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213 nm and 193 nm Laser Ablation Systems for geological applications - Which System for Which Application?

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Laser Ablation ICP-MS has come a long way since its introduction in the mid-eighties. Whereas the first generation of laser systems used infrared lasers - mainly the fundamental wavelength of an Nd:YAG laser (1064 nm) - modern systems are using UV-lasers at different wavelengths. Most common commercial systems are using 266 nm, 213 nm or 193 nm. Laser energy in the deeper UV is more efficient at delivering the laser energy to a wider variety of samples, allowing uniform sampling of even transparent materials. This is of special importance when analysing a variety of geological samples. However, a system designed to deliver 193 nm is more expensive than laser systems based on 213 nm making the choice of the right laser system for the anticipated applications important.

Operating at a wavelength of 213 nm the LSX-213 Laser Ablation system is optimised to deliver homogenized “flat-top” energy profile with $>$ 4mJ, 5 ns laser pulses with repetition rates of 1-20 Hz. The use of Helium as a carrier gas improves sample transport efficiency and reduces fractionation. The 213 nm wavelength is better suited than 266 nm for ablating harder and transparent solids. It finds its application in the analysis of several types of geological samples, such as soils and sediments, gemstones, quartz samples, calcite, fluorite and other materials. Various applications are discussed.

For the most challenging and highly transparent samples it may be necessary to use even shorter wavelengths, such as 193 nm. The concept of an excimer-laser based sys-

tem the GeoLas Pro is discussed with particular applications in Geochemistry. Due to the use of a very stable Excimer Laser, its high energy density of up to 45J/cm^2 at 193 nm, and a highly homogenized beam profile, the GeoLas Pro has advantages for very precise Geochronology and Fluid Inclusion analysis using LA-ICP-MS, especially for very small craters down to 4 μm in diameter. The use of a petrographic microscope enables the identification of even very small features of a few micrometers. Features and Applications for the GeoLas Pro are discussed.