## Abstract Details

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**Corresponding Author :** Prof. Toshihiko Shimamoto (shima@kueps.kyoto-u.ac.jp)

**Organization:** Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University

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**Title:** (IWG7) Subduction-Zone Rheology: Current Status and Future Tasks

**Abstract:**

Rheology and earthquakes in subduction zones are becoming a very hot issue recently not only because geodetic and seismic observations have been revealing quite variable behavior of subducting plate boundaries including low frequency tremors and slow slip events, but also because drilling-into seismogenic-zone in Nankai Trough is planned in IODP projects using �Chikyu�. The origin of quite variable behavior, from one subduction zone to the other and within the same subduction zones, is a difficult but a challenging research topic in fault rheology. Interdisciplinary studies integrating fault-zone analyses, laboratory deformation and fluid-flow experiments, theoretical/numerical analyses of earthquake rupture processes and seismological and geodetic analyses will be crucial for comprehensive understanding of subduction-zone processes. As a task in our Active Geosphere project, we have started such an integrated fault and earthquake studies using Chelungpu fault and Chi-Chi earthquake as a prototype (Shimamoto et al., this meeting). We are extending this work to subduction zones and �Taiwan to subduction zones� is our catch-word. I will summarize herein key issues and major unsolved problems in subduction-zone rheology. Shimamoto, Seno & Uyeda (1992) proposed a simple rheological model incorporating (1) thermal structure, (2) brittle to fully plastic transition, and (3) solution-transfer processes, promoted by the enormous amount of released H2O, that have potential to eliminate earthquakes. This model could predict the diversity of subduction zones by demonstrating a linear relationship between moment magnitude (Mw) of typical earthquakes and the logarithm of the width of the seismogenic zone (w). Hyndman & Wang (1993) revealed that earthquakes begin to occur at much shallower depth than postulated in this model and proposed that the onset of seismicity corresponds to the montmorillonite-illite transition. However, if their model is generally true, nearly aseismic behavior of some subduction zones cannot be explained. Recently, Kasahara (2003) proposed that chrysotile, low-temperature serpentinite in the wedge mantle behind Mariana, causes aseismic behavior. This model, replacing (3) above, can be combined with the model of Shimamoto et al to explain the diversity of subduction-zone earthquakes. However, whether chrysotile can really cause aseismic behavior needs to be tested fully. I will present our preliminary results for chrysotile-rich serpentinite from a serpentine seamount which is likely to have come from wedge mantle. Another fascinating recent discovery is low frequency tremors (Obara, 2002) and associated slow slip near the base of seismogenic zone in Nankai Trough. Many people vaguely assume that fluids are primarily causing such behaviors. I will present laboratory data showing that slow slip events are characteristic of fault slip near the base of seismogenic zone possibly due to the mixing of plastic deformation mechanisms.

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**Co-Authors**

| No. | Title | First Name | Family Name | Organization |
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