Figure S1

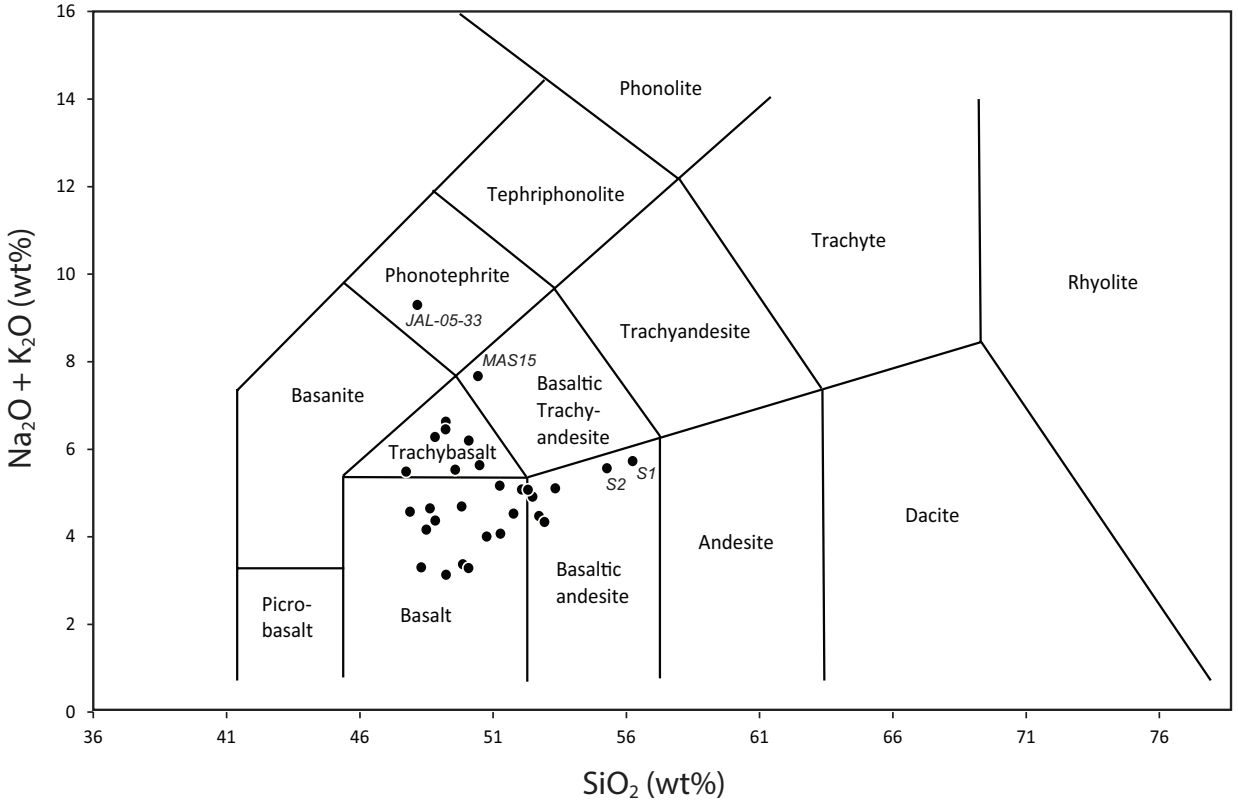

FIGURE S1: Total alkali versus silica (TAS) diagram of the whole rock samples studied in this contribution. Note that most samples are basalts, trachybasalts, or silica-poor basaltic andesites. Outliers are labeled with their sample numbers. We note that the two alkaline outliers do not contain plagioclase, and the two silica-rich basaltic andesites contain orthoclase.

