QUANTITATIVE ANALYSIS OF SINGLE FLUID INCLUSIONS USING SYNCHROTRON X-RAY FLUORESCENCE (SXRF)

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The highly intense light source of the ESRF (European Synchrotron Radiation Facility), a 3rd generation machine, is ideally suited for the analysis of major and trace elements in individual fluid inclusions. An experimental protocol for conducting quantitative analysis has been established on beamline ID22 using a beam spot size of 1 x 7 µm2 and an incident flux of 1010 photons/sec. Ka/Kb ratio of an element z in solution, which is directly related to the absorption by the host mineral and inclusion fluid, can be used as an accurate correction term. Chlorine, which is known from microthermometry, has proved to be a reliable internal standard. These absorption correction and calibration procedures allow concentration estimates without a precise knowledge of the inclusion 3D geometry. Detection limit for most elements (i.e., from Ca to U) is lower than the ppm level.The concentration and spatial distribution of relatively diluted (1 to 100 ppm) major (Cl, K, Ca, Mn, Fe) and trace (Ti, Cr, Cu, Zn, As, Br, Sr, Rb, Zr, Ba, La, Pb, U) elements were determined in several ore-deposits, worldwide. Results gives an insight into metal and halogen partitioning between the vapor and liquid phases of the fluid inclusion thus providing fundamental new perspectives for the understanding of hydrothermal processes responsible for the concentration of economic resources.