

Strain rate dependency of b-values of oceanic intraplate earthquakes

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Oceanic intraplate earthquakes (OCEQs), which are intraplate earthquakes occurred in the oceanic lithosphere (from oceanic ridge to before outer-rise), provide information regarding stress state in the oceanic lithosphere. We modeled stress evolution in the oceanic lithosphere and revealed that observed focal mechanism of OCEQs could be basically explained by thermal stress [Sasajima and Ito, 2015, SSJ fall meeting]. Also decreasing seismic moment release by OCEQs with age of the oceanic lithosphere could be well explained by age dependent thermal stress generation rate in young age oceanic lithosphere (<30Ma) quantitatively. However, seismic moment release by OCEQs in old age oceanic lithosphere (>45Ma) was only approximately 10% of expected one from model. This gap was significant even if we consider the uncertainties due to shortage of observation period.

In this presentation, we report candidate of explanation of this gap and remarkable results. We revealed that b-values of OCEQs show clear age dependency. OCEQ b-values in young oceanic lithosphere (<15Ma) are around 1.0, those in middle age (15-30Ma) are around 1.4, and those in old age (>30Ma) are around 1.7, which is significantly higher than b-values in the world. If b-value is greater than 1.5, contribution of small earthquakes on total seismic moment release becomes significant. Thus, we suggest that missing seismic moment release in old age oceanic lithosphere is released by unobservable ($M_w < 5.0$) small magnitude earthquakes.

We also found that b-value of intraplate earthquakes in the Ninety East-Sumatra orogen, where oceanic lithosphere has higher strain rate than it of normal oceanic lithosphere, is 0.93, which is significantly smaller than OCEQ b-value (1.7) at the same age. Thus, we conclude that OCEQ b-value age dependency relates to the age dependent slow strain rate of the oceanic lithosphere and is not caused by age dependent thermal structure.

Keywords: Oceanic intraplate earthquakes, b-value, Oceanic lithosphere