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Rate of Sediment Accumulation and Magnetic Susceptibility of Continental Shelf Sediments around the Cheju Island, Korea

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제주도주변 대륙붕 퇴적물에 대한 퇴적속도 및 대자율 연구

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제주도 주변 대륙붕 해역 181개 정점에서 채취한 표층퇴적물에 대한 입도분석, 탄산염 및 유기물 연구에 의한 이 지역 표층퇴적물의 특성을 파악하고, 동위원소 연구를 통한 퇴적속도 추정 및 대자율 연구를 통하여 주변 육상기원 쇄설성 퇴적물의 공급지로부터 얼마만한 거리까지 이동 · 분포하는지를 알아 보았다.

연구해역 표층 퇴적상은 모래, 소량역함유니질사, 점토질사 등 사질형 퇴적물이 분포하는 제주도 남동부 해역, 조 · 세립질이 혼합된 분포를 보이는 북동부 지역, 사질점토, 사질니, 니토 등 니질형 퇴적물이 분포하는 서부지역 등 그 퇴적상이 다양하다. 탄산염 함량은 평균 21.6%로 다양한 값을 나타내며 퇴적물 입도와 수심이 증가함에 따라 증가하는 경향을 보였고, 반면 총유기물 함량은 평균 6.26%로 세립질 퇴적물 분포지에서 높은 함량분포를 보여 탄산염 분포와는 상반된 경향을 나타냈다.

Pb-210 동위원소를 이용한 연구지역 현생퇴적물의 퇴적속도는 0.20~0.54cm/yr, 혹은 0.15~0.42g/cm^2/yr의 범위를 보였다. 이들 중 양자강 하구역과 가까운 J-101과 J-134 지역에서 퇴적속도는 0.45~0.54cm/yr, Pb-210이 flux되는 양은 1.48~2.31dpm/cm^2/yr보다 높은 값을 보였고, 제주도 주변 J-59와 J-91에서 퇴적속도는 0.21~0.44cm/yr, Pb-210의 flux는 0.82~1.44dpm/cm^2/yr의 범위로 동일 시료의 Pb-210에 의한 퇴적율 0.20~0.22cm/yr와 잘 일치한나, J-91, J-101, J-134 지역에서는 Cs-137에 의한 퇴적속도가 0.16~0.30cm/yr로 Pb-210에 의한 0.44~0.54cm/yr보다 낮은 값을 보였다. 퇴적물내의 대자율값은 제주도 주변 연안역과 양자강하구역에 근접하는 남서쪽 끝지역에서 4×10^{-6}emu/g 이상의 높은 값을 보이고 그 외 지역은 2×10^{6}emu/g 이하의 값을 보이는데, 이는 제주화산섬 기원의 육상풍화산물도 주변 연안역으로 이동 · 퇴적되고 있음을 의미하며, 철을 많이 함유한 양자기원 부유퇴적물이 본 역 남서쪽 끝지역까지 수송되고 있음을 의미한다.

The sediments in the study area are subdivided into twelve textural classes, namely clayey sand, slightly gravelly muddy sand, muddy sand, sand, sandy mud, sandy clay, mud and clay. The coarse sediments are distributed in the southeastern parts and around the Island, whereas the coarse and fine-grained mixed sediments are distributed in the central and northeastern region, and the fine-grained deposits are mainly distributed in the western part of the study area. Small scale mud patchs are distributed in the southwestern, and northern parts of the Island. The carbonate content(21.6% on average) are commonly abundant in sand-size sediments, whereas total organic matter(6.62% on average) are usually decreases with increasing mean grain size.

The use of Pb-210 geochronologies to estimate sedimentation rate ranges from 0.20 to 0.54 cm/yr or 0.15~0.42 g/cm^2/yr. This suggests a maximum accumulation rate in the study region given ignoring the mixing effect. The sedimentation rates in cores J-101 and J-134 near the Changjiang River estuary show 0.45~0.54 cm/yr, and the flux of Pb-210 in this region is 1.48~2.31 dpm/cm^2/yr, but two core J-138 and J-142 far from the Changjiang estuary show 0.20~0.22 cm/yr and 0.36~0.57 dpm/cm^2/yr respectively, which is much lower than above two samples. The decrease in accumulation rate with increasing water depth may be result of progressive seaward depletion of influx and reworking of detrital materials. The sedimentation rate in cores J-59 and J-91 around the Cheju Island show 0.21~0.44 cm/yr and the Pb-210 flux of 0.84~1.44 dpm/cm^2/yr is measured, indicating that the terrigenous materials from the Island were supplied to this environment.

The sedimentation rate measured using two peak concentration of Cs-137 in a sediment profiles J-59, J-138 and J-142 ranges from 0.12 to 0.30cm/yr, which agree well the Pb-21 calculated data 0.20~0.22cm /yr from that at same samples, but a comparison sedimentation rate in cores J-91, J-101 and J-134 measured by Cs-137(0.16-0.30 cm/yr) and calculated from Pb-210(0.44-0.54 cm/yr) show that in the studied core profiles, the Cs-137 survey data underestimate the sedimentation rate measured by Pb-210 data. Its presumably the result of difference in the behavior of Pb-210 and Cs-137 in natural water column.

Measurements of magnetic susceptibility of continental shelf sediments around the Cheju Island revealed two areas of anomalously high values: surrounding the Cheju inshore area, due to the influx and reworking of detrital volcanic materials distributed in the Cheju Island, and toward the mouth of Chanjiang River, suggesting due to the iron and steel works in the Changjiang estuary recently.

It was observed that low susceptibility values correspond to a high proportion of coarse sediment, whereas high susceptibility values correspond to silt and clay fraction. Down core variation in susceptibility shows a series of maximum and minimum which correlated with horizons of fine-and coarser particles respectively, that can possibly be used to establish a lithostratigraphy.

Key words : geochronology, sedimentation rate, depletion of influx, deterital materials, susceptibility values, lithostatigraphy.

INTRODUCTION

The study area is the continental shelf located between 32° 00'-34° 15'N in latitude, and between 126° 30' - 128° 00'E longitude around Cheju Island. The Cheju Island is the dormant volcanic mountain located at the southern part of the Korea Peninsula and is formed by Pleistocene to Holocene volcanic activity.

