On the Distribution of Organic Matter in the Nearshore Surface Sediment of Korea

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For the purpose of examining the distribution of organic matter in the nearshore surface sediments of Korea, organic carbon, nitrogen, ignition loss, chemical oxygen demand, phaeopigment and total sulphide for 117 surface sediments were measured and analyzed in February, 1993. Organic carbon and nitrogen contents ranged from 0.03% to 5.41% (average 1.08%) and from 0.01% to 0.44%(average 0.18%), respectively. The highest contents with the average 2.18% organic carbon and 0.23% nitrogen were found in the eastern part of the southern coast, while the lowest contents with the average 0.17% organic carbon and 0.03% nitrogen in Kunsan coastal area covering from Kum river to Dongjin river. The principal component analysis using all measured data distinguished the western coast from the eastern part of the southern coast clearly according to organic matter contents, that is, the degree of eutrophication in the sediments. Pusan harbor and the mouth of Masan Bay had high C/N ratio that might be resulted from the input of terrestrial sewage and industrial wastewater. A high concentration of total sulphide distinguished the surface sediment of Masan Bay from that of other areas.

Introduction

In general, organic matter in coastal sediments is derived from both autochthonous and allochthonous sources. Autotrophs continually produce organic matter *in situ*. Particularly eutrophication in Korean coastal waters has been accelerated by industrial and domestic wastes due to industrialization and urbanization from 1960's. This makes the water polluted due to the growth of phytoplankton. The excessive amounts of organic matter produced in the water column reach the bottom in the from of detritus. Organic matter contained in sediments is also formed by the deposition of particles transported to the sea from lands.

Organic matter constitutes the energy source for almost all transformations taking place in a sediment(Kennish, 1986 ; Hallberg, 1992). The flux of the inorganic compounds resulted from the transformation of organic matter in the superficial layer of sediment contributes to the development of plankton in surface waters(Daumas, 1976 ; 1990). Investigation on organic matter in sediments seems to have a greater advantage in acquiring the knowledge about the trophic level of an area because seawater has great variability by various factors.

Korean peninsula has regionally various coastal shapes. Some of coastal areas shape semi-enclosed bays and others face to open sea. Investigation on organic matter content in the sediment of the Korean coast has been conducted by some workers. Cho *et al.*(1982a, b) reported that the distribution of organic materials in the shellfish farms in Chinhae, Deukryang and Gamagyang Bays, respectively. Yang and Hong(1988) also reported the distribution of organic matter in the surface sediments and the impact of organic material degradation to oxygen consumption in the bottom water in Chinhae Bay system. Lee *et al.*(1989) analyzed the organic carbon contents in the sediments of the continental shelf and slope off the southeastern coast of Korea. However, the information available on the distribution of organic matter contents in the nearshore surface sediments of Korea is limited. Hence, the present study was carried out to determine the geographical distribution of organic matter contents in the nearshore surface sediments of Korea and some characteristics on organic matter distribution were also discussed with principal component analysis.

Materials and Methods

Survey cruise was made from Kyeonggi Bay in the western coast to Youngil Bay in the eastern coast of Korea(Fig. 1) between February 3 and February 10, 1993. The study area was divided into four major subareas conveniently : the mid-western coast(A), the southwestern coast(B), the eastern part of the southern coast(C) and Youngil Bay(D). Total 117 samples were collected in the nearshore surface sediments. Sediment samples were taken using a gravity core sampler. All sediment samples for analyses were stored in frozen from on board. In the laboratory samples for carbon and nitrogen analyses were ground after drying at 40~50℃ for 48 hours and stored in dried form in capped vials until analyzed.

Organic carbon and nitrogen in sediments were determined using a CHN analyzer(Perkin Elmer model 2400) after treatment with 2% HCl to remove calcium carbonates. Pheaopigment was determined using a spectrofluorometer(JASCO FP-550) on 90% aceton extracts with the fluorometeric analysis of Yentsch and Mentzel(1963) as modified by Parsons *et al.*(1984).

Weight loss on ignition at 450℃ for 3 hours yielded ignition loss. Total sulphide for 0.5 to 2.0*g* of moister sample was determined by the method using detection tube, Gastec ®. Chemical oxygen demand was measured by the KM_nO_4 consumption method.

Organic carbon and nitrogen data were expressed as % per dry weight of sediment and the others as weight per dry weight of sediment. Ludwing and Reynolds' package was used for principal component analysis.

