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New consideration of bacterial sulphate reduction in extreme condition (up to 170°C)

Riadh Abidi
Campus Universitaire,Tunisie

Microglobular sphalerite (90-180 µm) is a major form of sphalerite in the abandoned, Triassic carbonate-hosted Zn-Pb deposits at Ain Allega and El Aguiba, northern of Tunisia. The sphalerte occurs as yellow colored rounded grains, (<30 µm in size) in colloform bands, dendritic structure, spherolitic aggregates composed of rounded to subrounded microspheres (<15 µm in size), massive bodies and impregnated grains resulted from deposition in open spaces. Scanning electron microscope (SEM) and electron-microprobe analyses (EMP) showed that globules of sphalerite in the carbonate matrix are composed of agglomerations of individual sphalerite grains, from a few nanometers to a few µm in size. Individual sphalerite microglobules are from 20 to 60 µm diameter. So microbial nanotextures made visible by field emission scanning electron microscopy (FESEM) after etching, include sphalerite nanospheres (10-90 nm) and bacterial filaments. The observed sphalerite nanospheres are interpreted as *in situ* metabolic products of bacteria sulfate-reducing. However the $\delta^{34}S$ of microglobular sphalerite present a higher value from +10 to +16% suggesting a hydrothermal activity. The microthermometric analyses in two-phases (liquid and vapour) fluid inclusions calcite associated to globules of sphalerite suggest that sphalerite were precipitated by a higher-temperature (170°C) and higher salinitye (16.37 wt. % NaCl equivalent) solution originated possibly from a basinal brine. We suggest that the combined biogenic nano- to macrotextures of sphlerite, sulfur isotope data and micro-thermometric are evidence that microbes have a significant role in formation of the Ain Allega and El Aguiba carbonate-hosted Zn-Pb deposits in hydrothermal condition (170°C).

abidi1riadh@yahoo.com