Chemical Studies on the Ocean. (LX)

Chemical Studies of the Shallow-water Deposits. (13)
On the Chemical Constituents of the Shallow-water Deposits along the Sea-coasts of Yamaguchi and Shimane Prefectures

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We have analysed nine kinds of the deposits collected from the sea-coasts of Yamaguchi and Shimane Prefectures. In the deposits reported in this paper, there are comparatively many sands which are exceedingly high in SiO_2 and K_2O, and low in Fe_2O_3, Al_2O_3, CaO, MgO, etc. As for the K_2O content, it is considerably high in both sands and mud.

INTRODUCTION

In the previous paper[1], we have reported the chemical composition of eight kinds of the deposits from the sea-coast of Okayama Prefecture. In this paper, the analytical results on nine kinds of deposits from the sea-coasts of Yamaguchi and Shimane Prefectures are described. In these districts, there are few places where the shallow-water deposits near the shoreline consist of muds. It is shown only in the Chart No. 152** that mud banks dry at nearly lowest low water at the sea-coast of Yanai, Yamaguchi Prefecture.

The samples in this report consist of eight kinds of sands and one kind of mud.

SAMPLES

Locality and date of sampling are shown in Table 1.

All of these samples are the deposits collected in the neighbourhood of the shoreline.

Sample 57: grayish green mud; collected by K. Mimura in the neighbourhood of the estuary of the Yanai and Tsutsuboishi Rivers.

Sample 58: grayish white sand; collected by T. Kurata at the point about 700 m east of the estuary of the Kirito River.

Sample 59: yellowish white sand containing small amounts of shell fragments; collected by T. Shiraishi at the sea-coast of Ninomasu.

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** Issued by the Japanese Hydrographic Office in 1926.

Table 1.

Sample No.	Locality	Date
57	Yanai-machi, Kuga-gun, Yamaguchi Prefecture	Aug. 19, 1948
58	Shinzaki, Higashitoyoi, Kudamatsu-shi, Yamaguchi Prefecture	Sept. 12, 1947
59	Ninomasu, Nakanoseki-machi, Hōfu-shi, Yamaguchi Prefecture	Sept. 3, 1947
60	Kiwaura, Higashikiwa-mura, Yoshiki-gun Yamaguchi Prefecture	Aug. 10, 1947
61	Matsuoda, Shimonoseki-shi Yamaguchi Prefecture	Sept. 24, 1947
62	Ōhibi, Senzaki-machi, Ōtsu-gun, Yamaguchi Prefecture	Aug. 25, 1948
63	Uku, Nago-machi, Abu-gun, Yamaguchi Prefecture	Aug. 16, 1947
64	Asari-mura, Naka-gun, Shimane Prefecture	Aug. 19, 1947
65	Yasugi, Yasugi-machi, Nogi-gun, Shimane Prefecture	Aug. 22, 1948

Sample 60: yellowish white sand containing small amounts of shell fragments; collected by Y. Okamoto at the point about 500 m southwest of the estuary of the Hamada River.

Sample 61: light brownish gray sand; collected by S. Nakayama at the sea-coast of Matsuoda.

Sample 62: light brown sand containing comparatively many gravels; collected by T. Watanabe at the sea-coast of Ōhibi.

Sample 63: grayish sand containing many shell fragments; composite of two kinds of sands which were collected by B. Tsuchida at the points about 300 m and 500 m southeast of the Koisonohana.

Sample 64: yellowish white sand; collected by T. Yamamoto at the point about 700 m west of the estuary of the Higashi River.

Sample 65: brown sand containing shell fragments; collected by N. Ozawa

Table 2. Size composition of the deposits.

Sample No.	Mesh[a]						
	>8	14	28	48	100	200	pan
	%	%	%	%	%	%	%
57	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
58	2	2	30	45	15	5	1
59	6	10	44	25	9	5	1
60	11	28	30	25	5	1	0
61	5	21	43	19	6	4	2
62	29	12	38	16	4	1	0
63	1	3	78	17	1	0	0
64	1	16	71	12	0	0	0
65	7	5	10	28	23	22	5

[a] Tyler standard.

at the point about 200 m southeast of the estuary of the Hakuta River.

The size composition of these samples is shown in Table 2.

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

Samples 57 and 58: Quaternary formations; (granites and Ryōke metamorphics).

Sample 59: Quaternary formations; (granites and Sangun metamorphics).

Sample 60: Quaternary formations; (granites, peridotite and serpentine).

Sample 61: Quaternary formations; (granites). The Yoshida River which pours into the sea near the location, runs mainly through porphyrite, diabase, Mesozoic formations, Paleozoic formations and granites.

Sample 62: rhyolite and quartz-andesite.

Sample 63: Quaternary formations; (granites, quartz-porphyry and granite-porphyry).

Sample 64: Tertiary formations; (granites). The Gō River which flows in the neighbourhood runs mainly through quartz-porphyry, granites and liparite.

Sample 65: Quaternary formations; (Tertiary formations and granites).

EXPERIMENTAL PROCEDURE, RESULTS AND DISCUSSION

Experiments were carried out as described previously[2].

The analytical results of the air-dried samples are shown in Table 3. From this table we obtained the percentages of chemical constituents in the sea-salt-free samples dried at 105~110°C as shown in Table 4**.