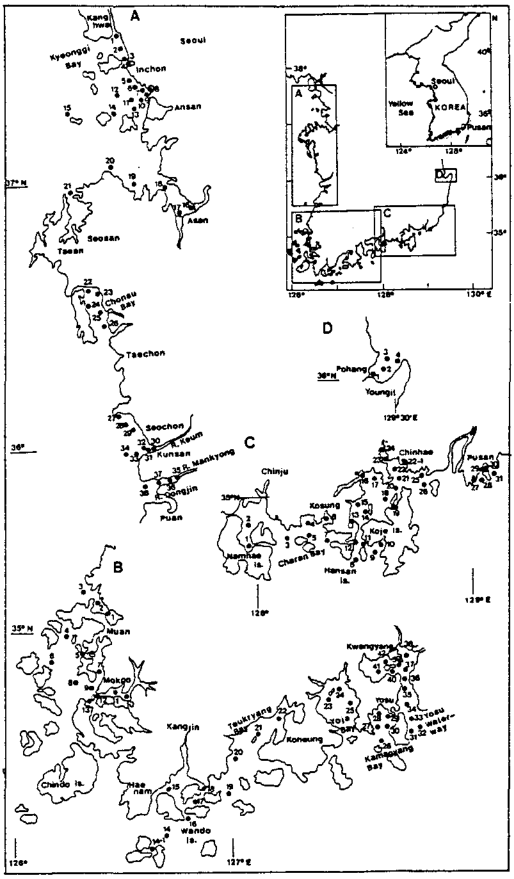

Fig. 1. Map showing the sampling sites in February, 1993.

Results

Distribution of organic matter contents

The average values of ignition loss(IL), chemical oxygen demand(COD), total sulphide(Total-S), phaeopigment, organic carbon(OC) and nitrogen content were given in Table 1. Average values of IL, COD and total sulphide were the highest in Chinhae Bay with 10.6%, 21.68*mg/g* and 1.12*mg/g*, respectively and the lowest in the coast of Kunsan with 1.4%, 3.19*mg/g* and nondetected value, respectively. Average IL content was very high in Hansan-Koje Bay, Chinhae Bay and the coast of Pusan

Table 1. Average values of ignition loss(IL), chemical oxygen demand(COD), total sulphide(Total-S), phaeopigment, organic carbon(OC) and nitrogen contents and C/N ratio in the nearshore surface sediment at each area in February 1993

Area	IL (%)	COD (*mg/g*)	Total-S (*mg/g*)	Phaeopigment (*μg/g*)	OC (%)	Nitrogen (%)	C/N ratio
Kyeonggi Bay	4.3	4.05	0.06	0.85	0.53	0.08	7.40
Asan Bay	4.4	6.20	ND	3.33	0.73	1.03	8.70
Chonsu Bay	5.7	7.08	0.28	1.50	0.74	0.11	7.84
Coast of Kunsan	1.4	3.19	ND	0.32	0.17	0.03	6.80
Hampyeng Bay	3.3	6.38	ND	0.83	0.50	0.08	6.97
Coast of Mokpo	6.2	8.41	0.06	0.91	0.63	0.09	8.53
Coast of Wando-Tuam	4.1	7.11	0.01	0.50	0.63	0.09	8.91
Teukryang Bay	6.4	12.90	0.06	1.14	0.61	0.11	8.30
Yoja Bay	6.8	14.53	0.04	1.27	0.79	0.13	7.44
Kamagyang Bay	8.6	14.91	0.46	1.91	1.01	0.14	8.84
Yosu Waterway	7.7	16.36	0.16	1.26	0.92	0.10	11.38
Kwangyang Bay	7.1	13.67	0.11	1.22	1.04	0.11	10.71
Chinju-Charn Bay	9.9	18.37	0.04	1.99	1.67	0.23	8.55
Hansan-Koje Bay	10.8	20.86	0.12	2.35	1.68	0.19	10.98
Chinhae Bay	10.6	21.68	1.12	2.03	2.36	0.26	10.73
Coast of Pusan	10.8	13.62	0.29	1.73	3.44	0.22	18.62
Youngil Bay	6.4	20.75	0.48	3.25	1.23	0.21	8.69

ND: Non detected

located in the eastern part of the southern coast with more than 10% and low in the western coast with less than 7%, Average COD value was also higher in the southern coast with more than 12 *mg/g* than in the western coast with less than about 10*mg/g*. Average total sulphide content was generally high at Chinhae Bay, Youngil Bay, Kamagyang Bay, the coast of Pusan and Chunsu Bay.

