

Quantitative proton-induced X-ray analyses of trace elements in individual fluid inclusions from hydrothermal quartz crystal

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Trace-element contents in single fluid-inclusion analogues with known composition and regular shape were analyzed by proton-induced X-ray emission (PIXE), to evaluate an accuracy and detection limits for the non-destructive analyses of single fluid inclusions. Using the present developed quantification, the elements with concentration of 10 to 1000 ppm were determined within a relative error of 7 % (mean). For the determinations of natural fluid inclusions in quartz, the total analytical error was estimated at approximately 14 % relative (mean) by considering uncertainty for microscopic measurements of inclusion depths. The detection limits have been achieved in the range from 4 to 46 ppm for elements of mass numbers 25-50 at a typical analytical condition.

By the present PIXE method, trace elements in single fluid inclusions from a hydrothermal quartz crystal were also determined. The concentrations varied largely for each inclusion and were of 0.2-9 wt.% for Ca and Fe, 300-8000 ppm for Mn and Zn, 40-3000 ppm for Cu, 100-4000 ppm for Br, Rb, Sr, and Pb, and less than 100 ppm for Ge.