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Geochemistry of pyrite in basic rocks of the Betic Cordillera

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Stocks and dikes of hypabyssal rocks (dolerites, ophites) intrude the Triassic evaporitic and carbonate sediments from the internal zones of the Betic Cordillera orogen in south Spain. In the easternmost portion of this orogen known as the Sierra de Orihuela, the intrusive bodies exhbit fractures filled with a Fe-(Hg) ore mineralization consisting of pyrite, specular hematite and cinnabar. Careful FEG-ESEM analysis of pyrite grains reveal a complexity of zoning patterns including sector, oscillatory and patchy. A combination of EPMA and LA-ICP-MS analysis relate the latter zoning patterns with varying concentrations of S (50.50 - 54.06 wt.%) and Fe (10.48 - 47.25 wt.%) as well as Ni (up to 23.99 wt.%), Cu (up to 14.68 wt.%), Co (up to 7.51 wt.%) and Hg (up to 1.42 wt.%), as is typical of pyrite (FeS_2)-vaesite (NiS_2)-cattierite (CoS_2) solid solution series. Besides, each one of the zoning pattern is related with a specific suite of mineral inclusions, including epidote±plagioclase at otwards contacts of the mineralization with host rocks and carbonates±cinnabar inwards. The observation that the Fe-(Hg) ores are intimately associated with a metasomatic rock (i.e., epidote ± albite ± carbonates ± chlorite ± quartz ±rutile± apatite±barite) suggests formation of the ores by hydrothermal fluids active during either late stages of cooling of the intrusive body or incipient ocean floor metamorphism within the conditions of greenschist facies (ca. 5 kbar at 350°C). Zoning in pyrite is related with metal sitting as bounded in the structure and micro-to-nanometric sized inclusions, through this complex evolutionary history through the magmatic-hydrothermal transition and afterwards.