1 Sample selection

- Seven scoria samples.
- Correct for post entrapment crystallisation, in the same way as . This correction assumes a constant K $_D$
- Looked for trends Al_2O_3 vs MgO/Cao to identify samples that had only undergone olivine fractionation.
- Added back in olivine in 0.1% increments until in equilibrium with Mg#=0.9 mantle. Required on average 22% olivine. Excluded samples that required greater than 30% addition. Assume $Fe^3+/Fe_t otal$=0.25.
- Total of 20 samples from their samples, and 15 from Shaw et al. [2008].
- Melt inclusions thought to represent more primitive magma compositions Schiano [2003] - Kelley et al. [2010] samples are on average ∼1 GPa deeper - can this tell us about magma evolution?

2 Melt fraction calculations

- Based on TiO_2/Y ratios, choose a source TiO_2 concentration of 0.123wt%, slightly more depleted than DMM.
- As do not know pre-eruptive H_2O in our samples, there is uncertainty in melt fractions. See figure

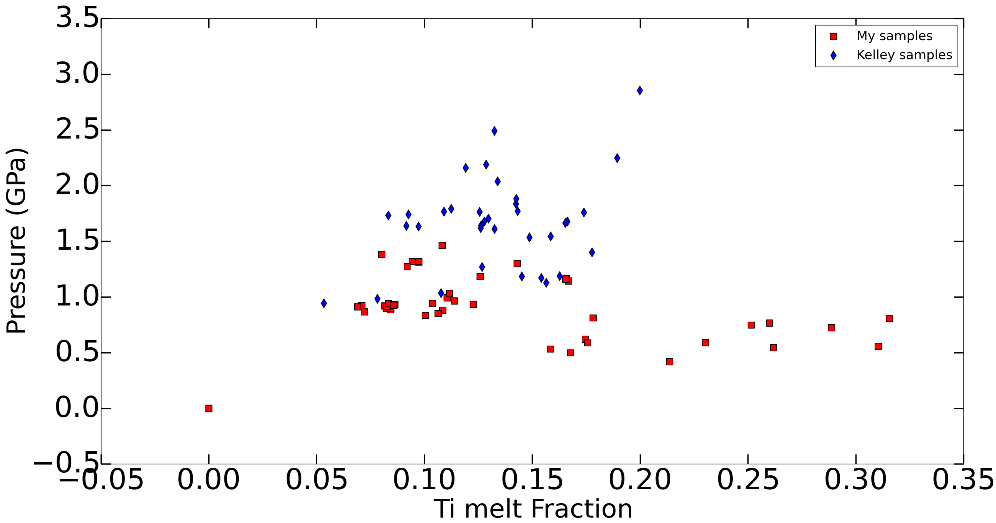


Figure 1:

- Assuming 4 wt% H2O for our samples, 0.123wt% mantle source Ti, 0.25 fo2.

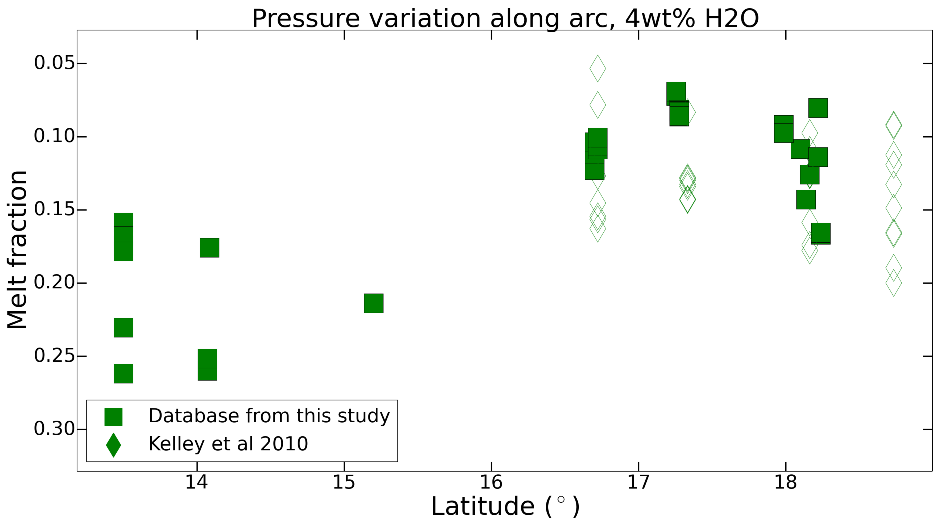


Figure 2:

- Assuming 4 wt% H2O for our samples, 0.123wt% mantle source Ti, 0.25 fo2.

