The relation between the dehydration reactions in oceanic crusts and pore pressure on a plate interface from numerical viewpoints

Yuta Mitsui[1]; Kazuro Hirahara[2]

[1] Dept. Geophys., Kyoto Univ.; [2] Geophysics, Sciences, Kyoto Univ.

http://www-seis.kugi.kyoto-u.ac.jp/˜mitsui/

At a plate interface in some subduction zones, slow slip events occur in the deeper portion of seismogenic zones occasionally [i.e. *Ozawa et al. (2002)*]. One of factors for causing such slow events is the metamorphic dehydration reactions in the oceanic crust [*Kodaira et al. (2004)*]. In particular, it has been suggested that the slow events are caused by low effective normal stress via pore pressure increasing due to the dehydration reactions. However, to the contrary, a recent numerical study [*Mitsui and Hirahara, in revision*] presents that high effective normal stress via pore pressure relaxing owing to the dehydration reactions is likely to cause slow events.

Hence, it is the key point whether the relaxed pore pressure owing to the dehydration reactions is realistic or not. In this presentation, we show that the pore pressure can relax when the dehydration reactions accompany great increase in the permeability, by numerical calculations following [*Wong et al. (1997)*]. Unfortunately, no rock experiments have so far revealed the permeability increasing due to the metamorphic dehydration reactions of the main component in oceanic crusts. One experiment [*Tenthorey and Cox (2003)*], however, revealed the dramatically increasing in the case of serpentinite. Our numerical results would be important for the clarification of the physical mechanism of the slow slip events occurrence, if the permeability of the main component in oceanic crusts also increases dramatically with the metamorphic dehydration reactions.

References

[Ozawa et al. (2002)] Shinzaburo Ozawa, Makoto Murakami, Masaru Kaidzu, Takashi Tada, Takeshi Sagiya, Yuki Hatanaka, Hiroshi Yarai, and Takuya Nishimura, “Detection and monitoring of ongoing aseismic slip in the Tokai region, central Japan”, *Science* , Vol. 298, pp. 1009–1012, 2002.

[Kodaira et al. (2004)] Shuichi Kodaira, Takashi Iidaka, Aitaro Kato, J.˜Park, Takaya Iwasaki, and Yoshiyuki Kaneda, “High pore pressure may cause silent slip in the Nankai Trough”, *Science* , Vol. 304, pp. 1295–1298, 2004.

[Mitsui and Hirahara] Yuta Mitsui and Kazuro Hirahara, “Effects of the metamorphic dehydration reactions on the occurrence of long-term slow slip events: Implications of two dimensional model calculations”.

[Wong et al. (1997)] Teng fong Wong, Suz chung Ko, and David˜L. Olgaard, “Generation and maintenance of pore pressure excess in a dehydrating system 2. Theoretical analysis”, *J. Geophys. Res.* , Vol. 102, No. B1, pp. 841–852, 1997.

[Tenthorey and Cox (2003)] Eric Tenthorey and Stephen F. Cox, “Reaction-enhanced permeability during serpentinite dehydration”, *Geology* , Vol. 31, No. 10, pp. 921–924, 2003.