Organic carbon contents ranged from 0.03 to 5.41 % with the average 1.08% (Fig. 2). Contents were low in Areas A and B with the normal distribution of less than about 1% except for the inner Kwangyang Bay and very high in Area C with the frequent values over 2%. The lowest OC contents (<0.2%) were found from St.A28 to St.A38 near Kunsan and the highest(>3.0%) in the narrow inlets of Masan Bay(Sts.C22 and C23) and Pusan Harbour(Sts.C29, C30 and C31). Average OC content in Pusan Harbour was 3 to 20 times higher than those in the western coast.

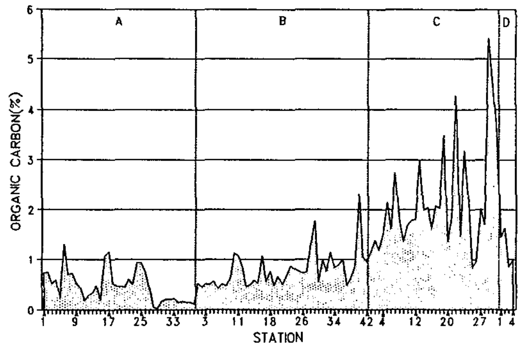

Fig. 2. Distribution of Organic carbon in the nearshore surface sediments of Korea.

Nitrogen contents in the nearshore surface sediments were distriduted in the range of 0.01 to 0.44 % (average 0.13%) and with the same pattern with OC contents(Fig. 3). Contents were very low (<0.05%) in the coast of Kunsan and relatively high(>2.0%) in Chinhae Bay, Pusan Harbour and the inner Youngil Bay. The other samples showed the intermidiate values.

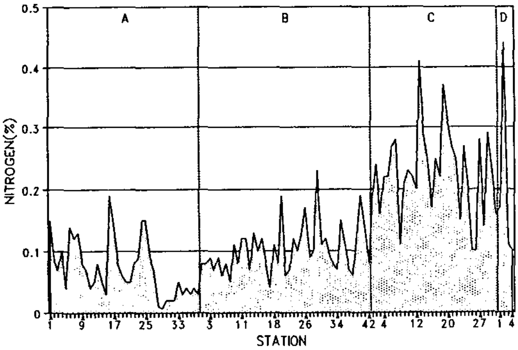

Fig. 3. Distribution of nitrogen in the nearshore surface sediments of Korea.

Distribution pattern of phaeopigment in the surface sediments followed that of nitrogen(Fig. 4). Phaeopigment contents varied from 0.14 to 7.79μg/g. The highest value was found at Sts.A16 and A17 at the inner Asan Bay and the lowest between St.A 27 and St.A38 at the coast of Kusan. Average phaeopigment content was relatively high in Youngil Bay, Hansan-Koje Bay and Chinhae Bay and more or less low in the coast of Kusan, Hampyeong Bay and the coast of Mokpo and Wando-Tuam.

The C/N ratios by atoms ranged from 4.3 to 25.7 with a mean of 9.3(Fig. 5). The C/N ratio was well-distinguished. The ratio in Pusan Harbour and the inlet of Masan Bay showed the highest and exceeded 20. At Sts.A31 and A32 of Lower Keum river, Sts.B16 and B17 of the coast of the Wando Island, Sts.C8 and C12 of the inlet of Chungmu Harbour and Sts.C22-1, C23 and C24 of Masan and Haengam Bays, C/N ratios were more than 10, while those of the other samples were lower than 10.

Principal component analysis

In an attempt to elucidate the relationships among all parameters(Appendix 1), we subjected the observations to principal component analysis. Table 2 showed the results of principal component analysis on original data. It seemed that the first

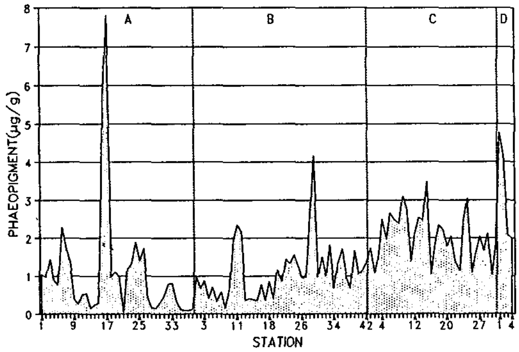

Fig. 4. Distribution of phaeopigment in the nearshore surface sediments of Korea.

