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Interactive comment on “The microstructural record of porphyroclasts and matrix of serpentinite mylonites – from brittle and crystal-plastic deformation to dissolution-precipitation creep” by J. Bial and C. A. Trepmann

Anonymous Referee #1

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The manuscript " The microstructural record of porphyroclasts and matrix of serpentinite mylonites – from brittle and crystal-plastic deformation to dissolution-precipitation creep" of J. Bial and C. A. Trepmann, provides microstructural observation and textural data, accompanied by EBSD investigations, on serpentinite mylonite from the Voltri Massif (Italy). Even if the aim of the paper sounds clear in the title, it's not clearly and sufficiently stressed out through the paper. The conclusion are not entirely supported by the presented data (mostly based on assumptions and general statements). I ex-

C230

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pect that the Authors will show better which is the major contribution of their analysis to the structural studies and respect to existing literature. I recommend a major revision and reorganization of the manuscript (a revision of English is also suggested)

"General comments" Reading the title and the abstract ("The aim is to differentiate between the potential record of independent successive deformation events."), I was expecting that this paper is mostly dealing with the description of the differences in microstructural features linked to different steps of the geodynamic evolution of the sampled serpentinite mylonites of the Voltri Massif, and the potential use of microstructure to unravel deformation history in complex terrains. On the other hand this is not clearly described through the paper and the aim is not achieved. 1. most of the conclusions are based on petrological assumptions (not always convincing ones) mostly inferred from (dated) literature rather than from petrological observation of the studied samples. 2. the transition cited in the title among different deformation mechanisms are not described in the same mineralogy. Moreover the type of analysis performed in olivine and pyroxene is different from the one in antigorite. 3. the geologic setting of the sampled area and mostly of the referenced literature are obsolete. they need to be updated, also because the Authors use the data from literature to infer most of the geological features of their samples and and to discuss the implications of their work. 4. the microstructural features of the serpentinite mylonites are poorly described . No references to the main structures in the field of the described foliation or to the relation with the previous foliations are reported. The conclusions (n.2) on antigorite and antigorite foliation are not sufficiently supported by the data and discussions.

SPECIFIC COMMENTS

Abstract page 366 Line 20 - "Accordingly, any intragranular deformation features of the newly precipitated olivine in strain shadows are absent" As they are strain shadows I expect that the strain is lower respect to the rest of the rocks and this cannot be related only to the general state of stress as suggested by the Authors. line 25 - "of the oceanic lithosphere probably related to rifting processes" Why "oceanic litho-

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sphere? In the literature the Erro-Tobbio peridotite have been always interpreted as subcontinental lithospheric mantle (Rampone et al., 2005; Vissers et al., 1991, Piccardo, 2003,2008,2010)

1 Introduction The title and the abstract of the paper suggest a use of the microstructural/textural analysis as potential tool to unravel the superposition of different deformation events. So I was expecting an introduction on this topic (the potential use of microstructures and deformation mechanisms in the analysis of polyphase metamorphic rocks). Despite the huge literature on the argument (i.e. the potential use of microstructure and textural as stress or temperature gauges in the olivine, pyroxene and antigorite) no references to the topic occur.

2 Geologic Setting The geologic setting, the references to the regional geology and to the petrology of the studied area are out-of-date. They are mostly based on the paper by Hoogerduijn Strating et al. (1990), but in the meantime a lot of papers and discussions on the ultramafics of the Voltri Massif and on the VM tectonic/geodynamic evolution have been published. New geochronological data of the high pressure metamorphism and new microstructural and petrologic data have been published. Even the interpretation of the geology (the serpentinite mylonite are really derived from the Erro Tobbio Unit?) of the area sampled by the Authors has been recently revised and questioned on published papers (see Capponi and Crispini, 2008-Geological Map Genova quadrangle, Piccardo, 2013 and Scambelluri, 2013 on the International Geology Review). An update of the literature and a correct description of the geologic setting is necessary. Most of the recent literature on the geology and petrology of the sampled area can be found reported in Scambelluri, 2013, in Capponi and Crispini, 2008 (<http://www.isprambiente.gov.it/Media/carg/liguria.html>), in Vignaroli et al., 2010, Malatesta et al., 2012.

