Microfractures observed in euhedral quartz from the Umanotani-Shiroyama pegmatite.

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Fluid inclusions in minerals are often classified into primary, secondary and pseudo-secondary ones based on their modes of occurrence (e.g., Goldstein, 2003). An inclusion along a growth plane of a host crystal may be thought as entrapped one during crystal growth, and thus be referred as primary one. On the other hand, inclusions on a trail cutting through the growth plane may be conceived as secondary or pseudo-secondary ones trapped along a healed microfracture in a host crystal. The inclusions on the trail may be categorized into secondary ones if the trail is thought to have been formed after crystal growth was complete, while they may be called as pseudo-secondary if the trail was formed during crystal growth. However, in general, it is quite difficult to classify fluid inclusions in naturally occurring crystals by strictly following those criteria. Therefore, the authors have investigated a possibility of exact categorization of fluid inclusions, trails and microveinlets observed in euhedral quartz collected from the Umanotani-Shiroyama pegmatite mine, Shimane prefecture, SW Japan. Euhedral crystals of quartz of about 20 cm in length occur at the boundary between the pegmatite and the host granitic rock in the mine. They are surrounded mainly by fine-grained K-feldspar and muscovite and their alteration products such as kaolinite.

Growth planes were well identified by trails of fine-grained muscovite (+ kaolinite) in the sampled quartz. Although numerous fine fluid inclusions consisting of liquid and vapor phases were observed in quartz, so-called primary inclusion on the growth planes or alignments parallel to the planes could not be found. Hence, the all inclusions should be classified as secondary or pseudo-secondary in a strict sense. The inclusions follow four trails of which sequence (order of formation) could be analyzed exactly by their modes of occurrence (cutting relation). The final trail at least cuts the growth planes. The inclusions in the trails show their homogenization temperatures as 280-320C with salinities of 6-10 wt.%. No significant difference in the temperatures or in the salinities could be found among the trails.

Microveinlets of 2-8 mm in width filled with fine-grained quartz were observed in the host quartz. They are oblique to and cut the growth planes coated by fine-grained muscovite (+ kaolinite). When the veinlets occur discontinuously on the same plane, a fluid inclusion trail connecting the veinlets could be seen. Fluid inclusion trails were also found in the vein quartz. Although the trails are perpendicular to the boundaries of the veinlets, they do not enter into the host quartz. Homogenization temperatures and salinities of the fluid inclusions in the trails are 320-340C and 10-12 wt.%, respectively, and are slightly higher than those in the host quartz. It is quite interesting that although the growth planes are cut by the microveinlets, which in turn are also cut by sharp microfractures filled with muscovite (+ kaolinite) along the extension of the growth planes.

As described in the above, some clear relations between the growth planes, fluid inclusion trails and microveinlets showing their sequences could be seen in the euhedral crystal of quartz. However, some of them are inconsistent with each other. It is also worth to note that the microveinlets might have been formed by replacement of the host quartz by the fine-grained quartz along the microfructures. Then, what was the condition under which quartz replaced quartz? Also, what was the difference in the conditions in which the microfructures grew up to form the microveinlts on one side, while the fractures were healed to form the fluid inclusion trails on the other side?