The marine environment of the study area, that is including the East China Sea and Yellow Sea, lies within the continental shelf in water less than 150m deep. The western part of the study area has the broad, almost flat seafloor and gradually steeper gradient of isobaths from southwest to northeastern, average water depth of 65m and seafloor toward the southeastward is deeper with maximum 150m in water depth. The northeastern part is bounded by numerous island and shoal extends. The sedimentary processes on the study area are strongly affected by the complicated hydrodynamic condition of this area, such as Kuroshio, Jiangsu and Southwest Korea Coastal Currents(Niion and Emery, 1961 ; Lie, 1984).

Many works have attempted to describe the sedimentary fancies, sea-level changes history, clay mineralogy and geochemistry, sediment dispersal budget, radiochemical measurement of sedimentation rate and physical characteristics of water mass on the Yellow Sea and East China Sea(Niino and Emery, 1961; Qin, 1979; Wang and Wang, 1980 ; Qin and Lie, 1983 ; Su et al., 1983; Lie 1984; Nittrouer et al., 1984; Wells and Huh, 1984; Buternko et al., 1985; DeMaster et al., 1985; Keller and Ye, 1985; Milliman et al., 1985a, b; Sternberg et al., 1985; Park et al., 1986; Lee and Chough, 1989), but that is a few data include the around the Cheju Island.

The present paper reports the results of an investigation of surface and core sediments around Cheju Island and adjacent shelf in terms of surfical sediments distribution, concentrations of organic matters and carbonates, sediment accumulation rates and magnetic measurements in coastal pollution monitoring

MATERIALS AND METHODS

Figure 1 shows the location of the sample station from where bottom sediment and core samples in the study area. A total of 181 surface sediments and 6 gravity core samples were collected using sampler and textural parameters were determined using standard sieve and pipette methods(Ingram, 1971).

About 5g of overnight-dried raw sediments were ground to pass 100-mesh sieve and used for determining the contents of carbonate, organic matter and heavy metals(Mn, Fe, Al).

The content of carbonates was determined with 30% HCI in bernard calcimeter. Total organic matters in sediments were substituted for ignition loss in muffle furnace at 550℃ for 1 h 30 min. Following the method suggested by Valin and Morse(1982), heavy metals were extracted from the sediments by three times digestion with the mixed solution of HF and $HClO_4$ in the teflon beaker on hot plate. The metal concentrations were measured by on atomic absorption spectrometer (Pye unicam SPP).

For estimating the flux of Pb-210 into sediments and determining the sedimentation rates, six core samples were obtained form the study area(Fig.1). Cores were sectioned into 1cm segments and each segment was split into one portions. Each sample fraction(1-2g) was used for Pb-210 analysis. Various methods are available for Pb-210 analysis. The one employed is similar to that described by Nittrouer et al.(1979) and depends upon its secular equilibrium with Po-210. Sediment samples were dried at 110°C overnight, and a weighed aliquot(1-2g) was ashed out at 400-450°C overnight and then spiked with Po-208 tracer. Sample were further processed in the following manner: the residue was treated with about 30 ml each of conc. hydrochloric acid, aqua regia, and conc. hydrochloric acid, in that order. With each treatment, the liquid was evaporated to dryness at simmering temperatures. The final residue was prepared for autodeposition by its dissolution in 0.3N hydrochloric acid. The alpha particles emitted by Po-208 and Po-210 deposited on silver disc were pulse-height analyzed with a surface barrier detector, usually for an overnight period. Using a gamma ray spectrometer with a Ge(Li) detector the activity of Cs-137 was measured in six sediment cores. To make these measurements the sediments were pulverized into a fine power and placed in the spectrometer. The samples were then left for about 24 hours while gamma rays were counted(Robbins and Edgingran, 1975).

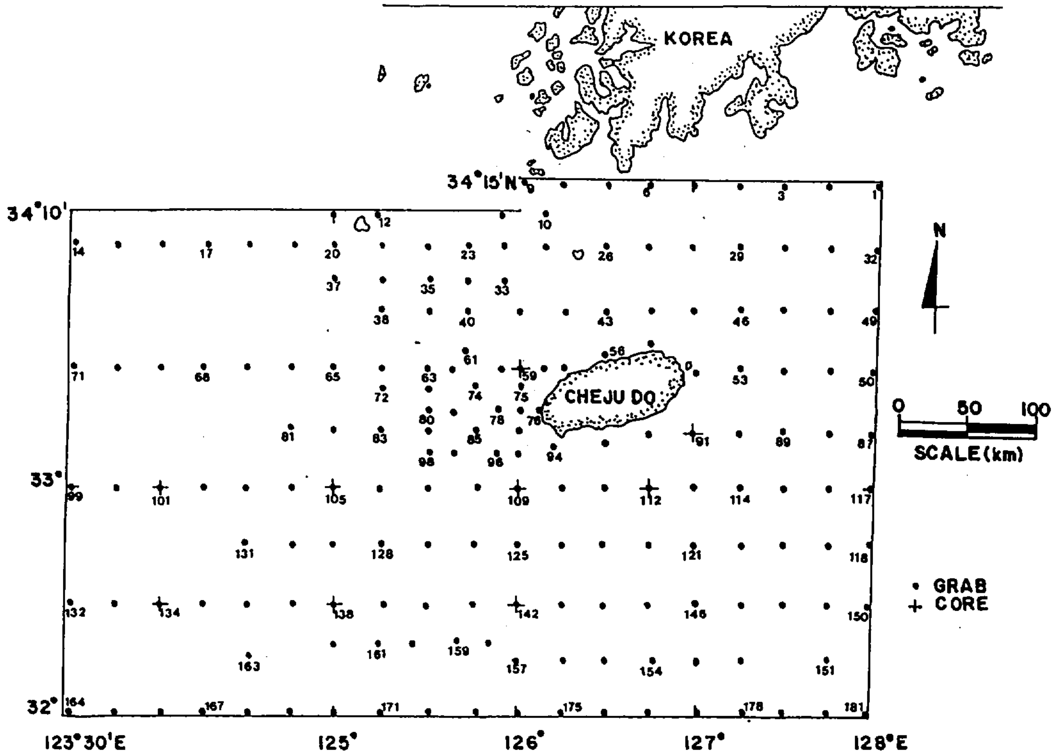

Fig. 1. Study area and sampling sites

The low field magnetic susceptibility was measured in a direction parallel to the each subsample using a Bartington M.S.2 susceptibility meter with M.S.2.B and M.S.2.K sensors. Magnetic susceptiobility is reported as either volume or mass susceptibility(Payne, 1981). The former will be reported in this paper as 1×10^{-6} cgs units. The mass magnetic susceptibility of sediment is determined by dividing the volume magnetic susceptibility measurement by the sediment density.