Figure S2

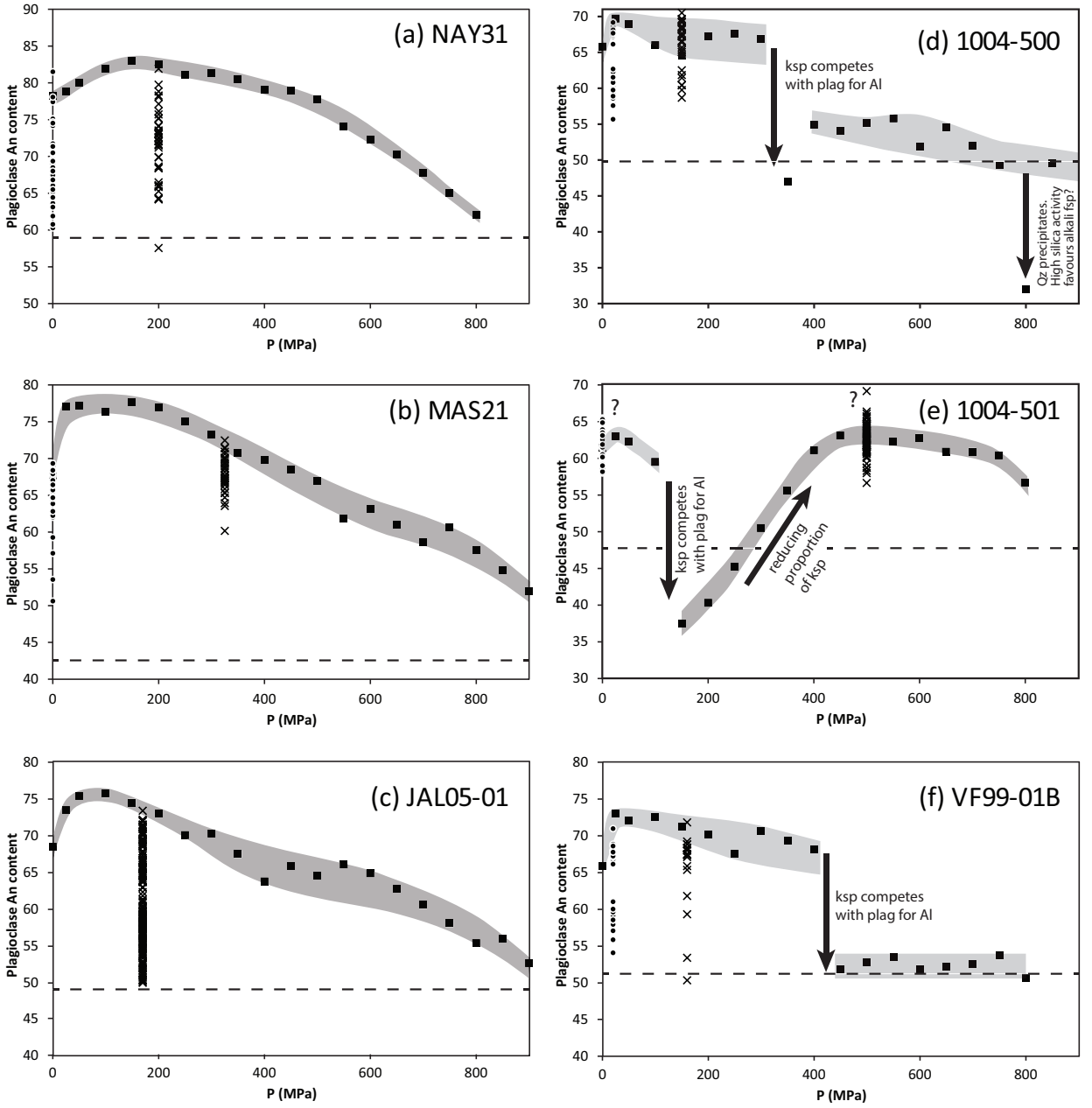

FIGURE S2A-F: An_{max}-MELTS pressure estimates. See caption of Figure 7 for details. One sample (cf. panel **e**) displays higher An contents than expected (indicated by question marks), and thus does not lend itself to pressure estimation.

Figure S2 (cont.)