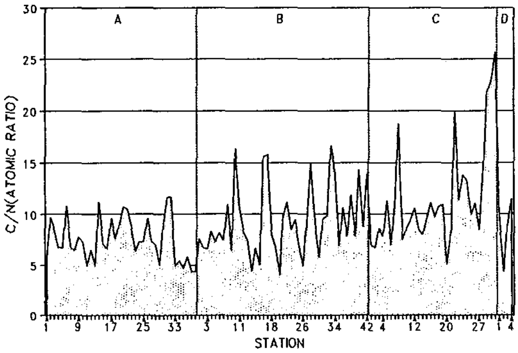

Fig. 5. Distribution of C/N ratio(by atoms) in the nearshore surface sediments of Korea.

Table 2. Principal component analysis on the original data

	COMPONENTS		
Parameter	I	II	III
IL	0.916	0.076	-0.153
COD	0.853	-0.190	0.189
Total-S	0.487	-0.088	0.841
Phaeopigment	0.690	-0.362	-0.088
OC	0.874	0.299	-0.180
Nitrogen	0.187	-0.339	-0.292
C/N ratio	0.473	0.848	0.052
Eigen value	3.936	1.104	0.895
% of variance	56.2	72.0	84.8

three components controlled the distribution characteristics of organic matter contents. Component I, II and III accounted for 84.8% of the variance in the system with the eigen value of 3.9, 1.1 and 0.9, respectively.

IL, COD, OC, nitrogen and phaeopigment, which represent the organic matter content, were positively correlated with component I. Component II was positively correlated with C/N ratio and organic carbon, but negatively correlated with phaeopigment and nitrogen. Component III was possitively correlated with total sulphide.

Discussion

The distribution patterns of organic matter contents in the nearshore surface sediments well-defined according to the degree of eutrophication. That is, the organic matter contents in Areas C and D from Chinju Bay to Youngil Bay were much higher than those in the other coasts.

Generally, the west coast of Korea is characterized by relatively strong tide and wave action. Many works on sediment transport have been carried out in relation to tidal current in the western coast (Choi, 1991; Choi *et al.*, 1992). Lee and Park (1991) reported the tidal currents played an important role in the transportation and deposition of sediments in a macrotidal bay, western coast of Korea and the calculated shear velocity of the tidal currents at sea bed exceeded the critical shear velocity for the silt particles. Organic carbon and nitrogen contents in sediments are in inverse proportion to grain size(Berner, 1981). In general, surface sediments in the western nearshore are coarser than those in the southern nearshore. From these results, it can be inferred therefore that the organic matter contents in the western coast are low.

Keum River estuarine sediments showed the lowest organic matter content in this survey area. Organic matter enters esturaries via riverine system and exports to nearshore oceanic areas with short residence time in the estuarine system by ebb-tidal flow(Kennish, 1986). In Keum Estuary, repetition of deposition and resuspension of fine sediments occur in response to the variation in current velocity associated with semidurnal tidal cycles. The increase in freshwater discharge can creat an ebb-dominant current pattern which enhanced the seaward transport of suspended sediments, resulting in the shortening of residence time of suspended materials in the esturary(Lee and Kim, 1987). The low organic contents in this esturary could be explained by little sedimentation of suspended organic materials owing to current velocity.

Of the western coast, however, the inner Asan Bay(Sts. A16 and A17) located at intertidal zone showed more or less high organic contents. High phaeopigment contents taken into consideration (Fig. 4), benthic macrophytic algae is likely to account for the organic matter contents in this area.

Organic matter contents of the sediments in Teukryang and Kamagyang Bays, located at the western part of the southern coast of Korea, were intermidiate values between the western coast and the eastern part of the southern coast. Cho *et al.* (1982a) reported that the bottom muds in these bays were in an early stage of eutrophication, unlike the Chinhae and Hansan Bays, though the water, similar to the other bays, showed a middle stage of eutrophication and a lot of arkshells were cultured in all bays. In this survey, COD, IL and total-S contents are similar to those in 1982.