RESULTS AND DISCUSSION

The geographic distribution of the textural classes reveled that most of this area is covered with slightly muddy sand, sand, muddy sand, clayey sand, sandy clay and sandy mud. The coarse sediments are distributed in the southeastern deeper part and around Cheju Island, reported that Holocene transgressive sand sheets (Yang and Sun, 1988). These sand mixed with recent muds forming sandy mud or muddy sand in the southern Yellow Sea and northern East China Sea, suggesting that are subjected to relatively strong waves and currents. The coarse and fine-grained mixed sediment are distributed in the central and northeastern region. On the other hand, the fine-grained sediments are mainly distributed in the western part of the study area. The small scale mud patchs are distributed in the southwest offshore of the Cheju Island and northern part.

According to Lee and Chough (1989), a distinctive mud belt of near equal amounts of

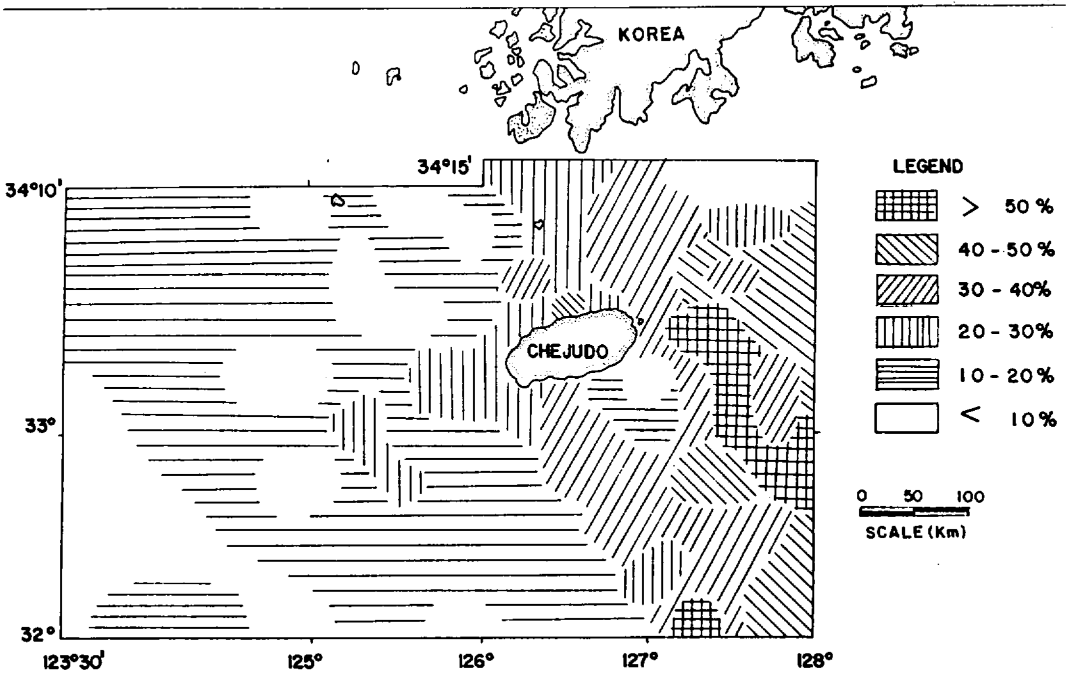

Fig. 2. Calcium matter content distribution in sediment

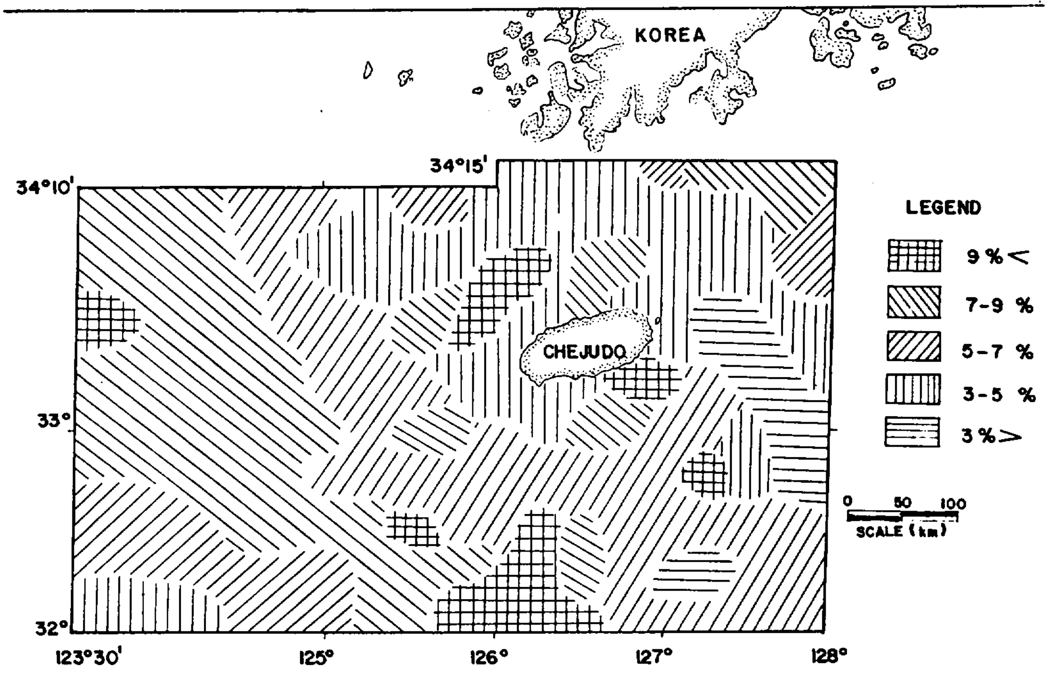

Fig. 3. Total organic matter content distribution in sediment

silt and clay fractions occurs off the southwestern coast of the Korean Peninsular extending to the north of Cheju Island. The central part of the Yellow Sea is dominated by silt of clayey mud derived from the Huanghe River and this mud is also found southwest offshore of Cheju Island (Nittrouer et al., 1984; Butenko et al., 1985; DeMaster et al., 1985; Milliman et al., 1985b).