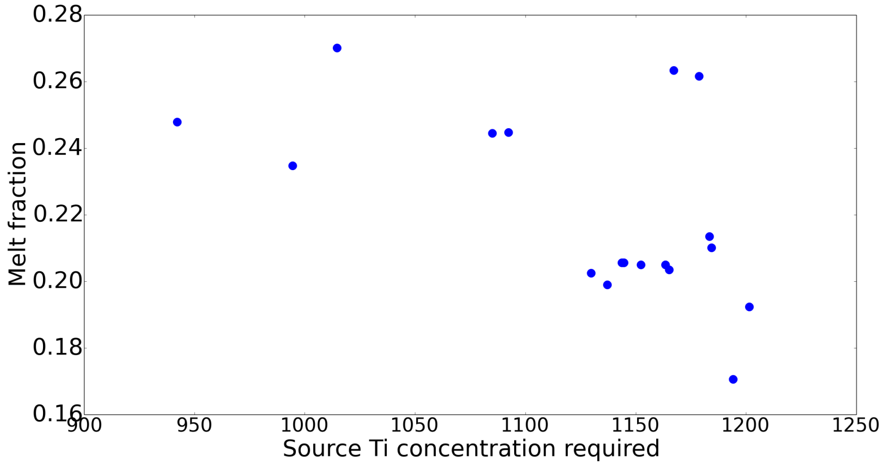


Figure 3:

- Assuming 4 wt% H2O for our samples. DMM has a concentration of 713 ppm. In Kelley et al. [2010] they infer a source Ti of 737 ppm from TiO_2/Y ratios.

- Kelley correct back to Mg#=0.9 in olivine correction.
- In thermobarometric calculations of melt fraction assume a more refractory source. The constants they use are for a DMM1 composition, which is equivalent to a Mg# of 0.899. After extraction of 15-25wt% melt, the residue would actually have a Mg# 0.91-0.92. Underestimating the Mg# could lead to a $\sim$ 0.3-0.7 GPa shallower pressure.
- They do not include the effect of cpx exhaustion, which is exhausted after 10% melt extraction of DMM. Inclusion of this effect would result in a lower melt fraction as melt productivity is reduced when cpx is exhausted. Therefore Kelley et al. [2010] may be overestimating melt fraction when using thermobarometry.

