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A powerful analytical tool for geosciences and environmental systems: Handheld Laser-Induced Breakdown Spectroscopy

Abstract: Knowledge about the chemical composition of minerals, rocks, soils and meteorites is of fundamental importance in the earth and environmental sciences (i.e. geosciences). Historically, during the late-19th and mid-20th centuries classical wet chemical analytical methods were the means of determining the elemental composition of such geological materials. Since then, intensive research in analytical inorganic chemistry has led to the development of a multiplicity of rapid and accurate instrumental analytical techniques for use in the laboratory that can be applied to elemental analysis across the periodic table.

One of the enduring needs within the geoscience community has been the availability of analytical instrumentation capable of routine use outside the laboratory setting. Laser-induced breakdown spectroscopy (LIBS) is one of the very few current analytical technologies suitable for routine use outside the laboratory and has a persuasive set of advantages that makes it ideally suited for chemical analysis in the field. These include rapid analysis with a compact and lightweight handheld instrument by a single individual of most types of natural materials under ambient environmental conditions in real time, and with little to no sample preparation.

Although LIBS is not able to address all questions arising in geochemical research and practice due to some inherent limitations in sensitivity, it can excel for specific geoscience applications.

Finally, in situ geochemical analysis features a high potential value not only for terrestrial field geology, but also for the next generation of planetary surface explorers as already shown by the various Mars rover missions of the past decade.

Keywords: Laser-induced breakdown spectroscopy, LIBS, Geochemical fingerprinting, GeoLIBS

Biography: Dr. Giorgio Saverio Senesi has been a Researcher of the National Research Council (CNR) since 2001 at the current Institute for Plasma Science and Technology (ISTP), located in the Research Area of the CNR in Bari.