Why are mantle melting residues still hydrous?

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The influence of water on mantle melting processes and rheological properties is substantial [1, 2]. Interestingly, melting models can rarely predict water contents measured in nominally anhydrous minerals of natural peridotites as a function of melting [e.g. 3-5]. Most peridotites are metasomatized and their relatively high water contents have thus been attributed to water addition by melt/fluids [5-7]. However, in metasomatized peridotites, water appears decoupled from incompatible elements such as Ce [5,6]. This contradicts observations that water and Ce behave similarly in oceanic basalts. [e.g. 8]. To avoid metasomatic overprinting, we have analyzed water by FTIR in peridotite xenoliths from Kilbourne Hole, NM (USA) characterized primarily by melting signatures and no obvious metasomatism. In addition, similar peridotite xenoliths from the literature were selected from Jiande, China [4] and abyssal peridotites of the Southwest Indian Ridge [5].

Water contents in peridotites from these locales are used in conjunction with trace element data to closely examine the behavior of water during melting and sub-solidus re-equilibration events. These peridotites still have high water concentrations for their degree of melting when modeled with traditional melting equations and the Nernst distribution law [9,10]. Alternative modeling approaches will be presented with a goal of reconciling model predictions and observed peridotite water concentrations.

[1] Gaetani and Grove (1998), *CMP*131, 323-346. [2] Hirth and Kohlstedt (1996), *EPSL* 144, 93-108. [3] Peslier and Bizimis (2015), *GGG* , 16, 1-22. [4] Hao et al. (2014), *CG* 380, 7-19. [5] Warren and Hauri (2014) *JGR* 119, 1851-1881. [6] Peslier et al. (2012), *GCA* 97, 213-246. [7] Peslier (2010), *JVGR* 197, 239-258. [8] Michael (1995) *EPSL*, 131, 301-320. [9] Shaw (1970) *GCA* 34, 237-243 [10] Johnson et al. (1990) *JGR* 95, 2661-2768.