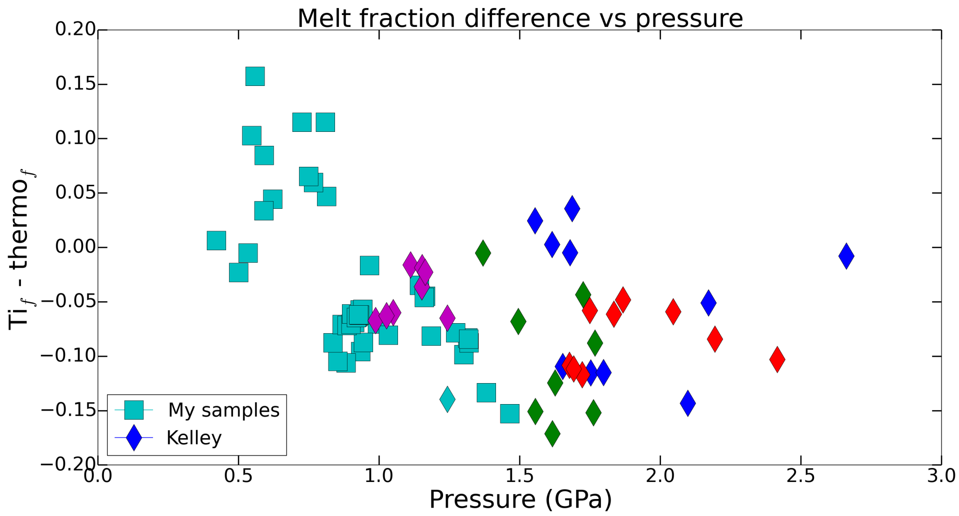


Figure 4

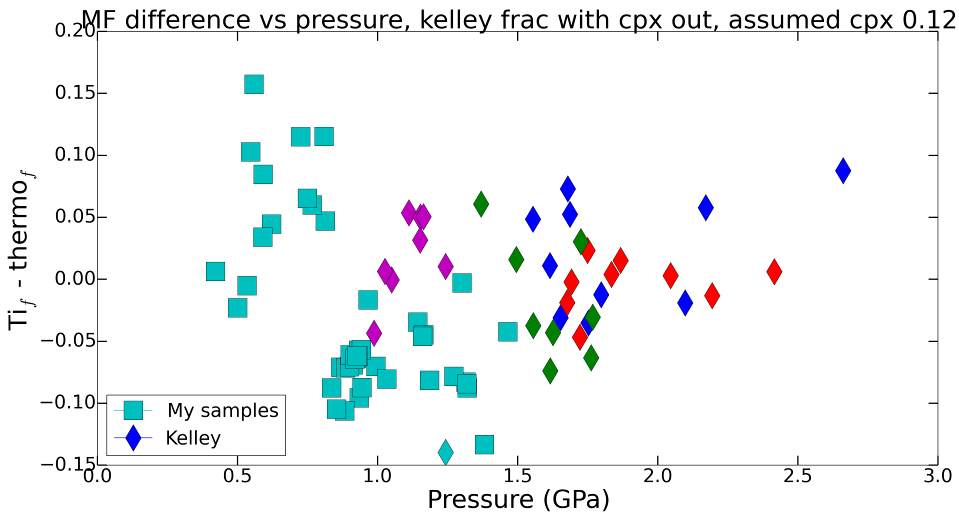
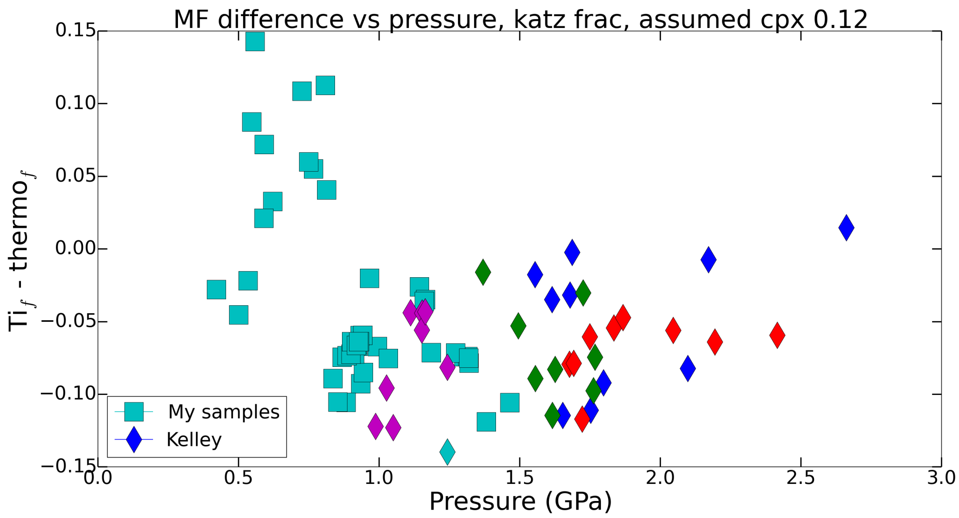


Figure 5:



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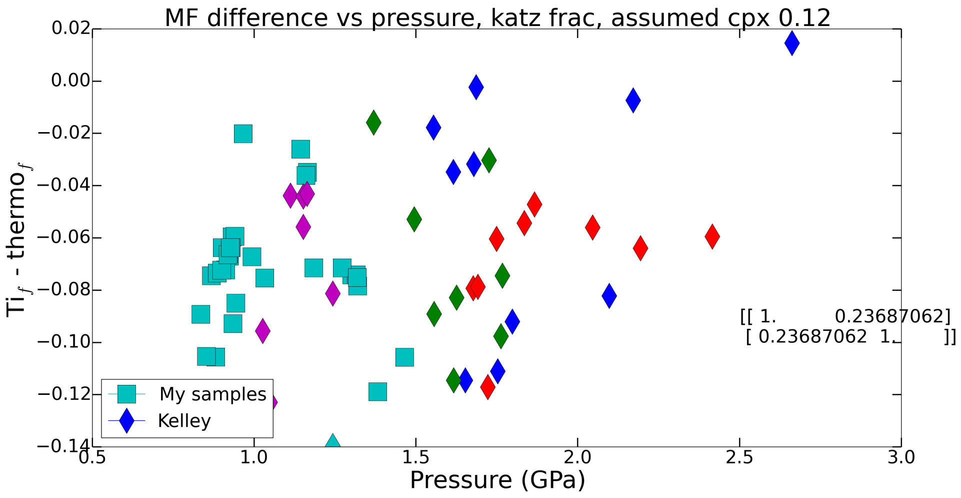

