

The Rossignol Fluorite Vein, Chaillac, France: Multiphase Hydrothermal Activity and Intravein Sedimentation

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Abstract

The Chaillac deposit of Indre, France, occurs at the contact between Hercynian metamorphic basement in the Massif Central and Mesozoic sedimentary cover. The deposit consists of a stratiform Ba-F-Fe-rich deposit (Les Redoutières) and a F-Ba-(Pb)-rich vein (Le Rossignol). Most fluorite mineralization in the northern French Massif Central occurs in north-south extensional veins that were filled during two main mineralizing stages. These stages are characterized by green and purple fluorite, and yellow fluorite and barite.

The early stage of the Rossignol vein is characterized by green and purple fluorite, quartz, minor adularia, and minor pyrite. Analysis of intravein sediments indicates that they were deposited in a low hydrodynamic regime (fluid velocities of $<0.02 \text{ ms}^{-1}$) during the mineralizing event. Primary fluid inclusions in the early-stage fluorite contain a very low salinity ($<0.5 \text{ wt } \% \text{ NaCl equiv}$) aqueous fluid and have a median homogenization temperature of 135°C . Yellow fluorite-barite mineralization stage began with deposition of yellow fluorite, barite, and galena, and culminated in a late brecciation stage. Analysis of sedimentary textures indicates that the yellow fluorite-barite assemblage was deposited in a high hydrodynamic regime (fluid velocities of $<0.4 \text{ ms}^{-1}$). Primary fluid inclusions in fluorite from this stage contain brines ($21.8 \text{ wt } \% \text{ NaCl equiv}$) and have a median homogenization temperature of 110°C . There is no evidence for fluids of intermediate salinity in the fluorite samples from either stage. The two stages of fluorite can be distinguished using Y and REE ratios; Y/Ho ratios average 100 for the yellow fluorite-barite and 50 for the green and purple fluorite stage. Both positive Eu anomalies and La/Ho ratios decrease with time and depth, suggesting that deposition of the yellow fluorite-barite assemblage began at the top of the vein and progressed downward.

A genetic model is proposed, whereby boiling of a single, deep hydrothermal fluid resulted in the deposition of green and purple fluorite from condensed vapor in the northern Massif Central, and yellow fluorite from residual brines. Comparison with other Jurassic fluorite veins suggests that the Rossignol model can be extrapolated to other vein systems.

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