In the eastern part of the southern coast large shellfish farms have been established. In the shellfish farms, eutrophication is accelated due to the accumulation of a large quantity of organic sediments in the seafloor, largely fecal materials of the shellfish(Kusuki, 1977; Cho *et al.*, 1982b; Yang and Hong, 1988; Kang *et al.*, 1993). Organic contents in the surface sediments of Chinju-Charan and Hansan-Koje Bays are very high. In the superficial mud of Hansan-Koje Bay, large amounts of COD, phaeopigment and total-S have been found in summer season since 1977(Cho and Kim, 1977). However, total-S contents were relatively low, compared to high organic matter contents in the present investigation. This implies that dissolved oxygen in the overlying water is not dificient. NFRDA(1989)'s investigation showed that dissolved oxygen concentration in the water of the bays was very high round the year.

The highest organic matter content was found in

Chinhae Bay and Pusan Harbour. Cho *et al.*(1982b) reported that great quantities of organic matters and sulphide in the innermost part of Chinhae Bay would be mainly due to excrements from shellfishes and fouling organisms, but not owing to the influence of pollutants, discharged from Masan, Chinhae Harbour and its vicinity. Yang and Hong (1988) also reported that large faecal pellets produced in shellfish farms could be easily settled down on the sediment because of weak current regime and suggested that biodegradation of organic materials in the surface sediments could be an important oxygen consuming process during summer. At the present time, the organic matter contents of the surface sediments did not show decrease over the whole area of Chinhae Bay in contrast to those in 1982 and 1988. On the other hand, organic carbon and nitrogen contents in Haengam Bay, located at the east end of Chinhae Bay, were 1.46% and 0.15%, respectively, much less than 2.37% and 0.27 % in 1988. It is likely to be result of the work for the amelioration of bottom sediments in this bay in 1991.

The distribution of organic matter content in the nearshore surface sediments was well characterized by principal component analysis. IL, COD, OC, nitrogen and phaeopigment, which represent the organic matter content, are positively correlated with component I (Table 2). Accordingly, component I is comprised of the organic matter content. Component II is positively correlated with C/N ratio and organic carbon, but negatively correlated with phaeopigment and nitrogen. Pocklington(1976) reported that marine sediments containing land-derived organic matter could be identified by high organic carbon concentration and high organic carbon relative to nitrogen. Redfield's C/N ratio for living matter is about 6.6(Redfield *et al.*, 1963). Kusuki (1977) reported that even C/N ratios of the organic content of faecal materials were between 6 and 10. These results indicate that component II might be divided by the main source of the organic matter in surface sediments.

Component III is positively correlated with total sulphide. Due to the activity of heterotrophic organisms, reducing conditions are maintained in most coastal sediments below a thin, oxidized surface layer. This stratification provides the basis of a transformation of inorganic sulphur compounds through a cyclic series of redox processes. In the anoxic sediment, sulphate is reduced to sulphide by the respiratory metabolism of sulphide reducing bacteria. Much of this sulphide is trapped in the sediment by precipitation with metal ions(Jφrgensen, 1977). Accordingly, high sulphide content repersents the reducing condition which dissolved oxygen is not provided. This indicates that component III is composed of the reducing environment.

The 117 cases are plotted in the space defined by component I-II and I-III in Fig. 6. Generally, there are three clusters in Fig. 6(a). Component I separates the left cluster from the right ones. It is obvious that the samples from the eastern part of southern coast are distinguished from those from the western coast by the degree of eutrophication.

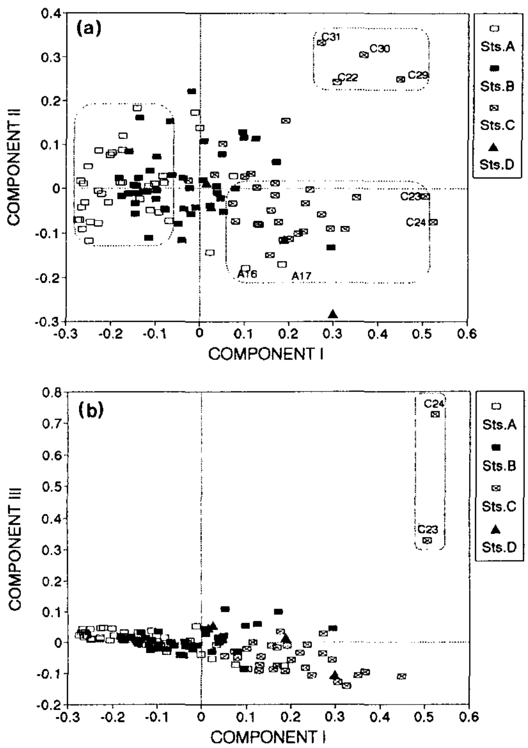

Fig. 6. Plot of first three components obtained by principal component analysis based on correlations of original data. (a), component I vs. II ; (b), component I vs. III.

