Invasion of barriers and stress diffusion: a case of the slip at the detachment beneath Izu Peninsula

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Elsassaer (1967) proposed a diffusion equation to describe the propagation of crustal deformation within a plate having a visous layer beneath it. Lehner et al. (1981) extended it to 2-dimensional cases with a layer of Maxwell type viscoelastisity. We find that it is impossible to solve the viscoelastic case, unless the elastic term can be neglected. For example, it can be neglected if the viscoelastic layer thickness is small enough compared with the plate thickness. Seno (2004) proposed that the abnormal crustal deformation, which has been believed to be caused by the Tokai slow event, is not a true slow event, but deformation propagated diffusively through the viscous layers of the Tokai and Kanto fault zones and the serpentinized mantle wedges (Kamiya and Kobayashi, 2001; 2003). The fault zones are likely to have been invaded because a long time has passed since the last events (See Seno, 2004). The fault zone thickness would be on the order of 10 m, which satisties the condition that the deformation can be described by the diffsion type equations of Lehner et al. (1981). We solved these equations using the finite difference method. The slip occurred amounts to 20 cm during the three months at the time of the Miyake dike injection event (Seno, this meeting). By fitting the horizontal deformation at Chita and Hamamatsu revealed by GPS (Geographical Survey Inst., 2003), we obtained the diffision coefficient of the order of ~50 m**2/s and the viscosity of the layer of 10**13 ~ 10**15 Pas. The viscosity is much smaller than that of the asthenosphere. Thus the abnormal crustal deformation after the Miyake event would be pertinent to the invasion of barriers and the serpentinized mantle wedge, not seen in the usual asthenosphere relaxation.