

## ***Interactive comment on “The internal structure and composition of a plate boundary-scale serpentinite shear zone: The Livingstone Fault, New Zealand” by Matthew S. Tarling et al.***

**Matthew S. Tarling et al.**

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We thank reviewer 1 for their constructive comments which will allow us to clarify and improve many aspects of the manuscript. We agree with all of the reviewers' comments and intend to make changes to the text and figures in response to each comment. Below we include a point-by-point response to the reviewers' comments outlining our intentions.

Reviewer comments are in **bold**, author responses are in *italics*.

C1

Specific comments (individual scientific questions/issues)

**Page 2 (Introduction) – I recommend the authors add a sentence or two providing specific examples of other serpentinite-bearing shear zones around the world.**

*As recommended, we will expand the introduction to include several other specific examples of previously-reported serpentinite-bearing shear zones around the world. Additionally, in response to comments by Reviewer Telemaco Tesei, we will expand our brief overview of serpentinite-bearing shear zones and broaden the reference list referring to previous studies of serpentinite shear zones, including references by Maltman, 1978; Williams, 1979; Twiss and Gefell, 1990; Alexander Harper, 1992; Gates, 1992; Bailey et al., 2000, Hirauchi and Yamaguchi, 2007, Bellot, 2008, Melosh, 2019.*

**Page 9 (sections 4.3.1), Figures 9 and 10, and throughout the text – I recommend the authors specify, to the extent possible, the type(s) of serpentine minerals present in the different serpentinites. Reading between the lines, the massive serpentinite described in section 4.3.1 is likely composed of chrysotile + lizardite (+ magnetite); antigorite and other forms of serpentine are rare.**

*We agree with the reviewer that we can be more precise in our definition of the different serpentine varieties, and we have put substantial effort in to developing new techniques of Raman Spectroscopy to characterise the serpentine minerals. Wherever possible in the updated manuscript, we will add details on the types of serpentine minerals present.*

**Page 10, line 15-16. I recommend expanding the first sentence “. . . with an**

C2

estimated ambient temperature during shearing of 300-350 C” to articulate the constraints on the estimated temperatures, citing appropriate references. The assemblage lizardite + chrysotile can occur over a broader temperature range, but perhaps the general absence of brucite and antigorite is being used to narrow the temperature estimate.

*In response to this comment as well as a similar remark made by reviewer Telemaco Tesei, we will apply a more conservative stance with regards to the temperature range and broaden our initial estimates. We will expand our treatment of the evidence for the temperature estimates, including the instability of antigorite, the general lack of the assemblage antigorite + brucite, the metamorphic facies in the wall rocks and the dominance of a chrysotile + lizardite assemblage.*

**Page 13, line 24 – What is the evidence that metasomatic reactions “can generate insitu fluid overpressures?” Would this not depend on the specific metasomatic reaction (e.g., cation exchange vs. dehydration reaction)?**

*Yes, the reviewer is correct, and this is the subject of another paper focused on the metasomatic reactions. In the revised manuscript, we will revise this statement to remove any mention of fluid overpressure.*

Technical corrections (typos, etc.)

**Page 3, line 5 and 14 – The rocks between the Western and Eastern Provinces are referred to as the Median “Batholith” in the text and the Median “Tectonic Zone” in Figure 1. I recommend using one or the other for consistency.**

C3

*We will revise Figure 1 such that the geological unit between Western and Eastern provinces is consistently referred to as the Median Batholith throughout the paper.*

**Page 2, line 23; page 9, line 20; page 11, line 16 - The question marks in cited references should be deleted and appropriate references added where necessary.**

*The errors in referencing will be addressed.*

**Page 21, Figure 1 – Several of the colours chosen for the geologic map are very similar making it difficult to distinguish some of the units (Dun Mountain terrane versus Median Tectonic Zone) particularly when similar coloured units are juxtaposed (e.g., contact between Dun Mountain terrane and Brook Street terrane). I recommend selecting different colours to ensure the geologic map can be easily interpreted.**

*Following this recommendation, the colour palette will be adjusted so that there is a greater contrast between adjacent units on the map.*

**Page 32, Figure 12 – “(Chapter 4)” should be removed from box (iv) Page 27, Figure 7 –**

*The erroneous label in Figure 12 box (iv) will be removed.*

**This detailed geologic map should be published at the largest size possible (i.e., full page width). At its current size most of the details are not legible.**

C4

*We note that the geological map that was embedded in the submitted manuscript .pdf was very low-resolution, but that the supplementary file we submitted provided a high-resolution version. Our intention was that the detailed geologic map should be published at high resolution at A3 size in the .pdf version of the paper, and we will request this option with the journal editors and typesetters. In the online version of the paper, the map will be high resolution and zoomable, which will allow for all details to be clearly legible.*

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-62>, 2019.