The calsium carbonate contents were ranged from 6.83 to 70.82% and commonly abundant in the sandy size sediments(Fig. 2). More than 50% high values of $CaCO_3$ concentration were found in the eastern deeper part which is covered with coarse grained sedimint whereas with those of less than 10% were distributed in tip of the northeast and southwest offshore of mud patch region. The organic matter contents in the bulk sediment varied from 1.35 to 17.68% and were usually dominant in the fine grained sediment(Fig. 3). More than 9% high values of organic matter were found in the northwestern part of Cheju Strait and in the southwest offshore of the Cheju Island, which are mainly distributed with fine-grained sediment. It was noted that the sediment grain-size exerted an strong influence on the organic matter content.

In an attempt to develop a useful marine core chronology the activity of Pb-210 present in the sediments were measured. Limnologist and Oceanographers often use Pb-210 in conjunction with Cs-137 to construct chronologies of sediment cores(Krishnaswamy et al., 1971; Koide et al., 1973). These two unstable isotopes have relatively short half-lives 22.3 and 30.2 years respectively, which makes them ideal to estimate the sedimentation rate of deposited marine sediment over the past 100 years(Nittroner et al., 1979). To determine the sedimentation rate using this method, the excess Pb-210 in the sediments must be determined rather than the total amount. The amount of parent supported Pb-210 is determined by measuring the activity of depths large enough to assure the atmospheric component to be negligible. The amount of excess Pb-210 representing in any particular sample is therefore the difference in activities between the sample in question and that of the parent supported sample. The sediment accumulation rate was determined from the slope of the least squares fit to the log excess Pb-210 activity versus total accumulation profile below the surface mixed layer. The Pb-210 supported activity determined in a few section core samples using the Rn-222 emanation method(Lucas, 1975; Nittrouer et al., 1979).

The amount of excess Pb-210 in samples calculated by extracted the background Ra-226 activity from the total Pb-210 activity. Pb-210 activities are ploted versus depth in a sediment cores as shows in Figures 4. The crosses represent the total Pb-210 activity and the closed circles represent the excess Pb-210 activity which with the same point after background is subtracted.

The accumulation rates obtained using the radioactive decay formular and the half-life of Pb-210 in the study area show ranges from 0.20 to 0.54 cm/yr or 0.15~0.42/cm^2/yr.. Thus, the sedimentation rate calculated from Pb-210 data may be an overestimated because we ignore the mixing effect (DeMaster et al., 1985). Figure 4 show the Pb-210 activities with depth for a sediment cores from the southwestern part in the area.

The sedimentation rates from the cores J-101 and J-134 northeastern offshore the Changjiang River estuary ranges from 0.45 to 0.54 cm/yr.. It may have been derived from the high input of suspended sediments in river runoff from the China side that receives the modern and ancient sediments of the Huanghe River. During the winter months frequent storms and an intensified southward flowing coastal current may resuspend

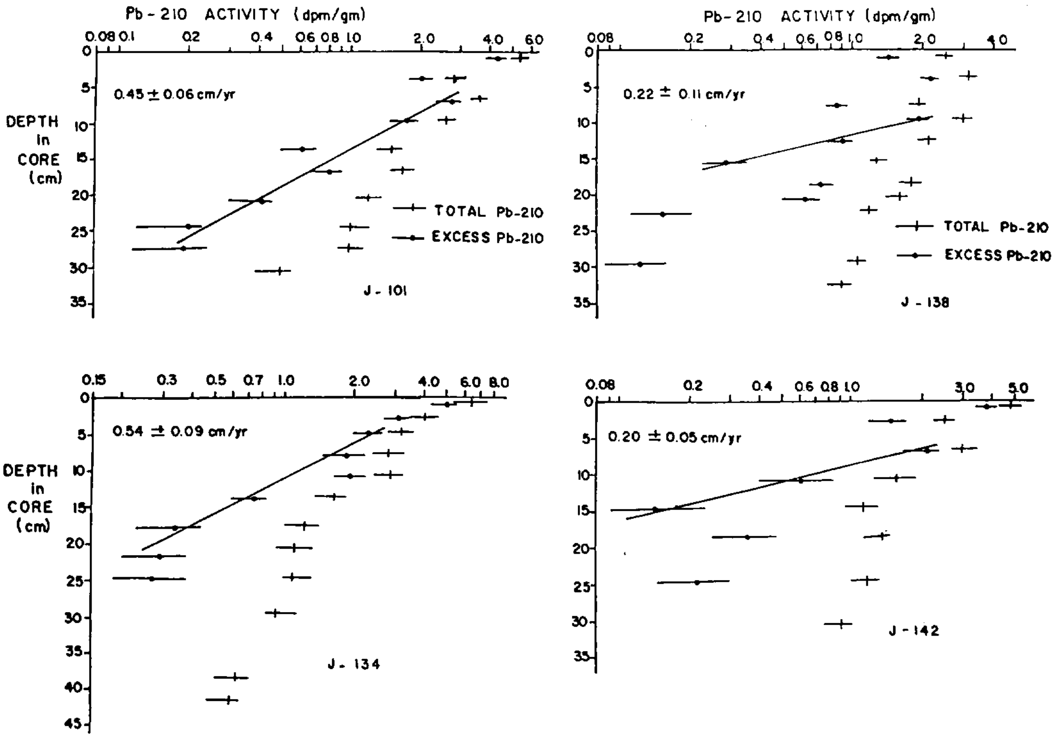

Fig. 4. A profile of Pb-210 activity from cores J-101, J-134, J-138 and J-142 in the study area

sediment transport of this material along the dispersal system (Mckee et al., 1983; Sternberg et al., 1985).

The sediment cores J-138 and J-142 from the offshore mud deposit in the southwest Cheju Island, the estimated of sediment accumulation rates show 0.20-0.22 cm/yr. that is much lower than those of above two samples, its may be the result form the weakened sediment transported. According to DeMaster et al. (1985) and Milliman et al. (1985b) these mud deposits are derived from the ancient Huanghe River delta off the northern Jiangsu Coast and where the Huanghe River induced mud are presently accumulating, and also reported a maximum sediment accumulation rate is 0.3 cm/yr.

