Journal of **Kim Il Sung** University (Natural Science)　　Vol. 4 No. 1 Juche104(2015)

The Tectonic Environment of Mesozoic Crust Evolution of East Areas in Korea-China Block

Ryang To Jun

Abstract The main cause that influenced in the Mesozoic tectonic environment of our country is the complicated tectonic boundary conditions Korea-China block and the activation of crust-mantle interaction attendant of upon the change of lithosphere-asthenosphere structure. Low Mesozoic crust evolution was influenced by mainly tectonic boundary conditions, after that time, the crust evolution was influenced by mainly activation of crust-mantle interaction attendant upon the change of lithosphere-asthenosphere structure.

Key words Korea-China block, Mesozoic crust evolution, tectonic environment

Introduction

The great leader Comrade **Kim Jong Il** said.

"**As topographical conditions are different from one country to another, and even the same natural law changes in its form of expression and mode of action when the natural conditions and circumstances change, all the problems arising in scientific research should be solved creatively on the basis of the actual conditions of one's own country.**"

("**KIM JONG IL** SELECTED WORKS" Vol. 12 P. 203)

The crust of the eastern Korea-China block that has been evolved safely from Middle Proteozoic to Late Paleozoic, entered sudden change stage [1, 2]. Such kind of "Mesozoic activation of platform" is related to the change of tectonic environment.

In Korea-China block including our country, crustal movement as well as tectonic movement and igneous activity that was progressed in high key since Mesozoic, was affected by complicated tectonic boundary condition causing by mutual collision of the blocks and sudden change of crust-mantle [1－20].

In this paper, I discussed Mesozoic tectonic environment of eastern Korea-China massif including our country by analyzing the recent geological, geophysical research results about mainly the adjacent area.

1. The Tectonic Boundary Conditions of Korea-China Block

Since Mesozoic, Korea-China block including our country was affected by complicated tectonic boundary condition.

In Late Paleozoic-early Mesozoic (≈250Ma～220Ma), the blocks as well as Korea-China block, Yangtze block, Indochina block, Tarim block, Kazakh block, Turkey block, Iran block formed

Asian continent, as colliding and combining rapidly with each other [5－8]. As Korea-China block was combined with northern Siberian block and southern Yangtze block by colliding with each other, they linked tobe a mass, thus they become a part of Eurasia continent.

This process of colliding and combining in Late Paleozoic-Early Mesozoic was greatly influenced from the boundary to the inner part of Korea-China block.

Viewed at colliding era, Korea-China block was collided with Siberian block toward the north in Late Paleozoic-Early Mesozoic and with Yangtze block toward the south in Middle-early Late Triassic. At the Dabie-Suru extra-high metamorphic belt, the era of high pressure-extra-high metamorphism is 242～224Ma (conform to the era of Songrim tectonic disturbance) [9－16].

The influence of this kind of the colliding was expressed by mainly compressive force south to north trending compressive force. By the influence of compressive force south to north trend, the near east to west trend linear folds and thrust had formed and the main faults NE or NW trend had formed or re-operated, thus the tectonic profile was started forming in our country. At that time, the linear folds and thrusts were formed in the sedimentary strata that was relatively weaker cementation than previous geological bodies. We can illustrate the regular linear folds and trusts near east to west trend in Phyongnam basin and thrusts in Rimjingang tectonic zone by example.

2. The Tectonic Features of Lithosphere-Asthenosphere (Crust-Mantle) in Our Country and The Adjacent Area

Based on the synthetic analysis about accumulated deep geophysical data up to now and the artificial seismic waves deep CT data (13 big deep geological section and 60 artificial seismic waves deep measurement data) of 50 000m long, 3-D layer velocity distribution data [5, 6, 11－20], we drew up a new lithosphere-asthenosphere model in this paper (Fig. 1).

As seen in this picture, the thickness of lithosphere is 50～80km, the thickness of asthenosphere is 200～300km in eastern Korea-China block. But the thickness of lithosphere is 140～200km, the thickness of asthenosphere is 40～100km in western China (Xizhang tableland and Tarim basin et al.). The variation range of lithosphere thickness is 50～200km and asthenosphere thickness is 40～300km, so variation range is large. Thus, we can know that there is a distinct difference of lithosphere thickness and asthenosphere thickness between Korea-China block and the adjacent area when comparing them.

