訂正のお知らせ

さきに配布したクルーズレポート No. 13, p. 75–88 に若干の欠陥箇所がありましたので，この論文のように訂正するとともに著者に深くお詫び致します。

地質調査所　海洋地質部

—CORRECTION—

Dear Sir,

We would appreciate if you replace kindly the article between page 75 and 88 of the Cruise Report no. 13, 1979 published by the Geological Survey of Japan, with the enclosing paper, because of erroneous printing of the former.

Marine Geology Department
Geological Survey of Japan

Complemental Print of Cruise Report No. 13, 1979
Geological Survey of Japan.

CHEMICAL COMPOSITION OF ARGILLACEOUS SEDIMENTS AROUND THE YAMATO BANK IN THE JAPAN SEA

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Introduction

The chemical composition of argillaceous sediments around the Yamato Bank in the central Japan Sea has been determined. The samples were chosen from cores which were collected during the cruise GH78-2, Geological Survey of Japan. In this chapter the chemical character of these sediments is outlined and a comparison is made with argillaceous rocks from other regions around the Japanese Islands.

Method and Result

The materials for this study (68 samples) were selected from 8 piston cores obtained during cruise GH78-2. In hand specimen they are described clay and silt. In order to prepare them for analysis the samples were dried at 80°C and subsequently ground. Each sample was analysed with an X-ray fluorescence spectometer JOEL-JSX-100 for Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K and P. The details of the method have been published (SUGISAKI *et al.*, 1977). FeO was determined with colorimetric method. The analytical methods for other elements are noted in Table XIV-1.

The results of the analyses are given in Table XIV-1. The silicate composition of the samples was recalculated by excluding carbonates, salts, water and residual materials (Table XIV-2).

Discussion

The average chemical composition and standard deviation of samples analysed in this work are given in Table XIV-3. Also given is comparison, the average composition of three representative sets from other regions around the Japanese Islands. The chemical character of these sediments is published by SUGISAKI, 1978 (Shikoku Basin and Nankai Trough), SUGISAKI and HONZA (Pacific margin of northeast Japan and Japan Trench, in prep.), SUGISAKI (Nishitsugaru Basin, in prep.).

All analysed samples are very similar in composition except with regard to TiO_2 and K_2O for which the present samples show slightly higher content than those from other regions. This may be an effect of the alkaline volcanism around the Japan Sea. Total iron oxide and MnO contents are also higher in this region, a point which will be discussed later.

Fig. XIV-1 shows the relationship between three molecules (SiO_2, Al_2O_3 and TiO_2) which are important in the examination of sediment-sources (SUGISAKI, 1978). The plot of these lie, mostly, along a line which connects two points representing averaged Japanese granite and averaged Japanese Quaternary volcanics. This facts indicate that the sedi-

Table XIV-1 Chemical composition of argillaceous sediments in weight percent.

1) Sample location is indicated as depth from the top of the core in centimeter. (For PeO_5 Read P_2O_5)
2) FeO was determined colorimetrically with O-Phenanthroline.
3) H_2O was gravitationally determined by the method of SHAPIRO and BRANNOCK (1955a)
4) $CaCO_3$ was calculated from CO_2 content which was manometrically measured by the method of SHAPIRO and BRANNOCK (1955b).
5) Residual materials were calculated by subtracting CO_2 and H_2O from ignition loss. They may contain sulfur, organic materials and others.
6) Salts was calculated from water soluble chlorine by assuming that pore water has the same composition as that of sea water.

No.	P124-1	P124-2	P124-3	P124-4	P124-5	P124-6	P125-1	P125-2	P125-3	P125-4
Location	30–35	90–95	140–145	221–226	281–286	341–346	25–30	65–70	129–134	184–189
SiO_2	55.10	56.09	55.83	53.70	53.98	56.65	54.02	46.29	57.74	54.25
TiO_2	0.55	0.54	0.60	0.62	0.62	0.63	0.62	0.58	0.69	0.68
Al_2O_3	13.52	13.23	14.60	15.43	15.15	15.21	14.83	13.89	15.26	15.84
Fe_2O_3	1.74	2.66	2.92	2.44	3.78	4.51	5.83	4.07	4.24	5.80
FeO	2.86	1.38	1.64	1.85	1.41	1.65	0.52	1.56	1.89	1.63
MnO	0.046	0.055	0.066	0.046	0.078	0.36	0.67	0.061	0.078	0.080
MgO	2.68	2.66	2.83	2.92	2.96	2.51	1.70	3.13	3.58	3.66
CaO	0.87	0.58	0.99	0.86	0.68	0.26	0.44	0.86	0.67	0.62
Na_2O	1.83	2.19	2.28	2.36	2.25	2.11	2.76	2.69	1.81	1.84
K_2O	2.61	2.57	2.74	2.79	2.84	3.04	3.00	2.79	3.38	3.33
PeO_5	0.15	0.13	0.15	0.15	0.15	0.14	0.29	0.16	0.14	0.12
$H_2O(\pm)$	9.05	7.91	8.84	8.60	8.56	6.67	9.53	15.72	6.95	8.34
$CaCO_3$	1.34	0.98	0.0	0.0	0.80	2.04	0.51	0.0	0.87	0.0
Res	2.56	3.97	2.94	4.91	2.38	2.30	0.14	0.25	0.44	0.47
Salts	4.13	4.08	4.12	4.25	3.45	3.13	4.57	6.92	3.37	4.22
Total	99.02	99.02	100.54	100.93	99.08	101.19	99.43	98.95	101.11	100.88

