The volatile compositions of Qilian ancient oceanic lithosphere: Evidences from peridotites in Yushigou ophiolite, west China

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The volatiles of mantle peridotite in the lowest part of Yushigou ophiolite, Qilian Orogenic Belt, west China, provide a unique insight into the geochemical evolution of Qilian ancient oceanic lithosphere (AOL). The chemical and stable isotopic compositions of volatiles in olivine (Olv) and orthopyroxene (Opx) of harzburgite and dunite have been measured by vacuum stepped-heating mass spectrometer to reveal the nature and origin of volatiles in the Qilian AOL.

The volatiles in ophiolitic peridotite are composed mainly of CO2, secondarily of H2 and CO in dunite, and SO2 in harzburgite. Four types of fluids have been identified based on volatile compositions, C-O-H isotopes and their releasing temperature, combined with the types, size, shapes and homogenization temperature of fluid inclusions.

(1) The fluids of ancient oceanic asthenosphere, which are derived from the volatiles hosted in primitive fluid inclusions and dissolved in mineral structure of Olv in dunite and released at degassing peak of 800-1200°C, display high contents of H2 and CO, lighter C isotopes of CO2 (-21.2 to -23.0 per mil.) and variable O isotopes (4.5 to 8.8 per mil.), resembling that of continental lithospheric mantle [1].

(2) Initial fluids of AOL, which are volatiles trapped in primitive fluid inclusions and mineral structure of Olv and Opx of harzburgite and released at peak of 800-1200°C, exhibit high concentration of SO2, heavier H isotope of H2O (-27.2 per mil.) and lighter C and O isotopes of CO2.

(3) Mantle metasomatic fluids, which are derived from fluid inclusions related to metasomatism and released at peak of 400-800°C, show highest contents of total volatile and CO2, lighter H isotope of H2O and C-O isotopes of CO2.

(4) Alteration fluids are derived from fluid inclusions formed in alteration and released at 200-400°C and show similar characteristics to mantle metasomatic fluids.

The volatile compositions and stable isotopes suggest that Qilian AOL was originated from the continental lithosphere, in which extensive crust-mantle interaction were occurred, and formed in the fluids dominated by oxidized volatiles. Ancient oceanic water and crustal components were involved in the mantle metasomatism, deformation and alteration etc. evolution of Qilian AOL, then Qilian AOL undergone different extent of degassing.

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References

[1] Zhang M.-J., Wang X.-B., Liu G., et al. (2004) *Acta Geol. Sin*. **78,** 125-130.