Mechanism of the Intraplate Earthquakes in and around the Korean Peninsula

Myung-Soon Jun

Earthquake Research Center, Korea Institute of Geoscience and Mineral Resources, Daejeon, Korea

Abstract

Earthquakes in and the around the Korean Peninsula are rather small in size with infrequent occurrence and show diffuse geographic distribution. The occurrence of earthquakes in this region does not correlated with any known specific surface geologic features.

In Korea, instrumental earthquake recording has started since 1905 however, Korea has 2000-year long history with more than 2000 documents which include not only earthquake information but also many other natural phenomena. Fig. 1, shows the historical seismicity for 2000 years and instrumental seismicity since the 20 century.

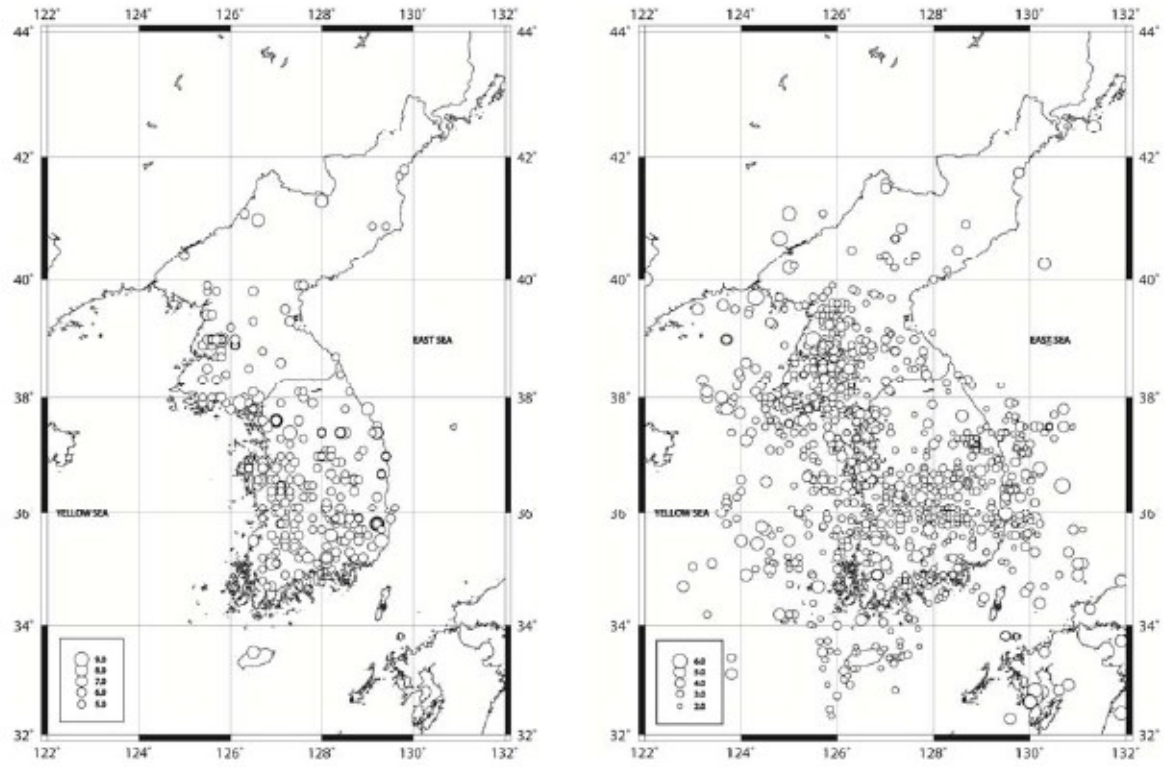

Fig. 1. Historical Seismicity(left) and instrumental seismicity(right) in the Korean Peninsula

The focal mechanism of 19 (M>4.5) shallow intraplate earthquakes in and around the Korean Peninsula since 1936 were analyzed(Fig. 2). Considering the low seismicity in the region, these studied shallow earthquakes may representative for the epicentral region and characterize the state of stress of the earth crust. The majority of earthquake source

mechanism in this region show predominant strike-slip faulting on steeply dipping nodal planes together with small amount of thrust components. In the Korean Peninsula, six earthquakes show predominant strike slip faulting and one event from the western central part of Korea show normal faulting. In the Yellow Sea, three earthquakes show strike slip faulting and two events show thrust faulting. Along the eastern coast of the Korean Peninsula, from the East Sea (Sea of Japan), four earthquakes show strike slip faulting and two events show thrust faulting.

