

Japan Geoscience Union Meeting 2011

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

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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 thickness 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 orogenesis 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