Trace element compositions of jadeite in a lavender-colored jade from the Itoigawa-Ohmi district: a LA-ICPMS study

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Jadeitite, mainly consisting of jadeite (NaAlSi2O6), typically occurs as tectonic inclusions in serpentinite-matrix melanges (e.g., Harlow and Sorensen, 2005 Int. Geol. Rev., 47, 113-146). The mineralogy and textural characteristics of jadeitites support that at least some jadeitites were formed by extensive metasomatism or crystallization from fluids (e.g., Coleman, 1961 J. Petrol., 2, 209-247; Miyajima et al., 1999 Min. Mag., 63, 909-916; Harlow and Sorensen, 2005).

The Itoigawa-Ohmi district, which belongs to the Renge high-P/T type metamorphic belt with Late Paleozoic age (Nishimura, 1998 J. metamor. Geol., 16, 129-140; Tsujimori and Itaya, 1999 Island Arc, 8, 190-205) (Fig. 1), is the most famous locality for jadeitite in Japan (Kawano, 1939 J. Jap. Ass. Min. Petrol. Econ. Geol., 22, 195-201; Ohmori, 1939 J. Jap. Ass. Min. Petrol. Econ. Geol., 22, 201-212). Jadeitites and eclogites in this area are thought to be tectonic inclusions in serpentinite-matrix melanges. Tsujimori (2002 Int. Geol. Rev., 44, 797-818) suggested that blueschist to eclogite metamorphism, which is preserved in glaucophane eclogite in the studied area, may be related to subduction of oceanic crust. A jadeitite, which varies in color from part to part in cm scales: white, pale green to blue (not green jade) and purple (lavender-colored jade) parts reflecting the variations in mineralogy, was corrected as a boulder from the Omi river. The white-colored part is an aggregate of prismatic jadeite with very minor amount of pectolite. The pale green to blue part consists of subhedral to euhedral prismatic jadeite in a prehnite matrix with minor amounts of pectolite, titanite and zircon. The lavender-colored part consists of Ti-bearing jadeite in an analcime matrix with a small amount of pectolite. Aggregates of fine-grained titanite associated with analcime are found at the center of the lavender-colored regions. The barian feldspars were found in the sample and were interpreted to be formed at pressure of around 0.6 GPa and temperature of less than 350 C (Morishita, 2005 Min. Mag., in press). In the studied sample, an euhedral jadeite is frequently found, supporting that the studied jadeitite, at least, would be directly crystallized from aqueous fluids.

Laser-ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) has become a standard analytical technique for direct elemental analyses of geological materials. The latest generation of quadrupole ICP-MS (Agilent 7500s) coupled with a 193 nm ArF excimer laser system (MicroLas: GeoLas Q-Plus) has been installed at the Incubation Business Laboratory Center of Kanazawa University (Ishida et al., 2004 Sci. Rep. Kanazawa Univ., 48, 31-42). The present work determines trace element characteristics of jadeite in the lavender-colored jade using the LA-ICPMS method to access insight on elemental circulation related to fluid-rock interaction in subduction environments, particularly at low-temperature regime. Details of analytical methods and data quality were shown in separate papers (Morishita et al., 2005a, b Geoanal. Geostand. Res., Geochem. J., in press).

LILE contents in jadeites are high compared to MREE-HREE which are usually lower than detection limit of the analyses (0.02-0.1 ppm using 30 micron diameter). No apparent positive Eu anomaly was found. Cr content is lower than detection limits (7 ppm). Fluid-mobile elements, such as Sr, Ba and Li contents, are high, although Pb content is lower than detection limit (0.3 ppm). It is interesting to note that jadeites in the studied sample contain very high concentrations of HFSEs (Ti, Zr, Nb, Ta and Hf). Although Ti-rich phases (titanite or preexisting Ti-rich phases now replaced by titanite aggregate) might be source for HFSE of Ti-rich jadeite, the fluids responsible for the formation of jadeitite would have unique geochemical characteristics, rich in both LILE and HFSE.