

An experimental method for simple and easy sand composition analysis using a digital color scanner, a CAMSIZER, a soil c

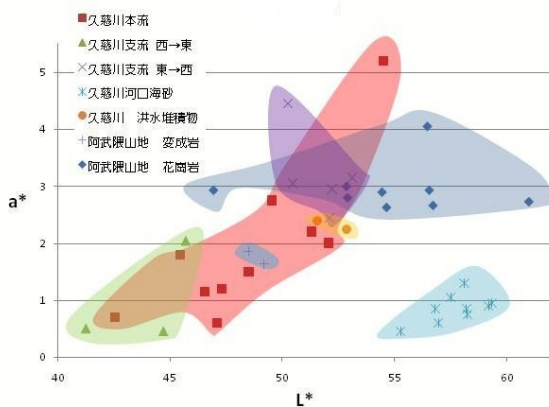
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Sand is intermediate particle size between gravel and silt (0.063mm to 2mm). Sand always exists in the vicinity of our living environment such as beach, eolian dune and riverside. However, we took time and effort to analyze the composition of sand using traditional research methods (Kumon and Tateishi, 1998). Therefore, according to the development of science and technology in recent years, everyone can easily get physical property values of sediments in a short time and more exactly.

In this presentation, we report about experimental method of river sand composition analysis using a digital color scanner Pixus iP8100 (Canon), a CAMSIZER (Horiba), a soil color reader SPAD-503 (Minoruta) and a magnetic susceptibility meter KT-10 (Terraplus) in the basin of Kuji River, Ibaraki Prefecture.

Keywords: digital color scanner, CAMSIZER, soil color reader, magnetic susceptibility meter, Kuji River, sand composition



Provenance of quartz of sediments along the Yangtze River drainage

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ESR is an analytical technique to estimate the amount of oxygen vacancy in quartz formed by natural radiation, whose amount shows positive correlation with the age of the host rock (Toyoda, 1992), whereas the Crystallinity Index [CI] of quartz has information on the physical condition of its formation (Murata and Norman, 1976). These two parameters give us information on the age and the rock type of its host rock characteristics.

The Yangtze River is the longest and largest river originates from the Tibetan Plateau, which has played a significant role in sedimentation and biogeochemical cycle in the drainage area, which is strongly influenced by East Asian summer monsoon. The provenance of the Yangtze River-derived sediments and its impact on the drainage and marginal seas have drawn our attention. Seven samples were collected from the bed of the mainstream and major tributaries along the Yangtze River drainages. Four samples were recovered from the rivers Lasa River, Nianchu River, Yarlung Zangbo River, which all located in the Tibet Plateau. Ten samples were collected from Yangtze River Delta. We extracted the two size fractions (<16 μ m, 16-63 μ m) separated from sediments and analysed ESR signal intensity of E1 center of quartz, and CI.

Our preliminary result revealed that ESR signal intensity values of the River located in the Tibet Plateau are around <0.6, indicating young detrital source. ESR signal intensity values are around <1.5 in the upper and middle Yangtze, suggesting average source age of Mesozoic. The ESR signal intensity values become 4 to 6 in the lower Yangtze, suggesting average source age of Palaeozoic to late Proterozoic. Therefore, the above results of ESR signal intensity show an increasing trend to the downstream along the main stream of the Yangtze River. ESR signal intensity values are different from each other in the Yangtze River Delta, which is around 4-12. Since ESR signal intensity values of Yangtze River are 4 to 6 in the lower Yangtze whereas the values become high (6.8 to 17.9) in the downstream of Dongting Lake (Yoshida, 2010). That means the provenance of the Yangtze River Delta sediments is not just main stream of Low Yangtze. Some major branches draining into the main stream or Dongting Lake drainage could impact on the Yangtze River Delta.

Keywords: Yangtze River drainage, ESR, CI

Late Cretaceous tectonics in the northern Japan deduced by detrital heavy mineral provenance

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It has been recognized that the Yezo Group, which is distributed in the Hokkaido islands, northern Japan, is regarded as a Cretaceous deposit in forearc area. The provenance of the Yezo Group offers the information of the significant aspect of the magmatic arc system developed in Asian margin during Cretaceous period. In the Upper Cretaceous succession of the Yezo Group, clastic rocks yield abundant detrital chromian spinels with other heavy minerals such as garnet, tourmaline, clinopyroxene, orthopyroxene and hornblende. In these detrital heavy minerals, chromian spinel found in sediments has particular significance to basin analysis because detrital chromian spinel derived from mantle peridotites and primitive rocks is indicative of magmatic and tectonic evolution in the source area. This study aims to clarify the transition of tectonic setting of the Cretaceous magmatic arc on the basis of the chemistry of chromian spinels with other heavy mineral characteristics. Thus, the upper Cretaceous sediments in Teshio-Nakagawa area were selected for this purpose.