The samples from the western part of southern coast intervened two lower clusters. The upper-right cluster consists of the samples from Pusan Harbour and the inlet of Masan Bay. Component II divides the samples from the eastern part of the southern coast into two clusters by the main source of organic matter. Evidently, the samples of the upper-right cluster could be identified by their deviation from the mean slope, having high quantities of carbon relative to quantities of nitrogen(Fig. 7). Pocklington(1976) reproted that the C/N ratio was a constant within a particular environment, although the mean value of the ratio was not the same for all environments and the likeliest source of highly carbonaceous organic matter is terrigenous. Therefore, these indicate that the likeliest source of organic matter of the samples from Pusan Harbour and the inlet of Masan Bay, located at the eastern part of Chinhae Bay, is terrigenous. There are large urban and insdutrial areas near Masan Bay and Pusan Harbour

In Fig. 6(b), correlativity with component I confirms that the level of eutrophication increase gradually from Area A to Area C. The samples(Sts. C23 and C24) from the inner Msan Bay are separated from the other samples by the high positive correlation with component III. This implies that anoxic condition has existed in the overlying water of the sediment in the bay for a long time. Accordingly various industrial and domestic waste waters have been entered the innerpart of Msan Bay and such a discharge of pollutants could have a significant effect on the fromation of an anoxic environment in the bottom water during summer season.

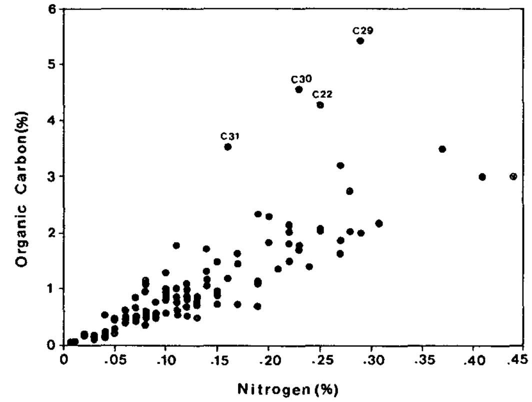

Fig. 7. Organic carbon and nitrogen in the nearshore surface sediments of Korea(117 samples).

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Received October 7, 1993
Accepted November 6, 1993