The sedimentation rates form the cores J-59 and J-91 in northwestern coast near the Cheju

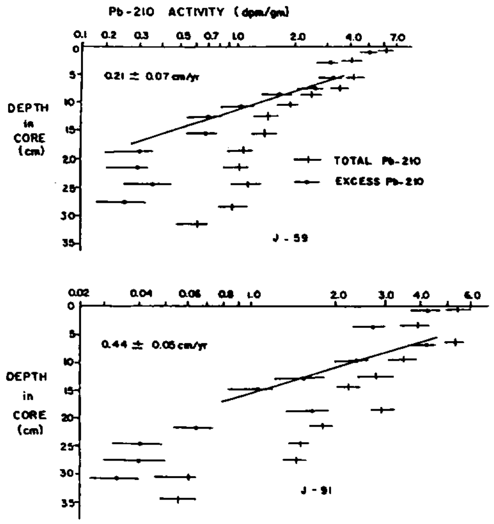

Fig. 5. A profile of Pb-210 activity from cores J-59 and J-91 in the study area

Island show ranges form 0.21 to 0.44 cm/yr(Fig. 5), indicating that terrigenous materials from the Cheju Island are supplied to this environment.

Table 1 presents the summary of the number and range of segments included in the least-squares fit, intercept, the slope, mass sedimentation rate, Pb-210 flux at the sedimentation surface. The fractional water content for the core sediments was taken as 0.47 and the mean density for the sediment was estimated to be 1.45 g/cm^2

The surficial Pb-210 activity values range from 1.79 to 4.15 dpm/g. The muddy sediment cores in northwest nearshore of Cheju Island have high surface Pb-210 activities compared to the entire cores in this area, which thought to be the more ease to absorption Pb-210 associated rather than the coaserer sediments. Pb-210 flux ranges from 0.36 to 2.31 dpm/cm^2/yr, and mass sedimentation rate values range from 0.15 to 0.42 g/cm^2/yr. The high sedimentation rate(0.42 g/cm^2/yr) in the sediment core J-134 is related to the high Pb-210 influx with the terrigenous suspended materials from the delta off the northern Jiangsu coast. The low sediment accumulation rate values 0.15-0.17 g/cm^2/yr were measured in the southwest offshore of mud deposit cores J-138 and J-142. The result is good agreement with the fact that the decrease in accumulation rate with increasing water depth may be the result of progressive seaward depletion of influx and reworking of detrial materials(Carpenter et al., 1981)

Cs-137 is a byproduct of atmospheric nuclear weapons testing. It is introduced into the environment only as a result of such testing or by accident involving nuclear plants. In the year 1963 deposition of atmospheric fallout resulting from weapons testing was at maximum (Taylor et al., 1988). A time lag of only 6-12 months has been observed between the atmospheric fallout of Cs-137 and its deposition in sediments(Ritchie et al., 1973). Therefore, a distinctive peak present in plots of Cs-137 activity as a function of sediment depth should mark deposition during the time period of 1963-1964. Limnologist have recognized the presence of this absolute time-line and have used it to construct chronologies of lake and marine sediments(Krishmaswamy et al., 1971; Koide et al., 1973; Pennington et al., 1973; Ritchie et al., 1973).

The activity of Cs-137 from the cores is shown as a function of depth in Figure 6.

The maximum Cs-137 activity peak was shown at depth of range from 5-6cm or 6-7cm respectively, and its assuming that the represents

Table 1. Sedimentation rates and Pb-210 flux of sediment cores, incouding linear coefficients, number and range of linear segments and correlation coefficients

Core	Number of linear segments (n)	Linear range (Cm)	Intercept (a)	Slope (b)	Cor. coeff	Sedimentation rate Cm y^{-1}	Mass sed. rate gCm^{-2}y^{-1} (r)	Pb-210 flux dpm Cm^{-2}y-1 (F)
J-59	13	32	3.07	-0.148	0.87	0.21× ±0.07	0.16	0.82
J-91	12	35	4.50	-0.065	0.85	0.44 ±0.006	0.34	1.44
J-101	10	31	2.78	0.069	0.89	0.45±0.06	0.35	1.48
J-134	12	32	2.96	-0.057	0.88	0.54±0.09	0.42	2.31
J-138	11	30	1.79	-0.139	0.78	0.22±0.11	0.17	0.36
J-142	8	31	1.84	-0.157	0.78	0.20±0.05	0.15	0.57

deposition during 1963 or 1964 (Ritchie et al., 1973). This peak concentration of Cs-137 in the sediment profile means that should be associated with peak rate of Cs-137 fallout from the atmosphere. The sedimentation rate measured from two peak concentration of Cs-137 in the sediment profiles J-59, J-138 and J-142 ranges from 0.12 to 0.30 cm/yr, which agree well the Pb-210 calculated data 0.20-0.22 cm/yr from that at the same samples, and that is support the effects of bioturbation on radionuclide in these core are minor. In contrast, a comparison sedimentation rate cores J-91, J-101 and J-134 measured by Cs-137 ranges from 0.16 to 0.30 cm/yr and calculated from the Pb-210 show 0.44-0.54 cm/yr at the same sediment core profiles, which shows the Cs-137 calculated data underestimate the sedimentation rate measured by the Pb-210 data, its presumably the result of difference in the behavior Pb-210 and Cs-137 in natural water column.

Most rocks contain some ferromagnetic minerals, usually as fine grains dispersed throughout a matrix. These minerals produce an induced magnetization J when placed in a weak magnetic field H. These ratio(K=J/H) is the magnetic susceptibility, a dimensionless quantity with respect to a unit volume of material(Nagata, 1961). Magnetic susceptibility measures magnetization temporarily induced in a rock by an artificially applied low amplitude magnetic field. The strength of the susceptibility signal depends on the concentration and grain size of magnetic minerals.