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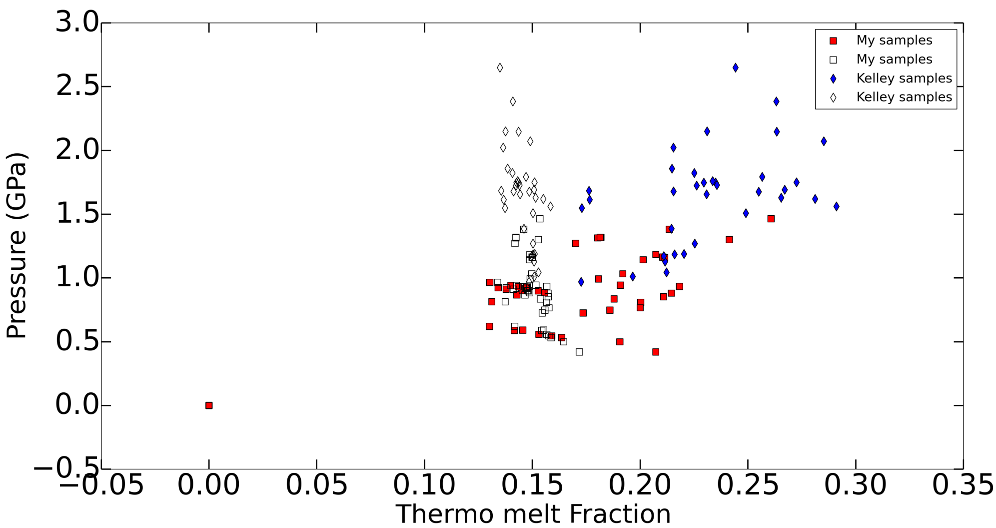

Figure 8:

- Hollow symbols- Katz melt fraction.

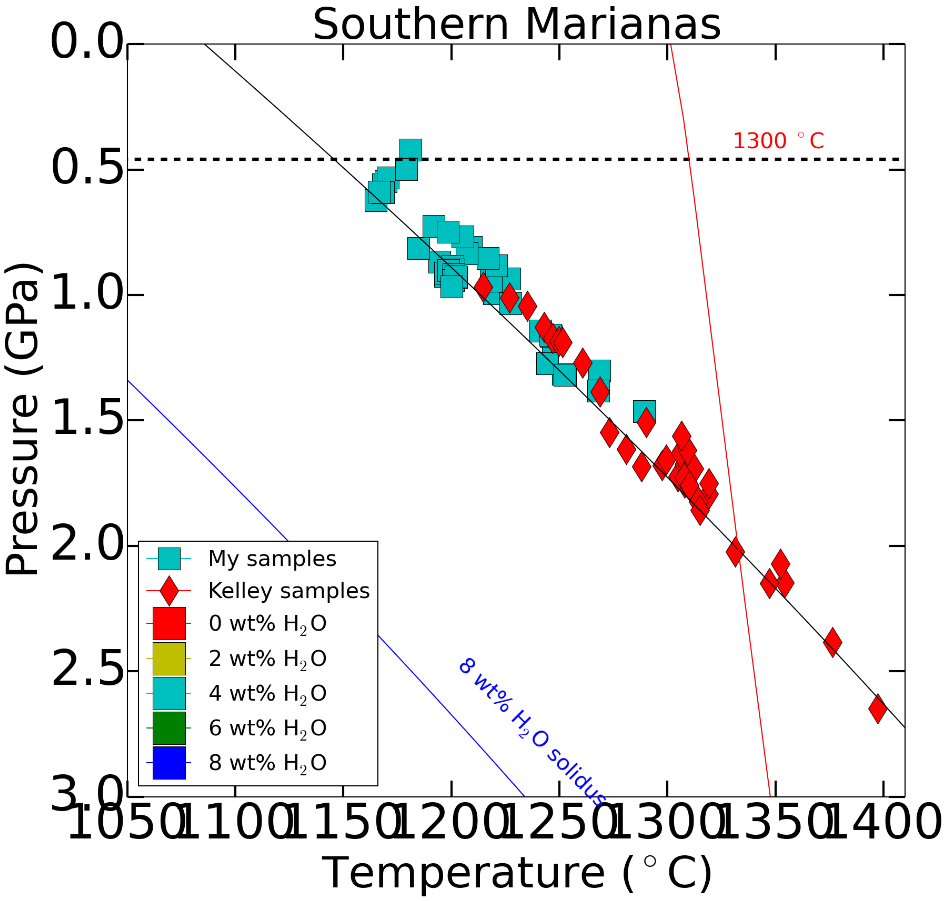

Figure 9:

