

**Online Resource 4:** High-resolution element EMPA maps for a) Fe, b) BSE, c) Ga, d) In, e) Ge, and f) Cu of sphalerite 2 from the Auguste Victoria mine (sample AugVik-03); relative color scale reflecting sector zoning structures and the absence of Ga and In (bdl = below detection limit); full dataset for quantitative EMPA spots (black) and sulfur isotope LA-(QQQ)-ICP-MS spots (red) is given in Online Resources 5 and 7

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