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Abstract

Two fragments of an iron meteorite shower named Dronino were characterized by a novel technique, i.e. Double-Pulse micro-Laser Induced Breakdown Spectroscopy (DP-μLIBS) combined with optical microscope. This technique allowed to perform a fast and detailed analysis of the chemical composition of the fragments and permitted to determine their composition, the alteration state differences and the cooling rate of the meteorite. Qualitative analysis indicated the presence of Fe, Ni and Co in both fragments, whereas the elements Al, Ca, Mg, Si and, for the first time Li, were detected only in one fragment and were related to its post-falling alteration and contamination by weathering processes. Quantitative analysis data obtained using the calibration-free (CF) - LIBS method showed a good agreement with those obtained by traditional methods generally applied to meteorite analysis, i.e. Electron Dispersion Spectroscopy - Scanning Electron Microscopy (EDS-SEM), also performed in this study, and Electron Probe Microanalysis (EMPA) (literature data). The local and coupled variability of Ni and Co (increase of Ni and decrease of Co) determined for the unaltered portions exhibiting plessite texture, suggested the occurrence of solid state diffusion processes under a slow cooling rate for the Dronino meteorite.

Keywords: Dronino iron meteorite, Alteration, DP-μLIBS, Scanning Electron Microscopy, Chemical analysis