Why Is the Korean Seismicity Not So Severe As the Vicinities Such As NE China, SW Japan, and Sakhalin?

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Although the Korean Peninsula is located in great earthquake regions such as NE China and SW Japan, it has never been in calamitous and catastrophic earthquakes for last 2000 years according to historical and instrumental records. We propose a hypothesis of the Baikal- Korea Plate (BKP) or Amurian Plate to account for the low seismicity of Korea. The Baikal-Korea Plate is generated by the Baikal Rift Zone active spreading and passive rifting due to a collision of the Indian and the Eurasian plates and is heading toward primary NW- SE movement with a counter- clockwise rotation and translation (Figure 1).

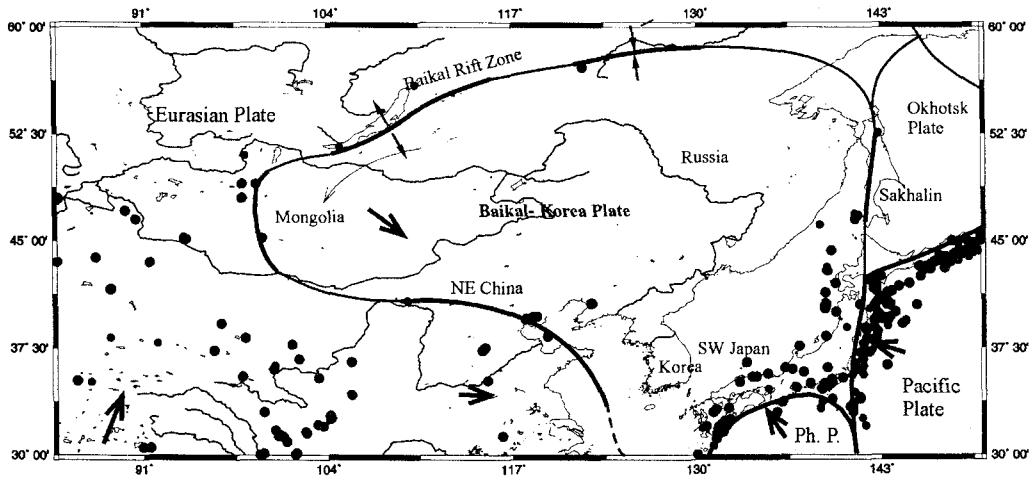

Figure 1. Large shallow- focus Earthquakes (M> 6.0) in NE Asia (1900- 1998).

This movement continues through the Central Mongolia, NE China, SW Japan and Sakhalin (see Figures 2a and 2b). We also found that the seismicity of Western Mongolia is more severe than Eastern Mongolia, indicating that the Eastern Mongolia is influenced by the high compression tectonic force, whereas the Western Mongolia is related to the extensional tectonic force of the Baika Rift Zone [*Auyshjav, et al.,* 1982]. Calais et al., [*Calais et al.,* 1999], also investigated the crustal deformation in the Baikal Rift Zone using GPS measurements (see Figure 2a through 2d) and they found relativity small rate displacements of 4.5±1.2 mm/yr in a WNW- ESE direction. The focal mechanisms of the intra- continental earthquakes along and near the boundary of the Baikal- Korea Plate (Figure 3) mostly show the horizontal motions except for some normal faults near the Baikal Rift Zone, and thrust faults in a few compressional region [*Sherman and Gladkov,* 1998]. Especially the focal mechanisms of large earthquakes for Central Mongolia, NE China,

Korea, SW Japan and Sakhalin are found to be a right- lateral strike slip, which means that the Baikal- Korea Plate rotates counter- clockwise and moves southeast-ward against the Pacific, Philippine, and Okhotsk plates.