Appendix 1. Data matrix on all parameters used for principal component analysis

Sub-area	ST.	IL (%)	COD *mg/g*.dry	Total-S	Pigment *μg/g*.dry	OC (%)	N (%)	C/N ratio
A	1	5.0	9.80	0.23	1.04	0.72	0.15	5.6
	2	5.4	7.56	0.19	0.97	0.75	0.09	9.7
	3	5.8	3.79	0.02	1.43	0.51	0.07	8.5
	4	4.4	4.98	0.00	0.89	0.58	0.10	6.8
	5	1.9	1.88	0.27	0.75	0.23	0.04	6.7
	6	12.0	5.72	0.01	2.28	1.30	0.14	10.8
	7	4.1	6.29	0.08	1.73	0.69	0.12	6.7
	8	6.2	5.39	0.00	1.35	0.72	0.13	6.5
	9	3.0	3.23	0.03	0.39	0.53	0.08	7.7
	10	4.4	3.71	0.01	0.25	0.44	0.07	7.3
	11	1.4	0.41	0.00	0.52	0.17	0.04	5.0
	12	2.2	0.80	0.00	0.54	0.28	0.05	6.5
	13	3.4	2.77	0.00	0.14	0.34	0.08	5.0
	14	3.6	3.44	0.00	0.23	0.48	0.05	11.2
	15	1.0	0.94	0.00	0.28	0.18	0.03	7.0
	16	6.3	8.09	0.00	5.79	1.08	0.19	6.6
	17	7.2	12.22	0.00	7.79	1.15	0.14	9.6
	18	2.9	5.50	0.00	0.97	0.52	0.08	7.6
	19	2.6	2.82	0.01	1.10	0.46	0.06	8.9
	20	3.1	2.41	0.00	0.99	0.46	0.05	10.7
	21	3.0	2.45	0.00	0.04	0.45	0.05	10.5
	22	6.0	3.95	0.32	1.18	0.59	0.08	8.6
	23	4.6	6.41	0.42	1.32	0.49	0.09	6.4
	24	6.5	10.41	0.20	1.89	0.94	0.15	7.3
	25	5.7	9.94	0.40	1.38	0.94	0.15	7.3
	26	5.5	4.67	0.08	1.72	0.74	0.09	9.6
	27	3.0	5.84	0.00	0.43	0.44	0.07	7.3
	28	1.4	2.06	0.00	0.17	0.06	0.01	7.0
	29	1.4	2.46	0.00	0.14	0.03	0.01	5.0
	30	0.8	2.28	0.00	0.28	0.16	0.02	9.3
	31	0.8	3.34	0.00	0.46	0.20	0.02	11.7
	32	1.5	4.92	0.00	0.78	0.20	0.02	11.7
	33	1.7	2.66	0.00	0.79	0.21	0.05	4.9
	34	0.9	3.24	0.00	0.33	0.14	0.03	5.4
	35	1.2	3.80	0.00	0.12	0.16	0.04	4.7
	36	1.3	1.74	0.00	0.09	0.15	0.03	5.8
	37	1.2	3.10	0.00	0.09	0.15	0.04	4.4
	38	1.3	2.83	0.00	0.12	0.11	0.03	4.3
B	1	3.8	6.55	0.00	0.96	0.52	0.08	7.6
	2	3.0	4.39	0.00	0.67	0.46	0.08	6.7
	3	3.0	8.19	0.00	0.86	0.51	0.09	6.6
	4	5.4	6.39	0.01	0.04	0.50	0.07	8.3
	5	5.9	6.16	0.00	0.07	0.56	0.09	7.3
	6	3.3	4.96	0.00	0.33	0.42	0.06	8.2
	7	5.4	4.34	0.00	0.58	0.51	0.08	7.4
	8	4.7	4.58	0.00	0.16	0.47	0.05	11.0
	9	7.0	6.02	0.00	0.64	0.61	0.11	6.5
	10	11.0	18.28	0.66	1.93	1.12	0.08	16.3
	11	10.5	13.94	0.09	2.35	1.08	0.12	10.5
	12	8.8	12.42	0.01	2.15	0.85	0.12	8.3
	13	5.0	6.68	0.00	0.36	0.45	0.07	7.5
	14	4.4	8.89	0.00	0.40	0.49	0.13	4.4
	14-1	3.7	4.41	0.00	0.37	0.57	0.10	6.7
	15	3.6	8.57	0.02	0.34	0.52	0.12	5.1
	16	5.2	5.62	0.00	0.76	1.07	0.08	15.6
	17	3.7	6.07	0.00	0.35	0.54	0.04	15.8
	18	4.7	8.26	0.01	0.85	0.76	0.11	8.1
	19	3.3	7.94	0.00	0.40	0.47	0.08	6.9
	20	6.6	10.74	0.01	1.15	0.65	0.19	4.0
B	21	6.0	6.87	0.00	0.84	0.50	0.06	9.7
	22	6.7	21.10	0.17	1.43	0.67	0.07	11.2
	23	5.9	25.76	0.09	1.30	0.87	0.12	8.5
	24	7.1	12.05	0.02	1.55	0.81	0.10	9.5
	25	6.8	11.47	0.07	1.26	0.77	0.13	6.9
	26	7.3	8.84	0.01	0.95	0.72	0.17	4.9
	27	7.4	8.25	0.00	0.97	0.74	0.09	9.6
	28	10.4	21.68	1.12	2.49	1.28	0.10	14.9
	29	10.1	28.03	1.15	4.15	1.78	0.23	9.0
	30	7.9	7.74	0.00	0.97	0.54	0.11	5.7
	31	8.0	18.64	0.08	1.50	0.98	0.12	9.5
	32	7.1	13.15	0.02	0.98	0.76	0.09	9.9
	33	8.5	20.49	0.44	1.82	1.14	0.08	16.6
	34	8.6	16.71	0.13	0.65	0.84	0.07	14.0
	35	6.3	12.80	0.13	1.33	0.88	0.15	6.8
	36	7.3	17.94	0.21	1.71	0.10	0.11	10.6
	37	4.5	8.69	0.03	0.95	0.47	0.07	7.8
	38	4.5	11.11	0.09	0.66	0.61	0.06	11.9
	39	6.7	12.99	0.11	1.65	0.87	0.13	7.8
	40	10.0	4.77	0.03	1.05	2.32	0.19	14.2
	41	8.2	19.79	0.20	1.13	1.05	0.14	8.8
	42	8.3	20.43	0.09	1.36	0.95	0.08	13.9
C	1	9.5	17.09	0.02	1.73	1.14	0.19	7.0
	2	10.1	23.07	0.10	1.08	1.38	0.24	6.7
	3	9.1	18.74	0.03	1.54	1.18	0.16	8.6
	4	9.6	16.45	0.00	2.49	1.48	0.22	7.8
	5	9.7	17.28	0.00	1.97	2.14	0.22	11.3
	6	10.8	19.01	0.01	2.65	1.61	0.27	7.0
	7	10.6	16.95	0.09	2.48	2.74	0.28	11.4
	8	11.4	20.07	0.16	2.37	1.77	0.11	18.8
	9	11.6	24.13	0.07	3.09	1.35	0.21	7.5
	10	9.4	29.14	0.18	2.79	1.69	0.23	8.6
	11	12.0	11.29	0.01	1.38	1.79	0.22	9.5
	12	9.8	19.66	0.43	2.11	1.81	0.20	10.6
	13	12.0	16.81	0.32	2.54	2.98	0.41	8.5
	14	10.7	22.59	0.15	2.47	1.99	0.29	8.0
	15	11.9	27.10	0.27	3.46	2.04	0.25	9.5
	16	8.6	20.36	0.12	1.04	1.62	0.17	11.1
	17	10.9	31.24	0.87	1.80	2.08	0.25	9.7
	18	10.3	26.26	0.52	2.35	2.02	0.22	10.7
	19	11.9	19.42	0.51	2.22	3.48	0.37	11.0
	20	9.6	16.63	0.87	1.79	2.05	0.31	5.1
	21	9.8	16.02	0.62	2.05	1.85	0.27	8.0
	22	12.4	10.49	0.11	1.38	4.27	0.25	19.9
	22-1	10.3	20.11	0.30	1.13	1.46	0.15	11.4
	23	12.9	35.46	4.18	2.46	3.19	0.27	13.8
	24	11.4	34.32	7.75	3.03	2.28	0.20	13.3
	25	6.7	13.97	0.06	1.07	0.85	0.10	9.9
	26	9.2	14.50	0.07	1.60	0.95	0.10	11.1
	27	10.5	10.00	0.30	2.03	2.02	0.28	8.4
	28	8.0	7.43	0.07	1.65	1.70	0.14	14.2
	29	11.7	20.15	0.41	2.11	5.41	0.29	21.8
	30	12.9	18.94	0.19	1.02	4.55	0.23	23.1
	31	10.9	11.56	0.47	1.85	3.52	0.16	25.7
D	1	6.4	23.16	0.56	4.78	1.44	0.17	9.9
	2	8.2	25.41	0.35	4.17	3.03	0.44	4.3
	3	6.2	17.49	0.59	2.06	0.85	0.11	9.0
	4	4.9	16.93	0.41	1.99	0.99	0.10	11.6

