Quantitative analysis of heavy metals in natural fluid inclusions using synchrotron radiation X-ray fluorescence

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Fluid inclusion means fluid trapped in crystal by the crystal growth, and it is usually several tens or hundreds of micrometers. Information containing fluid inclusion makes it possible to clarify the process of the metal transportation and precipitation in mineralization. The analysis of single fluid inclusion contributes to build higher resolution model of ore formation than bulk analysis. For this purpose, we obtained calibration curves for the quantitative analysis using synchrotron radiation X-ray fluorescence (SXRF) in our previous study.

But, one problem arose for the quantitative analysis of fluid inclusions. Natural fluid inclusions generally contain several elements, but it is not usually realistic to obtain calibration curves for all the elements from experiments. Therefore, we introduce a theoretical estimation for the various elements using Cu and Zn. In our previous study, we have explained the results for quantitative analysis theoretically, and it suggests that we can estimate concentration for elements which is not obtained their experimental calibration curve using experimental and published parameters. So, natural fluid inclusion analysis by SXRF was performed using theoretically estimated calibration curves.

We used a fluid inclusion from a quartz vein in Mocha porphyry deposits, Chile (Hayashi and Iida, 2001) as a sample. We have already known that this inclusion contains Mn, Fe, Cu, Zn, As and Br by qualitative analysis. We obtained a quantitative data for the fluid inclusion. The analysis was performed at BL-4A, Photon Factory, KEK (Tsukuba, Japan).

As a result, we detect 91000ppm Fe, 8900ppm Mn, 6300ppm Zn, and 1800ppm Cu for the inclusion. This value is equivalent to concentrations of fluid inclusions in porphyry-type deposits.