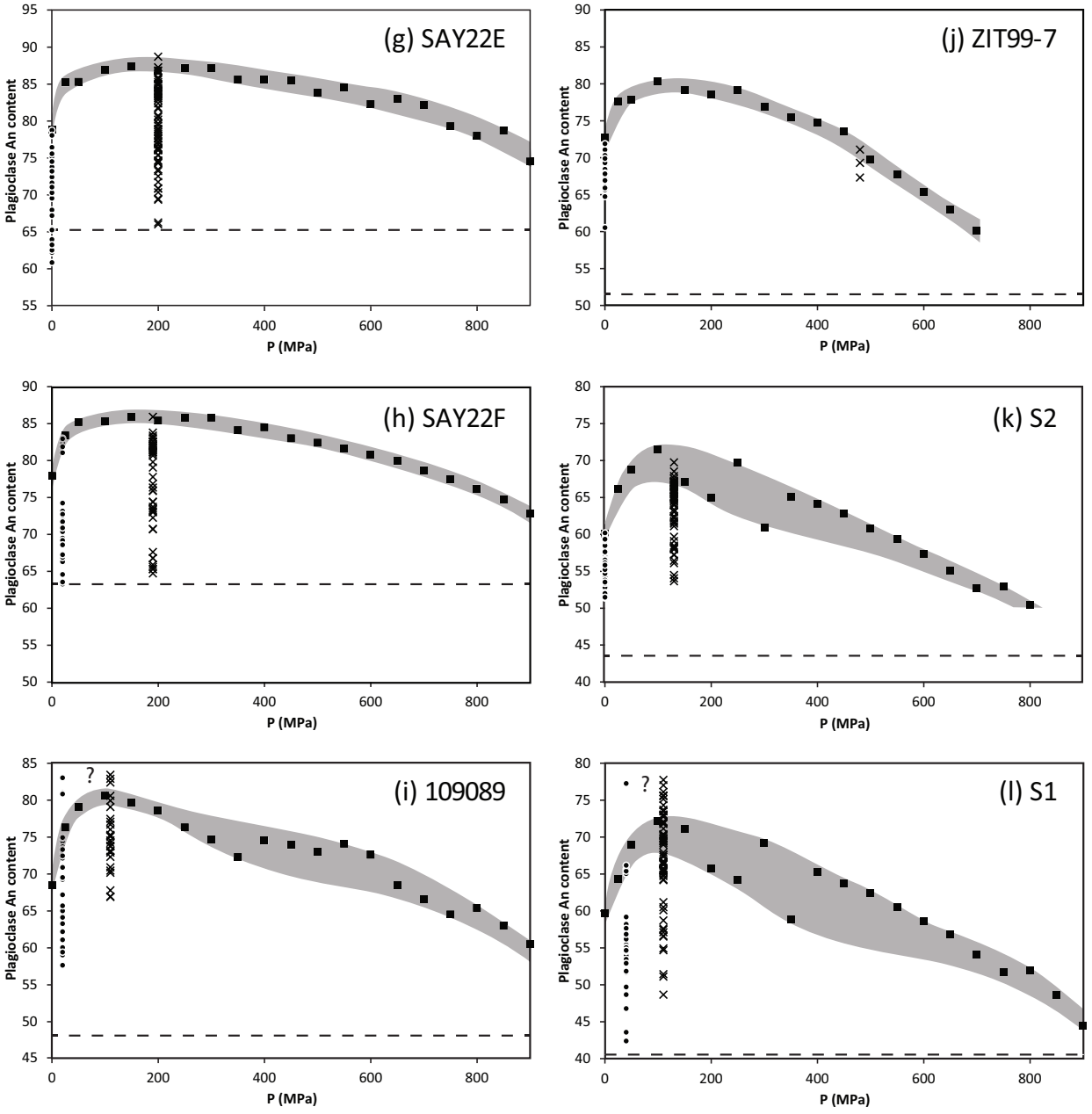

FIGURE S2G-L: An_{max}-MELTS pressure estimates. See caption of Figure 7 for details. Two samples (cf. panels **i** and **l**) display higher An contents than expected (indicated by question marks), and thus do not lend themselves to pressure estimations.

Figure S2 (cont.)