The detrital heavy minerals for analysis were prepared by heavy liquid separation. The number of grains analysed by EDS is 97 grains of the chromian spinel, 183 grains of the garnet and 132 grains of the tourmaline. The chemical composition of detrital garnets suggests that the source area was composed of metamorphic rocks reaching greenschist to granulite facies condition and contact metamorphic rocks. Chemical analysis of detrital tourmalines indicates the derivation from metasediment. Chemical composition of the chromian spinel can be classified into three main groups that are (1) low TiO₂ (<0.5wt.%) type, (2) high Cr# (Cr/Cr+Al) - high TiO₂ (>0.5wt.%) type and (3) especially high TiO₂ (>2.5wt.%) type. In particular, this study has focused on high Cr# and high TiO₂ type, which belong to the most major group of chromian spinels. It is not clear that where these type chromian spinels, implying the sediment supply from primitive volcanic rocks was delivered. In addition, melt inclusions, which were included in some detrital chromian spinels, suggest that their parental magma has basaltic-andesitic affinity. The discovery of chromian spinels with the melt inclusion and high Cr# - high TiO₂ wt.% chromian spinels support existence of primitive volcanic rocks, which had been formed at the onset of the Cretaceous volcanic arc.

Keywords: Cretaceous, Yezo Group, chemical composition, detrital chromian spinel, heavy mineral

Provenance study of the Tetori Group in the Shokawa area, based on the polycrystalline quartz and whole-rock chemistry

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It is believed that the Jurassic sedimentary rock in Japan was deposited during later stage of the Yangtze and Sino-Korea continental collision. Most of the Jurassic sandstones are characterized by scarceness of rock fragments. The Upper Jurassic sandstones are more quartzose and lack in typical regional metamorphic fragments, however, tectonic environment showing increasing influence from crystalline rocks is obscure. In this study, whole rock geochemistry that obtained by XRF and sedimentary petrology of sandstones in the Middle Jurassic - Lower Cretaceous Tetori Group are discussed.

Sandstones of the Upper Tetori Group contain abundant polycrystalline quartz. Polycrystalline quartz show several varieties from elongated, bimodal, slightly curved, intercrystal boundaries to polygonized. Such polycrystalline quartz was possibly derived from mylonite, ultra mylonite, gneiss and crystalline schist originated from granite and quartzose sedimentary rocks.

The geochemistry of the sandstones in the Upper Tetori Group have less variety in comparison with those in the Lower Tetori Group, which suggests that the Upper Tetori Group was supplied from more monotonous provenance. The Chemical Index of Alteration (CIA : $CIA = Al_2O_3 / (Al_2O_3 + CaO + Na_2O + K_2O)$), which is established as a method of quantifying the degree of source weathering (Nesbitt and Young, 1982, 1984), the Upper Tetori Group exhibits higher CIA values with an enrichment in Zr and REE than those of Lower Tetori Group. Thus the Upper Tetori Group indicates considerable influence by recycled material. Because the late Jurassic major granitic intrusion with uplift are reported in inland area in the eastern part of the Chinese Continent, this transition of provenance implies denudation and exposure of old sedimentary rocks caused by the major uplift of continental crust.

Estimation of the wind variety using morphology of isolated sand dunes

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Sand dunes change their shaped depending on the wind variety. The shape of sand dunes is often used for an indicator of wind condition in areas where the wind conditions do not be known yet (e.g. extraterrestrial sand dunes on Mars and Titan).

Although sand dunes were used for estimation of long-term averaged wind direction only, a new method for estimating wind conditions was developed based on a series of flume experiments. The method using a phase diagram of isolated sand dunes can indicate bidirectionally-approximated wind variety (i.e. the angular variation and intensity ratio of the bidirectional flows).

In order to confirm the method, the method was applied to some dune field in Western Sahara and Mauritania, because the wind variety in this area was know by previous studies (direct measurement and meteorological reanalysis). The distribution of isolated sand dunes showed bidirectional wind condition consisting of northerly and easterly wind and gradual change of the intensity ratio of bidirectional wind elements. The estimation consisted with the data from the previous s studies.

Keywords: isolated dune, barchan dune, longitudinal dune

Terrigenous organic carbon contents of submarine earthquake and flood induced sediments

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Deep-sea sediments can preserve records of submarine earthquakes and floods older than the historical record, because they are unlikely to be affected by post-depositional erosion and transport. In this study, we analyzed the stable organic carbon isotope of seafloor sediments from the large 19th century Totsukawa flood, the severe flood in August, 2003, the Offshore Southeast of the Kii Peninsula Earthquakes 2004, and the 2011 Pacific coast of Tohoku Earthquake. The terrigenous organic carbon ratio of sediments from these natural disasters were estimated and correlated with those of normal seafloor sediments.

Flood induced sediments were characterized by high contents of terrigenous organic carbon. The contents of terrigenous organic carbon were low and similar in submarine earthquake-induced sediments and normal sediments. These results are useful for sedimentary analyses of older natural disaster.

Keywords: seafloor sediments, turbidite, flood, submarine earthquake, terrigenous organic matter, stable carbon isotope ratio