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PII: S0375-6742(17)30892-0
DOI: https://doi.org/10.1016/j.gexplo.2017.12.014
Reference: GEXPLO 6065

To appear in: *Journal of Geochemical Exploration*

Received date: 11 July 2016
Revised date: 14 November 2017
Accepted date: 18 December 2017

Please cite this article as: Bo Yuan, Changqing Zhang, Hongjun Yu, Yaomin Yang, Yuexia Zhao, Chaocheng Zhu, Qingfeng Ding, Yubin Zhou, Jichao Yang, Yue Xu , Element enrichment characteristics: Insights from element geochemistry of sphalerite in Daliangzi Pb–Zn deposit, Sichuan, Southwest China. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Gexplo(2017), https://doi.org/10.1016/j.gexplo.2017.12.014

Element enrichment characteristics: Insights from element geochemistry of sphalerite in Daliangzi Pb–Zn Deposit, Sichuan, Southwest China

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ABSTRACT

Sphalerite in the Daliangzai Pb-Zn deposit, one of the hundreds of Pb-Zn deposits in South China, was chosen as an case study for geochemical research using in situ laser-ablation inductively coupled mass spectroscopy analysis. Many kinds of minor and trace elements were investigated and subsequently treated by multivariate statistical analysis, especially principal component analysis (PCA). These research works indicate that the enrichments of Cu, Ga, As, Cd, Ge, Ag, Sb, Pb, Ni in sphalerite from different depths of the super-large No. Ⅰ orebogy mutually imply a lower-temperature hydrothermal process dominating the mineralization in Daliangzi Pb-Zn deposit. A small temperature gradient controls the almost similar element distribution patterns indicated by the sphalerite samples which were enriched in Fe, Mn, Co, Cu, Ge, Ag, and Cd in the lower orebody whereas those in the upper orebody were enriched in Fe, Mn, Co, Cu, Ge, Ag, Cd, plus Ga and In. The enrichment of Fe in sphalerite matrix assists the incorporation of many metals, for example, Mn, Co, Ge, and (Ag +Sb). Some important coupled substitutions are discovered: $4Zn^{2+} \leftrightarrow 2Fe^{2+} + Ge^{4+} + \square$ (where □ denotes a vacancy), $2Zn^{2+} \leftrightarrow Ag^{+} (Cu^{+}) + Sb^{3+}$, and $3Zn^{2+} \leftrightarrow 2Ag^{+} (Cu^{+}) + Ge^{4+}$. Moreover, tetrahedrite–tennantite and jordanite–geocronite solid solution series distinctly feature the sphalerite formed in Daliangzi Pb-Zn deposit which differentiates it from other metallogenic types, especially those related to magmatic activities.

Results of PCA work to the selected sphalerite samples from deposits of skarn, syngenetic massive sulfide, MVT, special Jinding and Daliangzi reveal that significant differences, which are mainly defined by the concentration of Fe, Mn, Co,

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