American Mineralogist, Volume 90, pages 310–315, 2005

Successive zoning of Al and H in hydrothermal vein quartz

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ABSTRACT

Electron microprobe and micro-FTIR (mFTIR) analyses of a quartz crystal from a hydrothermal vein reveal zoning in Al and H concentrations. The Al concentration ranges from 27 to 468 Al/10^6Si, and the H concentration ranges correspondingly from 49 to 266 H/10^6Si. The zoning profile reveals a positive correlation between Al and H concentrations. At low Al concentration (<100 Al/10^6 Si), the H/Al ratio is ~1.0 and the infrared spectra show strong bands due to Al-OH and very weak bands due to Li-OH. These results indicate that most of the charge imbalance resulting from Al^{3+} substituting for Si^{4+} is compensated by H. At an Al concentration >100 Al/10^6 Si, the ratio of H/Al drops to ~0.5 and the infrared spectra show absorption bands due to both Al-OH and Li-OH species. No other alkali ions were detected by microprobe analysis. These results suggest that a combination of H and Li are providing charge compensation in the more Al-rich zones. Replacement of Si^{4+} by $Al^{3+} + H^+ \pm Li^+$ is the principal mechanism for the incorporation of these trace elements into the quartz structure.