* C/N ratio : by atoms

한국연안 표층퇴적물중의 유기물함량 분포특성

강창근 · 이필용 · 박주석 · 김평중
국립수산진흥원

한국연안해역 표층퇴적물중의 유기물함량 분포특성을 밝히기 위하여 1993년 2월에 총 117개 정점에서 중력식 corer로 채취한 표층퇴적물 시료에 대해서 유기탄소와 질소함량, 강열감량, 화학적산소요구량, phaeopigment 및 총황화물량을 측정하였다. 표층퇴적물중 유기 탄소 및 질소함량은 각각 0.03~5.41%(평균 1.08%), 0.01~0.44%(평균 0.18%) 범위였는데 진주만에서 부산항사이의 남해동부연안역에서 각각 평균 2.18%와 0.23%로서 한반도 주변해역중 가장 높았고 금강에서 동진강에 이르는 군산연안 해역이 각각 평균 0.17%와 0.03%로 가장 낮은 분포였다. 주요인 분석의 결과는 조사해역의 표층퇴적물중 유기물함량 분포특징을 잘 나타냈는데 유기물 함량 즉 부영양화의 정도에 따라 서해와 남해동부해역이 뚜렷이 구분되며 부산항과 마산만 입구에서의 높은 C/N비는 이 수역이 인근 도시의 생활하수나 산업폐수의 영향을 크게 받고 있음을 보여준다. 또한 마산만내의 표층퇴적물은 높은 황화물량을 보여 다른 해역과 뚜렷이 구분된다.