There are comparatively many samples in the deposits reported in this paper, such as Nos. 59, 60, 61, 62 and 64, which are yellowish or brownish sands resembling those of Hiroshima Prefecture[4], and it is seen from Table 4 that these sands have similar chemical composition to that of the deposits from Hiroshima, being exceedingly high in SiO_2 and K_2O, and low on the whole in Fe_2O_3, TiO_2, Al_2O_3, MnO, CaO, MgO etc., strikingly contrasting to the blackish sands from Aomori and Iwate Prefectures[5] which are exceedingly low in SiO_2 and K_2O, and high in Fe_2O_3, TiO_2, MnO, CaO, MgO, etc. But, as for Sample 57, which is mud, it is considerably low in SiO_2 and high in Al_2O_3, and comparatively so in Fe_2O_3, TiO_2, MgO and the like.

Sample 63 which contains many shell fragments shows particularly different chemical composition from that of others. So, recalculating its chemical composition on the shell fragments-free basis from Table 4, following results were obtain-

* The rocks and formations which distribute in the land areas not so far from the location of collection are put in parentheses.

** We performed this calculation on the basis of the same assumption as in the previous paper[3].

Table 3. Chemical composition of the deposits.

Sample No.	57	58	59	60	61	62	63	64	65
	%	%	%	%	%	%	%	%	%
Drying loss	4.39	0.02	0.14	0.27	0.47	0.55	0.39	0.13	1.68
Ignition loss	8.24	1.66	1.08	1.02	1.17	1.99	25.26	0.63	2.92
Fe_2O_3	4.08	2.69	1.84	0.51	0.90	3.26	0.46	0.76	2.41
TiO_2	0.50	0.31	0.12	0.09	0.12	0.14	0.08	0.14	0.29
Al_2O_3	17.53	11.92	8.47	6.80	10.53	6.83	4.82	10.65	14.05
MnO	0.06	0.04	trace	0.01	0.01	0.01	0.01	0.01	0.04
CaO	1.32	2.50	1.75	1.04	0.80	0.72	29.50	1.06	1.80
MgO	1.36	1.45	0.48	0.27	0.33	0.42	1.57	0.40	0.69
K_2O	2.49	2.56	3.05	3.34	4.26	2.38	2.03	3.28	3.31
Na_2O	1.69	1.97	1.95	1.09	1.71	1.13	0.99	2.34	3.85
SiO_2	58.20	75.09	81.84	86.32	80.15	82.58	34.27	80.97	69.16
SO_3	1.24	0.17	0.09	0.07	0.12	0.10	0.63	0.07	0.31
Cl	0.77	0.30	0.04	0.24	0.41	0.13	0.28	0.07	0.44
P_2O_5	0.07	0.03	0.04	0.01	0.08	0.11	0.06	0.12	0.10
CO_2	—	—	0.60	0.40	—	—	23.60	—	0.61
N	0.08	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Table 4. Chemical composition of the deposits on sea-salt-free and dry basis (calculated from Table 3).

Sample No.	57	58	59	60	61	62	63	64	65
	%	%	%	%	%	%	%	%	%
Fe_2O_3	4.33	2.71	1.84	0.51	0.91	3.29	0.46	0.76	2.47
TiO_2	0.53	0.31	0.12	0.09	0.12	0.14	0.08	0.14	0.30
Al_2O_3	18.61	11.99	8.49	6.85	10.66	6.88	4.86	10.68	14.41
MnO	0.06	0.04	trace	0.01	0.01	0.01	0.13	0.01	0.04
CaO	1.38	2.50	1.75	1.04	0.80	0.73	29.76	1.06	1.84
MgO	1.35	1.43	0.48	0.24	0.28	0.41	1.55	0.39	0.66
K_2O	2.62	2.56	3.06	3.35	4.30	2.40	2.04	3.29	3.38
Na_2O	1.19	1.76	1.92	0.92	1.43	1.04	0.79	2.30	3.61
SiO_2	61.77	75.51	82.01	86.93	81.13	83.24	34.58	81.18	70.92
SO_3	1.22	0.14	0.09	0.04	0.07	0.08	0.61	0.06	0.27
P_2O_5	0.07	0.03	0.04	0.01	0.08	0.11	0.06	0.12	0.10
CO_2	—	—	0.60	0.40	—	—	23.81	—	0.63
N	0.08	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Na_2O+K_2O	3.81	4.32	4.98	4.27	5.73	3.44	2.83	5.59	6.99
K_2O/Na_2O	2.20	1.45	1.59	3.64	3.01	2.31	2.58	1.43	0.94

ed*: SiO_2 75.16 %, Fe_2O_3 1.00 %, TiO_2 0.17 %, Al_2O_3 10.56 %, MnO 0.28 %, etc. From these figures we can surmize that this sample consists of the sand which is comparatively high in SiO_2 and low in Fe_2O_3, TiO_2, Al_2O_3, etc.

* In this recalculation, we excluded $CaCO_3$ and $MgCO_3$ equivalent to CO_2 in Table 4, assuming it results from shell fragments only.

As for alkalies, the K_2O content is considerably high in both sands and mud, and especially high in most of the above-mentioned yellowish or brownish sands. Though it is the lowest in Sample 63, being 2.04 %, it becomes the highest, i.e. 4.43 %, when its percentage is recalculated on the shell fragments-free basis. The average K_2O content in the sands, calculated from Table 4, amounts to 3.05 %, which is lower than that of the sands from Hiroshima Prefecture, 4.38 %[4], but higher than that of the sands from other districts already reported, i.e. 2.39 % of Korea[6], 2.65 % of Ishikawa and Toyama Prefectures[2], and the like[7]. And the Na_2O content is rather low in general, being less than 2 % in many samples. The Na_2O+K_2O content ranges 2.83~6.99 %, and it is low in Samples 57, 62 and 63 and comparatively high in Samples 61, 64 and 65.

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