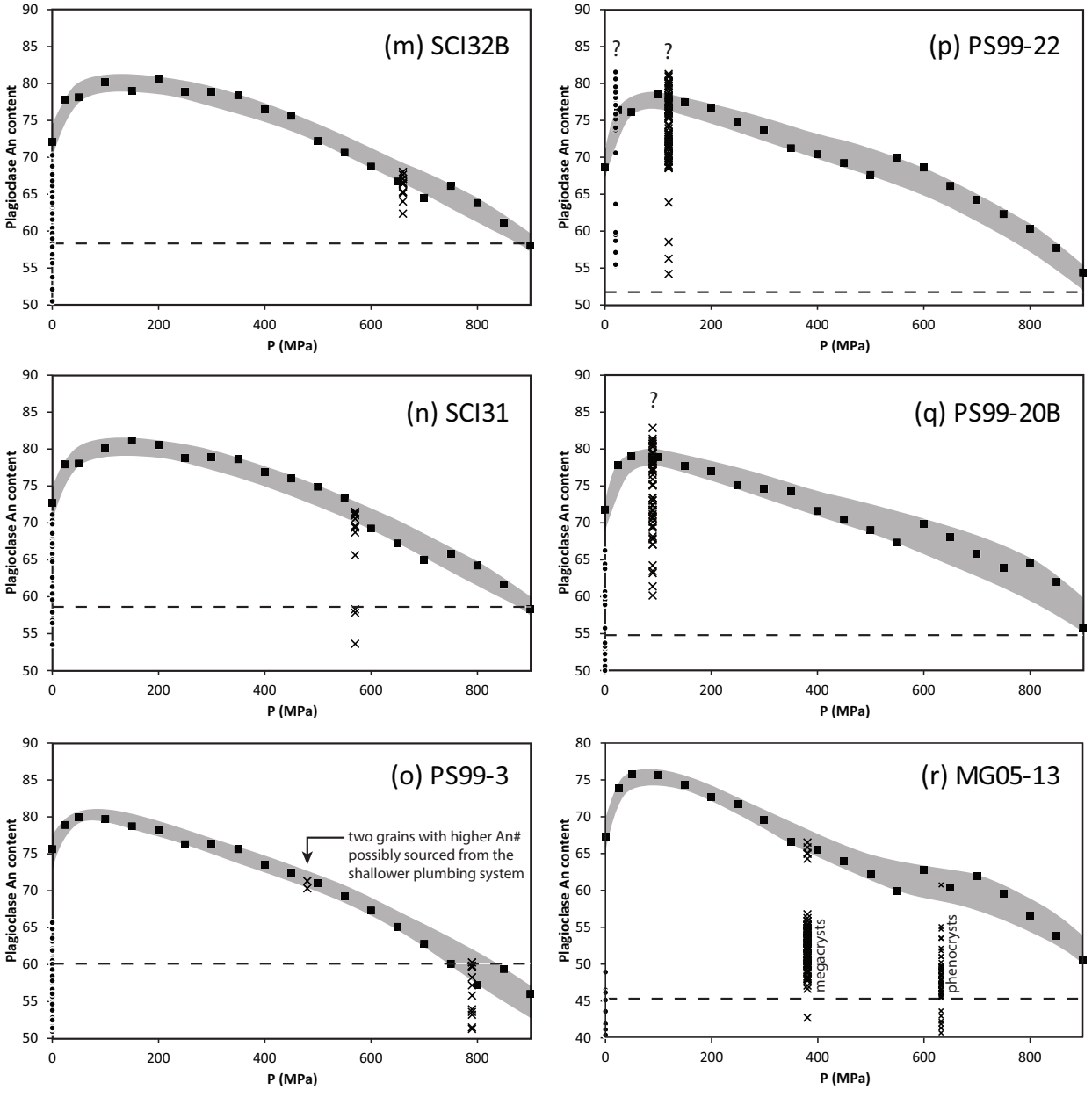

Figure S2m-r: An_{max}-MELTS pressure estimates. See caption of Figure 7 for details. Two samples (cf. panels **p** and **q**) display higher An contents than expected (indicated by question marks), and thus do not lend themselves to pressure estimations.

