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Identification of several mineralising events with combined (U-Th)/He dating and lanthanide geochemistry at La Azul fluorite deposit (Mexico)

T. Pi[1], J. Solé[1] and Y. Taran[2]

[1] Instituto de Geología, UNAM, Cd. Universitaria, 04510 México D.F. (tpuig@geologia.unam.mx; jsole@geologia.unam.mx)
[2] Instituto de Geofísica, UNAM, Cd. Universitaria, 04510 México D.F. (taran@tonatiuh.igeofcu.unam.mx)

One of the most debated topics in the study of ore deposits is the duration of the mineralising event. It is common to speak of "age of the deposit" in the bibliography of mineral deposits, but this phrase is misleading, because it masks the possibility of a multistage ore deposition.

The epithermal deposits, as the one studied here, are generally located in zones of intense fluid circulation, with many fractures, breccias, filling, replacements, etc. A petrographic study of these types of deposits shows that multiple stages of mineralisation, in the paragenetic sequence, are commonplace. It is probable that the early stages can be truly cogenetic (in a temporal sense), but late textures (or secondary ones) cannot be assigned to an unambiguous time.

We present a petrographic, geochronologic and geochemical study from the "La Azul" fluorite mine, Taxco mining district (Mexico). One of the goals of this study is the recognition of different mineralising events. The combination of petrography, lanthanide geochemistry and direct (U-Th)/He dating of fluorite has allowed us to distinguish three stages of fluorite precipitation with well-defined age differences.

The first stage, dated at 32±2 Ma, precipitates fluorite with low lanthanide contents and characteristic primary textures (massive, rhythmite, botryoidal, etc.). Fluorite replaced carbonates put in contact with acid volcanic rocks by faulting.

The second stage, dated at about 20 Ma, precipitates fluorite with relatively high lanthanide contents and is related to the input of new fluids to the system. Textures are typically secondary, such as breccias.

The late stage, dated between 5 and 15 Ma, precipitates nodular fluorite and external crusts of millimetric cubic fluorite crystals with intermediate lanthanide concentrations. It is interpreted as a remobilization and reprecipitation of the previous stages.

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Trace and REE geochemistry of auriferous BIFs in Gadag greenstone belt, Western Dharwar Craton: Implications for mantle derived hydrothrmal activity

D. Srinivasa Sarma

National Geophysical Research Institute, Hyderabad-7, India (dssarma@ngri.res.in)

The Late Archean Gadag greenstone belt is made up of high-MgO basalts in association with tholeiitic basalt, rhyolite, andesite, dacite, clastic and chemical sediments. The BIFs showing six different lithological associations are highly deformed and sheared. These BIFs are auriferous in the sheared zones showing gold concentrations ranging from 0.4 – 4.8 ppm in association with quartz-carbonate veining and secondary gold-sulphide mineralisation.

A mantle source hydrothermal input into the depositional basin for the formation of these BIFs is indicated by trace element signatures defined by Cr, Co, Ni, Zr and Hf. The ∑REE contents in these BIFs show low to moderate abundance(5.2-51.6) across the mineralised zones and their patterns define slight LREE enrichment, mildly positive Eu and negative Ce anomalies and slight HREE depletion in similarity with REE signatures of volcanogenic hydrothermal solutions[1]. Geochemical data on these BIFs and the associated bimodal volcanic suite of rocks suggests plume derived magmatic and hydrothermal activity resulting in simultaneous deposition of BIF and volcanogenic exhalative activity in the depositional basin.

Reference

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