

Miniature laser mass spectrometer and optical microscopy: current capabilities for the quantitative analysis of micro- sized solid materials

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Abstract

High resolution in situ chemical analyses on planetary surfaces are highly desirable. They can yield important information on surface heterogeneity, basic grain mineralogy and chemical composition of surface and subsurface. This data allows to understand the physical and chemical processes which led to the formation, alteration and evolution of planetary material. In particular, a small size living species or micro-sized fossilised materials are currently discussed to be potentially important for searches of life on the other planets.

The current progress in the development of the instrumentation for the context analysis of planetary surfaces is described. By combining a miniature laser time-of-flight mass analyser with a microscope-camera system, one can conduct detailed optical and mass spectrometric analyses of the solid material down to micrometre-sized samples. Improvements of the instrument performance made by installation of a pulser, high-resolution microscope and modification of laser ion source are discussed. It is shown that with the current instrument capabilities quantitative elemental and isotope analyses even of small micrometer-sized grains or fossilized materials are possible. The performance capabilities are demonstrated by measurements conducted on standard and natural samples of rocks and meteorites.

References

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