No.	P125-5	P125-6	P125-7	P125-8	P125-9	P125-10	P126-1	P127-1	P127-2	P127-3
Location	224–229	264–269	35–40	353–358	389–394	428–433	75–80	50–55	110–115	189–194
SiO_2	55.37	59.50	56.40	55.16	51.42	58.79	57.71	54.73	54.49	55.57
TiO_2	0.71	0.74	0.75	0.71	0.67	0.70	0.52	0.64	0.63	0.57
Al_2O_3	15.32	15.85	15.69	16.05	15.02	16.88	11.29	14.64	14.34	14.54
Fe_2O_3	3.98	3.92	4.16	4.37	3.94	4.16	4.19	3.15	3.38	3.51
FeO	2.08	1.80	1.75	1.67	2.45	1.69	1.24	1.61	1.43	1.41
MnO	0.069	0.067	0.058	0.058	0.064	0.070	0.038	0.055	0.086	0.61
MgO	3.010	3.26	2.83	3.46	3.20	3.12	1.25	2.88	2.59	1.99
CaO	0.55	0.51	0.72	1.05	0.91	0.73	2.18	1.03	0.37	0.085
Na_2O	1.94	1.76	1.51	2.15	2.33	2.02	0.56	2.19	2.32	3.60
K_2O	3.36	3.44	3.34	3.23	3.19	3.41	3.17	2.74	2.72	2.89
PeO_5	0.13	0.14	0.13	0.13	0.14	0.13	0.094	0.13	0.14	0.15
$H_2O(\pm)$	6.21	5.43	6.59	8.33	7.55	6.07	3.29	8.83	7.85	8.60
$CaCO_3$	0.90	1.21	1.45	0.0	0.78	0.0	9.23	0.0	2.47	1.56
Res	3.83	0.03	1.47	0.34	5.40	0.20	0.79	1.84	1.81	2.58
Salts	1.66	2.20	2.56	3.79	3.37	3.07	3.54	4.61	4.40	3.29
Total	99.11	99.860	99.40	100.49	100.43	101.04	99.09	99.09	99.02	100.96

No.	P127-4	P127-5	P127-6	P127-7	P127-8	P128-1	P128-2	P128-3	P128-4	P128-5
Location	264–269	324–329	401–406	451–456	501–506	47–52	90–95	140–145	155–160	205–210
SiO_2	52.68	52.87	50.45	55.54	56.80	60.45	63.52	58.40	60.27	60.77
TiO_2	0.63	0.66	0.64	0.68	0.64	0.68	0.43	0.66	0.39	0.71
Al_2O_3	15.03	15.18	14.16	15.72	14.97	14.73	13.65	15.77	8.17	16.72
Fe_2O_3	3.96	4.00	4.52	4.23	3.22	3.47	2.95	3.89	2.78	3.72
FeO	1.68	1.92	2.09	2.03	1.69	1.43	1.05	1.48	1.61	1.72
MnO	0.82	0.10	0.077	0.079	0.065	0.053	0.041	0.034	0.021	0.034
MgO	0.10	3.21	2.86	3.40	2.71	2.43	2.15	3.52	2.48	3.40
CaO	2.15	0.75	0.22	1.40	0.90	0.71	0.93	0.76	0.72	0.099
Na_2O	1.39	1.78	1.50	2.09	1.97	2.25	2.71	1.95	1.12	1.74
K_2O	3.02	3.18	2.96	3.22	2.85	3.36	3.26	3.56	1.86	3.52
PeO_5	0.15	0.13	0.13	0.14	0.14	0.12	0.079	0.10	0.073	0.11
$H_2O(\pm)$	6.57	6.68	8.85	6.45	6.10	5.52	5.20	6.56	7.94	4.05
$CaCO_3$	0.0	2.66	8.47	1.21	2.35	0.82	0.51	0.0	0.0	1.50
Res	4.21	2.56	2.90	2.31	2.83	0.59	0.21	0.71	5.50	0.96
Salts	5.79	3.40	2.54	2.53	2.69	2.32	2.22	2.91	5.90	2.11
Total	99.08	99.07	102.36	101.03	99.92	98.94	98.92	100.30	98.82	101.16

