Deep structure and evolution of the Eurasia continent, derived from seismic investigations

Masaki Kanao[1]

[1] NIPR

http://polaris.isc.nipr.ac.jp/~pseis/

Study on the present structure and past evolution of lithospheric environment on the Eurasia continent provide an information to reconsider the process of amalgamation and breakup of super-continents in the Earth's history. The knowledge about the lithospheric environment would give rise to a unique speculation on the future super-continent formation. The largest continent on the present Earth, Eurasia, has been formed from an assembly of several sub-continental blocks including Asia, India and Europe: it is also considered to be the nucleus of a future super-continent expected to form 250 m.y. after the present. In this presentation, several significant seismic topics are introduced on the basis of recent progressed studies on the Eurasia continent, particularly focused on the Siberia and Arctic Russia.

a) Characteristic features in various tectonic provinces from Archean to Phanerozoic ages. These terrains have evolved affecting to each other originated from the nucleus of Precambrian ctratons, followed by adjacent Proterozoic mobile belts, Mesozoic and Cenozoic tectonic terrains, together with the recent subduction, rift, and lithospheric deformed area. A tentative process of continental growth was demonstrated by investigating architecture of present lithospheric structure.

b) Significant characteristics of deeper part of the crust and topmost mantle were identified beneath Northern Siberian craton, Yatukia region, by deep seismic surveys. Depth and velocity variations can be found in the inner crustal structual boundaries, attributed by the high correlation between topography and the deeper boundaries. Crust - Mantle boundaries, moreover, have velocity variations in 7.7-9.0 km/s, together with thickened Moho discontinuity particularly in the kinberlite province, Northern Yakutia. Tectonic activation was occurred associated with kinberlite magmatism in Middle Paleozoic age. Deepened crust with high Pn velocities were formed by the magmatic underplating.

c) Specific seismic and volcanic activities are distributed within Arctic Eurasia terrains. Recent development in field surveys, laboratory measurements for the supra-crustal rocks, satellite geodetic measurements such as GPS, together with computer sciences have improved the knowledge of ongoing lithospheric activity and deformation processes. Stress distribution of the elastic lithosphere derived from seismic anisotropy and geological drilling indicate complex features consist from compression, shearing and extension in the individual tectonic province.

d) Remarkable features in the upper mantle can be observed from several seismic techniques, associated with subduction of the oceanic plates (slabs) in the Far East region of Russia, together with continent-continent collision such as India-Himalaya-Tibet area. A thermal fluctuation beneath Siberian platform has been revealed by deep seismic sounding from PNE sources with ultra long profiles about 400 km in length. Partially molten and delaminated lithosphere is identified beneath Western Siberian Basin (Morozova et al., 1999). Depression of 410 km seismic discontinuity is also detected associated with high geotherms on the surface of the Basin.

e) The present scheme and formation mechanism of a super-plume have significance in order to learn about the structure, dynamics of deep interior of the Earth. Any scale of heterogeneity, anisotropy at the CMB and the above D layer, would help us to know about the chemical / physical interaction between Crust-Mantle system and deeper portion of the Core. Upwelling / downwelling process of a super-plume within the mantle beneath Eurasia have significance to obtain knowledge of mantle dynamics and development of super-continents.