METHANE (CH_4)-BEARING FLUID INCLUSIONS IN THE MYANMAR JADEITE

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Fluid inclusion studies in jadeitites therefore provide important constraints on the composition of the metamorphic fluid present during formation of the jadeitites in deep subduction zone environments. CH_4 is a common fluid species in hydrothermal systems in the oceanic crust and commonly forms either by reactions involving magmatic CO_2 or during serpentinization of olivine and/or other mafic phases (KELLEY & FRÜH-GREEN, 1999). So far there is only indirect evidence for the presence of CH_4 in subduction zones from shallow (1 - 3 km depth) CH_4-rich plumes emanating from the accretionary prisms in convergent margins. Recent investigations to constrain the retention and loss of volatile elements such as CH_4 during subduction showed that fluxes of carbon into subduction zones are larger than returned to the surface, thus indicating that CH_4 could occur in deeper levels of subduction zones (SADOFSKY & BEBOUT, 2003).

A combined hydrogen-carbon-isotope and fluid-inclusion study has been carried out on high-pressure jadeitites from the famous jadeite tract Myanmar. CH_4-bearing fluid inclusions were found in jadeites containing CH_4 and H_2O. Microthermometric results yield lower temperature limits for the entrapment of these fluid inclusions of ca. 300 – 400°C. The bulk composition of the fluid inclusions is mostly H_2O (87 - 94 mol.% H_2O) and the isotopic composition of methane and water in the inclusions is characterized by $\delta^{13}C(CH_4)$ values ranging from -30.1 ‰ to -25.5 ‰, and $\delta D(H_2O)$ values ranging from -56.3 ‰ to -49.8 ‰. The stable isotope data would be indicative of an abiogenic mechanism of CH_4 formation which could be due to either CH_4 of primordial origin (mantle degassing), CH_4 production during serpentinization (Fischer-Tropsch synthesis) or thermal maturation of subducted organic carbon.

Due to the lack of evidence (no Ni-Fe alloys, low hydrocarbon fractions) for primordial CH_4 and for the formation of CH_4 by Fischer-Tropsch synthesis during serpentinization, the occurrence of the jadeite veins in this paleo-subduction zone thus most likely point to the formation of these CH_4-bearing fluid inclusions by abiogenic thermal maturation of subducted organic carbon. These also data show that CH_4 not only occurs as shallow CH_4-rich plumes in accretionary prisms of recent subduction zones but also occurs in deeper portions of at least the upper 20 km of subduction zones.

References

KELLEY, D. S. & FRÜH-GREEN, G. (1999): J. Geophys. Res., 104, 10439-10460.
SADOFSKY, S. J. & BEBOUT, G. E. (2003): Geochem. Geophys. Geosyst., 4.