

**CREATION OF QUARTZ ID CARDS FOR SOURCE TRACING USING A MULTI-METHOD APPROACH AS PART OF THE ANR QUARTZ PROJECT: LITHIUM AS A KEY ELEMENT**

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Quartz is one of the most abundant minerals of the continental crust. Being highly resistant to weathering, it is ubiquitous in fluvial sediments and an ideal marker of their dynamics. The chemistry and physical properties of quartz are intricately linked and dependent on the mineral crystallization environment and subsequent history [1]. One of the main objectives of the French ANR Quartz project is to use this characteristic of quartz to trace its origin within fluvial sediments by combining conventional characterization methods with dosimetric methods such as Electronic Spin Resonance (ESR) and Optically Stimulated Luminescence (OSL) usually used for dating. The first step to this is the characterization of the quartz signature of each of the bedrocks of the watershed of interest. In this context, Li is a critical element to study. It is one of the main trace elements of quartz and has previously been reported as active in both paramagnetic and luminescent centers which are responsible for the signal measured by ESR and OSL techniques [2,3].

In this study, we focus on the Strengbach watershed (French Vosges). Its relatively small size allowed for an exhaustive sampling of the various bedrocks, including granites, gneiss, Buntsandstein sandstones and hydrothermal fractures filled with quartz. Within these samples, quartz has been systematically analyzed using cathodoluminescence (CL), Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and Laser Induced Breakdown Spectrometry (LIBS). Laser ablation of quartz is made difficult by its hardness and transparency which can lead to intensive tearing of the sample. To ensure usable data, analyses were made on thick (100  m) rock sections and using a more energetic laser setup than usual. Bedrock samples have also been treated mechanically (grinding, sieving and magnetic separation) and chemically (HCl, H<sub>2</sub>SiF<sub>6</sub> and heavy liquid separation) to extract quartz grains for Electronic Spin Resonance (ESR), Thermo-Luminescence (TL) and Optically Stimulated Luminescence (OSL) analyses.

Results highlight the critical role of lithium in the definition of quartz origin signature. Concentration of Li and other main trace elements (such as Al, Ti) vary depending on quartz type and origin. However, the distinction is not complete between the different groups. CL, OSL and/or ESR signals are sensitive to chemistry but also to the position of foreign atoms within the quartz lattice, providing supplementary criteria for sample distinction. Interestingly, we report a discrepancy between the signal intensity of the ESR center associated with Li and the Li concentration likely indicating the occurrence of Li at several different sites within the mineral lattice. The combination of techniques is a valuable tool to better define the role(s) and positions of Li within the quartz lattice. This both helps better understand ESR and OSL signals, thus improving associated dating techniques, and sharpen differences between quartz signatures of the different Strengbach bedrocks.

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