On the possibility of pseudotachylyte in serpentinite

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Recent development of seismic tomography shows a possible serpentinization of the wedge mantle in a subduction zone. Serpentinization of an upper mantle has a significant implication on the mechanical behavior of the crust – mantle system in a subduction zone, especially on the occurrence of earthquakes. Geophysicists usually consider that a stable sip will occur in serpentinite (and also in serpentinized upper mantle) rather than a faulting which causes an earthquake. Is this view correct? That is the theme of this paper. Recently we found a pseudotachylyte – like vein in a serpentinite from the Nomo metamorphic rocks (a member of the Nagasaki Metamorphic Rocks), Kyushu, Japan. To the naked eye it looks like a glassy greenish – blue vein in a massive serpentinite having a lot of pseudomorph afer clinopyroxene. Under the microscope it is cryptocrystalline with some acicular crystals of crysotile and prismatic serpentine pseudomorphs after unknown mineral (possibly orthopyroxene or forsterite). Some spherulitic texture consisting of serpentine also occurs in the cryptocrystalline vein. The cryptocrystalline part is identified to be a mixture of clinocrysotile and antigorite(20 to 30 % in volume) by X-ray powder diffraction analysis. Such cryptocrystalline serpentine vein is very peculiar and also very rare in the Nomo serpentinites in which coarse- grained serpentine (mostly antigorite) veins occur ubiquitously. Bulk rock compositions of the vein and the country rock were measured by XRF. The vein has a composition very similar to the country rock in terms of both major and minor elements. No enrichment in incompatible elements such as Ba and Sr is observed. The water content of the vein is determined with CHN analyzer to be 13 wt %, which is almost the same as that in serpentinite. We consider that this vein represent a pseudotachylyte vein having undergone a weak serpentinization after its formation. The behavior of incompatible elements may show bulk melting, and the water content may be partly due to weak serpentinization postdating the pseudotachylyte formation. Although our postulate of the pseudotachylyte is not completely confirmative at present, it is worth studying such a kind of vein in serpentinite considering a possibility of pseudotachylyte origin. We present the following propositions.

1) Some serpentine veins in massive serpentinite have a possibility of pseudotachylyte origin, which have been escaped to be identified so because of postdated serpentinization.

2) A view of mechanical behavior of the serpentinized upper mantle should be reconsidered. The earthquake possibly occurs even in serpentinized upper mantle.