

FT-IR spectra of NaCl-H₂O at high temperatures upto 650 °C

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Observations of aqueous solutions and their molecular spectra at high temperatures and pressures were performed using a new design hydrothermal diamond anvil cell (HDAC), connected to both a light and an infrared microscope. We have modified the diamond window of HDAC with a wide angle, to allow the infrared beam to pass the window. FT-IR spectra of NaCl-H₂O-D₂O has been examined at high temperatures up to 850°C and 3 GPa. Rising temperature effects on water spectra is different with increasing pressure. As phase transition H+L+V → L+V → L or F of NaCl-H₂O (39wt%NaCl), the spectra were measured from 29 to 650°C. There remains one liquid phase as T>467°C. From 29 to 300°C a wide band from 3200 to 3700 cm⁻¹ reflects a deconvoluted spectrum of O-H stretching vibrations corresponding to the hydrogen bond (HB) and the non-hydrogen bond (NHB). At 330°C, a big shape peak of O-H stretching vibration was reached at 3623 cm⁻¹. The sharp and strong O-H stretching vibration at 330°C near the critical state of water proves the breakdown of the hydrogen bonding net work. Above 330°C, the O-H symmetric stretch vibration corresponded to NHB predominates. The OH stretching vibration frequency increases with increasing temperature: from 3623 to 3659 cm⁻¹ (ν₁+ν₃). Also the combined OH stretch and HOH bend frequencies increase with temperature. Anion effects on the vibration frequency of water molecules of hydration of NaCl. For NaCl-H₂O at 300°C, the combined OH stretch and HOH bend frequencies increase from 5229 to 5265 cm⁻¹, while salinity increases from 30 to 40wt%.

Lack of the garnet effect on zircon trace elements for TTG-like rocks

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To assess the garnet effect on uptaking of trace elements in TTG petrogenesis, *in situ* trace elements, U-Pb and Lu-Hf isotopes were analyzed for zircon from four rock suites of the TTG-like Huangling batholith at Yangtze Gorge in South China. The results indicate that the temperature is critical to HREE uptake in zircon. The Huanglingmiao suite have typical TTG composition, with higher La/Yb and Sr/Y ratios, lower Nb/La ratios, whole-rock ε_{Na}(t) values and zircon ε_{Hf}(t) values than the other suites. For zircon from this suite, inherited cores and co-magmatic zones have indistinguishable trace element characteristics although their U-Pb ages and Lu-Hf isotopes differ significantly. All the zircons from the four suites are depleted in LREE, enriched in HREE with shallow MREE-HREE patterns, a positive Ce anomaly, and no Eu anomaly or very weak Eu anomaly. The last observation is in contrast to typical magmatic zircon, suggesting that feldspar was neither a stable phase during partial melting nor a removed phase during fractional crystallization. While LREE overabundance relative to whole-rock LREE is very common in the zircons from the granitoid suites, it is not so for zircons from the mafic dykes. The zircons from the TTG-like Huanglingmiao rocks have higher Hf, Y, Nb and Ta contents than those from other suites. However, Nb/Ta ratios for the all zircons from the Huangling batholith are similar to each other, with an average of 4.4. Most of the zircons have Ti concentrations lower than 30 ppm, yielding Ti-in-zircon temperatures of about 850°C.

The most important observation in this study is that no flat HREE patterns occur in the all zircons from the TTG-like Huangling batholith. In particular, neither the inherited cores nor the co-magmatic zones for the Huanglingmiao granitoids with typical TTG compositions show flat HREE patterns. This observation suggests that the garnet effect on the HREE uptake is quite limited even if garnet did exist as a residual phase during partial melting of the source materials of TTG rocks. Because partition coefficients of garnet/melt, zircon/melt and zircon/garnet in mafic to felsic rocks decrease with increasing temperature, relatively low temperatures of anatexis and crystallization may be a key to the HREE uptake in zircon from the TTG-like rocks.