

# Estimating the depth of the roof and floor of intra-crystalline inclusions in a light-mineral matrix: application of RBS spectrometry

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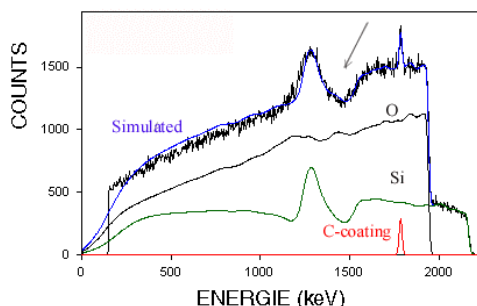
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A characteristic feature of the nuclear microprobe using a 3MeV proton beam is the long range of particles:  $\approx 70\text{ }\mu\text{m}$  in light matrices. The PIXE method, with EDS analysis and using the multilayer approach for treating the X-Ray spectrum allows the chemistry of an intracrystalline inclusion to be measured, provided the inclusion roof and thickness at the impact point of the beam (R and F, respectively) are known (the depth of the inclusion floor is R+F). The parameter R of an inclusion in a mineral can be measured with a precision of  $\pm 1\text{ }\mu\text{m}$  using a motorized microscope. However, this value may significantly depart from R if the analysed FI has a complex shape. The parameter F can hardly be measured optically, unless a confocal microscope is used.

Measuring R and F by RBS spectrometry. A negative crystal-shaped FI in quartz, containing  $\approx 4\text{ wt.}\%$  solutes, was analysed by PIXE using a 2.5MeV proton beam,  $3\times 3\text{ }\mu\text{m}^2$  in size (charge on the target=  $0.3\text{ }\mu\text{C}$ ). Simultaneously, a RBS spectrum was obtained with an annular charged-particle detector ( $\alpha\approx 170$ , see Figure). The depression



at 1500keV on the spectrum (arrow) corresponds to the H<sub>2</sub>O-filled cavity along the beam path. Modeling of the spectrum using the SIMNRA program allows R to be measured at 11.6  $\mu\text{m}$ , in good agreement with the optically determined value (11  $\mu\text{m}$ ). Simulation also fixes the depth of the FI floor at 17  $\mu\text{m}$  in quartz. This paper will present preliminary measurements on synthetic samples to investigate the advantages of the technique, and also on

natural solid and fluid inclusions in quartz. The influence of the geometrical parameters will be discussed with regard to the concentration determination by PIXE. In particular, accuracy of monazite micro-inclusion dating by coupled PIXE-RBS will be presented.