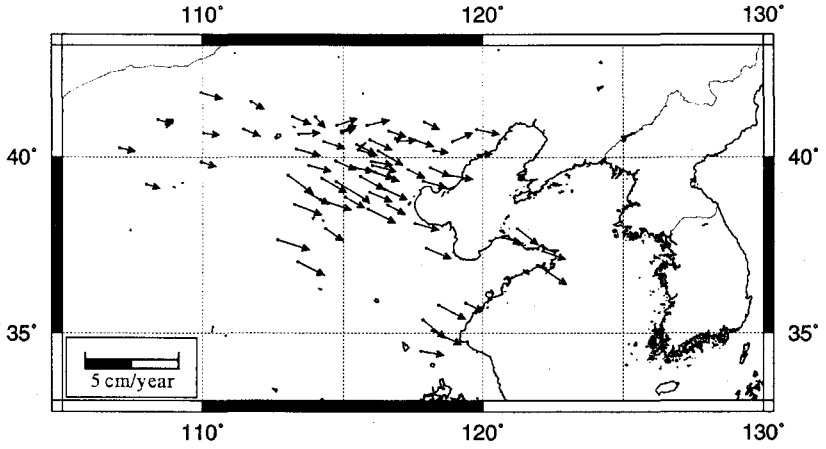

Figure 2c. GPS velocity field in Eastern China relative to the NNR NUVEL-1 A model (from Zhen-kang Shen et al., 1999).

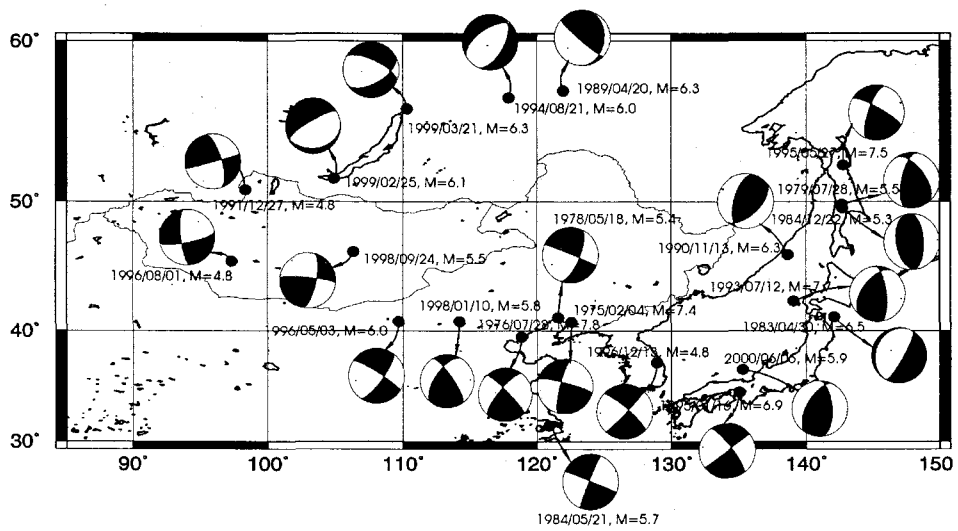

Figure 3. Focal mechanisms on and near the boundary of Baikal- Korea Plate boundary.

Accordingly the seismicity of the Korean Peninsula may be influenced by the Baikal- Korea Plate rather than the Pacific plate. The Korean Peninsula is located in the margin of the Baikal- Korea plate which moves southeastward with the counter- clockwise rotation from the Baikal Rift Zone in the NE Asia. As shown in figure 1, there are four high Seismic Regions such as Mongolia, NE

China, SW Japan, and Sakhalin from the Baikal Rift Zone.

The catastrophic earthquakes in NE China and SW Japan are due to a collision of the Baikal-Korea Plate against to China plate (Eurasian plate) and the Pacific plate.

Therefore, the large amount of seismic energy is released in NE China and SW Japan (see Figure 4) where the relative deformation is high and it makes the Korean Peninsula free from calamitous earthquakes. We also found that the relative displacement pattern of GPS of BKP to the Eurasian plate and BKP to Pacific plate converge near NE China and Japan islands, implying that two different directions of deformation displacement meet each other in these regions. Takahashi, [*Takahashi, et al.,* 1999], also studied velocity field around the Okhotsk and Japan Sea regions using GPS displacements and estimated the motion of the Amurian plate with respect to the Eurasian plate (see Figure 2d).