No.	P128-6	P128-7	P128-8	P128-9	P128-10	P128-11	P129-1	P129-2	P129-3	P129-4
Location	255–260	330–336	360–365	440–446	480–485	515–520	22–27	70–75	110–115	170–175
SiO_2	62.00	59.89	62.22	61.55	51.17	54.90	40.46	54.59	51.53	55.28
TiO_2	0.72	0.43	0.41	0.38	0.43	0.50	0.55	0.67	0.65	0.67
Al_2O_3	14.93	9.66	9.56	9.30	9.63	13.38	11.85	15.38	13.70	14.45
F_2O_3	4.30	5.03	5.26	3.97	10.44	5.09	6.03	4.03	5.09	6.79
FeO	1.41	0.83	1.64	1.14	2.12	1.38	0.35	1.66	1.94	2.09
MnO	0.041	0.034	0.031	0.033	0.063	0.039	12.77	0.068	0.20	0.13
MgO	2.29	2.35	2.53	1.74	3.48	2.96	2.84	2.77	2.32	2.35
CaO	0.53	0.49	0.42	0.37	0.040	0.50	1.57	1.25	0.97	0.86
Na_2O	1.19	1.01	0.87	1.02	1.40	1.04	1.46	1.43	1.80	1.74
K_2O	3.51	2.53	2.70	2.01	3.49	2.87	2.46	3.18	2.99	3.17
PeO_5	0.11	0.072	0.071	0.063	0.10	0.075	0.31	0.13	0.14	0.13
$H_2O(\pm)$	5.43	11.36	9.16	9.60	9.90	9.48	9.49	7.35	4.84	5.08
$CaCO_3$	0.54	0.0	0.0	0.0	0.57	0.0	0.0	1.29	7.50	0.47
Res	1.86	2.63	0.92	5.21	4.47	3.61	2.40	0.38	3.44	5.90
Salts	1.99	3.70	2.98	2.86	1.70	3.32	6.17	4.68	2.88	2.05
Total	100.84	100.01	98.77	99.25	99.00	99.14	98.71	98.85	100.00	101.15

No.	P129-5	P129-6	P129-7	P129-8	P129-9	P129-10	P129-11	P130-1	P130-2	P130-3
Location	206–211	256–261	296–301	346–351	395–400	427–432	486–491	0–5	55–60	65–70
SiO_2	57.10	54.03	56.61	58.65	57.91	51.38	61.44	59.84	58.29	59.87
TiO_2	0.71	0.64	0.70	0.71	0.78	0.69	0.51	0.59	0.57	0.63
Al_2O_3	15.44	13.18	15.55	16.39	16.16	14.53	14.02	14.44	13.84	14.72
Fe_2O_3	4.79	6.10	4.65	3.15	3.99	4.45	2.70	5.86	6.31	2.76
FeO	1.91	1.75	1.82	2.34	1.75	2.61	2.64	0.18	0.21	1.53
MnO	0.15	2.89	0.14	0.12	0.11	0.24	0.12	1.51	1.25	0.073
MgO	2.71	1.52	2.71	2.52	2.48	2.28	1.24	1.74	1.64	2.19
CaO	0.67	0.54	2.52	2.20	1.98	2.09	0.75	1.18	0.89	1.12
Na_2O	1.70	2.72	1.38	1.65	1.40	1.07	3.68	2.05	1.64	1.83
K_2O	3.41	3.15	3.36	3.28	3.45	3.03	4.21	2.18	2.23	2.36
PeO_5	0.13	0.15	0.14	0.14	0.13	0.14	0.065	0.24	0.53	0.11
$H_2O(\pm)$	6.62	7.64	7.05	5.38	6.08	7.36	4.93	7.28	9.02	6.07
$CaCO_3$	0.62	3.00	0.79	0.99	1.26	0.86	0.0	0.0	0.34	0.0
Res	0.19	1.31	0.67	0.52	0.046	6.19	0.97	0.21	0.78	2.91
Salts	3.20	3.31	2.81	2.56	2.29	3.26	2.32	3.79	3.54	2.76
Total	99.34	101.92	100.89	100.60	99.82	100.19	99.60	101.08	101.07	98.94

No.	P130-4	P130-5	P130-6	P130-7	P130-8	P130-9	P130-10	P130-11	P130-12	P130-13
Location	90–95	100–105	110–115	121–126	150–155	202–207	252–257	302–307	352–357	394–399
SiO_2	57.04	59.37	58.24	58.54	57.72	58.94	57.08	58.06	57.64	56.03
TiO_2	0.64	0.61	0.63	0.62	0.71	0.70	0.69	0.71	0.70	0.66
Al_2O_3	14.77	14.40	14.75	14.10	14.79	15.12	14.62	14.68	14.40	13.54
Fe_2O_3	3.29	5.10	2.43	4.24	3.71	3.69	3.91	3.69	3.89	3.67
FeO	1.98	1.33	1.97	1.49	1.75	1.83	1.64	1.69	1.66	1.52
MnO	0.13	0.11	0.17	0.12	0.27	0.31	0.33	0.44	0.39	0.41
MgO	2.63	2.61	2.13	2.37	1.84	2.09	1.98	2.01	1.78	1.70
CaO	2.46	0.91	1.02	1.73	1.17	0.59	1.19	0.43	1.10	1.01
Na_2O	1.87	1.80	1.97	0.65	1.80	2.72	2.42	3.17	2.85	2.83
K_2O	2.53	2.46	2.34	2.45	3.06	3.07	2.94	2.99	2.96	2.79
PeO_5	0.18	0.11	0.12	0.15	0.13	0.14	0.14	0.14	0.14	0.13
$H_2O(\pm)$	7.12	7.32	6.58	5.87	4.94	6.01	7.56	6.36	7.47	11.92
$CaCO_3$	0.0	0.0	0.0	0.0	0.0	1.16	0.0	1.49	0.31	0.57
Res	2.12	0.37	3.39	1.70	3.13	1.64	1.74	0.96	1.91	1.15
Salts	2.80	4.24	3.24	6.44	3.97	3.13	3.13	3.18	2.88	3.15
Total	99.55	100.74	98.98	100.47	98.99	101.13	99.36	100.01	100.07	101.07