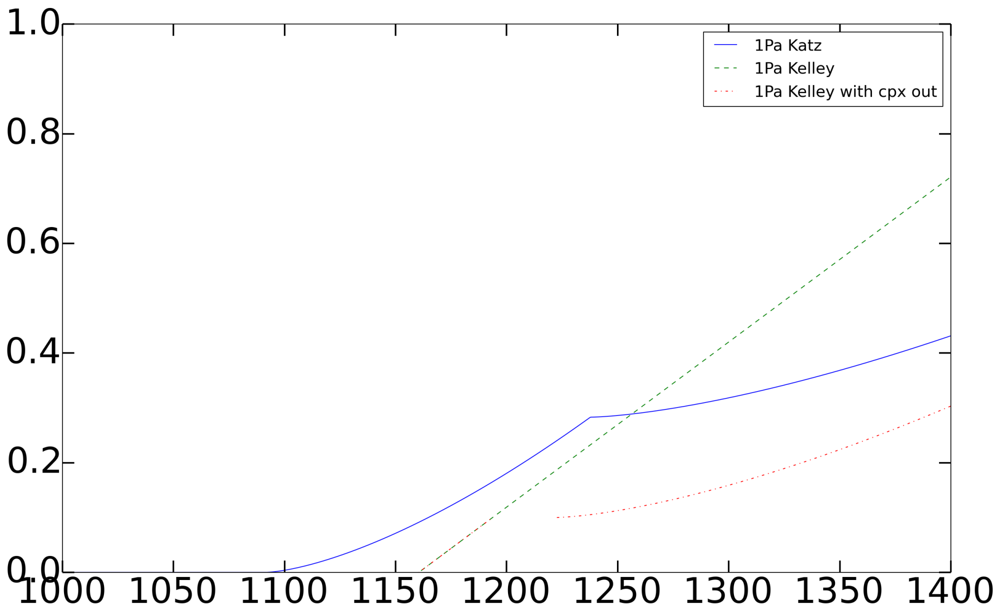

Figure 10:

