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Geochemistry of jadeitites and jadeite-lawsonite rocks in a serpentinite mélange (Rio San Juan Complex, northern Dominican Republic): Constraints on fluid composition in a subduction channel environment

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Jadeitites are excellent rock types for obtaining information on fluid composition in subduction zones. Recent studies indicate that many jadeitites appear to have formed by direct precipitation from a fluid [1]. In almost all localities worldwide (see e.g. Harlow and Sorensen, 2005) jadeitites are found either as allochthonous blocks or as veins and lenses directly within the serpentinite country rock of serpentinite mélanges. In the Rio San Juan Complex on the other hand jadeitite also frequently occurs as veins (cm to some dm in thickness) within lawsonite-blueschist blocks [2,3,4] entrained in the serpentinite mélange. The mélange of the Rio San Juan Complex also contains blocks (m to 10m scale) of different metamorphic grade and lithology (eclogites, blueschists, orthogneisses and very low grade rocks) showing contrasting but interrelated P-T-t paths. The consistency of such interrelated P-T-t paths with those obtained by numerical models led Krebs et al. [5] to interpret the mélange of the Rio San Juan Complex as a former subduction channel.

So far, two types of jadeitite have been found in the blueschist blocks: either as discordant veins cutting the foliation, or as concordant layers. In some cases the jadeitites contain large amounts of lawsonite and should then better be called jadeite-lawsonite rocks. The latter rock type may form a network of thin (< 1cm) veinlets that are folded. In both jadeitite and jadeite-lawsonite rocks XJd in clinopyroxene ranges between 0.80 and 0.99. The contact between vein and host rock is very sharp and petrographically no sign of a depletion zone near the vein can be recognized, indicating that the infiltrating fluid originated from an external source and was not released from the adjoining host rock. A mineralogical center-to-rim zonation has been identified in the jadeitite veins. Near the contact to the blueschist, lawsonite is the dominant mineral phase and towards the center the amount of jadeite increases. Major and trace element concentrations also change from centers to rims. Ca/Na varies from 0.75-0.77 in the center to 1.03-1.29 in the rim; the rims are enriched in Rb, Ba, Pb, Eu and have slightly higher REE concentrations than the centers. This may be explained by the lower solubility of lawsonite compared to that of jadeite [6], causing lawsonite to crystallize first during precipitation. Lawsonite crystallization leads to a decrease of the Ca/Na ratio in the fluid. When the Ca/Na ratio becomes low enough jadeite starts to crystallize.

Based on chemical data, jadeitites and jadeite-lawsonite rocks can be subdivided into two groups. The chondrite-normalised REE pattern of the first group shows decreasing normalized values from LREE (40-10 times) towards HREE (8-1 times). The second group has a U-shaped pattern with a strong positive Eu (5 times) anomaly. Even though no depletion zone in the adjoining host rock of the jadeitite is petrographically visible, there are lower REE concentrations in blueschists directly adjacent to the veins as compared to homogeneous blueschists without any veins. This clearly indicates some fluid-rock interaction during formation of the veins.

References

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