Abstract

論文内容の要旨

Investigation of slip parameters and fault slip behavior in the shallow part of subduction zone on the basis of vitrinite reflectance

（ビトリナイト反射率分析に基づく断層すべりパラメータの推定と

沈み込み帯浅部断層すべり挙動の解明）

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Enormous earthquakes repeatedly occur in subduction zones, and the slips along megathrusts, in particular those propagating to the toe of the forearc wedge, generate ruinous tsunamis. Quantitative evaluation of slip parameters (i.e., slip velocity, rise time and slip distance) of past slip events for the shallow, tsunamigenic part of the fault is critical to characterize such earthquakes. Here I attempt to quantify these parameters for slip events that occurred along the shallow part of a megasplay fault and a plate boundary décollement in the Nankai Trough, off southwest Japan. I apply a kinetic approach to profiles of vitrinite reflectance data obtained from Integrated Ocean Drilling Program (IODP) cores that intersected the slip planes of the two thrusts. This approach constitutes calculation of heat generation and numerical analysis of vitrinite reflectance data. For the purpose of obtaining optimal slip parameters, , residue calculation for fitting is implemented. As the result, the measured distribution of vitrinite reflectance is fitted when heat generation rate ($\dot{Q}$) and slip duration (t_r) are 16,600 J/s/m^2 and 6,250 s for the megasplay, and 23,200 J/s/m^2 and 2,350 s for the frontal

décollement, implying slow and long-term slips. To compare the estimated slip behaviors with those in other settings of shallow part of subduction zone, I perform measurement of vitrinite reflectance and numerical analyses for slip estimation on fossilized analogue faults, hosted in the Miura-Boso accretionary complex (the Shirako fault and the Emi fault). The measurement is conducted under a newly-developed optical microscopy which allows us to 2-dimensional measurement on polished slab samples. This measurement reveals that both fossilized fault show strong anomaly of vitrinite reflectance within the slip zone. For the Shirako fault, the reflectance anomaly is recognized even outside of the slip zone as is the case for the megathrusts in the Nankai trough. On the other hand, the increasing in reflectance is limited only inside of the slip zone of the Emi fault. The numerical analyses on the measured data from the Shirako fault yield slip velocity and slip distance of 0.14 cm/s and 5.17 m, respectively, under the optimal parameters set of $\dot{Q}$ = 14,500 J/s/m^2 and t_r = 3,600 s. For the Emi fault, the residue analysis cannot be employed due to lack of increase in reflectance in the host rock; instead, $\dot{Q}$ and t_r is constrained based on the absence of reflectance anomaly in the host rock. These slip parameters are then compared with that obtained in previous research. In the megasplay fault, estimated maximum temperature, T_{max}, is consistent with the temperature constraint suggested by Hirono et al. [2009]. In the Shirako fault, the calculated temperature contradicts with estimation deduced from clay mineral analysis [Kameda et al., submitted]. This might indicate that the Shirako fault had experienced two types of slips; faster slip which caused temperature increase only inside the fault and accelerated illitization, and slower slip which keep a high temperature state for a while enough to heat up even the host rock by thermal conduction. Two constraints are combined to estimate slip parameters for the Emi fault. One constrain is that T_{max} is 350-1100 °C [Hamada et al., 2011], and another is the absence of vitrinite reflectance anomaly in the host rock [this study]. Slip parameter ranges defined by these constraints are relatively faster (~ 1m/s) and shorter (~ 1m) slip than those in other faults. These results show large variation of slip parameters in shallow part of subduction zone. Especially, slow slip velocity, long-term risetime and large displacement are recognized in the three fault zones (the megasplay, the frontal décollement and the Shirako fault). Estimated parameters are longer and slower than typical coseismic slip, but are rather consistent with rapid afterslip.