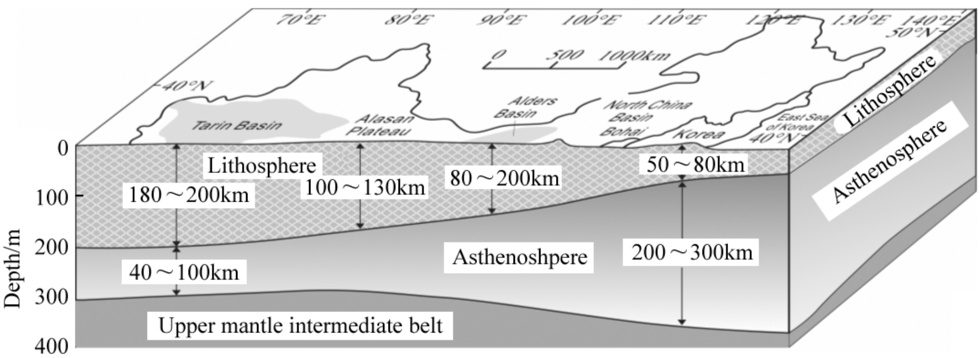

Fig. 1. Lithosphere-asthenosphere model in Korea-China block and the adjacent area

In western China, lithosphere thickness is only 40～100km. But eastern Korea-China block is an asthenosphere upheaval area that its asthenosphere thickness is 100～120km thicker than western China, it gives us suggestions that continental lithosphere thickness is decreased and is at tensile stress state as hot mantle material was risen up. Thus, some researchers call the eastern Korea-China block is a lithosphere thickness decrease area, lithosphere tensile area or eastern Asia lift area [17].

As seen in Fig. 2, average thickness of lithosphere is very closely related with tectonic movement in time. The old block(old platform) that their formation period like Korea-China block, their average thickness of lithosphere is all about 200km [10]. But average thickness of Korea-China block is 50～80km likely Mesozoic orogen or active belt in Fig. 2, thus we must regard the average thickness of Korea-China block as 200km like the Precambrian blocks. Thus, decreased thickness is about more than 100～120km from Mesozoic to now. Such thickness decrease of lithosphere is begun from Low Mesozoic after Middle-Late Mesozoic when south-north trend compressive force them.

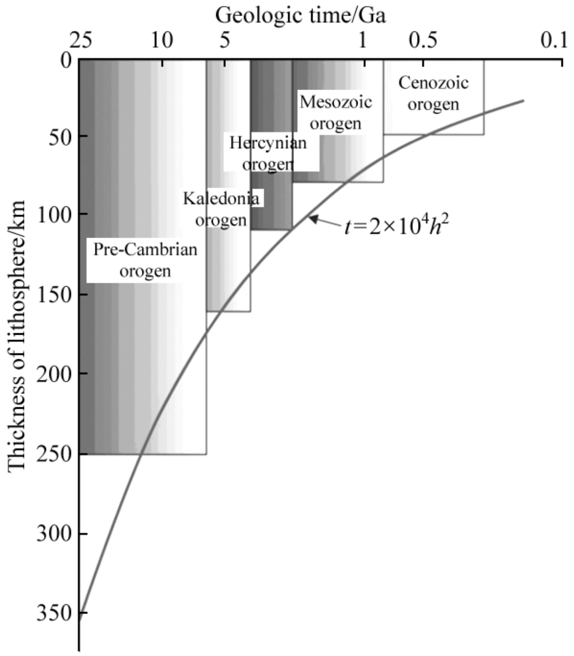

Fig. 2. Relation with lithosphere thickness of different tectonic units and tectonization period

Eastern Korea-China block is clearly different with western China in seismic wave velocity of lithosphere and asthenosphere. Transversal wave of lithosphere V_S is 4.25～4.40km/s in eastern Korea-China block, more than 4.50～4.60km/s in western China [9]. Transversal wave velocity of lithosphere in eastern Korea-China block is 0.2～0.25km/s lower than western China, transversal wave velocity of asthenosphere is 0.15km/s lower than western China.

The main effect among the effects influence to the variation of seimic wave velocity is temperature, next, chemical composition. In this way, lithosphere temperature of eastern Korea-China block is about 360℃ higher than western China [9].

Like this, lithosphere thickness was decreased at least 100～120km, south to north trend compressive deformation in low Mesozoic was turned to near east to west trend continental lithosphere tensile system from Middle-Late Mesozoic as rising of the huge asthenosphere material and heating of lithosphere by that, decreasing their thickness.

Under these intricate tectonic environments, the NE, NNE trending lift system began to develop in our country and the adjacent area, intrusion action of huge amount granite and magma eruption action happened in eastern Asia continental including our country. In our country, Cretaceous basin was expanded under the influence of tensile action and a large amount of intrusion action of granite was happened. In Late Cretaceous-early Tertiary period, Bohai basin, North China basin, Jianghan basin as well as Korean West Sea basin was formed [12]. And the Phyongwon metamorphic core complex and Anak-Sinchon metamorphic core complex, Ichon metamorphic core complex, Yangdok metamorphic core complex in our country and Yakan metamorphic core complex, Huhehaote metamorphic core complex, Winmengsan metamorphic core complex, Songliao metamorphic core complex in China were formed.

The appearance of the tensile structure as well as the lift basin and volcanic-metamorphic core complex in the upper crust is a main expression form of lithosphere thickness decrease.

