Eu ANOMALIES, TETRAD EFFECT AND HREE ENRICHMENT IN FLUORITES FROM Sn DEPOSITS: EVIDENCE FOR TWO SOURCE MIXING AND PHASE SEPARATION

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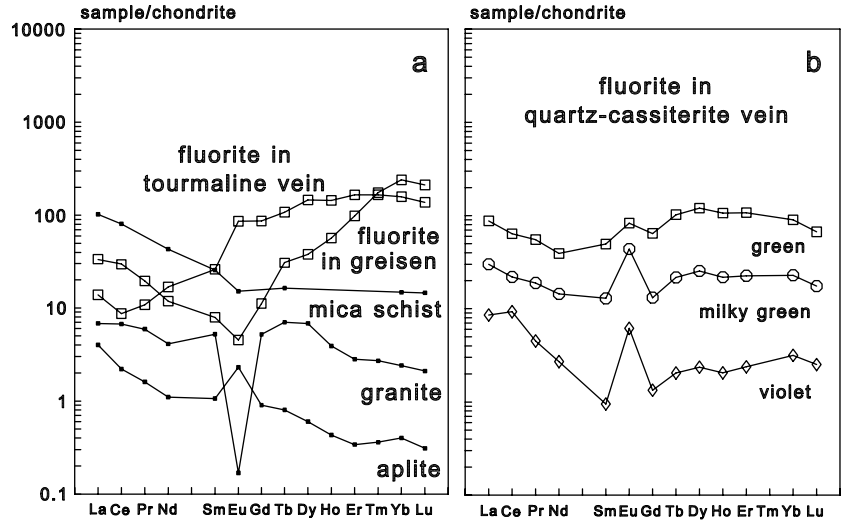
The genesis of fluorite-bearing deposits may be discussed comparing REE distribution patterns for fluorite samples of well-known geological position with the REE contents of the surrounding rocks.

Results of our investigations on Sn(-W) deposits in the Erzgebirge (Zinnwald, Sadisdorf, Ehrenfriedersdorf), Central Kazakhstan (Karaoba, Akchatau), Mongolian Altai (Kyzyltau, Shaar ukha) and Central Mongolia (Modoto) together with literature data led us to the conclusion that REE distribution patterns for the rocks and minerals can be interpreted as a result of two source mixing. We assume that (1) a mantle or lower crust-derived fluid and (2) crustal compounds (rocks and fluids) were involved in the deposit formation. On the other hand, the data reflect phase separation undergone by the ore-forming fluid-magma system under non-equilibrated conditions at a subvolcanic emplacement level.

The fluid derived from a deep-seated source is characterised by a strong enrichment in HREE. The REE distribution may be inherited from depleted mantle or caused by fluid separation from a mafic magma source. The crustal compounds show a typical enrichment in LREE. They are involved in the evolution of fluid-saturated Li–F magmas and ore formation through melting, assimilation and fluid-rock interaction. Under subsurface conditions, the fluid-magma system is split by phase separation into different fluid and magma subsystems. The latter process is closely connected to the ore deposition. Different types of mixed REE distribution patterns with Eu anomalies occur as a result of fluid-magma separation and interaction with wall rocks.

In the Fig. 1, REE distribution patterns for fluorites and rocks from the Ehrenfriedersdorf deposit are shown as an example. Pale rose fluorite from early tourmaline veins reflects the REE characteristics of the deep-seated source. The crustal compound is represented by the mica schists hosting granite, aplites and quartz veins with Sn mineralization. The REE distribution patterns for granites, aplites and fluorites from endocontact greisens and exocontact ore veins are interpreted as results of mixing and separation processes. Strong negative Eu anomalies in endocontact rocks and minerals are accompanied by positive anomalies in exocontact aplites and fluorites. The tetrad effect is a general characteristic of the fluid-magma system which was possibly generated during separation from a deep-seated source.

Fig. 1. REE distribution patterns for fluorites and rocks from the Ehrenfriedersdorf deposit (Erzgebirge).



Data for granite and aplite in (a) from Seltmann et al. (1994), other data obtained by ICP-AES.

Data for fluorite in (b) from Seifert and Kempe (1994) measured by P. Dulski (ICP-MS).