Slow earthquakes coexsting with regular earthquakes in a fault zone evidenced from an exhumed accretionary complex, the Cretaceous Shimanto Belt, southwest

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Slow earthquakes have been discovered by geophysical observations in recent years and their relationships to regular earthquakes is focused to study. It is, however, difficult to understand spatial interactions by geophysical observation. Although identifying a fault for slow earthquakes from geology with high spatial resolution is the key, no definitive evidence has been found. In this study, we partly constrained slip velocity of a cataclastic fault zone including dynamic recrystallization of quartz coexisted with a fossil seismogenic fault.
The study area is Goshikinohama fault, in the Yokonami mélange, the Cretaceous Shimanto Belt, SW Japan that is an exhumed accretionary complex. The Goshikinohama fault has a pseudotachylyte within ~1mm thin faults as a fossil of large earthquakes cutting in 20cm thick cataclasitic fault zone.
First, we estimated deformation temperature from recrystallized grain size, then temperature distribution was examined as a function of the distance from the center of the fault. As a result, the estimated deformation temperature was 299-324℃, which was reasonably higher than the paleo-maximum temperature of host rock from vitrinite reflectance, and temperature distribution shows a constant value within the measurement range (about 15 mm from the center of the fault).
We calculated time evolution of thermal diffusion patterns due to frictional heating at different slip velocities for the case that heat generation zone is 1 mm or 20 cm.
Then we constrained slip velocity and slip duration at when the thermal diffusion patterns fit with the temperature distribution.
As the result, when heat generated zone is 1 mm, slip velocity and slip duration were estimated to be 10^{-5} -10^{-6} m/s and 10^{4}-10^{7} s. For the case that heat generated zone is 20 cm, slip velocity and slip duration were estimated to be 10^{-1}-10^{-6} m/s and 10^{0}-10^{7} s.
Although the latter case could constrain the wider range of slip behavior, it was suggested that the fault rock of Goshikinohama fault contains not only a fossil of the large earthquake but also a fossil of a slow earthquake, indicating the slow and fast slip coexist in a fault zone.

Keywords: subduction zone, accretionary complex, slow earthquake