No.	P130-14	P130-15	RC-24-1	RC-24-2	RC-24-3	RC-25-1	RC-25-2	RC-25-3
Location	439–444	484–489	45–50	105–110	180–185	25–30	138–143	185–190
SiO_2	58.15	50.27	58.36	57.40	64.97	57.11	63.44	59.06
TiO_2	0.64	0.70	0.71	0.69	0.42	0.71	0.38	0.73
Al_2O_3	15.30	15.29	15.51	14.76	8.77	14.60	13.60	15.16
Fe_2O_3	2.92	4.39	4.19	5.07	3.04	4.63	2.41	3.62
FeO	2.26	1.82	1.43	1.55	1.08	1.03	1.33	1.80
MnO	0.086	0.12	0.039	0.037	0.047	0.16	0.059	0.044
MgO	2.31	2.57	2.77	2.68	1.81	2.33	1.40	2.76
CaO	1.11	0.16	0.77	0.58	0.43	0.43	0.80	0.74
Na_2O	1.83	1.43	1.21	1.17	0.46	1.54	2.04	1.51
K_2O	2.52	3.31	3.55	3.68	1.97	3.09	3.21	3.38
PeO_5	0.13	0.15	0.11	0.10	0.053	0.13	0.083	0.12
$H_2O(\pm)$	6.85	10.12	7.01	7.86	7.96	7.30	5.38	4.66
$CaCO_3$	0.0	3.05	0.0	0.0	0.0	2.00	0.67	0.80
Res	2.36	3.31	1.04	0.69	3.35	1.43	2.57	3.21
Salts	2.72	3.51	2.59	2.80	4.45	2.69	2.58	1.41
Total	99.19	100.19	99.28	99.05	98.81	99.16	99.95	99.01

Table XIV-2 Chemical composition recalculated by excluding carbonates, residual materials, water and salts in Table XIV-1.

No.	P124-1	P124-2	P124-3	P124-4	P124-5	P124-6	P125-1	P125-2	P125-3	P125-4
SiO_2	67.25	68.34	65.96	64.57	64.34	65.07	63.79	60.85	64.53	61.75
TiO_2	0.67	0.66	0.71	0.75	0.74	0.72	0.73	0.76	0.77	0.77
Al_2O_3	16.50	16.12	17.25	18.55	18.06	17.47	17.51	18.26	17.06	18.03
Fe_2O_3	2.13	3.24	3.45	2.94	4.51	5.18	6.89	5.34	4.74	6.60
FeO	3.49	1.68	1.94	2.22	1.68	1.90	0.61	2.05	2.11	1.86
MnO	0.056	0.067	0.078	0.055	0.093	0.41	0.79	0.080	0.087	0.091
MgO	3.27	3.24	3.34	3.51	3.53	2.88	2.00	4.11	3.00	4.17
CaO	1.06	0.71	1.17	1.03	0.81	0.29	0.52	1.13	0.75	0.71
Na_2O	2.23	2.66	2.70	2.84	2.68	2.42	3.25	3.53	2.02	2.10
K_2O	3.19	3.13	3.24	3.36	3.39	3.49	3.54	3.67	3.78	3.79
P_2O_5	0.17	0.16	0.18	0.18	0.18	0.16	0.34	0.21	0.16	0.14

No.	P125-5	P125-6	P125-7	P125-8	P125-9	P125-10	P126-1	P127-1	P127-2	P127-3
SiO_2	64.00	65.39	64.58	62.66	61.71	64.11	70.17	65.31	66.05	65.43
TiO_2	0.82	0.81	0.86	0.80	0.80	0.76	0.63	0.76	0.76	0.67
Al_2O_3	17.71	17.42	17.97	18.23	18.03	18.41	13.73	17.47	17.38	17.12
Fe_2O_3	4.60	4.31	4.76	4.97	4.73	4.54	5.10	3.76	4.10	4.14
FeO	2.40	1.98	2.00	1.90	2.94	1.84	1.51	1.92	1.73	1.66
MnO	0.080	0.074	0.066	0.066	0.077	0.076	0.046	0.066	0.11	0.72
MgO	3.48	3.59	3.24	3.93	3.84	3.41	1.52	3.44	3.14	2.35
CaO	0.63	0.56	0.82	1.19	1.10	0.80	2.66	1.23	0.44	0.10
Na_2O	2.24	1.93	1.73	2.44	2.80	2.20	0.68	2.62	2.81	4.24
K_2O	3.88	3.78	3.82	3.67	3.83	3.72	3.85	3.27	3.30	3.40
P_2O_5	0.15	0.15	0.15	0.15	0.17	0.14	0.11	0.16	0.17	0.18