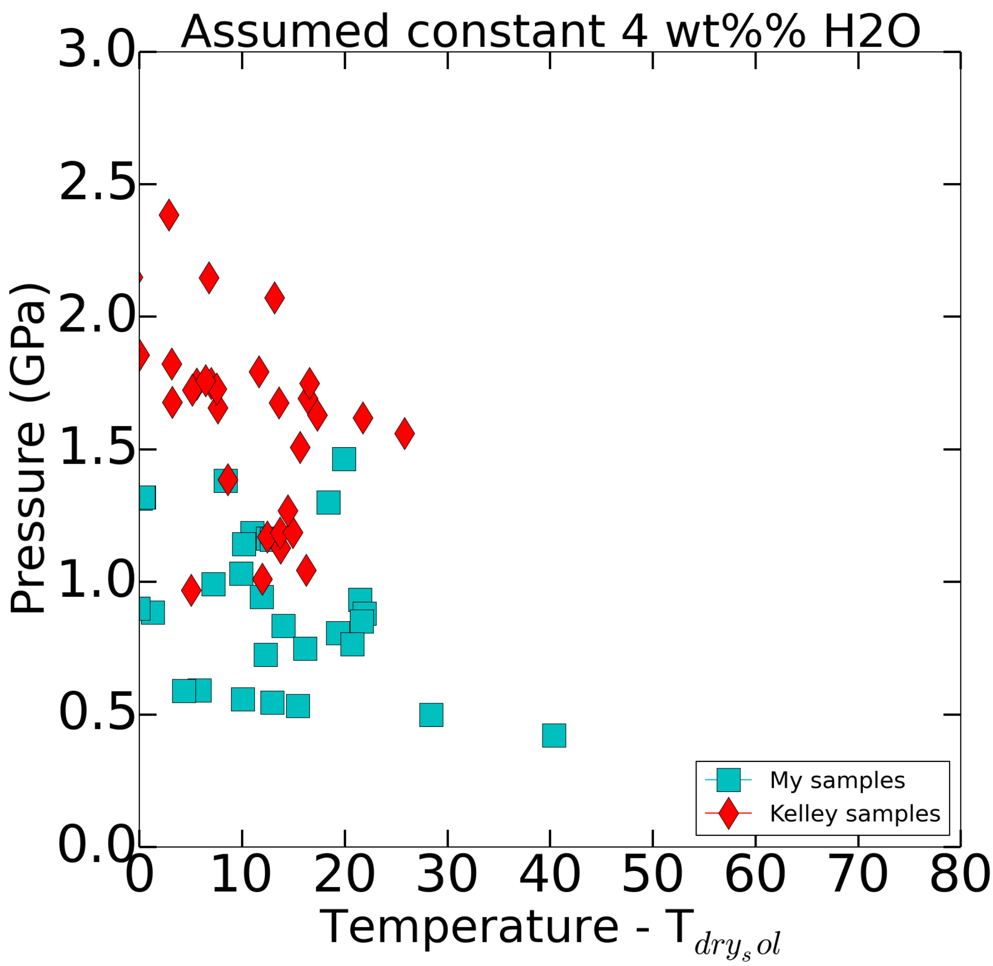

Figure 11:

29 ## 3 Katz/Kelley comparison

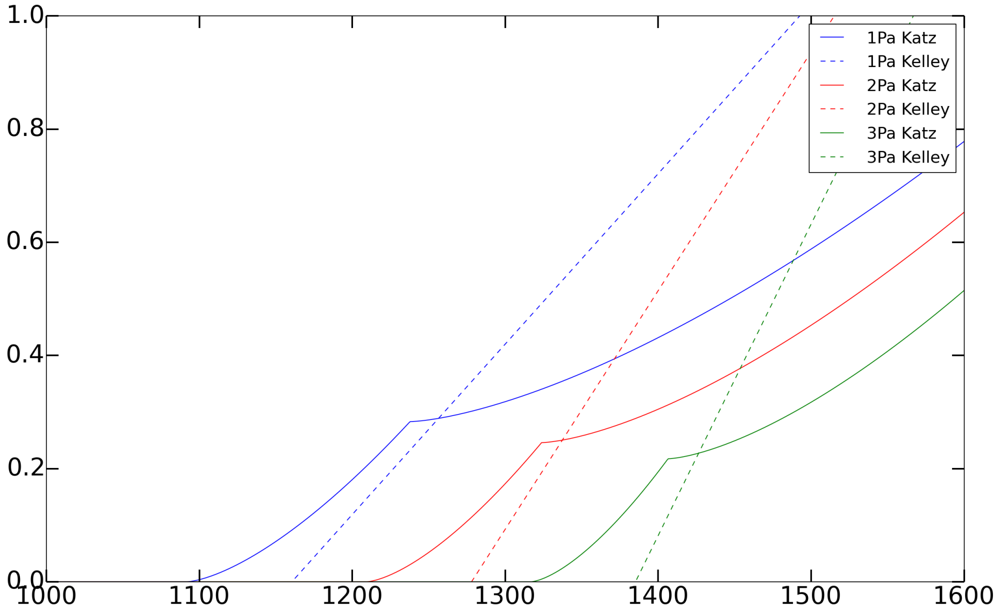

Figure 12:

- Assuming 4 wt% H2O for our samples, 0.25 fo2.

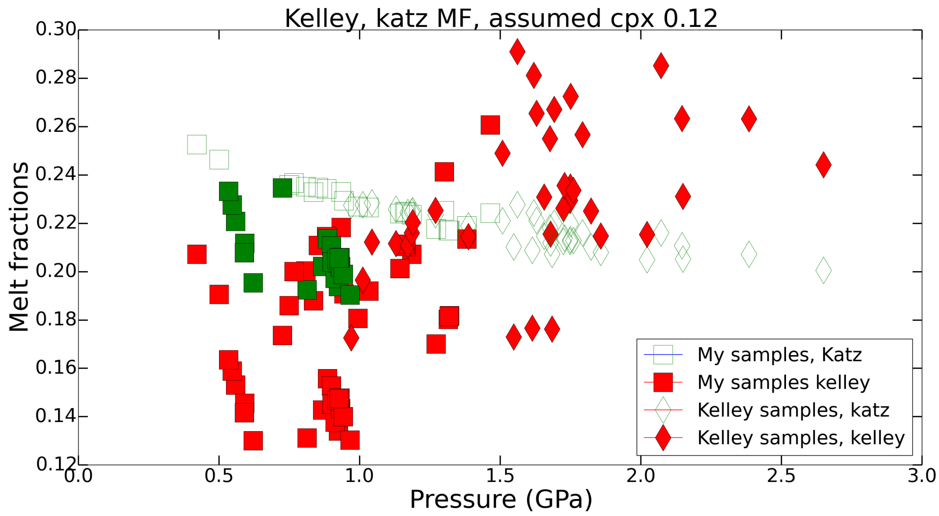

Figure 13:

