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AMORPHOUS MATERIALS: PROPERTIES, STRUCTURE, AND DURABILITY

The effect of the [Na/(Na+K)] ratio on Fe speciation in phonolitic glasses[†]

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ABSTRACT

Natural iron-bearing sodic phonolitic melts represent an extreme compositional range of the effect of the [Na/(Na+K)] ratio on the geochemical behavior of Fe in volcanic systems. Yet phonolitic melts have not been well investigated. The glasses studied here have been synthesized from liquids equilibrated over a range of oxygen fugacity conditions $[log_{10}(f_{02}) \text{ from } -0.68 \text{ to } -11]$ to elucidate the role of the alkali ratio in influencing the local environment around both divalent and trivalent Fe. In this study, the Fe *K*-edge XAS spectra (XANES and EXAFS) have been employed, to constrain the Fe structural role (oxidation state, coordination number, bond distances) in phonolitic glasses as a function of synthesis temperature (*T*), [Na/(Na+K)] ratio (= 0.0, 0.25, 0.5, 0.75, 1.0) and redox state. We verify that at constant oxygen fugacity, the [Na/(Na+K)] ratio has a strong effect on the Fe³⁺/ (Fe²⁺+Fe³⁺) ratio. The results obtained are parameterized and discussed in terms of the contrasting effects of *T*, *f*₀₂, and alkali ratio.

Keywords: Alkalis, iron, oxidation state, phonolitic glasses, XAS