Relationships between chemical composition and grain size of the alluvial sediment in Nobi plain, central Japan

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Coastal fluvial plains with high sedimentation rates and rapid tectonic subsidence rates contain thick shallow marine sediments so called coastal prism, which formed during the Holocene. The sequential chemical composition of the coastal prism provides changes of the background information about chemical composition of bay sediment. This information is required for separating human pollutions from variations of natural chemical compositions. Fluvial deposits from far mountain terrain are homogenized and whose chemical composition strongly depends on their grain size distribution (Terashima et al. 2004). The relationship between grain size and chemical elements is necessary to address chemical composition variation. Two boring cores KZN (altitude:-1.52m, length:49.89m) and YM1 (altitude:0.69m, length:47m) drilled in Nobi plain were used for this study. Samples were collected at 1m intervals in depth. Two boring cores were divided into 4 sedimentary units based on depositional facies, Lower Sand/Mud(LS/M), Middle Mud(MM), Upper Sand/Mud(US/M), and Top Sand/Mud(TS/M) in ascending order. Chemical elements such as sodium(Na), magnesium(Mg), aluminum(Al), silicon(Si), phosphorus(P), sulfur(S), potassium(K), calcium(Ca), titanium(Ti), manganese(Mn) and iron(Fe) were analysed by wavelength-dispersive x-ray fluorescence spectrometer(ZSX PrimusII, RIGAKU) by calibration curve method. Grain size was analysed by Laser Diffraction Particle Size Analyser (SALD-3000S, SHIMADZU). For 89 samples, the correlation coefficient between each chemical element and median of grain size distribution was calculated: Na(-0.21), Mg(0.79), Al(0.93), Si(-0.61), P(0.46), S(0.09), K(-0.04), Ca(0.03), Ti(0.87), Mn(0.39), Fe(0.89). These elements were divided into 3 groups such as positively correlated elements(Mg, Al, P, Ti, Mn, Fe), negatively correlated elements(Si), and uncorrelated elements(Na, K, S, Ca) by 1% significance level of an uncorrelated test. Si content indicates the existence of siliciclastic sediments. Fine particles containing much Al are probably composed of clay minerals. Divalent cation such as Mg moves to solid phase by cation-exchange reaction(Clark and Herman, 1992) and adsorbed to the surface of clay minerals. Na, K and Ca are subjected to weathering and eluviation. These elements easily rework even after deposition for example by transgression and eluviation of acidic water(precipitation or groundwater). No correlation between S content and grain size suggests S is a suitable indicator of marine effect in depositional environment and the threshold of S content that divides marine stratum from terrestrial sequence was about 0.15% in the Nobi plain.

[References]

Terashima et al.(2004)Bulletin of the Geological Survey of Japan, 53, 749-774.

Clark and Herman(1992)in Water-Rock Interaction, 779-782.