

Compositional zoning in sphalerite crystals

**FRANCESCO DI BENEDETTO,^{1,*} GIAN PIERO BERNARDINI,² PILAR COSTAGLIOLA,³ DAVID PLANT,⁴
AND DAVID J. VAUGHAN⁴**

¹Museo di Storia Naturale, Università di Firenze, via G. La Pira, 4-I50121, Firenze, Italy

²Piazzale Donatello 18, I-50132, Firenze, Italy

³Dipartimento di Scienze della Terra, Università di Firenze, via G. La Pira, 4-I50121, Firenze, Italy

⁴Department of Earth Sciences, University of Manchester, Oxford Road, H13 9PL, Manchester, U.K.

ABSTRACT

A series of natural sphalerite samples, characterized by an inhomogeneous (zonal) distribution of Fe, Mn, and Cd atoms substituting for Zn, has been investigated by electron probe microanalysis and X-ray element distribution mapping. The cation distributions are markedly inhomogeneous due to the reciprocal effects of the minor elements on their respective solubilities. In particular, zonal partitioning between Fe and Mn and between both cations and Hg was observed in sphalerite, as well as coupled Cu-In and Cu-Fe substitutions. Distinctly different distribution patterns were identified in Mn-free samples with a low Fe-content, as compared to Mn-bearing samples. In the former case, Fe and Cd distribution patterns are very similar, whereas in the latter case, Cd is distributed homogeneously and Mn and Fe patterns are antithetic. The different oscillatory zoning observed in Mn-free samples is attributed to a fast, self-organized solute (Fe, Cd) deposition, although an alternative external origin cannot be ruled out. On the other hand, in the presence of Mn, zoning may be related to an absorption process at the mineral-fluid interface controlled by a competition between Mn and Fe that may explain the observed limited coupled concentration of these elements in sphalerite. The homogeneous distribution of Cd suggests relatively slow crystal growth.