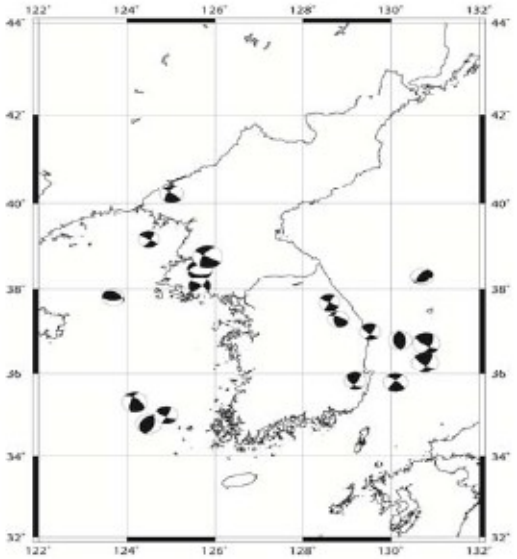

Fig. 2. Epicentral distribution of 19 studied earthquakes and their simplified mechanisms

The seismogenic zone indicated by the deduced focal depths of earthquakes from the Yellow Sea, the Korean Peninsula and the western part of the East Sea are very shallow and restricted to the upper 10km of the crust. While focal depth from the southwestern part of the East Sea show larger than 20km. Since the depth of crust in this region is about half of the typical continental crust (about 15km) and probably being oceanic crust, these events from the SW of the East Sea might occur in the upper most mantle.

We compared the earthquake source parameters in the region with other shallow (h<60km) focus earthquakes in neighboring regions, i.e. in northeastern China, southwestern part of Japan and the eastern part of the East Sea, which are also part of the Eurasian plate(Fig. 3). We compared data which source mechanisms are obtained by centroid moment tensor inversion from USGS since 1976.

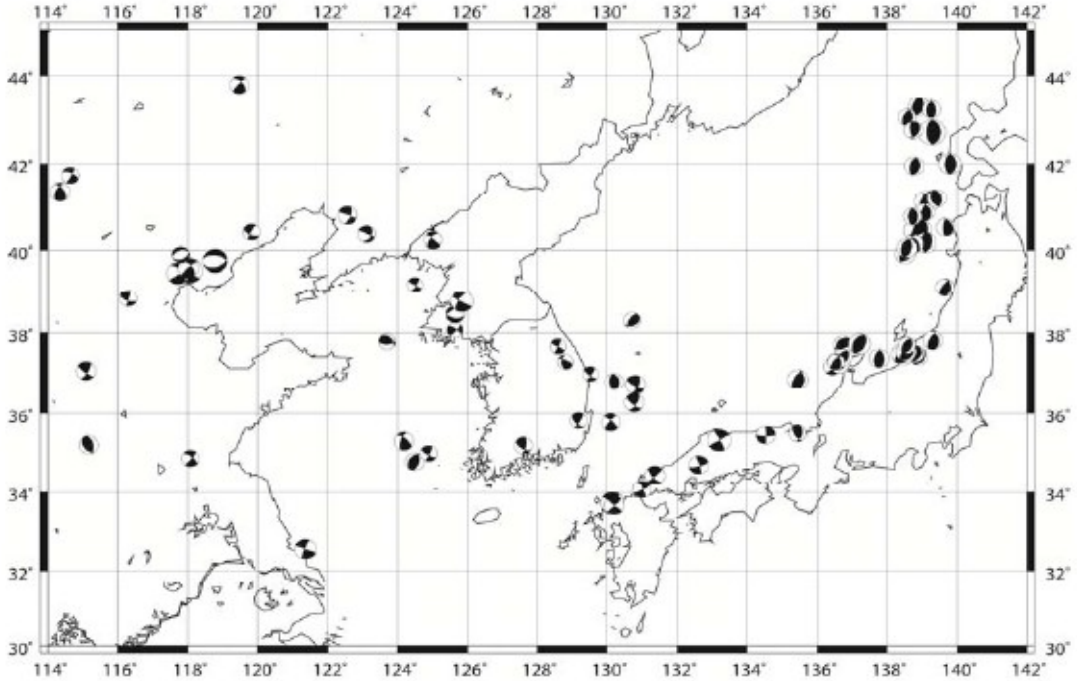

Fig. 3. Comparison of earthquake mechanisms from the Korean Peninsula and neighboring regions.

Two major differences are evident from the pattern of earthquake mechanisms. The first difference is the faulting style. Thrust faulting is dominant in the eastern part of the East Sea, while strike slip faulting dominates around the Korean Peninsula, southwestern part of Japan and in northeastern China. The other major difference is the direction of P-axes. Around the Korean Peninsula, the trend of P-axes shows almost horizontal in ENE - WSW direction. In NW China and SW Japan, the P-axes trend ENE - WSW direction which are similar to that observed around the Korean Peninsula. By contrast, ESE - WNW trending P-axes with almost vertical T-axes are dominant in the eastern part of the East Sea. This stress pattern departs considerably from the Korean Peninsula but is consistent with the relative motion of the Pacific plate against Eurasian plate along the Japan Trench. One possible explanation for the difference in the P-axis direction around the Korean Peninsula with the eastern part of the East Sea is that the collision of Indian plate gives appreciable effect to the stress field to the extent large enough to control the seismicity in and around the Korean Peninsula, NE China and SW Japan.