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

SCG065-P01 Room:Convention Hall Time:May 23 10:30-13:00

Major Tectonic Lines and Tectonic Erosion during the Opening of Japan Sea

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Median Tectonic Line (MTL) and Fossa Magna (Itoigawa-Shizuoka Tectonic Line) had long been considered to be the most critical fault boundaries to control the development of the Japanese Islands since Naumann (1885) and Kobayashi (1941). After the appearance of plate tectonics, several new interpretations emerged, e.g., sub-surface Benioff plane for the MTL. In this paper, we propose those tectonic lines, major faults, as well as Tanakura Tectonic Line (TTL) were formed through the process as microplate boundaries during the opening of Japan Sea in the Miocene.

MTL could have been formed along the consuming boundary between PHS plate and Japan Sea microplate, which has shifted southward to Nankai trough, accompanying a huge scale tectonic erosion. Fossa Magna was formed as a gigantic transform fault with a transtension component in the Medial-Japan Sea when opening initiated. The eastern and western boundaries of Japan Sea must be strike-slip fault, corresponding to TTL on the east, and a newly proposed strike-slip fault called West Kyushu Tectonic Line herein, respectively. Fossa Magna, an medial region defined by two NS-trending Miocene parallel faults in central Honshu, defined by Nauman(1885) could be interpreted to be a largest transform fault in Medial-Japan Sea to offset the spreading axis when Japan Sea opened.

It should be emphasized that the occurrence of huge-scale tectonic erosion in front of consuming plate boundaries faced to PHS and PAC plates oceanward during the opening of Japan Sea. The volume of the tectonic erosion is calculated to 17,581,500km3, mostly equivalent to that of 2/3 present-day Japan arc crust, which is much enough to reach the depth of megalith between upper and lower mantle boundary, even with the 10km thichness of materials eroded and transported along the Benioff zone.

Although MTL, Fossa Magna and TTL are remarkable in geology of Japan, these young faults have never affected orogeneses of Japan back to 520Ma, which have grown continental crust of Japan. We propose herein that microplate boundary processes decreased the amount of Japan crust.

Keywords: Japan Sea Opening, MTL, Fossa Magna, microplate, tectonic

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Tectonic development of Buchan metamorphic unit in NE Scotland,UK

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Buchan metamorphic unit in NE Scotland has been argued relations between Barrovian metamorphic unit. Fettes et al. (1976) suggested that the Buchan zones were the part of a progressive decrease in the pressure of metamorphism from the southwest to the northeast Highland. On the other hand, Read (1952) regards the Barrovian and Buchan metamorphisms as quite separate events. Dempster (1985) and Dempster et al. (1995) reported certain gap metamorphic age between Buchan and Barrovian, and Kawai et al. (2008) reported pressure gap between those unit. Newer gabbro proximity Portsoy area is relation with sub-arc lower crust (Droop et al., 2003). To ascertain the above-mentioned uncertainty of geotectonic attribution between the Buchan and Barrovian metamorphic unit, in this study I investigate U-Pb age populations of detrital zircons from Buchan and Barrovian metasedimentary rocks, with using LA-ICP-MS. Detrital zircons in Buchan metamorphic unit and Highland Boundary Fault yield U-Pb ages ranging from 3400 Ma to 400 Ma. Detrital zircons separated from metasandstone in the Argyll Group, Southern Highland Group and Highland Boundary Complex yielded ages which are predominantly of Archaean to Mesoproterozoic. In contrast, zircons from Fintna Group, top sequence of Buchan metamorphic unit, yield ages ranging from late Paleoproterozoic to Archaean and Phanerozoic grains rare. This result constrains tectonic development of Buchan metamorphic unit. Based on result of zircon age distribution, it was rejected that possibility of intra-oceanic arc history or resting on large scale ocean that interrupted sediment from Laurentia. I contribute explanation of Buchan metamorphic unit based on result of this study and already reported expertise of petrology.

