brought from another place. The yield of unhulled rice and straw increased considerably in this test. Ishibashi analysed this deposit and found it exceedingly rich in Ra and K compared with ordinary soil[2]. Then he gathered various deposits from the main sea-coasts of Korea under the auspices of the Goverment-General of Korea at that time and instituted his researches into the analysis of them.

So far, some of the experimental results, the chemical composition of the depos-

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its from the west sea-coast of Korea and the western sea-coast of Korean Straits, has been reported[3].

In this paper, the analytical results on the samples from the sea-coast of the Korean Straits and a part of the east sea-coast of the peninsula are described.

SAMPLES

Locality is shown in Table 1.

Table 1.

Sample No.	Locality
K 12_1	Royang-ri, Kumnan-myon, Hadong-kun, Kuongsang-namdo
K 12_2	Royang-ri, Kumnan-myon, Hadong-kun, Kyongsang-namdo
K 13	Sonjin-ri, Yongkyoun-niyonmyon, Sachon-kun, kyongsang-namdo
K 14	Tupu-ri, Samsan-myon, Kosong-kun, Kyongsang-namdo
K 15	Shinjon-ri, Sanyang-myon, Tongyong-kun, Kyongsang-namdo
K 16	Kyonghwa-tong, Chinhae-ub, Changwon-kun, Kyongsang-namdo
K 17	Chedok-ri, Ungchon-myon, Changwon-kun, Kyongsang-namdo
K 18	Bangou-ri, Tong-myon, Ulsan-kun, Kyongsang-namdo
K 19_1	Pohang-tong, Pohang-ub, Yongil-kun, Kyongsang-pukto
K 19_2	Pohang-tong, Pohang-ub, Yongil-kun, Kyongsang-pukto

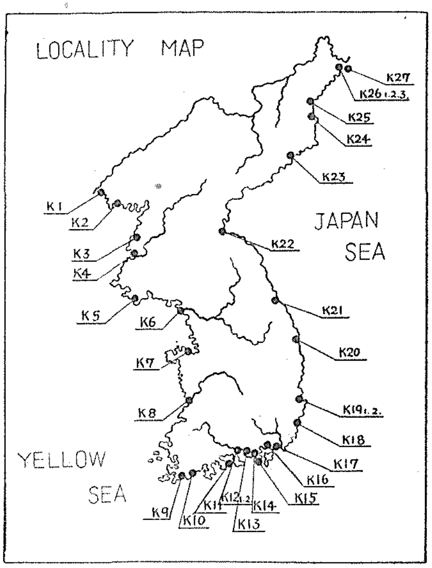

Fig. 1.

These samples are the deposits gathered in the neighbourhood of shoreline.

Types of the deposits are as follows :

K 16 : brown mud,

K 12_2, K 14, K 17, K19_1 : dark brown muds,

K 12_1, K 13, K 15 : dark brown sandy muds,

K 18 : yellow clay,

K 19_2 : light yellowish brown sand.

In these samples, K 12_2, K 13, K 15, K 16, K 17 and K 19_2 contain some shells fragments.

The geology of the land adjacent to the locations of collection is briefly as follows :

These deposits were collected from the sea-coast of the districts south of the Sobaek Mts. Though Korea consists for the most part, of gneiss of the Archeozoic era in these districts there are new strata subsequent to the Archeozoic era such as Naktong and Kyongsang Formations which consist of sandstone, conglomerate, shale, mudstone and tuff. Moreover, guartz-porphyry, granite and porphyrite intrude or inject into these strata everywhere.

EXPERIMENTAL PROCEDURE

Preparation of the Sample : The deposits were thoroughly air-dried for several days in the room protected from dust and then sifted through a sieve of 2 mm diameter. The fraction passed through the sieve was ground finely in the mortar and then used for analysis.

Drying Loss : 2 g of the sample was dried in an air-oven, heated by electricity at 105$\sim$110°C, until the weight became constant. The loss in weight represents the drying loss.

Ignition Loss : The dried smaple which had been used for the determination of the drying loss was ignited in an electric crucible furnace until its black colour disappeared completely and the weight became constant. The loss in weight represesents the ignition loss.

Method of Quantitative Anlysis : Because the analytical method of the chemical constituents is referred to in the previous paper[3], it is not repeated here.

RESULTS AND DISCUSSION

Analytical results of the air-dried samples are shown in Table 2. From this table we obtained the percentages of chemical constituents in the sea-salt-free samples dried at 105 $\sim$ 110°C as shown in Table 3*.

* We performed the correction of the sea-salt adhering to the sample on the basis of Cl value in Table 2, assuming that Cl results only from the adhered sea-salt.

Table 2. Chemical composition of the deposits.