Magnetic susceptibility was measured using an air cored bridge in a low magnetic field at a

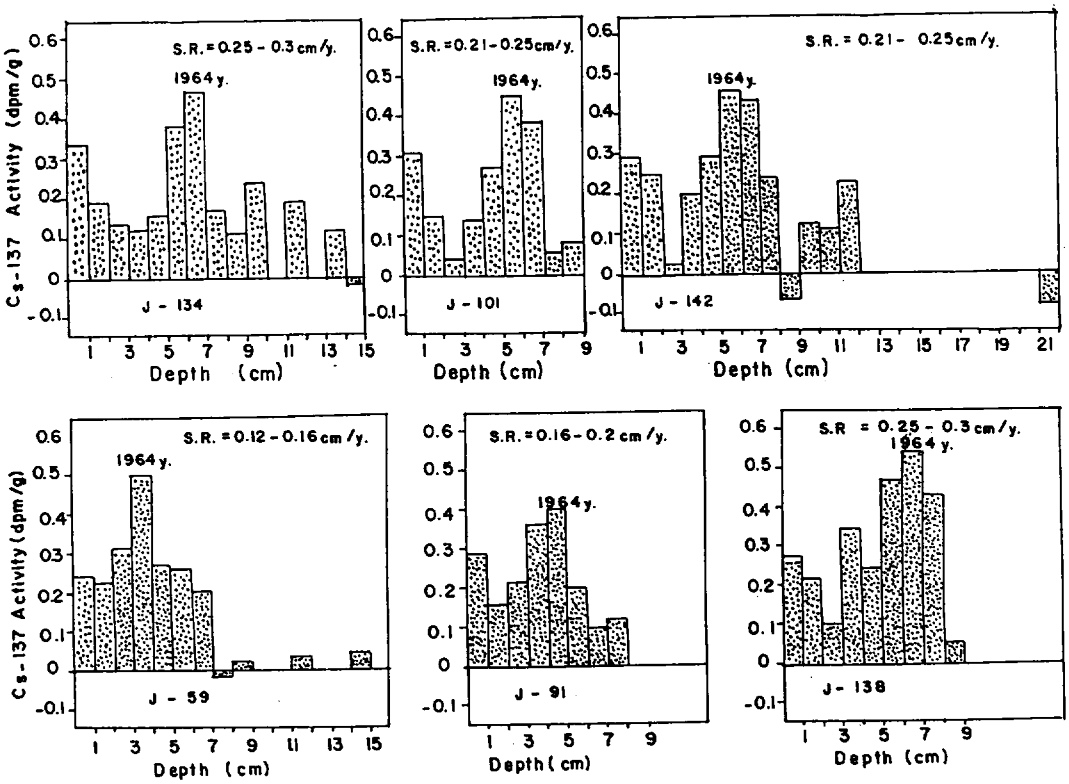

Fig. 6. Plots of Cs-137 activity with for samples from cores J-134, J-101, J-142, J-59, J-91 and J-138

frequency of 10KHZ (Molyneux and Thompson, 1973).

Magnetic susceptibility; its anisotropy, remanent magnetization and its coercivity have been applied to a number of sedimentological and environmental problems (Thompson et al. 1980). A study Scoullous et al., (1979) illustrated the potential value of magnetic measurements in coastal pollution monitoring where major sources are discharging high particulate concentration which include ferromagnetic oxides. Magnetic susceptibility is a highly variable parameters and depends upon the minerals present, their concentration, grain size and shape of mode of dispersion. However, among the minerals that contribute to the magnetization, the most fundamental and important source is a magnetite. This has led to several empirical formulations of a relationship between susceptibility and magnetite content(Mooney and Bleifuss, 1953; Nagata, 1961; Jahren, 1963; Shandley and Bacon, 1966). Although the difference exists among those published, most indicate a linear relationship between susceptibility and magnetic content. The magnetite content was determined by magnetic

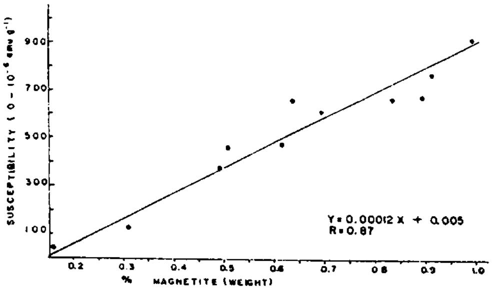

Fig. 7. Magnetic susceptibility vs. magnetic content of 11 samples

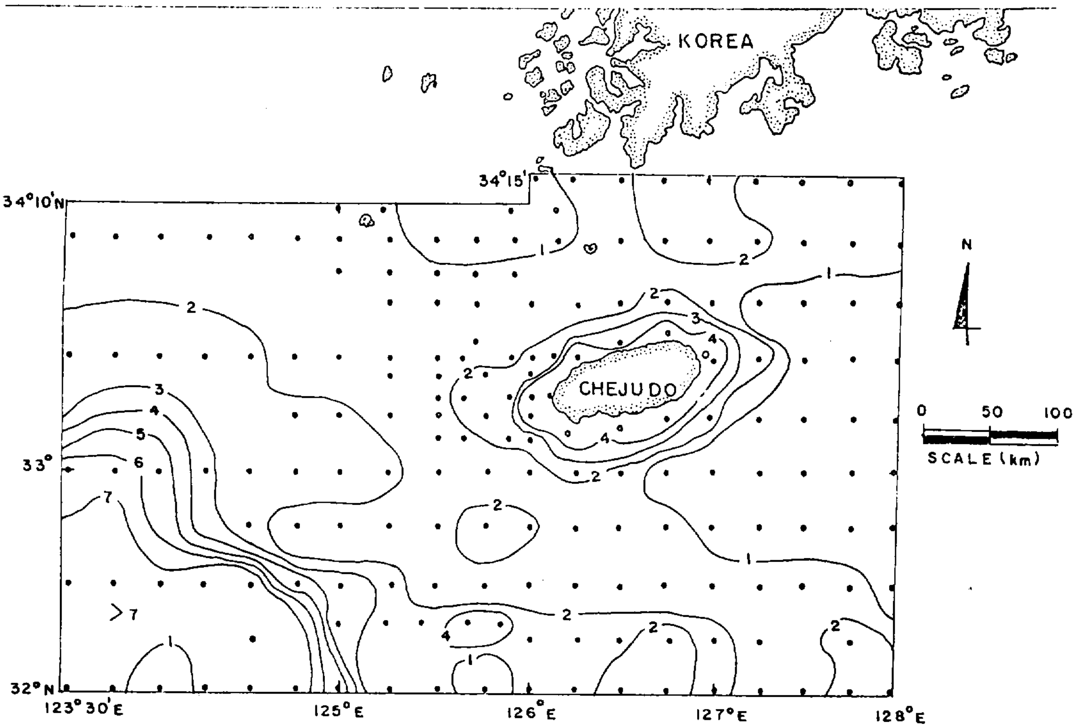

Fig. 8. Areal distribution of the magnetic susceptibility for the study area ($0\text{-}10^{-6}$ emu g^{-1})

separation for a subset of 11 samples in the study area(Fig. 7).

