

Micro-Raman spectroscopic determination of Fo# in olivine

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Raman spectra of olivine samples with $Fo\#[=100Mg/(Mg+Fe)$ in mol] between 100-62.8 were analyzed for five apparent peaks at $700-1050\text{cm}^{-1}$: two prominent peaks at $826-820\text{cm}^{-1}$ and $858-849\text{cm}^{-1}$ and three subordinate peaks at $883-881\text{cm}^{-1}$, $920-914\text{cm}^{-1}$, $967-951\text{cm}^{-1}$. These five peaks were denoted as p1, p2, p3, p4, and p5, respectively. Each peak's position, ν , shifts monotonously toward the lower wavenumber with decreasing $Fo\#$. Actually, $(100-Fo\#)$ and $(\nu_{Fo}-\nu)$ can be linearly regressed for the five peaks as

$$(\nu_{Fo}-\nu)=A(100-Fo\#),$$

where ν_{Fo} is a Raman frequency of pure forsterite and ν is that of olivine with $Fo\#$ ranging from 100 to 62.8. This formula was adapted in order to cancel out inter-laboratory and device differences in the absolute value of measured peak positions. The respective regressed parameters A were 0.1717, 0.2323, 0.0796, 0.1560, and 0.4694 for p1-p5. These equations are consistent with previously published dataset, indicating that inter-laboratory and device differences were successively canceled out. The p2 equation indicates $Fo\#$ for 100-62.8 from the Raman peak position with geologically satisfactory precision within 1 Fo unit (1 sigma). Combined dataset of this study and Kuebler et al.(2006), which covers full range of $Fo\#$, shows that the relationship between ν and $Fo\#$ of p1 is linear with inflection near $Fo\#$ of 70 rather than progressively curved, implying some structural change of olivine near this composition.