Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SGL042-P01 Room:Convention Hall Time:May 23 14:00-16:30

Stratigraphic study and sedimentary facies analysis of deep drill core in coastal area, Horonobe, Hokkaido

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Coastal area of Horonobe town in Hokkaido is a demonstration field to develop the evaluation methodology of a characteristic deep geological environment on the coastal region in Japan. Horonobe town locates in the Teshio plain where the basin subsidence is remarkable. Comprehensive geological structure of the Teshio plain has been understood by a large-scale geophysical exploration. The drilling site locates in the dune developed along the coast of the Teshio plain and the subsurface geology is composed alluvium (about 85m in thickness), Sarabetsu Formation (Pliocene to lower Pleistocene) and Yuchi Formation (Pliocene). However detail geology is not clarified because of any deep drilling has not been done at all in the coastal region of Horonobe town. We are carrying out the deep drilling survey to the depth of 1,004m in the site and the laboratory analysis of the core. From the result of analysis, it is cleared that geology is composed Sarabetsu Formation in which the cycle of gravel and sand rocks to mud repeats at a 30 to 50m cycle at thickness until 470m and Yuchi Formation in which sand or mud rocks at depth between 470m and 1,004m. In Sarabetsu Formation, sedimentary facies are classified several types such as shallow marine, lagoonal and fluvial deposits, and Upper part of Sarabetsu Formation is mainly composed of lagoonal and fluvial deposits. Yuchi Formation is mainly composed of shallow marine deposits in which repeated cycles of fining-upward succession are considered. From the cyclic succession of rock and the long-term change of sedimentary facies, it is suggested that geological environment of the site has been changed regionally from marine to fluvial environment with the sea level fluctuations.

Keywords: Coastal area, Deep all core drilling, Stratigraphy, Sedimentary facies, CNS elemental analysis

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Provenance study of the Jurassic clastic rocks in the Sizugawa area, South Kitakami Terrane

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The previous result of the provenance studies from conglomerate, sandstone and heavy minerals in the Jurassic sedimentary rocks in the South Kitakami Terrane revealed that the most of detritus was derived from granitic rocks and continental basement. However, sparse work has focused the provenance change during Jurassic time. Moreover, little work has addressed whole-rock chemical composition with trace elements related to provenance analysis.

The Jurassic sediments distributed in the Shizugawa area, South Kitakami Terrane, are divided into two groups; the Lower Jurassic Shizugawa Group and Middle-Upper Jurassic Hashiura Group. The purpose of this study is to examine the provenance change from the Lower to Upper Jurassic sediments in the Shizugawa area, on the basis of its major and trace elements compositions including rare earth elements (REE) by XRF and ICP-MS.

Major elements: Sandstones show SiO_2 contents between 61-76 wt% (average 69 wt%). Average of Al_2O_3 and K_2O/Na_2O ratios are 15 wt% and 0.7 respectively. Siltstones show SiO_2 contents between 59-70 wt% (average 65 wt%). Average of Al_2O_3 and K_2O/Na_2O ratios are 17 wt% and 1.3 respectively. Chemical composition of sandstones and siltstones closes to felsic igneous rocks, however Al_2O_3 is relatively enriched. Moreover, there is no significant trend become enriched in SiO_2 content in the Late Jurassic sediments that was suggested from the sandstones in the Soma and the Oshika areas, South Kitakami Terrene.

CIA index and A-CN-K diagram: The Chemical Index of Alteration (CIA : $CIA=Al_2O_3/(Al_2O_3+CaO*+Na_2O+K_2O)$ is established as a method of quantifying the degree of source rocks weathering (Nesbitt and Young, 1982, 1984). The Jurassic sediments in the Shizugawa area show CIA index from 51 to 70. The plots in A-CN-K diagram, which consists of Al_2O_3-CaO+Na_2O and K_2O as end-members, suggest the protolith of the Jurassic sediments is correlated to felsic igneous rocks. Furthermore, it is also suggested that the Middle-Late Jurassic sediments were supplied from more felsic source rocks than the Early Jurassic.