No.	P127-4	P127-5	P127-6	P127-7	P127-8	P128-1	P128-2	P128-3	P128-4	P128-5
SiO_2	63.84	63.11	63.38	62.73	66.08	67.40	69.97	64.80	75.82	65.67
TiO_2	0.76	0.79	0.80	0.77	0.75	0.76	0.47	0.73	0.49	0.77
Al_2O_3	18.22	18.12	17.79	17.76	17.42	16.42	15.04	17.50	10.28	18.07
Fe_2O_3	4.80	4.77	5.68	4.78	3.75	3.87	3.25	4.31	3.50	4.02
FeO	2.04	2.29	2.63	2.29	1.97	1.59	1.16	1.64	2.03	1.86
MnO	0.99	0.12	0.097	0.089	0.076	0.059	0.045	0.038	0.026	0.037
MgO	1.21	3.84	3.59	3.84	3.15	2.71	2.37	3.90	3.12	3.67
CaO	2.61	0.89	0.28	1.58	1.05	0.79	1.03	0.84	0.91	0.11
Na_2O	1.69	2.12	1.88	2.36	2.29	2.51	2.99	2.17	1.40	1.88
K_2O	3.66	3.80	3.72	3.64	3.32	3.75	3.59	3.95	2.34	3.80
P_2O_5	0.18	0.16	0.16	0.16	0.16	0.13	0.087	0.11	0.092	0.12

No.	P128-6	P128-7	P128-8	P128-9	P128-10	P128-11	P129-1	P129-2	P129-3	P129-4
SiO_2	68.11	72.76	72.59	75.44	62.13	66.36	50.16	64.12	63.35	63.07
TiO_2	0.79	0.52	0.48	0.47	0.52	0.60	0.68	0.79	0.80	0.76
Al_2O_3	16.40	11.74	11.15	11.40	11.69	16.17	14.69	18.06	16.84	16.49
Fe_2O_3	4.73	6.11	6.13	4.87	12.68	6.15	7.48	4.73	6.26	7.74
FeO	1.55	1.01	1.91	1.40	2.57	1.67	0.43	1.95	2.39	2.39
MnO	0.045	0.041	0.036	0.040	0.076	0.047	15.83	0.080	0.25	0.15
MgO	2.52	2.85	2.95	2.14	4.22	3.58	3.52	3.25	2.85	2.68
CaO	0.58	0.60	0.49	0.45	0.049	0.60	1.95	1.46	1.20	0.98
Na_2O	1.30	1.22	1.01	1.26	1.70	1.26	1.81	1.68	2.21	1.98
K_2O	3.86	3.07	3.15	2.46	4.24	3.47	3.05	3.74	3.68	3.62
P_2O_5	0.12	0.087	0.08	0.077	0.12	0.091	0.38	0.15	0.17	0.15

No.	P129-5	P129-6	P129-7	P129-8	P129-9	P129-10	P129-11	P130-1	P130-2	P130-3
SiO_2	64.36	62.35	63.20	64.35	64.24	62.26	67.24	66.64	66.70	68.66
TiO_2	0.80	0.74	0.78	0.78	0.87	0.84	0.56	0.66	0.65	0.72
Al_2O_3	17.40	15.21	17.36	17.98	17.93	17.61	15.34	16.08	15.84	16.88
Fe_2O_3	5.40	7.03	5.19	3.46	4.42	5.42	2.95	6.53	7.22	3.17
FeO	2.15	2.02	2.03	2.57	1.94	3.16	2.89	0.20	0.24	1.76
MnO	0.17	3.34	0.16	0.13	0.12	0.29	0.13	1.68	1.43	0.084
MgO	3.06	1.76	3.02	2.76	2.75	2.76	1.36	1.94	1.88	2.51
CaO	0.76	0.62	2.81	2.41	2.20	2.53	0.82	1.31	1.02	1.28
Na_2O	1.91	3.14	1.55	1.82	1.55	1.29	4.03	2.28	1.87	2.10
K_2O	3.84	3.64	3.75	3.60	3.83	3.67	4.61	2.43	2.55	2.71
P_2O_5	0.15	0.17	0.16	0.15	0.14	0.17	0.071	0.27	0.61	0.13

No.	P130-4	P130-5	P130-6	P130-7	P130-8	P130-9	P130-10	P130-11	P130-12	P130-13
SiO_2	65.18	66.85	67.90	67.71	66.38	66.08	65.66	65.96	65.87	66.48
TiO_2	0.73	0.69	0.74	0.72	0.82	0.79	0.79	0.81	0.80	0.78
Al_2O_3	16.88	16.22	17.20	16.31	17.01	16.95	16.82	16.68	16.46	16.07
Fe_2O_3	3.76	5.75	2.83	4.91	4.26	4.13	4.50	4.19	4.44	4.36
FeO	2.26	1.50	2.30	1.72	2.01	2.05	1.89	1.92	1.90	1.80
MnO	0.15	0.12	0.20	0.14	0.31	0.35	0.38	0.50	0.45	0.49
MgO	3.00	2.94	2.48	2.74	2.12	2.34	2.28	2.29	2.03	2.01
CaO	2.81	1.03	1.20	2.00	1.35	0.66	1.37	0.49	1.25	1.20
Na_2O	2.14	2.02	2.30	0.75	2.07	3.05	2.78	3.60	3.26	3.35
K_2O	2.89	2.77	2.73	2.83	3.52	3.44	3.38	3.40	3.38	3.31
P_2O_5	0.21	0.12	0.14	0.17	0.15	0.16	0.16	0.16	0.16	0.15

