

Interactive comment on “Experimental deformation and recrystallization of olivine – processes and time scales of damage healing during postseismic relaxation at mantle depths”

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We very much appreciate the constructive review by the anonymous referee. In the following we address the points one by one. Comments by the referee are in quotation marks.

“Sec. 2.1 p. 468 lines 10-14 -convert piston velocity to strain rate”

In “kick-and-creep” tests, changes in pressure and temperature conditions are imposed on the axially loaded sample. On the one hand, these changes in conditions hinder a

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sensible friction correction. On the other hand, sample dimensions as well as piston dimensions change due to their finite compressibility and thermal expansion. The relative dimensional changes are not known to an extent justifying a calculation of strain as a function of time (and thus strain rates) but we have to refrain to the back-of-the-envelope calculations presented later in the text (page 470 lines 22-28, page 471, lines 1-5). Therefore, at this stage, we prefer to state the imposed piston velocities only.

“p.471 line 14 - stress is uncertain so explain why “a reduction in strength from the first to the second deformation stage can be excluded”?”

The friction characteristics changed relative to the first deformation stage when the experiment was cooled down to the temperatures of the second deformation stage (300, 600 °C) after extended high-temperature annealing rendering the quoted stresses of the second stage more uncertain. Despite this uncertainty, the recorded values of stress are systematically higher for the second deformation stage compared to the first, suggesting that a significant reduction in strength from the first to the second deformation stage is unlikely.

“p. 472 lines 8-9 - it is a misnomer to refer to crushed grains as “recrystallized” and ultimately confuses the terminology, however, this usage is sufficiently explained later in the text to allow it. I would prefer that this be made a little clearer earlier in the text however. There are additional minor corrections that should be discovered during normal proof reading prior to submission of the final manuscript.”

We greatly appreciate this comment and admit that the currently used terminology may be confusing, as pointed out also by the first referee. We now use the term “new grains” as the superordinate concept comprising (i) “fragments” (small fragments from the original grain; formed in highly damaged zones with inherited defects; present already after low-temperature deformation; they are modified by recovery and grain-boundary migration during isostatic annealing) and (ii) “recrystallized grains” (evolving during annealing from small dislocation free crystalline volumes in highly damaged

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zones). “Porphyroclasts” are large remnants of the original grains in low-strain areas with inherited defects.

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