SUPER-SILICIC GARNET MICROSTRUCTURES: AN UNUSUAL BUT POTENTIAL POWERFUL MICROSTRUCTURE FOR LITHOSPHERE EVOLUTION

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Fossil UHP continental subduction zones, now exposed at the surface of the earth, consist dominantly of subducted continental crust with subordinate mantle fragments (subduction zone- and / or relict peridotites (BRUECKNER & MEDARIS, 2000)) incorporated within them. In such terranes characteristic mineral indicators for UHPM conditions (CHOPIN, 2003), such as coesite, micro-diamond, ellenbergite or super-silicic garnet microstructures can be combined with more classical petrological techniques to make estimates about maximum exhumation depths of these fossil continental subduction zones. In principle the characteristic UHP mineral indicators / classical petrological techniques should be applied to all rock types: i.e. the subducted continental crust *AND* the intercalated mantle fragments. If this is not done the two rock types may originate from different depth levels putting severe constraints on possible exhumation mechanism

In this respect the super-silicic (or majoritic) garnet microstructure forms an unusual, but potential powerful, UHP mineral indicator. Sofar it has been recognized in mantle xenoliths, brought to the surface by kimberlite-related magmas, and in orogenic peridotites associated with UHP subduction zones formed by continental collision. In the latter case the super-silicic garnet microstructure is, however, only present within mantle fragments and not in associated subducted continental crust, indicating that the formation of super-silicic / majoritic garnet is either strongly controlled by bulk rock chemistry or that significant pressure (and / or age) differences exist between the various mineral / bulk rock compositions that together form the fossil UHP continental subduction zone. All available experimental evidence (FEI & BERTKA, 1999; GASPARIK, 2003) sofar, is consistent with the latter solution and clearly demonstrates that, when super-silicic garnet microstructures are found within fully recrystallized subduction zone peridotites, these mantle fragments cannot have been derived from the hanging wall of the subduction zone system as predicted by the model of BRUECKNER & MEDARIS (2000) and BRUECKNER & VAN ROERMUND (2004). Such findings would require hitherto unrecognized exhumation mechanism(s). Alternatively the super-silicic garnet microstructure may be unrelated to the age of the (continental) subduction event; i.e. the microstructure is related to lithosphere evolution of the hanging wall of the subduction system. PT constraints require that this lithoshere is cold and thick, most likely subcontinental.

A review of the occurrence, age and interpretation of supersilicic garnet microstructures will be given and discussed within the light of the text given above.

References

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