

Relation of seismicity with age in stable oceanic plates and its implication for the mechanism of intraplate earthquakes

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It is considered that the main cause of oceanic intraplate earthquakes is thermal stress due to plate cooling. Thermal stress increases with age of an oceanic plate. On the other hand, it is shown that seismicity in oceanic plates tends to decrease with age until 40 Ma (e.g., Wiens and Stein, 1983). In this research, we investigated the seismicity in stable oceanic plates to reveal this apparent contradiction. We used the seismic data catalog provided by IRIS (Incorporated Research Institutions for Seismology). Earthquakes that happened in stable oceanic plates are plotted on a world-wide map with the seafloor age, and counted the number of seismic events for each age range. In this analysis, we removed the earthquakes which occurred in tectonically active regions, such as near plate boundaries, marginal seas, Arctic sea, and the hotspot in Hawaii. In order to remove the effect of the difference of areas in oceanic ages, we normalized the number of events by the area of the analyzed region for each age range. As a result, we found that seismicity in stable oceanic plates decreased with the seafloor age until 50 Ma, which was consistent with the result of previous studies. This result suggests that not the absolute value of thermal stress but the change of it mainly controls the seismicity. We also investigated the difference of seismicity in areas (the Pacific, Indian, and Atlantic oceans), and found that the seismicity was the highest in the Atlantic ocean, where the spreading rate is the slowest, and the seismicity was the lowest in the Pacific ocean, where the spreading rate is the fastest. The difference in the accumulation rate of elastic strain in the direction parallel to the ridge axis would be the cause of this difference.

Keywords: oceanic intraplate earthquakes, thermal stress, oceanic sea floor age