- Assuming 4 wt% H2O for all samples, 0.25 fo2.
- hollow symbols - cpx has been exhausted.
- Below 1GPa Katz MF higher than Kelley MF - due to lower solidus of Katz.
- Above 1 GPa - Kelley do not consider cpx out - generally higher melt fractions.
- With increasing pressure, a certain cpx content can be exhausted quicker - this effect is incorporated with Katz, and is why more samples exhaust CPX at increasing pressure.
- Kelley also have a dT/dF variation with pressure, leading to higher melt productivities at higher pressures.

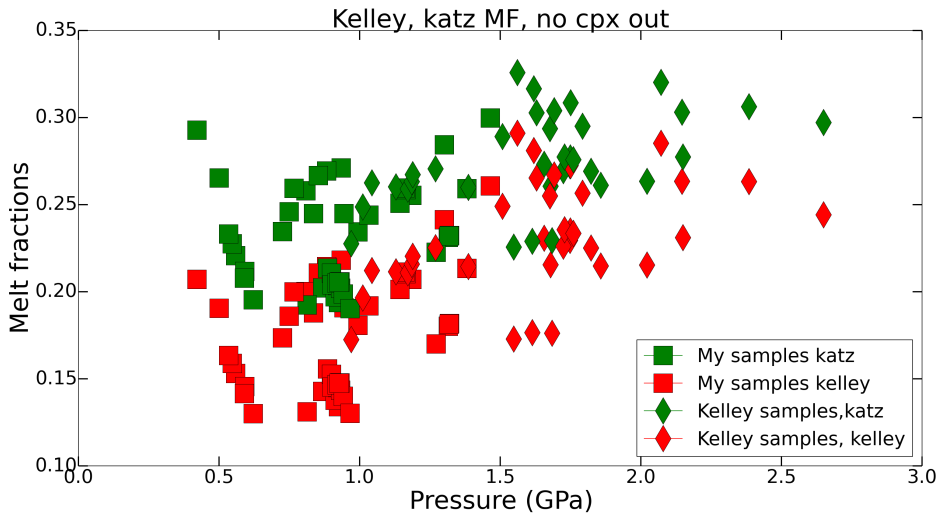

Figure 14:

- Assuming 4 wt% H2O for all samples, 0.25 fo2.
- When cpx exhaustion is excluded from Katz calculation,

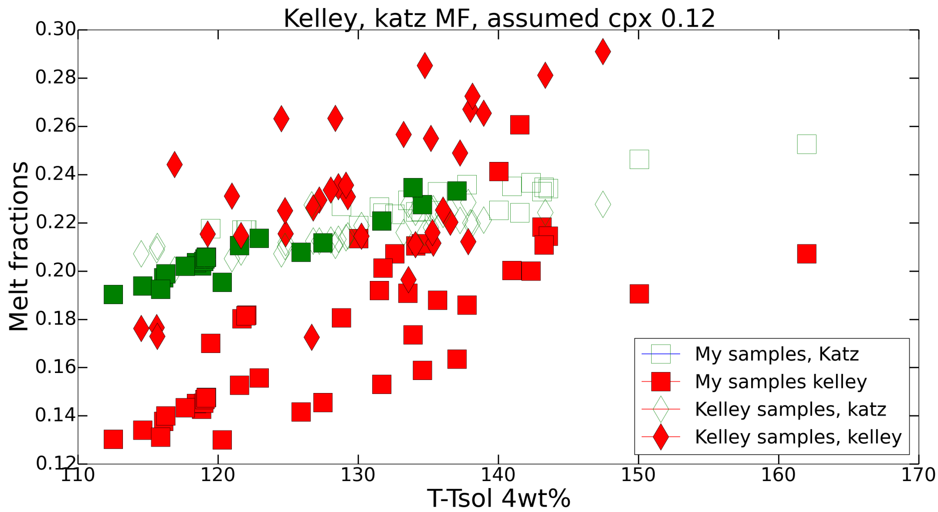

Figure 15:

- Assuming 4 wt% H2O for all samples, 0.25 fo2.
- When cpx exhaustion is excluded from Katz calculation,