Although the scatter is too great to permit a reliable prediction to be made, which data trend of increasing susceptibility with increasing magnetite is clearly supported(correlation coefficient of 0.87) by samples from this environment.

The dominant trend in the areal distribution of susceptibility of the surface sediments is a decrease with increased waterdepth (Fig. 8).

High susceptibilities were found in surrounding Cheju Island inshore area and toward the mouth of Changjiang River. More than 4×10^{-6}emu/g high content of susceptibilities were found in surrounding Cheju Island inshore area, due to the influx and reworking of detrial volcanic materials distributed in Cheju Island. Secondary, at the southwest part toward the mouth of Changjiang River, its means that the relatively high proportion of fine-grained sediments are being supplied by Changjiang River and transported to this environment, and that is a good agreement the diluted Changjiang River freshwater flows northward near the Cheju island(Zheng and Klema, 1982). Its was observed that low susceptibility values correspond to a high proportion of coarse sediments, whereas high susceptibility values correspond to silt and clay fractions. Studies of magnetic susceptibility vs. various size fraction from the surface sediment samples appear to confirm that magnetite is responsible for most the susceptibility signal in the study area. Samples chosen from contrasting water depths in the study area and with contrasting susceptibility were subdivided into 2-4 ø fractions. It was observed that the highest susceptibility was always found in the very fine sand sediments and coarse silt(3-4 ø)(Fig. 9 and 10). Magnetic susceptibility data from dried weight bulk core subsamples from the study area are shown Figure 11 and 12. There is also a marked correlation between the particle size of sediment and the maximum or minimum peaks of susceptibility in the sediment core profiles. In study area the sediment core profiles show that low susceptibility values correspond to a high proportion of coarse sediment and high susceptibility values correspond to horizons of finer material. It was also noted that magnetic susceptibility can be used to establish a lithostratigraphy for marine sediments directly from the rapid acquired magnetic data without the need for subsample all cores. The chemical variation are dependent on particle size and core depth. The chemical contents of the six core profiles normally shows the increase upward and

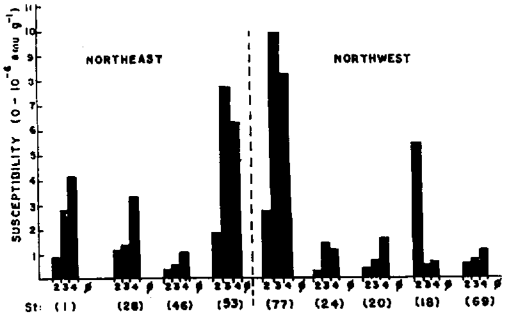

Fig. 9. Magnetic susceptibility vs. grain size from southern parts off Cheju Island

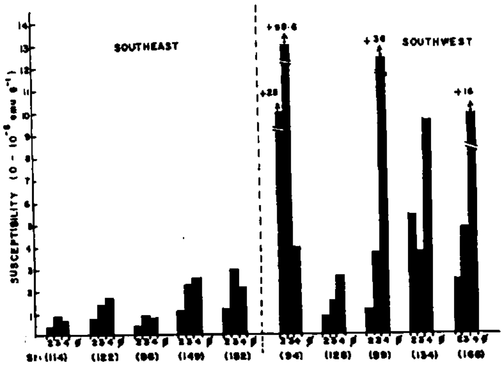

Fig. 10. Magnetic susceptibility vs. grain size for northern parts off Cheju Island

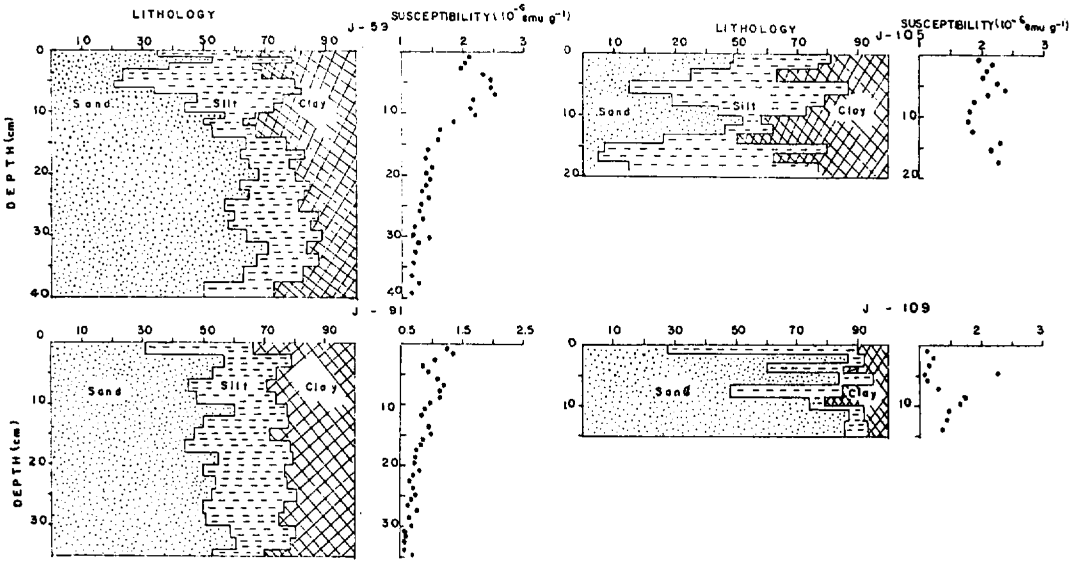

Fig. 11. Variation in mass susceptibility with depth plotted against changing particle size composition for core J-59, J-91, J-105 and J-109

