



The structure and CO₂ solubility of Kimberlite melts

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Kimberlitic magmas have the deepest origin of all terrestrial magmas. They are generated by low degree partial melting of carbonated mantle peridotite and may originally contain up to 30 wt% CO₂. The solubility of CO₂ in these melts is therefore expected to exert a prime influence on the melt buoyancy, structure and henceforth eruption dynamics. The study of Kimberlitic melt has previously been hampered by the apparent impossibility to quench them into stable glass. We have studied the CO₂ solubility and molecular structure of successfully quenched CO₂-bearing kimberlitic glass by FTIR, Raman and NMR spectroscopy. Our results suggest that the solubility of CO₂ decreases steadily with increasing amount of network forming cations and that pressure has little effect on the solubility of CO₂ for these compositions up until very shallow depth. Raman and ²⁹Si NMR investigation suggest that the Kimberlite melt structure is more polymerised (dominated by Q₁ configuration) than theoretically predicted while ¹³C NMR spectrum show a single resonance peak at -168 ppm similar to that of non-bridging carbonate species. Understanding the solubility and speciation of CO₂ in Kimberlitic melt has strong implications regarding the carbon content of the cratonic mantle and carbon's pathway to the surface in these tectonically lethargic settings.