The role of different activity models

The curves used in Fig.5 and 6 of the main text are actually rather sensitive to the activity models used (see details in Appendix SE1). Here we briefly explore the effect of using another set of models.

Two calculations were performed, one using the previous generation of solid solution models (Holland & Powell 2001) established for metasedimentary compositions, and one with the latest (Green et al. 2016) models calibrated for mafic rocks. Details of the setup and results are available in electronic appendix SE1. The results are plotted in the figure on the next page, similar to Figs. 5 and 6.

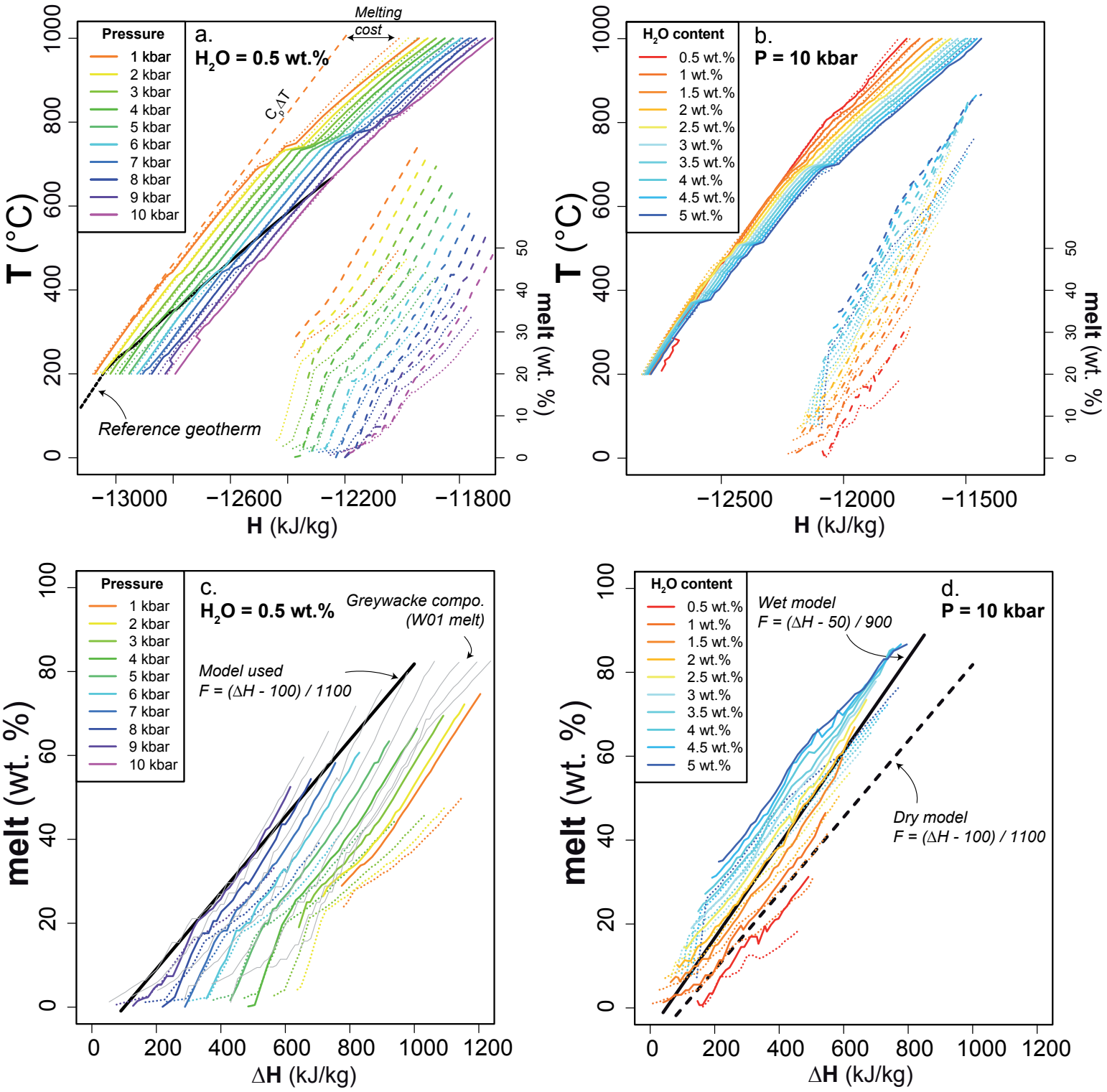
Whereas the temperatures predicted by the two set of models are very similar, the amount of melt generated differs. Green et al. (2016)'s models yield larger melt fractions than White et al. (2001)'s. This is probably because melts generated in an average continental crust are metaluminous, something that is hard to predict using model calibrated for peraluminous compositions: the stable assemblage in this case cannot be a metaluminous melt and is therefore a mixture of a peraluminous liquid and a balancing amount of low-Al crystals (clinopyroxene) (Appendix SE1).

Finally, we can also see that using a metagreywacke composition with the "old" (peraluminous) melt model yields comparable melt amounts than the average crust with the same models, confirming that the key effect is the inability of the old, peraluminous melt model to dissolve the elements that would make it metaluminous.

References

Green, E., White, R., Diener, J., Powell, R., Holland, T. & Palin, R. 2016. Activity–composition relations for the calculation of partial melting equilibria in metabasic rocks. *Journal of Metamorphic Geology*, **34**, 845-869.

White, R. W., Powell, R. & Holland, T. 2001. Calculation of partial melting equilibria in the system CaO–Na2O–K2O–FeO–MgO–Al2O3–SiO2–H2O (CNKFMASH). *Journal of Metamorphic Geology* **19**, 139-153.



Models used (see SE1)	Composition used
White et al., 2001 Green et al., 2016	Colour: Average CC, Rudnick & Gao 2003 Grey: Greywacke, Wedepohl, 1995