



HAL
open science

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

Claire Aupart, Catherine Lerouge, Philippe Lach, Samuel Moncayo, Florian Trichard, Pierre Voinchet, Manon Boulay, Magali Rizza, H el ene Tissoux

► To cite this version:

Claire Aupart, Catherine Lerouge, Philippe Lach, Samuel Moncayo, Florian Trichard, et al.. 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. International Workshop on the Characterisation and Quantification of Lithium, Jun 2023, Paris, France. hal-04320505

HAL Id: hal-04320505

<https://hal.science/hal-04320505>

Submitted on 4 Dec 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destin ee au d ep ot et  a la diffusion de documents scientifiques de niveau recherche, publi es ou non,  emanant des  tablissements d'enseignement et de recherche fran ais ou  trangers, des laboratoires publics ou priv es.



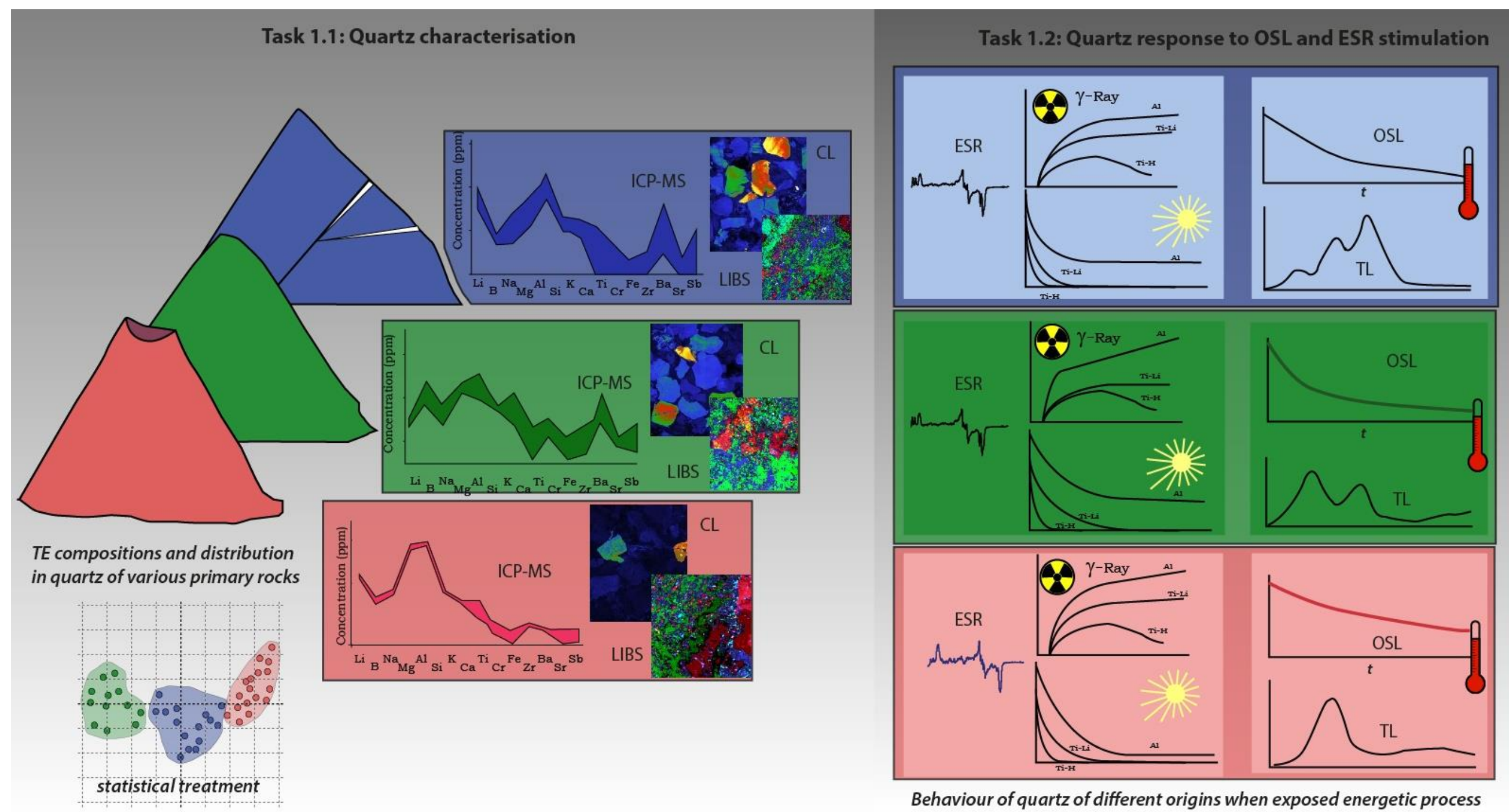
Creation of Quartz ID cards for source tracing using a multi-method approach as part of the ANR Quartz project: Lithium as a key element