Figure S3

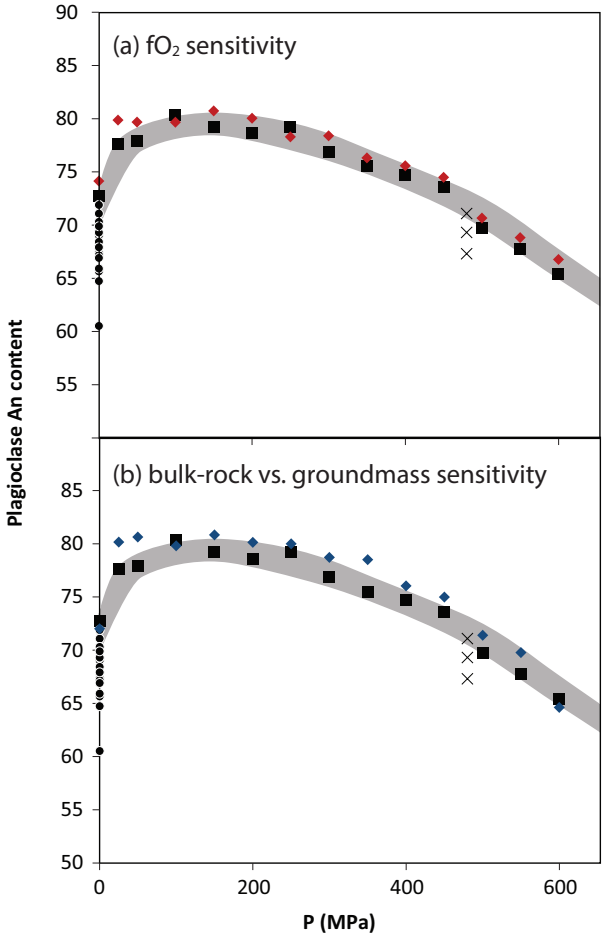

FIGURE S3: An_{max}-MELTS pressure estimate of sample ZIT99-7, with 10% crystallinity, reproduced from Figure S2j. (**a**) Added is the MELTS same melts model run at NNO+0.5 instead of NNO+1 as an f_{O_2} sensitivity test (red diamonds). The Anmax-MELTS pressure estimates are close and partially overlap. This shows that half a log-unit change in oxygen fugacity has no significant effect on the predicted plagioclase compositions. (**b**) Added is the MELTS model of the groundmass (blue diamonds), assuming that the crystallinity of this sample is due to equal proportions of olivine and pyroxene with the average mineral compositions of these phases in this sample. The An_{max}-MELTS pressure estimates are close and partially overlap. This shows that for samples with low crystallinity, whole rock compositions may be used instead of groundmass compositions for An_{max}-MELTS pressure estimation, with errors within as little as a few tens of MPa.

Figure S4

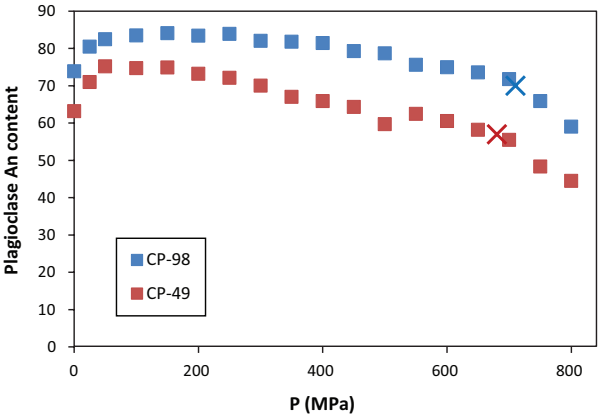

FIGURE S4: An-MELTS pressure estimates for Toxlacuaya (CP-49) and Rio Naolinco (CP-98) deposits of the El Vocancillo paired vent (Carrasco-Núñez et al., 2005). MELTS isobaric fractional crystallization models show the An contents of the first plagioclase crystal formed at a range of pressures (solid squares), as in Figure 7 and Figure S2. Anhydrous melt compositions at the onset of plagioclase crystallization vary from basaltic at low pressure to dacitic at high pressure. Average plagioclase phenocryst compositions (×) of each deposit are tagged to the respective MELTS trends such that the An content coincides with the MELTS trend. As these are averages, not maxima, pressures are likely slight overestimates. Irrespectively, both flows return very similar pressures at around 700 MPa, despite their very different bulk compositions. See main text for discussion.