No.	P130-14	P130-15	RC-24-1	RC-24-2	RC-24-3	RC-25-1	RC-25-2	RC-25-3
SiO_2	66.64	62.68	65.84	65.44	78.23	66.60	71.48	66.42
TiO_2	0.73	0.87	0.80	0.79	0.51	0.83	0.43	0.82
Al_2O_3	17.54	19.06	17.50	16.83	10.56	17.03	15.32	17.05
Fe_2O_3	3.34	5.47	4.73	5.78	3.66	5.39	2.72	4.07
FeO	2.60	2.27	1.61	1.77	1.30	1.20	1.50	2.02
MnO	0.099	0.15	0.044	0.042	0.057	0.19	0.066	0.049
MgO	2.65	3.21	3.12	3.05	2.18	2.71	1.57	3.11
CaO	1.27	0.20	0.87	0.66	0.52	0.50	0.91	0.83
Na_2O	2.09	1.78	1.36	1.34	0.55	1.80	2.30	1.70
K_2O	2.89	4.13	4.01	4.20	2.37	3.60	3.62	3.80
P_2O_5	0.15	0.19	0.12	0.11	0.064	0.15	0.094	0.14

Table XIV-3 Average chemical compositions of sediments and their standard deviations

	Yamato Bank area	Nishitsugaru Basin area[1]	Pacific margin of northeast Japan[2]	Pacific margin of southwest Japan[3]
SiO_2	65.80 ± 3.84	61.73 ± 1.66	64.90 ± 2.67	63.56 ± 2.16
TiO_2	0.73 ± 0.11	0.62 ± 0.05	0.58 ± 0.07	0.69 ± 0.06
Al_2O_3	16.54 ± 1.96	14.96 ± 0.75	12.83 ± 1.43	15.73 ± 0.54
Total Fe as Fe_2O_3	6.94 ± 1.54	5.43 ± 0.03	5.35 ± 0.03	5.73 ± 0.01
MnO	0.48 ± 1.95	0.065 ± 0.042	0.064 ± 0.02	0.083 ± 0.053
MgO	2.91 ± 0.71	3.07 ± 0.40	2.93 ± 0.34	2.18 ± 0.33
CaO	1.04 ± 0.65	1.80 ± 0.87	2.26 ± 1.14	1.45 ± 0.90
Na_2O	2.16 ± 0.75	2.79 ± 0.53	3.56 ± 0.41	3.13 ± 0.34
K_2O	3.47 ± 0.47	2.31 ± 0.29	2.00 ± 0.28	2.94 ± 0.38
P_2O_5	0.16 ± 0.075	0.16 ± 0.14	0.14 ± 0.12	0.13 ± 0.012

1) SUGISAKI (in prep.) 2) SUGISAKI and HONZA (in prep.) 3) SUGISAKI (1978)

ments are mostly derived from these two major components of the Japanese Islands which were chemically homogenized during sedimentary processes as observed in the regions around the Japanese Islands. Some points on the diagram deviate toward the SiO_2 apex beyond the point of the averaged granite. This is discussed in further detail below.

Briefly discussed below are some peculiar characteristics of the sediments which emerged from the present work.

$CaCO_3$: The samples from the Nishitsugaru Basin, northeast Japan Sea, do not contain calcium carbonate, even at a shallow depth, and it was thus assumed that the calcium carbonate compensation depth is shallow($\sim$500 m) in the Japan Sea (SUGISAKI, in prep.). However, calcium carbonate was detected in samples from more than half the regions covered by the survey and in water depth ranging from 640–3,230 m. Only core RC-24, (2,155 m) lacks calcium carbonate in the taken during this survey. KANAYA and INOUE (1972) stated that foraminiferal ooze in the Japan Sea exists only around the Yamato Bank, while UJIIÉ and ICHIKURA (1973) have suggested that the calcium carbonate compensation depth is around 1,500 m. Samples containing foraminiferal shells which