REE pattern: REE patterns show enriched LREE and significant negative Eu anomalies, which is similar to the one of PAAS (post-Archean Australian shale: Taylor and McLennan,1985). Those patterns suggest that the provenance of the Jurassic sediments was mainly granite and continental basement. Middle Jurassic sandstones show significant trend enriched LREE. Because no siltstones show this trend, it is possible that the sandstones had different provenance from siltstones.

Trace elements: It is known that Th/Sc ratios reflect magmatic differentiation (Taylor and McLennan,1985; McLennan and Taylor,1991). The Middle and Upper Jurassic sediments have relatively high Th/Sc ratios (>1).

Geochemistry of the Jurassic sediments indicates the source rocks was granite and continental basement. The plots in A-CN-K diagram and trace elements imply the derivation from more felsic source during Middle to Late Jurassic time.

The obvious compositional change during Jurassic period has been reported from chemical composition and modal analysis of the sandstones in Japanese islands. The derivation from more felsic source rocks is recognized in the Middle and Late Jurassic time also in the Shizugawa area, which suggests the large provenance change in the eastern margin of the Asian continent.

Keywords: Jurassic, clastic rocks, provenance, chemical composition, rare earth element, trace element

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The chemical composition of the detrital heavy minerals in the Upper Cretaceous Kuji Group, northeast Japan

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The Kuji Group distributed in the northern part of the Kitakami Mountains is regarded as a Cretaceous deposit on forearc area. The sediments in the Kuji Group have remarkable characters with a large amount of lithic fragments, which reflects the derivation from various rock types. The provenance of the Kuji Group offers the information of the significant aspect of the Cretaceous arc system. Thus the provenance analysis of sandstones from the Kuji Group was carried out to clarify the detail of the hinterland on the basis of the chemical composition of detrital heavy minerals using by EDS. The detrital heavy minerals for analysis were prepared by heavy liquid separation. The number of grains analyzed is 36 grains of the garnet, 108 grains of the chromian spinel, and 127 grains of the tourmaline. Chemical analysis of detrital garnets reveals that the source area of the Kuji Group was composed of regional metamorphic rocks reaching greenschist to granulite facies condition and contact metamorphic rocks. The chemical composition of detrital tourmalines suggests the derivation from metasediment. Detrital chromian spinels is characterized by high TiO_2 ($>$ 0.5wt.%) implying the supply from island-arc basalts and intra-plate basalts. Small amount of chromian spinels with low TiO_2 ($<$0.5 wt%) are derived from ultramafic rocks. These chemical compositions of detrital heavy minerals suggest that the provenance of the Kuji Group was composed mainly of thermal metamorphic rocks, basic volcanic rocks and ultramafic rocks. The source rocks are found mainly in the North Kitakami Terrane and its contact metamorphic zone by Cretaceous granite, close to the Kuji Group. In respect to chromian spinels with low TiO_2 wt%, the source rocks are limited in ultramafic rocks of the Hayachine Terrane. During the late Cretaceous time, northeast Japan arc was situated along the eastern margin of the Asian continent where was suffered by active lateral fault (Xu et al., 1989). Thereby, it is likely that the wide variety of rocks were distributed with various erosional levels in the hinterland affected by such enhanced tectonism.

Keywords: detrital garnet, detrital chromian spinel, detrital tourmaline, provenance, Late Cretaceous, chemical composition

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Zircon U-Pb ages for granitic rocks from the cores drilled in the Kanto Plain

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We present the results of SHRIMP zircon U-Pb ages for basement granitic rocks of core samples drilled by AIST at Iwatsuki (1971) and southern Tsukuba (Kukizaki: 2006). For comparison, the zircon U-Pb age for Namee Granite exposed to the north of the Median Tectonic Line in the Shimonita area is also presented. The two core samples dated are 3509 m, the deepest part, from Iwatsuki and 809 m from Kukizaki, and are both mylonitized tonalite yielding cooling ages of 77-70Ma (Iwatsuki) and 66Ma (Kukizaki) reported. The results of zircon ages are:

IT3509 (Iwatsuki, tonalite) : 79.8 +/- 0.8Ma, 69.9 +/- 0.4Ma

KZ803 (Kukizaki, tonalite) : 86.3 +/- 0.7Ma

03122304 (Namee, granite) : 70.3 +/- 0.3Ma

These results suggest that the Iwatsuki and Kukizaki core samples are not correlative in age with the Abukuma and Tsukuba granitic rocks, but with the Ryoke granitic rocks, especially, with the older Ryoke granitic rocks. The Namee Granite is correlative with younger Ryoke granitic rocks, and is concordant with the lack of Ryoke regional metamorphic rocks around the granite body.

