LIBS profiles of sedimentary sections: a new tool for paleoclimatic and paleoenvironmental reconstructions?

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Reconstructing climates and/or environments of the past requires analysis of sedimentary sections based on profiles of various geological data (geochemistry, sedimentology, mineralogy, paleontology, ...). LIBS analysis can be carried out with a fast acquisition rate on minimally-prepared samples, allowing measurement of large geological sample sets such as sedimentary sections.

Here we show preliminary results obtained from a field and a core section to illustrate the potential of LIBS for paleoclimatic and paleoenvironmental studies.

The studied field section consisted in 6 m thick Devonian siliciclastics with varying carbonate content used as a reference for cyclostratigraphy (New York State, USA [1]). 300 samples were analyzed manually in less than two days and the results showed very good match with the XRF measurements previously used for astrochronology, including productivity (Ca) and detrital (Ti, Al, etc.) proxies. Therefore, astronomically-forced climatic cycles could be analyzed based on LIBS data as it is reliably done with XRF.

The studied core section, which consists of 150 m of Ypresian to Bartonian formations (Le Tillet borehole, France) was more challenging for LIBS measurement as it consists of both soft siliciclastic sediments and consolidated carbonate rocks [2]. Therefore, the 157 selected samples were powdered and fixed onto double-sided adhesive and automatically analyzed with the LIBS within about 1 hour. The obtained data, still under interpretation, showed that some elemental ratios such as Cs/k and Li/k exhibit interesting correlations with mineralogical and environmental data (Fig. 1).

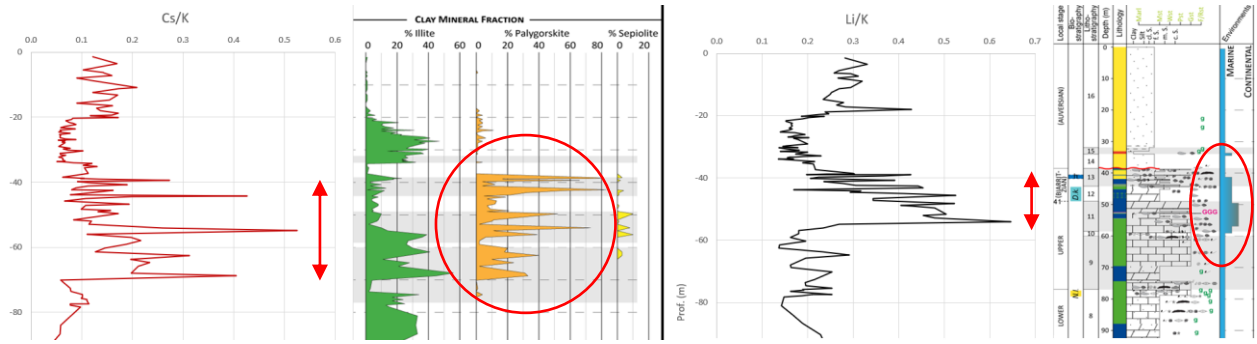

Fig. 1. Elemental ratio profiles Cs/K and Li/K measured by LIBS on Le Tillet borehole (Upper Lutetian, Paris Basin).

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