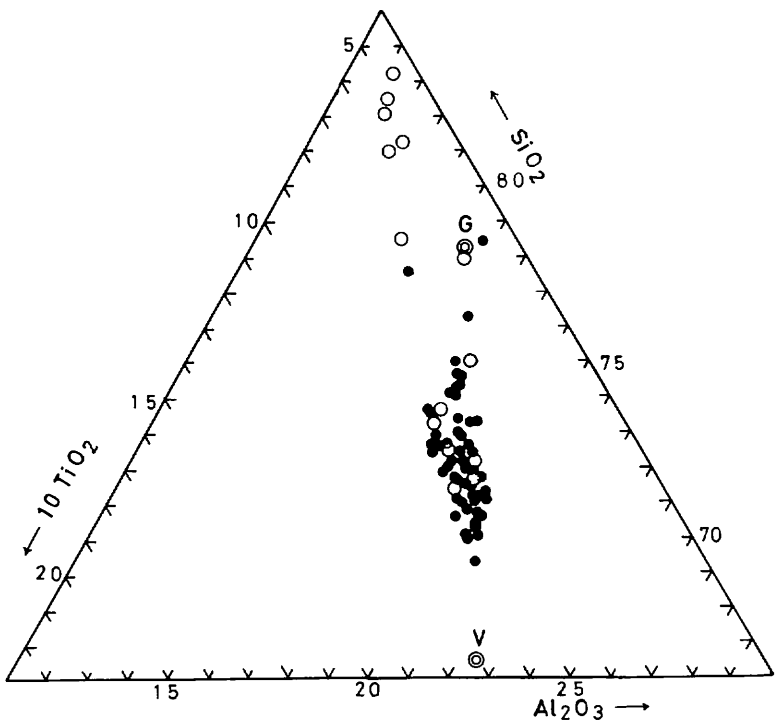

Fig. XIV-1 Relationship among SiO_2, Al_2O_3 and TiO_2. Open circles represent samples from cores of P128 and RC24, which are of the Late Neogene (See text). Double circle represents averaged Japanese rocks. G: granites (calculated from 440 analyses by Geological Survey of Japan, 1960). V: Quaternary volcanic rocks (769 analyses; SUGISAKI, 1976).

were studied by the latter authors, however were collected in the vicinity of Yamato Bank. It appears the distribution of calcium carbonates in the Japan Sea bears no relation to the depth of water but is localized around the Yamato Bank.

Fe_2O_3: Some samples in the area studied show a high Fe_2O_3 content. Total iron oxide Fe_2O_3 (averaged) is also a little higher than that of other regions as listed in Table XIV-3. Figure XIV-2 illustrates the relationship of Fe_2O_3 versus total iron oxide. The correlation coefficient of the relation is 0.908 and the regression line calculated on the basis of the least square method gives 2.01 % of total iron oxide when Fe_2O_3 is null. This value is approximately identical to the average of FeO (1.90 $\pm$ 0.58 %). The relationship cannot be inherited from the averaged Japanese rocks and explicity indicates that some amounts of iron precipitated as ferric iron in this region. Iron, like manganese, usually precipitates as ferric hydroxide in an oxidizing environment whereas, under reducing conditions, it precipitates as iron sulfide. It seems possible from the relatively higher Fe_2O_3 content that the Japan Sea was under slightly oxidizing conditions.

MnO: Manganese is abundant in certain samples. For example, the MnO content of sample No. P129-1 amounts to 12.77 %. HAMAGUCHI *et al.* (1952) reported high content of MnO in some bottom sediments of the Japan Sea. MASUZAWA and KITANO (1978) reported that high proportions of the manganese in a core from the Japan Sea was formed under a reducing condition, and that Fe_2O_3 contents bore no relation to MnO. The correlation coefficient between Fe_2O_3 and MnO in the present samples is 0.275, which

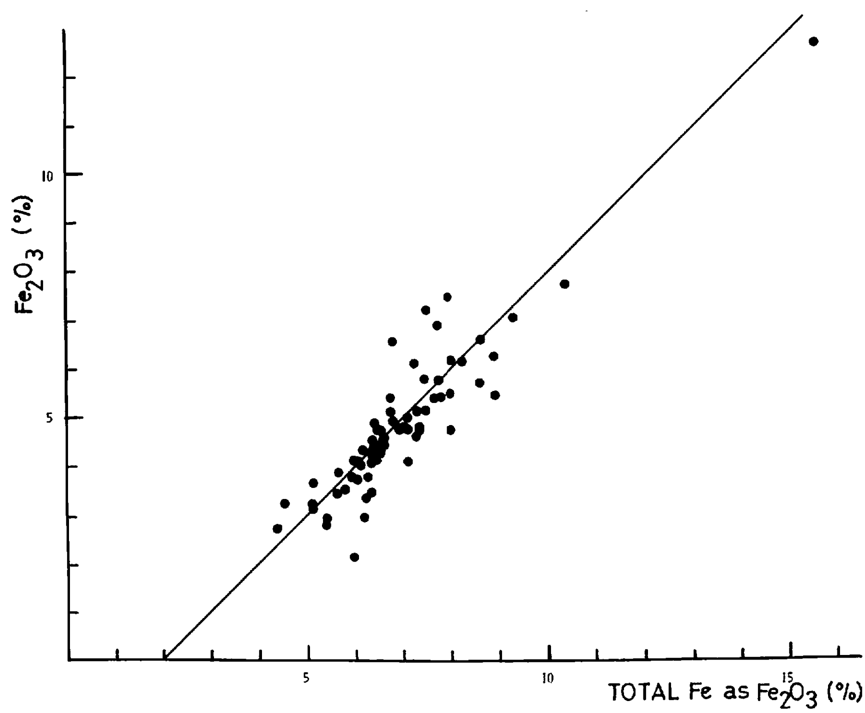

Fig. XIV-2 Relationship between Fe_2O_3 versus total iron oxide as Fe_2O_3. The regression line: Fe_2O_3 = 0.981 (total Fe) − 1.97. The correlation coefficient: 0.908.