Keywords: Kanto Plain, Ryoke granitic rocks, SHRIMP zircon age

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Geology of the Takato-Hase district and the Ohsawa fault in the eastern Ryoke belt

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Jurassic accretionary complex and Ryoke metamorphic rocks are widely exposed in the easternmost Inner Zone of the Southwest Japan where strikes of bedding and schistosity planes are approximately N46E. The southern part of the Takato district is however an exceptional region where strikes of foliations are approximately N15E. A fault is suggested between the Takato district and its surrounding region. Hence, geological survey was carried out. The result is shown in Figure 1. The left map is of the southern part of the Takato district and the right map is of the Hase-Ichinose district located in the south of the Takato district.

Geology of the Takato district

Tomigata Granite is exposed in the western part of the surveyed region. The granitic pluton intruded into coarse-grained gneisses in northern regions and medium-grained gneisses in southern regions. Nevertheless, large blocks of low-grade metamorphic rocks which consist of biotite schists, biotite-cordierite schists and small amounts of meta-chert and calcareous rocks occur in the northern part of the pluton. The existence of a fault which is named as Ohsawa Fault (Figure 1) is suggested on the basis of the significant gap of metamorphic temperatures.

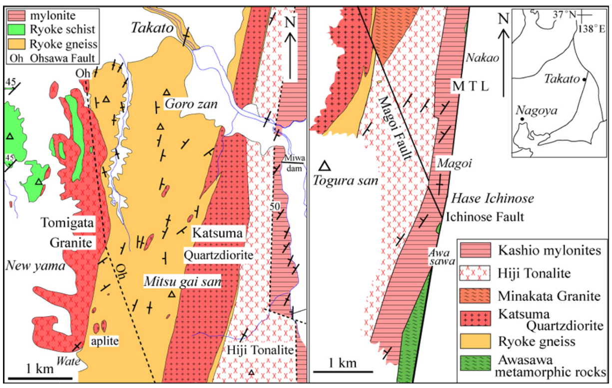
The location of the Ohsawa fault cannot be determined precisely in the Newyama area to the west of Mt. Mitsugaisan where psammitic gneisses are widely exposed. However, the existence of the Ohsawa fault is evident from the differences in strikes of foliations and grain-sizes of minerals. Quartz and plagioclase of psammitic gneisses to the west of the Ohsawa fault are small in grain sizes as compared with those of garnet-containing psammitic gneisses exposed near Mt. Mitsugaisan.

Geology of the Hase-Ichinose district

Hiji Tonalite and Katsuma Quartzdiorite are cut by the Magoi fault according to the geological maps published before. Actually, many faults are observed near the Magoi fault. Nevertheless, the strikes of foliations of Hiji Tonalite are approximately N40E in the Hase-Ichinose region. An exceptional site is found where the strikes of foliations are approximately N40W. Moreover, highly altered granitic rocks are exposed adjacent to the exceptional site. The exceptional site appears to be the Magoi fault. Altered granitic rocks which contain abundant oxychlorite are found at another locality to the southwest of the exceptional site. The trend of the Magoi fault is approximately N15W.

Summary

The Ohsawa fault was formed during the deformation of the Ryoke belt of the Takato district after the Ryoke regional metamorphism. The northern part of the fault is a boundary between Ryoke schists and gneisses. The Ryoke metamorphic rocks were intruded by Hiji Tonalite and Katsuma Quartzdiorite after the formation of the Ohsawa fault. Finally, the late Cretaceous granitic plutons were cut by the Magoi fault. The Magoi fault may be formed by the reactivation of the Ohsawa fault.



Keywords: eastern Ryoke belt, Mitsugaisan, Tomigata Granite, metamorphic rocks, Ohsawa Fault, Magoi Fault