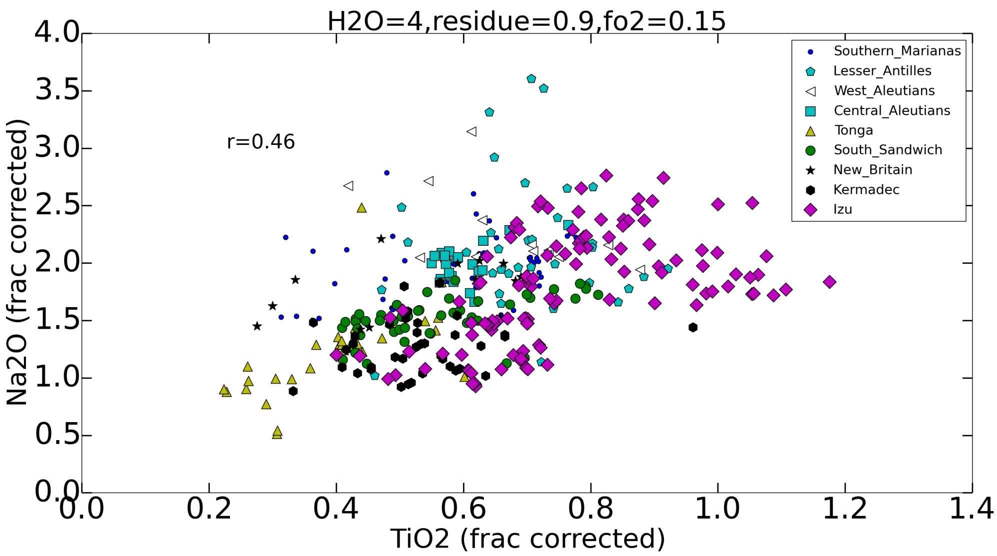

Figure 16:

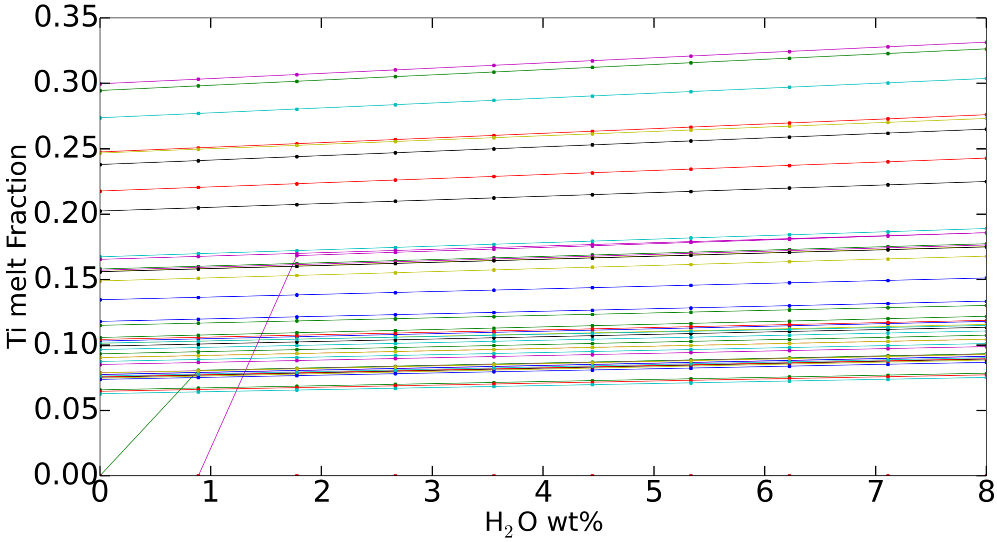

Figure 17:

- Changing H_2O from 0-8 wt% results in around 2% melt increase.

References

Katherine A Kelley, Terry Plank, Sally Newman, Edward M Stolper, Timothy L Grove, Stephen Parman, and Erik H Hauri. Mantle melting as a function of water content beneath the mariana arc. *Journal of Petrology*, page egq036, 2010.

Pierre Schiano. Primitive mantle magmas recorded as silicate melt inclusions in igneous minerals. *Earth-Science Reviews*, 63(1):121–144, 2003.

AM Shaw, EH Hauri, TP Fischer, DR Hilton, and KA Kelley. Hydrogen isotopes in mariana arc melt inclusions: Implications for subduction dehydration and the deep-earth water cycle. *Earth and Planetary Science Letters*, 275(1):138–145, 2008.