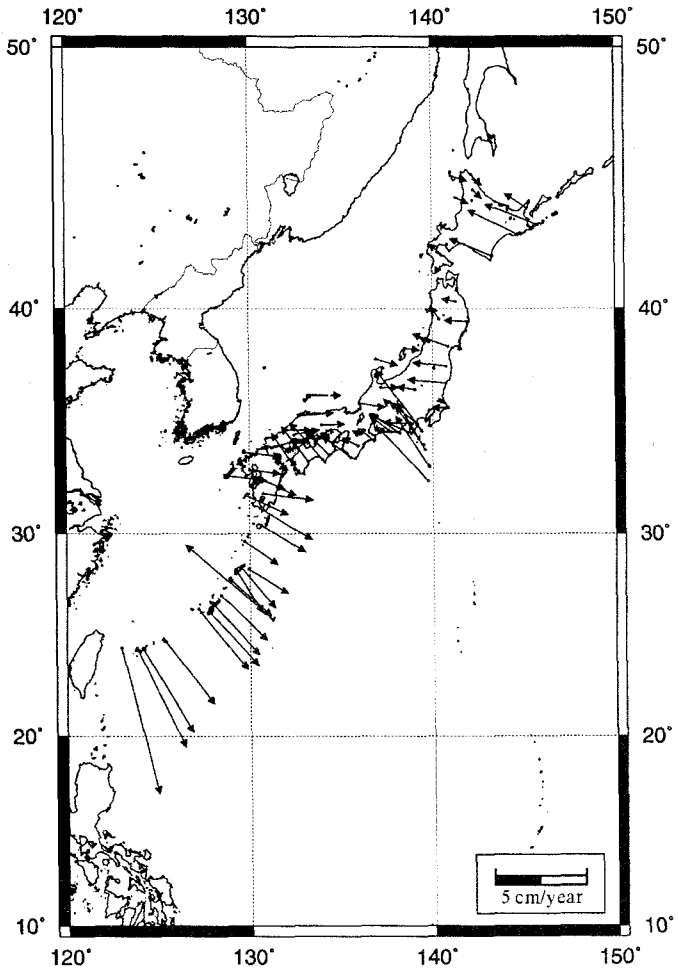

Figure 2d. GPS velocity field in Japan relative to NIIGATA station (from the result of observation by the GEONET, GPS Earth Observation Network of the Geographical Survey Institute).

It is worthwhile to compute the released energy of the NE Asia compared to the Korean Peninsula in order to estimate the subplate boundary (see Tables 1 and 2). From the figure 4, the energy release histogram, the energy releases (1900- 1999) from the major disastrous earthquakes ($M \geq 6.0$) along the Baikal- Korea subplate are about 10^3-10^4 times as much as those of the Korean Peninsula ($M \geq 3.0$). Especially the Mongolian earthquakes released the largest amount of energy 10^{25} ergs, while the released energy of the NE China and SW Japan are estimated as 10^{24} ergs, respectively. On the other hand, released seismic energy of the Korean Peninsula is about 10^{21} ergs. Furthermore, the Korean Peninsula has never been in disastrous earthquakes, which killed many people and/or destroyed housing facilities according to the historical record for last 2000 years. These factors indicate that the Korean Peninsula does not stay along the plate boundary to generate large earthquakes (Figure 5) and it is not along the boundary of the BKP subplate. Shen et al., [*Shen et al.,* 2000], however, proposed that the significant eastward motion and/or southeastward motion of NE China may be due to either extrusion or east-west extension that occurs in southeastern Tibet. The large earthquakes in NE China may be due to the collision of eastward and southeastward motion of the deformation in this region. On the other hand, Djadakov, [*Djadakov,* 1999], suggested that the movement of NE Asia may be due to the episode of the active rifting of the Baikal Rift Zone and passive rifting from the collision of the Indian and Eurasian plates. So we need more high quality geophysical data such as GPS and high resolution tomography in order to explain the motion and the boundary of the BKP.

Key words : Baikal-Korea plate(Amur plate), GPS, focal mechanism, energy released

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