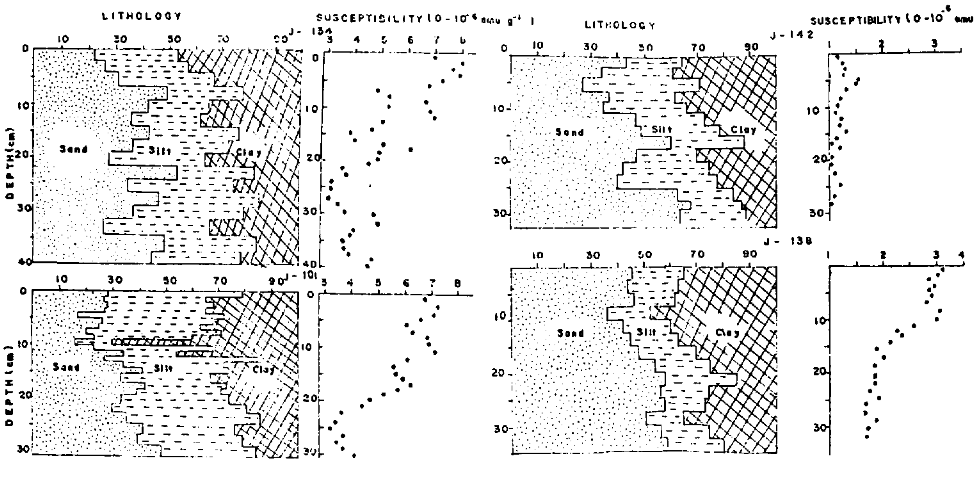

Fig. 12. Variation in mass susceptibility with depth plotted against changing particle size composition for core J-134, J-101, J-142 and J-138

decreases to the bottoms(Fig. 13). It can be seen that there is a good correlation between the maximum and minimum with the .magnetic susceptibility and particle-size. Down-core changes in chemistry can be explained by variation in particle-size and transported the industrial pollution materials from the source area in recently rather than a change of sources materials in the drainage basin.

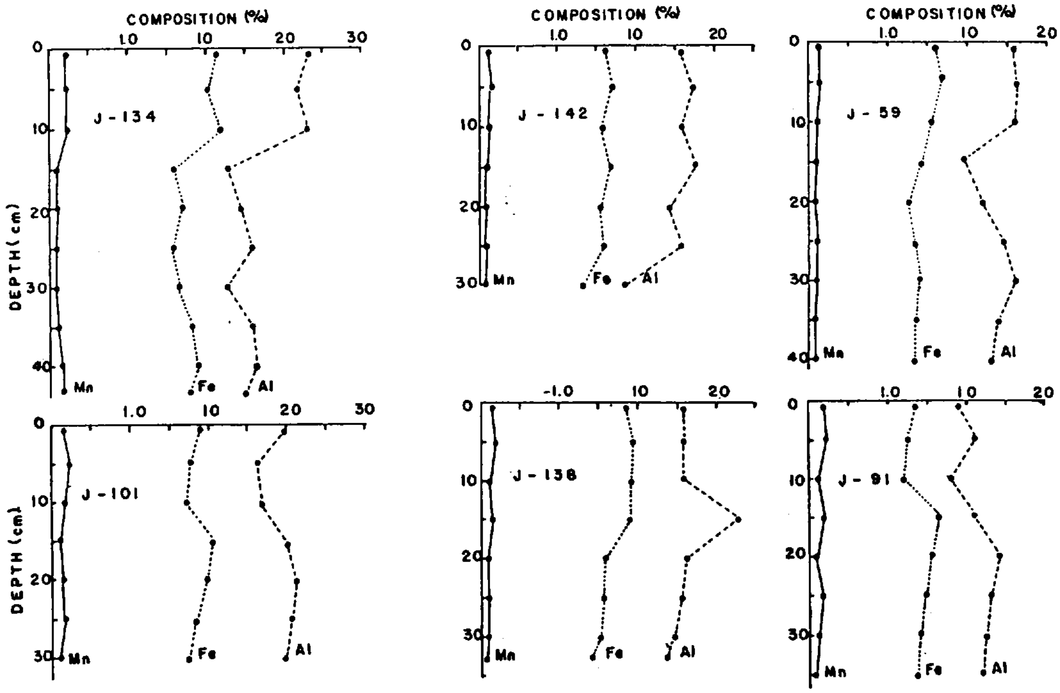

Fig. 13. Variation of Mn, Fe and Al content with increasing depth

CONCLUSIONS

The coarse sediment are distributed in the southeastern deeper part and around Island with the Holocene transgressive sand sheets, whereas the coarse and fine-grained mixed sediments are distributed in the central and northeastern region, and the fine-grained deposits are mainly distributed in the western part.

Total organic matters are generally more incorporated into the fine-grained sediments in the study area.

The sedimentation rates from the cores J-101 and J-134 northeastern off the Changhiang River estuary ranges from 0.45 to 0.54 cm/yr (0.35-0.42 g/cm^2/yr.). It may have been derived from the high input of suspended sediments in river runoff from the China side that receives the modern and ancient sediments of Huanghe River. The sediment cores J-138 and J-142 from the offshore mud deposit, the estimated of sediment accumulation rates show 0.20-0.22 cm/yr (0.15-0.17 g/cm^2/yr.) that in much lower than above two samples, its may be result from the weakened sediment transported. The sedimentation rate from the cores J-59 and J-91 in northwestern coast near Cheju Island ranges from 0.21 to 0.44 cm/ar (0.16-0.34 g/cm^2/yr.), indicating that terrigenous materials from Cheju Island are supplied to this environment.

The sedimentation rate measured by two peak concentration of Cs-137 in the sediment profiles J-59, J-139 and J-142 ranges from 0.12 to 0.30 cm/yr, which agrees well with the Pb-210 calculated data 0.20-0.22 cm/yr from that at the same samples, but a comparison of sedimentation rate cores J-91, J-101 and J-134 measured by Cs-137 ranges from 0.16 to 0.30 cm/yr and the calculated by the Pb-210 show 0.44-0.54 cm/yr at same sediment core profiles, which shows the Cs-137 calculated data underestimated the sedimentation rates measured by Pb-210 data, its presumably the result of difference in the behavior of Pb-210 and Cs-137 in natural water column.

There is relationship between magnetic susceptibility, particle-size and influx of fine-grained sediment of the point source at the industrial works.

Studies of magnetic susceptibility vs. various size fraction from the sediment samples appear to confirm that magnetite is responsible for most the susceptibility signal. It was observed that highest susceptibility was always found in the very fine sand sediments and coarse silt.

Down core susceptibility fluctuations and the correlation of susceptibility maximum with decrease in sediment particle-size and increase in heavy metal concentration indicators can be explained by increased erosion of fine particles from surface materials recently.

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