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Genesis of the charnockite from Mt. Cronus in the Napier Complex, East Antarctica

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One of the themes that important of the Earth's history is the Archean -Proterozoic crustal formation and evolution. The felsic gneiss of igneous origin and granitic rocks, of Archean to Proterozoic age, are widely distributed in the Napier Complex, East antarctica, that a suitable field to study the formation and the evolution of the initial continental crust. The aim of this study has been clarify the origin of the charnockite and suggest the evolution model of the continental crust when the Archean to early Proterozoic.

Mt. Cronus is located in the center of the Napier Complex, and is in the area of the ultra high temperature (UHT) metamorphism. The dominant rock in the Mt. Cronus is charnockite that have a weakly gneissose structure, and metagabbro cuts structure of the charnockite. In addition, the sapphirine(Spr)-bearing granulite was confirmed.

Charnockite is composed of Qtz, Pl, Opx, Bt, Grt, and mesoperthite. Bulk compositions are plotted to the area of post-Archean TTG and within-plate granite. The Rb-Sr whole rock isochron age of 2323+/-191 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.71903+/-0.01299, and the Sm-Nd whole rock isochron age of 2294+/-73 Ma with an initial $^{143}Nd/^{144}Nd$ ratio of 0.50945+/-0.00007 are obtained from charnockite. On the other hand, an initial $^{87}Sr/^{86}Sr$ ratio of the metagabbro is considerably low with 0.7029. As a result of having used plagioclase- alkali feldspar thermometer about mesoperthite in the charnockite, it was estimated at about 1,000-1,100?C. In addition, Spr-Grt-Opx-Sil-Qtz-bearing granulite contains evidence for the early stability of Spr+Qtz. This assemblage is later replaced by Opx+Grt+Sil.

Based on the above-mentioned result, I examined the continental crust formation and the evolution model of the Archean to the early Proterozoic in the Mt.Cronus. Asami et al.(1998, 2002) reported the zircon ages, of the quartzofelspathic gneiss in the Mt.Cronus, are as follows; 3.65Ga, 3.0Ga, 2.7Ga, and 2.4Ga. The Rb-Sr whole rock isochron age of 2323+/-191 Ma in this study that is similar to zircon ages, as a formation age of charnockite. On the other hand, 3.3-3.7Ga of Nd model ages same as 3.65Ga from zircon. Therefore, it is thought to indicate the protolith age. High epsilon Sr and low epsilon Nd values of charnockite show that the original rocks derived from continental material.

The pressure condition as UHT metamorphism of Spr-bearing granulite is estimated at 1GPa degree, and afterwards isobaric cooling. The heat source satisfying such a condition, it is easy to explain that the heat derived from the mantle. The heated crust was partially melting, and granitic crust grows up by its magma. The basaltic magma of the heat source intruded in the crust and would make gabbro as low initial Sr isotope ratio.

In the Nd model ages of the feldspathic gneiss, a result of Mt. Bergin:2.3-2.7 Ga, Geffrey Hills:2.7-2.8 Ga, Fyfe Hills:2.8-3.4 Ga, and Mt. Cronus:3.3-3.7 Ga, were provided from West to central area of Napier Complex. Mt.Cronus, the near to the center of Napier Complex, is the oldest model age, and the outward is younger model age. It show that the growth process of the Napier Complex as a continent crust, if there is a meaning of a difference ages and the place.

<References>

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Keywords: Napier Complex, charnockite, Sr, Nd isotope, continental crust, Archean, Proterozoic

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The superplume-supercontinent cycle from the viewpoint of thermal evolution of the mantle

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In this talk, we will review the superplume-supercontinent cycle from the viewpoint of thermal evolution of the mantle.

According to recent geological and geochemical studies, it is becoming obvious subduction erosion take place at plate boundaries all over the world. Then, the next question is what is the role of the subduction erosion on thermal evolution of the mantle. We propose a new superplume-supercontinent cycle model in which subducted granite works as an effective heat source in the mantle to invoke superplume, resulting supercontinent breakup.

Keywords: thermal evolution, superplume, supercontinent, mantle dynamics