Figure S5

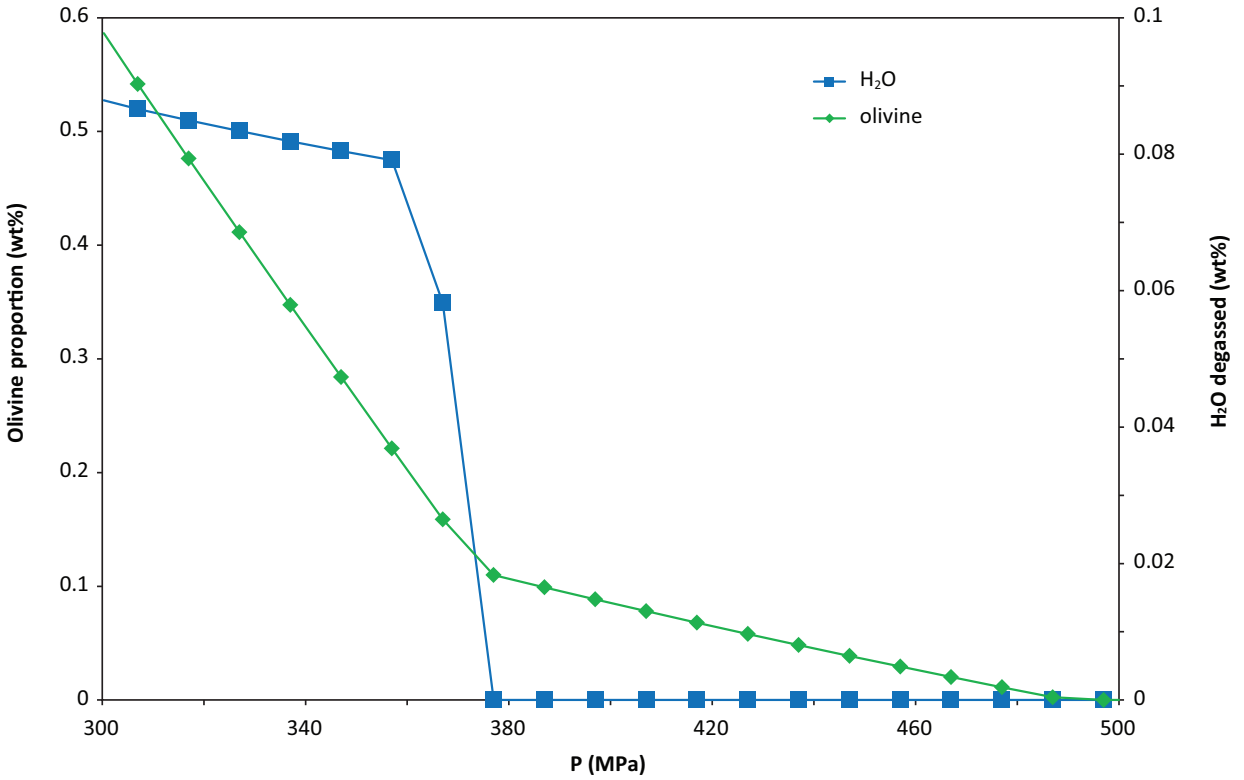

FIGURE S5: Crystallization rate is predicted to increase upon H_2O saturation and degassing. The alphaMELTS example shown here is for a short pressure interval of equilibrium crystallization of olivine during adiabatic decompression of composition NAY31 with initially 5.7 wt% H_2O and starting *P-T* conditions of 677 MPa and 1260 °C, at NNO+1.