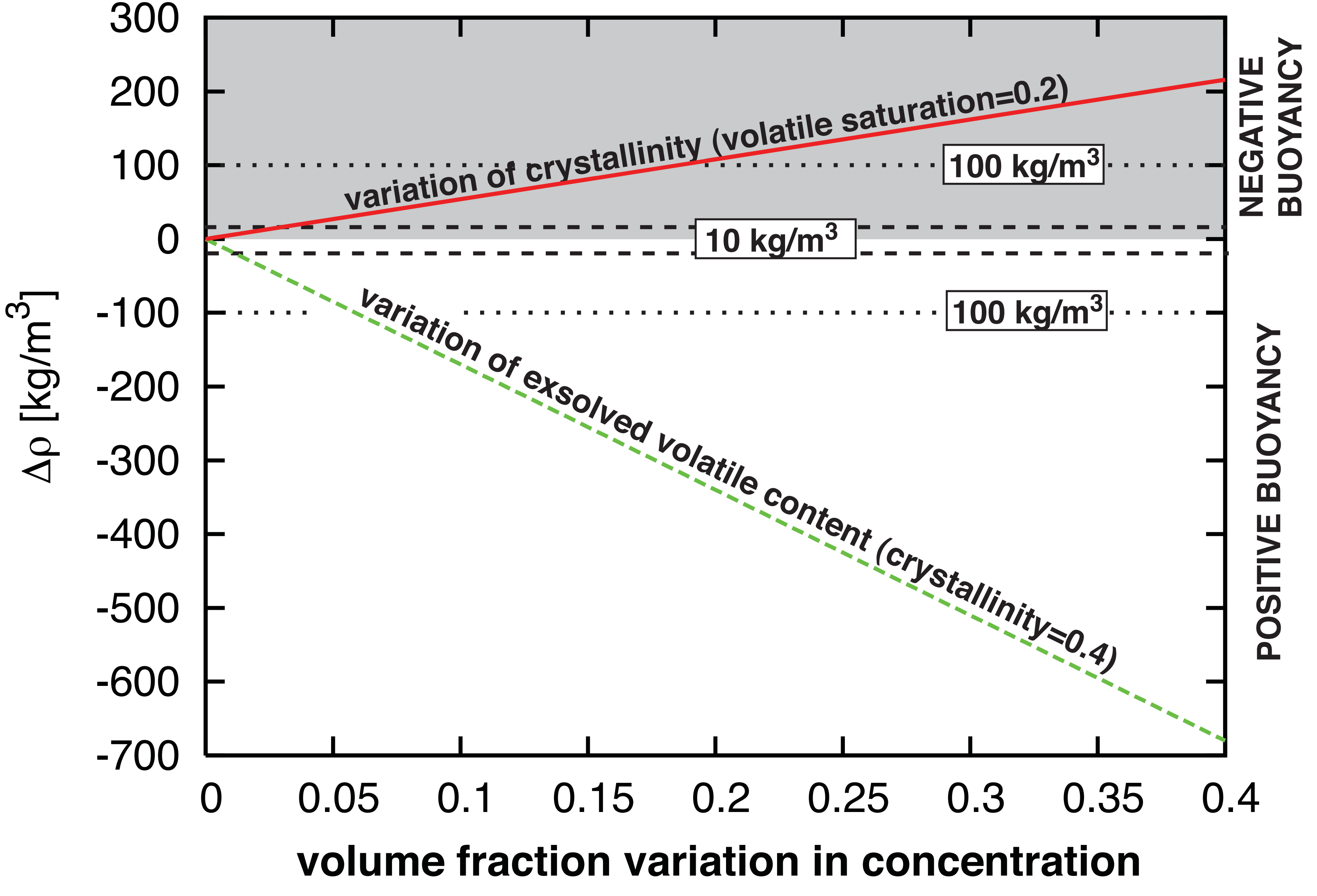
Supplementary Material

The stirring time scale depends, by definition, on the source of buoyancy contrast responsible for convection. Bergantz and Ni and Ruprecht and co-workers showed that the two main sources of buoyancy in silicic magmas are (1) crystallinity differences associated with the sinking of crystal-rich plumes from the chamber's roof and (2) exsolved volatiles (bubbles) liberated from a deeper part of the edifice (Bergantz and Ni, 1999; Ruprecht et al., 2008). In our calculations, we always assumed that an injection of magma was responsible for the intense stirring during the reactivation of crystal mushes. In Figure DR1, we show how the buoyancy contrast depends on the variation of volume fraction of gas bubbles (here using a density of 700 kg/m^3 for a water-rich mixture at about 2 kb) or crystallinity (using a density contrast between crystals and melt of 200 kg/m^3).

Figure DR1.Comparison between different buoyancy sources as stirring agents in a convecting magma body. The density contrast for crystallinity variations at a fixed volume ratio of volatile to melt (0.2) is shown in red (solid line). In green (dashed line), we show the buoyancy generated by gradient in volume fraction of exsolved volatiles (bubbles) assuming a density of 700 kg/m^3 for the volatile phase (P ~2 kb), assuming a fixed crystallinity of 0.4. Ascending volatiles provide a greater amount of potential energy for convection than descending crystal-plumes for similar volume fraction variations in the magma.


300
200
100
0
-100
-200
-300
-400
-500
-600
-700
Δρ [kg/m3]
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
volume fraction variation in concentration
variation of crystallinity (volatile saturation=0.2)
100 kg/m3
10 kg/m3
100 kg/m3
variation of exsolved volatile content (crystallinity=0.4)
NEGATIVE BUOYANCY
POSITIVE BUOYANCY