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# Mineral Textures in Orogenic Gold Systems: Still More to Learn

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Orogenic Au veins are generally interpreted as having formed according to the well-established fault-valve model, typically under greenschist facies P–T conditions. In this model, cyclic seismogenic ruptures allow deep hydrothermal fluids to ascend, whereas vein sealing during aseismic periods leads to progressive fluid-pressure build-up. As a result, orogenic Au veins record multiple successive episodes of crystallization and deformation. Both types of episodes are critical for Au mineralization: crystallization is associated with primary gold deposition, whereas deformation is linked to gold remobilization and upgrading.

However, distinguishing these successive episodes within vein minerals is challenging due to the cyclic nature of the fault-valve process. Yet, such identification is essential for interpreting trace-element and isotopic data of veins minerals within the framework of the fault-valve model.

Quartz, tourmaline, and pyrite are among the most important minerals in orogenic Au veins, each characterized by distinct physical behavior during deformation and fluid circulation under greenschist P–T conditions, and therefore each records different aspects of vein evolution. Quartz deforms plastically, and euhedral zoned grains—evidence of crystallization episodes—are rarely preserved; most quartz grains are strongly deformed and thus primarily record deformation events. In contrast, tourmaline typically forms well-zoned grains, behaves brittely, and is relatively unreactive during deformation, meaning it preserves information about crystallization episodes but not deformation. Pyrite, like tourmaline, forms well-zoned grains and behaves more brittely than quartz, but unlike tourmaline, it is affected by dissolution-recrystallization processes during or after active fault-valve deformation. This is expressed by minor grain deformation and prominent dissolution–reprecipitation textures associated with Au remobilization.

Using examples from orogenic gold veins in the Val-d'Or vein field, we highlight the importance of deciphering mineral textures to properly interpret trace-element and isotopic data, as well as the mechanisms of Au precipitation and remobilization.