4 Sample description and microfabrics page 369-Lines 16 to 19: Is really a mineral paragenesis the one reported by the Authors or instead is it a mineral association? I suggest to avoid this confusion as the mineralogic association described by the Au-

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thors is also typical of the Peridotite Mylonites of the Erro Tobbio Unit (see for instance: Hoogerduijn Strating et al., 1991, 1993; Rampone et al. 2005). The mineral paragenesis is first ly described as consisting also of + Ti-clinohumite and enstatite, nevertheless Ti-clinohumite is not considered in the modal composition. It's occurrence is important in these rocks, as described in literature, a more correct description of the sample mineralogic composition is required. I expect a more detailed petrographic and petrologic description if then they are used to infer the deformational steps and the paper conclusion.

6. Implications 1 - It's not clear which are the evidences used by the Authors to consider the enstatite and the olivine in the pressure shadows as the results of the (1) and (2) reactions. As described in literature, these minerals developed also during the formation of peridotite mylonites during the pre-alpine "mantle evolution". 2 - How the Authors deduce that Olivine and Enstatite in their samples derived from the dehydration process of antigorite and they don not derive from previous metamorphic stage? 3 - The microstructures/texture in the peridotite and serpentinite of the Erro Tobbio Unit have been also described in Hoogerduijn-Strating, 1991 (published PhD thesis) and 1993. I expect a reference or at least a comparison with the previous literature. page 372 - line 21-24 - "It is remarkable that the deformed and recrystallised microstructure of the peridotites is partly preserved and not more effectively modified by serpentinization" This is not a new obsarvation in these rocks and in general in metamorphic mylonites.

REFERENCES ON THE STUDY AREA AND STUDIED SAMPLES Most of the recent literature on the geology and petrology of the sampled area can be found reported in: Vignaroli, G., F. Rossetti, D. Rubatto, T. Theye, F. Lisker, and D. Phillips (2010), Pressure-temperature-deformation-time (P-T-d-t) exhumation history of the Voltri Massif HP complex, Ligurian Alps, Italy, *Tectonics*, 29, TC6009, doi:10.1029/2009TC002621. Malatesta, C., Crispini, L., Federico, L., Capponi, G., and Scambelluri, M., 2012a, The exhumation of high pressure ophiolites (Voltri Massif, Western Alps): Insights from structural and petrologic data on metagabbro bod-

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others: Hoogerduijn Strating (1991) - The evolution of the Piemonte-Ligurian ocean: a structural study of ophiolite complexes in Liguria (NW Italy). Ph.D. Thesis, University of Utrecht, Geol. Ultraiectina, 74, 145. Piccardo, G.B., 2003, Mantle processes during ocean formation: Petrologic records in peridotites from the Alpine-Apennine ophiolites: Episodes, v. 26, p. 193–199; Piccardo, G.B., 2008, The Jurassic Ligurian Tethys, a fossil ultraslow spreading ocean: The mantle perspective, in Coltorti, M., and Grogoire, M., eds., Metasomatism in oceanic and continental lithospheric mantle: Geological Society of London, Special Publications, Volume 294, p. 11–33. Piccardo, G.B., 2010. The evolution of the lithospheric mantle during Mesozoic rifting in the Ligure-Piedmontese domain. Journal of the Virtual Explorer, Electronic Edition, v. 36, paper 7 Scambelluri et al. 1995; Brouwer et al. 2002, 2004; Capponi and Crispini 2002; Federico et al. 2005, 2007, 2009; Piccardo 2003, 2008, 2010; Rampone et al. 2005; Rampone and Borghini, 2008; Malatesta et al. (2012a,b), Capponi et al., 2009,

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