Fluid phase separation from residual intercumulus alumosilicate liquid of the Merensky Reef

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Fluid inclusions in both symplectitic and miarolitic quartz of the Merensky Reef of the Bushveld Complex (South Africa) have been studied using cryometry, microthermometry, Raman-spectroscopy, LA ICP-MS, scanning electronic microscopy, gas-chromatography and isotopic methods. This allowed us to obtain principally new information about an order of fluid phase separation from the Merensky Reef crystallizing intercumulus liquid.

We attempted to document at least three generations of fluid separated from boiling residual alumosilicate intercumulus liquid in the following sequence.

The earliest fluid phase composed of homogenous high dense gas mixture (from CH_4-98.48 and N_2-1.52 to CH_4-73.21, CO_2-24.42 and N_2-2.37 mol.%) was identified in primary gas and co-existing anomalous (combined) fluid inclusions from miarolitic quartz.

The next generation was heterophase fluid, composed of brines or water-salt solution, containing a free low dense gas phase (CO_2>N_2). This fluid was observed in primary multiphase and coexisting gas-rich inclusions from interior zones of miarolitic quartz crystals.

The latest generation was also heterophase fluid (low salinity water-salt solution and free low dense gas phase) that was found in primary water-salt and syngenetic CH_4-rich gas inclusions from peripheral zones of miarolitic quartz crystals.

The results give us a possibility to suggest that magmatogene fluids that successively separated from alumosilicate liquid changed from homogenous high dense gas phase to immiscible heterophase oxidized mixture during the crystallization evolution of the Merensky Reef.

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Different forms of sulphur in the Lower Cambrian Ni-Mo mineralized black shale in Zunyi, Guizhou Province, southwest China

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A great and famous Ni-Mo polymetallic deposits are developed in the Lower Cambrian Niutitang Formation in South China. As these mineral deposits are all sulfide, we measured different forms of sulfur in the outcrop Zhuliushui section, Zunyi (SW China) and have a preliminary analyses on their distribution.

Analytical results indicate that along the section, in wallrocks around deposits, the sulfur-content is less than 1%; whereas at the deposit seam (ca. 20-cm-thick) the content exceeds 1%, even high up to 23.807%. This implies that the formation of mineral deposits is closely related to sulfur. In order to know what roles do different kinds of sulfur play, three forms of sulfur including sulphate, pyrite sulfur and organic sulfur were further investigated. It is showed that the content of sulphate is mostly lower than 1.0%, while the other two forms ranging from 0.0441-6.233 (pyrite sulfur) and 0.0192-16.822 (organic sulfur), respectively. This likely implies that the sulfur in the mineralization comes relatively low from sulphate and great from pyrite. Futhermore, under microscopic observation, most of the pyrites occur in the formation of crystal granule, which may be ascribed to slow and successive sedimentation during the early diagenesis.

Otherwise, there is not a good relation between the organic and pyrite sulfurs, as the variation of the former was greater than the latter. Thus, it is suggested that the organic sulfur was also not the key factor in the process of pyrite's formation. In a word, based on the above analyses, we tentatively suggested that both hydrothermal fluid and surfur produced by biodegradation were responsible for the mineralization here.

Lastly and interestingly, besides the high sulfur content in the presently known Ni-Mo mineralized deposits, we also found another sulfur-peak in the upper 10-cm-thick seam, which located about 5 m on the above. Whether this is an indicative of another mineral deposit needs a more comprehensive investigation in the future.

Reference

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