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eEarth Discussions

Interactive comment on "Earthquake fault rock indicating a coupled lubrication mechanism" *by* S. Okamoto et al.

Anonymous Referee #2

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This paper described and analyzed the pseudotachylyte and breccia zone in the Shimanto accetionary complex based on kinematic analysis, geochemical analysis, and electro-microscopic analysis for interpretation of the seismic faulting mechanism in subduction zone.

This paper is generally well written and suggested proper evidences to support their arguments. Although I am not a specialist on pseudotachylite, some raised questions, which are mainly associated with fault and fracture deformation mechanism, are simply listed below.

- Page 138, section 3 line 5-10: The evidences for the deformation sequence (for the two stages) are very weak. Much stronger evidences are necessary to argue the

deformation order. Furthermore, I am not sure about the “dilational jogs” in the Figure 2. It looks like “asperity” of only a result of irregular fault surfaces to me. Jogs (Sibson, 1989) are very systematically related with fault slip senses and systematically arranged along fault bends or steps. However, the gaps along the fault surface in Figure 2 of this paper are very irregular and do not give any strong information for the movement along the fault. It may be better to describe the patterns more clearly.

- Page 138, line 25: It is a very vague evidence for displacement. It may be better to replace “displacement” to “slip sense”. The lengths of the jogs are not always indicative of displacement along the faults. Some of jogs may be opened by mode I extension (or normal fault; Crider and Peacock, 2004.), by injection of the fault related materials or by fault surface asperity. Therefore, more careful observations and key marks are necessary to talk about displacement or amount of displacement.

- Page 140, line 13-15: Although some large pseudotachylyte systems are interpreted as a single rupture event (e.g. Allen, 2005). If the pseudotachylyte was injected from deeper parts into the previous fault slip surface later, the texture may be reasonable for two separate stages. Thus, it may be better to suggest a much clearer supporting evidences for a progressive deformation.

- Page 140, line 19-20: Why do you think that the fractures are generated by fluid implosion? What is the structural difference from fluid implosion along previous fractures? If the fluid implosion and pseudotachylyte injection is a progressive deformation by a single event, it is necessary to explain the different mechanisms that generated different materials at the same fault surface. If your mechanism is rapid decrease of the fluid pressure and fusion melting at the slip plane, it is necessary to explain the possibility to recover the temperature and pressure in a single event period.

- Page 140, line 21-24: The difference of the planar parts and the jogs (?) may be related with the asperity of the fault surfaces. Also it partly depends on the stress condition during seismic event, that is, the planar parts mainly experience shear and friction,

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but the jogs experience opening and fluid injection from the deeper parts. Therefore, it may be possible at irregular fault surfaces.

- Page 139, line 26: Fig. 4H => may be 4F (?)

- Page 140, line 6: Figs. 2A, D => may be 4A, D (?)

References Allen, J. L. 2005. A multi-kilometer pseudotachylyte system as an exhumed record of earthquake rupture geometry at hypocentral depths (Colorado, USA). Tectonophysics 402, 37-54. Crider, J. G., Peacock, D. C. P. 2004. Initiation of brittle faults in the upper crust: a review of field observations . Journal of Structural Geology 26, 691-707. Sibson, R. H. 1989. Earthquake faulting as a structural process. Journal of Structural Geology 11, 1-14.

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