indicates no sympathetic variation between them, although both the oxides exhibit identical characteristics under a reducung or an oxidizing environment. Attention is directed towards the high contents of Fe_2O_3, MnO and P_2O_5 and high ratio of Fe_2O_3/FeO and low FeO in the top of cores P125, P129 and P130. These three cores were taken from water depths more than 2,500 m around the Japan Basin. Ferric oxide, manganese and phosphoric iron precipitates in the surface muds of the Japan Sea were formed under oxidizing conditions.

A further aspect is the decrease in MnO and Fe_2O_3/FeO with increasing distance from below the top of the cores. This vertical distribution may be attributed to the post-depositional migration of these elements by diffusion in the interstitial solutions. Iron and manganese may have been reduced in the lower section of the core due to the decomposition of organic matter. In solution the elements may then migrate upwards and evetually become deposited in the upper zone of the core in an oxidizing environment. A similar distribution which was also ascribed to postdepositional migration of elements was observed by BONATTI *et al.* (1971) in deep sea hemipelagic sediments from the east Pacific. However, the thickness of the top oxidizing zone with concentrated MnO and Fe_2O_3 is at most 10 cm in the east Pacific whereas, in the Japan Sea, it exceeds 50 cm. This difference may stem from the more extreme reducing condition in a marginal basin such as the Japan Sea where organic material is more abundant.

SiO_2: Some samples from core P128 and RC24 show high content of SiO_2. These samples on the diagram of SiO_2–Al_2O_3–TiO_2 deviate towards the SiO_2 apex beyond

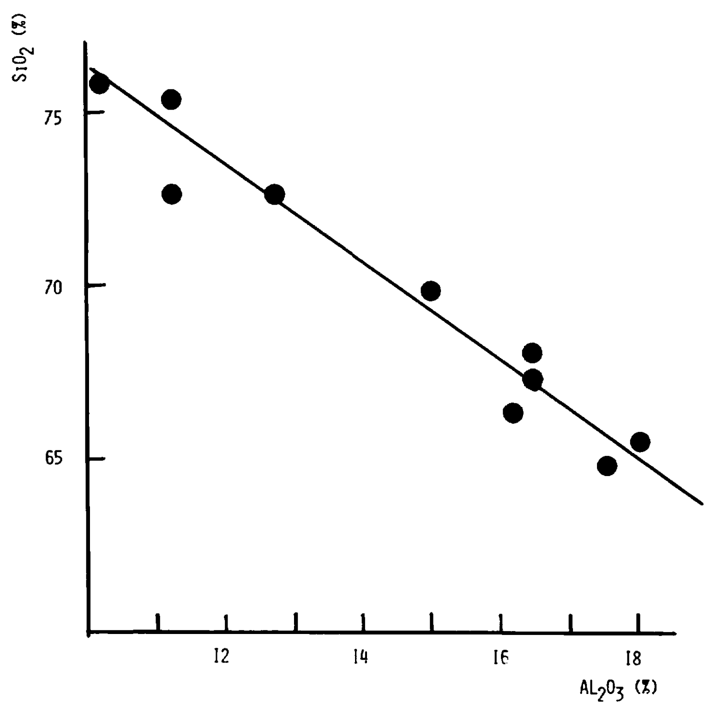

Fig. XIV-3 SiO_2–Al_2O_3 relation in core P 128. The regression line: $SiO_2 = -1.37(Al_2O_3) + 89.65$. The correlation coefficient: 0.965.

the averaged granite as previously described. This implies the precipitation of silica in these samples. In order to evaluate this possibility, SiO_2 contents of P128 were plotted against Al_2O_3 as shown in Fig. XIV-3. The correlation coefficient is 0.965. It seems evident that silica precipitates and dilutes sediments derived from the source rocks of the Japanese Islands. SUGISAKI and HONZA (in prep.) reported that large amounts of silica precipitated as diatoms occur in the sediments of the Japan Trench. Sediment-samples of IPOD from the inner wall of the Japan Trench have also high content of SiO_2 owing to the precipitation of pure silica as diatoms (SUGISAKI, in press). The regression line on Fig. XIV-3 gives the value of 89.7% in SiO_2 when Al_2O_3 is null. This seems to suggest that silica may precipitate with only a small amount of other elements as impurities.

According to the diatom-chronology by KOIZUMI (in this Report), it is reasonable to suppose that diatoms were abundant in the Japan Sea during the Late Miocene to the Late Pliocene. Furthermore, various types of diatomaceous deposits occur at several horizons of the Neogene strata in the circum-Japan Sea areas such as Noto Peninsula (OKUNO, 1952; ICHIKAWA and KASENO, 1963). It can be concluded that the core samples with high SiO_2 content had deposited under an environment favorable for diatom development during the late Tertiary.

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