

Variation of salinity and gas composition of fluid inclusions in the Culebra granitic rocks of the Palleca mining area in Peru

T. HIROTAKA* AND K. HOSHINO

Hiroshima University, Higashi-Hiroshima, 739-8526, Japan
(*correspondence: hiroataka821@hiroshima-u.ac.jp)

The Raman microprobe can analyze vapor-rich and other inclusions of low liquid water content which are difficult to analyze by microthermometry [1]. In order to apply Raman spectroscopic analysis to salinity measurements of natural fluid inclusions, synthetic brines were analyzed to obtain calibration curves by the reflex Raman microscope (Renishaw) with a LD laser as the source of 532 nm radiation. Dubessy *et al.* [2] mentioned the dependency of the crystal orientation of host quartz on the Raman spectra of water inclusions. Therefore, the dependency was also investigated by analyzing the synthetic brines covered with doubly polished thin sections of natural quartz cutting in parallel to and perpendicular to its C axis. The results show systematic variations in the spectra due to the orientation of the covered thin sections.

A number of fluid inclusions were observed in quartz phenocryst of the Culebra granodiorite and quartz porphyry of the Palleca mining area in Peru. Most fluid inclusions distribute within several trails probably formed by microfracturing and healing. Raman spectroscopic analyses of the trailed inclusions revealed four types of trails with different salinities and gas compositions of the CO₂-CH₄-N₂ (-H₂O-salt) systems. It is also worth to note that CH₄ is a major gas component in fluid inclusions of the trail in which sphalerite was observed, implying CH₄ dominant fluids as a source of ore dissemination in the rocks.

[1] Mernagh and Wilde (1989) *GCA* **53**, 765-771. [2] Dubessy (2002) *Appl spectrosc* **56**, 99-106.

Partial melts in the seismic low velocity zone

MARC M. HIRSCHMANN

Dept. Geology and Geophysics University of Minnesota,
Minneapolis, MN 55455 USA
(Marc.M.Hirschmann-1@umn.edu)

More than 30 years ago, Peter Wyllie and the other pioneers of high pressure experimental petrology explored the possibility that small amounts of CO₂±H₂O rich magma could plausibly be stable in the seismic low velocity zone (LVZ). Today, the hypothesis is still debated, with some arguing that the LVZ arises from the properties of solid peridotite close to its solidus and others advocating hydrous silicate or carbonatitic partial melts as the responsible agents.

Experiments defining the partitioning of H₂O between peridotitic minerals and silicate melts demonstrate that H₂O is modestly incompatible during partial melting of the mantle. Consequently, near-solidus partial melts of mantle with normal sub-oceanic H₂O concentrations (100 ppm) are not particularly H₂O-rich, ranging from ~1.25 wt.% at 100 km to ~2.5 wt.% at 200 km. These small concentrations are insufficient to incite partial melting in the LVZ beneath mature oceanic lithosphere without a significant influence of CO₂. On the other hand, carbonate is effectively incompatible in peridotite once the stability of magnesite is exceeded at ~300 km, and therefore carbon-rich melts may be stable throughout the LVZ. However, these melts may be carbonatitic only in the deepest (>150 km) and oldest (>60 Ma for a cooling half-space model, older for a plate model) portions of the LVZ. In the younger shallower portions of the LVZ, carbonatite will react with peridotite to form hydrous carbonated silicate melts with compositions ranging from melilitite to alkali basalt as the volatiles become diluted in the shallowest and youngest parts of the LVZ.

Thus, partial melts are thermodynamically stable throughout the LVZ and their composition varies spatially. However, this does not resolve the debate as to whether the LVZ is caused by small amounts of retained partial melt. First, the fractions of partial melt generated from normal sub-oceanic mantle are very small (<0.02% carbonatite and <0.1% carbonated silicate, except at depths >80 km and lithospheric ages <20 Ma) and may not be sufficient to account for the seismic properties of the LVZ. Second, thermodynamic stability is not the same as dynamic stability, as the buoyant melts may be extracted rapidly from the LVZ by compaction.