Sample No.	$K12_1$	$K12_2$	K13	K14	K15	K16	K17	K18	$K19_1$	$K19_2$
	%	%	%	%	%	%	%	%	%	%
Drying loss	2.19	1.27	1.56	3.77	1.85	3.13	1.59	4.85	3.95	2.24
Ignition loss	4.79	7.92	4.06	5.87	3.78	4.83	5.78	6.21	7.82	3.53
Fe_2O_3	4.28	6.66	3.47	6.37	6.50	8.39	6.29	5.61	7.30	2.72
Al_2O_3	12.16	15.27	9.00	15.58	10.49	13.06	12.12	17.75	15.92	12.65
MnO	0.03	0.09	0.03	0.05	0.05	0.10	0.09	0.03	0.03	0.05
CaO	1.67	3.81	5.17	1.03	1.89	2.06	6.75	1.06	2.77	5.85
MgO	0.85	2.32	1.17	1.54	1.20	1.39	1.36	1.22	3.14	0.99
K_2O	2.58	2.25	1.67	2.35	1.45	2.06	1.06	2.55	2.35	1.77
Na_2O	2.79	2.46	1.66	2.37	1.54	1.40	2.12	1.99	2.72	2.24
SiO_2	69.01	57.04	71.12	60.82	71.74	63.01	61.75	58.72	52.91	66.57
SO_3	0.26	0.48	0.42	1.16	0.55	0.64	0.64	0.51	1.60	0.13
Cl	0.87	1.62	0.70	0.61	0.33	0.74	0.73	0.80	1.15	0.70
P_2O_5	0.08	0.10	0.07	0.14	0.08	0.13	0.13	0.07	0.18	0.06
CO_2	—	1.38	2.46	—	0.67	—	3.07	—	—	3.18
N	0.07	0.12	0.07	0.10	0.05	0.04	0.08	0.01	0.15	0.02

Table 3. Chemical composition of the deposits on sea-salt-free and dry basis (Calculated from Table 2).

Sample No.	$K12_1$	$K12_2$	K13	K14	K15	K16	K17	K18	$K19_1$	$K19_2$
	%	%	%	%	%	%	%	%	%	%
Fe_2O_3	4.45	6.95	3.56	6.70	6.66	8.78	6.48	5.99	7.77	2.82
Al_2O_3	12.64	15.94	9.26	16.38	10.75	13.67	12.48	18.94	16.94	13.11
MnO	0.03	0.09	0.03	0.05	0.05	0.10	0.09	0.03	0.03	0.05
CaO	1.70	3.92	5.30	1.06	1.93	2.14	6.93	1.11	2.92	6.04
MgO	0.78	2.23	1.12	1.55	1.19	1.37	1.32	1.21	3.20	0.94
K_2O	2.66	2.31	1.70	2.46	1.48	2.14	1.07	2.70	2.47	1.81
Na_2O	2.22	1.32	1.17	2.02	1.32	0.89	1.63	1.49	1.99	1.78
SiO_2	71.71	59.54	73.19	63.93	73.54	65.96	63.60	62.67	56.30	68.99
SO_3	0.17	0.30	0.35	1.15	0.52	0.58	0.58	0.45	1.56	0.05
P_2O_5	0.08	0.10	0.07	0.15	0.08	0.14	0.13	0.07	0.19	0.06
CO_2	—	1.44	2.53	—	0.69	—	3.16	—	—	3.30
N	0.07	0.13	0.07	0.11	0.05	0.40	0.08	0.01	0.16	0.02
Na_2O+K_2O	4.88	3.63	2.87	4.48	2.80	3.03	2.70	4.19	4.46	3.59
K_2O/Na_2O	1.20	1.75	1.45	1.22	1.12	2.40	0.66	1.81	1.24	1.02

As obvious from table 3, the SiO_2 content is high in the sand or sandy muds such as K 12_1, K13, K 15 and K 19_2, being about 70 % or more, while it is low in most of the others which are muds or clay, especially low in K 19_1, being 56.30 %. The average content of SiO_2 in muds including sandy muds and clay amounts to 65.60 %. This value is slightly larger than that of 11 kinds of muds, i. e. 53.88 ~ 70.64 % and on an average 63.41 %, from the west sea-coast of Korea and the western sea-coast of the Korean Straits about which we reported in the previous paper[3].

The Fe_2O_3 content is low in K 19_2 which is sand, but high in most muds, especially high in K 16, being 8.78 %. The average content of Fe_2O_3 of these muds amounts to 6.37 %, which is slightly smaller than value of muds, i. e. 4.64 ~ 13.82 % and on an average 7.80 %, as shown in the previous report.

The Al_2O_3 content is highest in clay K 18, being 18.94 %, and higher in K 12_2, K 14 and K 19_1, where it ranges 15.94 ~ 16.94 %, while it is low in sandy muds K 13 and K 15. In general, there are comparatively many samples of low content of Al_2O_3, compared with the muds shown in the previous paper.

As for the P_2O_5 content, it is minimum in K 19_2, being 0.06 %, and maximum in K 19_1, being 0.19 %. The average value in muds amounts to 0.11 %, which is equal to that of muds in the previous paper.

The N content is less than 0.1 % in many samples. Comparing with the previous muds which are mostly 0.1 % N or more, these samples in this report are low in N on the whole.

As for alkalies, the K_2O content in this report seems to be slightly less comparing with the deposits previously shown in which it is mostly 2 ~ 3 %, namely, in this case it is less than 2 % in the samples such as K 13, K 15, K 17 and K 19_2. The Na_2O content is also less than 2 % in all the samples except K 12_1 and K 14, therefore, the Na_2O+K_2O content is considerably low in general, being less than 4 % in more than half of these samples. The average content of Na_2O+K_2O in muds amounts to 3.67 %, which is considerably lower than the values, i. e. 2.29~10.41 % and on an average 5.33 %, of the previous muds. It seems that this is mainly due to the difference of the geology of the land areas which supply the deposits.

REFERENCES

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