Many studies on the process and cause of lithosphere thickness and asthenosphere elevation have been done, the most important things are two opinions, first is the mantle plum model, second is that the cause is the subsidence action of the Pacific Ocean plate at the present time [5].

In 1980s, the Mesozoic crust evolution problems of our country and the northeast China, Russia Far East area were widely studied, the view that it was related to the evolution of West Pacific Ocean structural zone, was superior [7]. In 1990's, it formed the greater part of the opinions that subduction of West Pacific Ocean oceanic crust to the bottom of east-north Asian continent is main cause of lithosphere thickness decrease of east-north Asian continent in upper Mesozoic era and thus, huge scale magma intrusive action was progressed [3, 4, 13−20]. But the recent research data were contradictory to these opinions. Those are same as follows:

Mesozoic eruptive rock in northeast China and north China is distributed as a planar pattern, not a banded pattern and the rule is not clearly that basalt's components, K_2O+Na_2O, K_2O/Na_2O, K_2O is increasing more from adjacent sea to inner continent, the polarity of typical island arc eruptive rocks is not appeared such as eruptive rock's K_{60} content is increasing more from east to west, the study about the inclusion body originated in mantle of eruptive rocks and geochemical characters of eruptive rocks.

Among the guest elements of eruptive rocks in northeast of China, there is a linear relationship between Sr−Nd and Ba/Nb isotope specific value, this is difference from the eruptive rocks formed by oceanic crust subsidence action.[16] Thus, many researchers began to find out the cause of lithosphere thickness decrease in Middle-Upper Mesozoic and broad distribution of alkalinity eruptive rocks and intrusive rocks within a lot of Na, K in northeast of Asia continent [15, 16]. Thus, mantle plum model was suggested.

Mantle plum model regards that thermomechanical erosion and chemical erosion is progress at the bottom of the lithosphere and thickness of lithosphere is continually decrease, while heat of mantle material is transmit to inner lithosphere, so lithosphere is heat by upheaval of hot mantle plum, this heating process is attended with the process that hot molten mass from asthenosphere is permeated into lithosphere (such as granite intrusion) [4, 9].

Conclusion

The main cause that influenced to the Mesozoic tectonic environment of our country is the complicated tectonic boundary conditions and the activation of crust-mantle interaction attendant upon the change of lithosphere-asthenosphere structure.

Low Mesozoic crust evolution was influenced from mainly tectonic boundary conditions, after that time, the crust evolution was influenced from mainly activation of crust-mantle interaction attendant upon the change of lithosphere-asthenosphere structure.

According to the up-to-now research materials, in eastern Korea-China block, the cold and thick(＞180km) lithosphere that had existed until Late Paleozoic-Early Mesozoic was changed with hot and thin(＜100km) lithosphere in Middle-Later Mesozoic-Cenozoic and there was a wide difference in the lithospheres of two era, it is difficult to explain with only subduction of Pacific plate and we must make greater study about that.

References

[1] 강처순 등; 지질 및 지리과학, 2, 33, 주체91(2002).

[2] 김려찬 등; 지질 및 지리과학, 2, 36, 주체91(2002).

[3] Y. Liu et al.; Tectonophysics, 398, 3－4, 199, 2005.

[4] U. R. Christensen et al.; Mantle Plumes, Springer Press, 1～499, 2007.

[5] 张兴洲 等; 中国兴蒙－吉黑地区岩石圈三维结构及演化, 地质出版社, 29～138, 2011.

[6] 段秋梁 等; 地球物理学进展, 22, 2, 403, 2007.

[7] 葛肖虹 等; 中国地质, 34, 2, 22, 2007.

[8] 葛肖虹 等; 石油学报, 22, 5, 1, 2001.

[9] 王良书 等; 二十一世纪初构造地质学发展战略学术研讨会论文摘要, 149, 2003.

[10] 张文佑 等; 地质学报, 1, 33, 1983.

[11] 马演生 等; 地球学报, 23, 2, 113, 2002.

[12] 马寅生等; 中国东部－朝鲜半岛海陆构造格局及含油气盆地特征, 地质出版社, 158～163, 2007.

[13] 段吉业 等; 地质通报, 14, 6, 558, 2005.

[14] 葛肖虹 等; 地质通报, 25, 9－10, 1022, 2006.

[15] 任收麦 等; 地质学报, 80, 8, 1110, 2006.

[16] 任收麦 等; 第四纪研究, 25, 4, 484, 2005.

[17] 刘俊来 等; 自然科学通报, 16, 1, 77, 2006.

[18] 赵海滨 等; 地质科学, 42, 1, 34, 2007.

[19] 万天丰; 中国大地构造学刚要, 地质出版社, 75～117, 2004.

[20] 朱介寿 等; 中国地质, 38, 1, 793, 2006.