Claire AUPART¹, Catherine LEROUGE¹, Philippe LACH¹, Samuel MONCAYO², Florian TRICHARD², Pierre VOINCHET³, Manon BOULAY², Magali RIZZA², and H  l  ne TISSOUX^{1,3}
 1 Bureau de Recherches G  ologiques et Mini  res (BRGM), France; 2 Aix Marseille Univ, Centre Europ  en de Recherche et d'Enseignement en G  osciences de l'Environnement (CEREGE), France

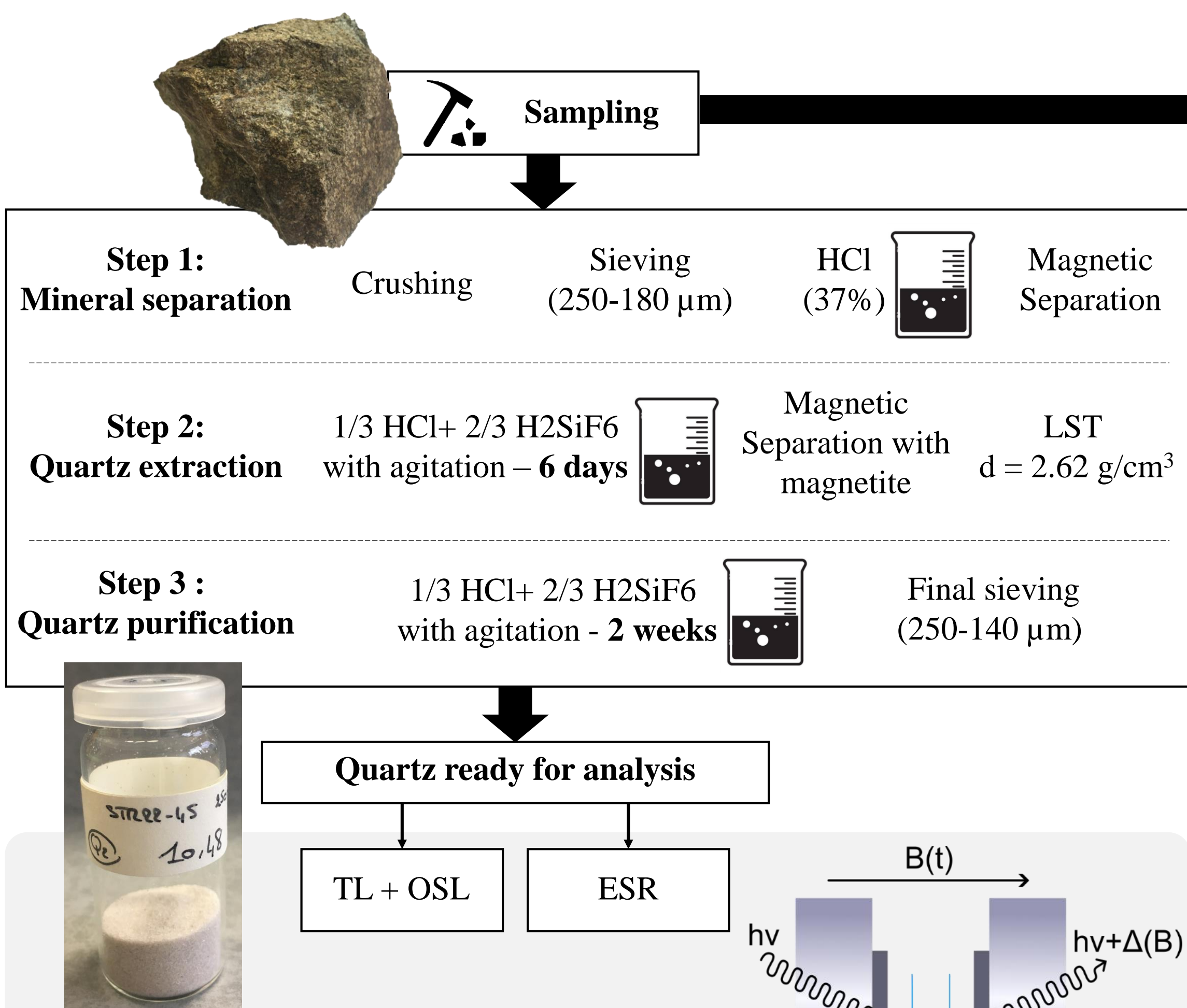
Corresponding author : c.aupart@brgm.fr

Quartz, because of its high resistance to weathering, is ubiquitous and abundant in fluvial sediments. Its chemistry and physical properties provide information on its formation context and subsequent history making it an interesting marker of fluvial dynamics in a source to sink approach.

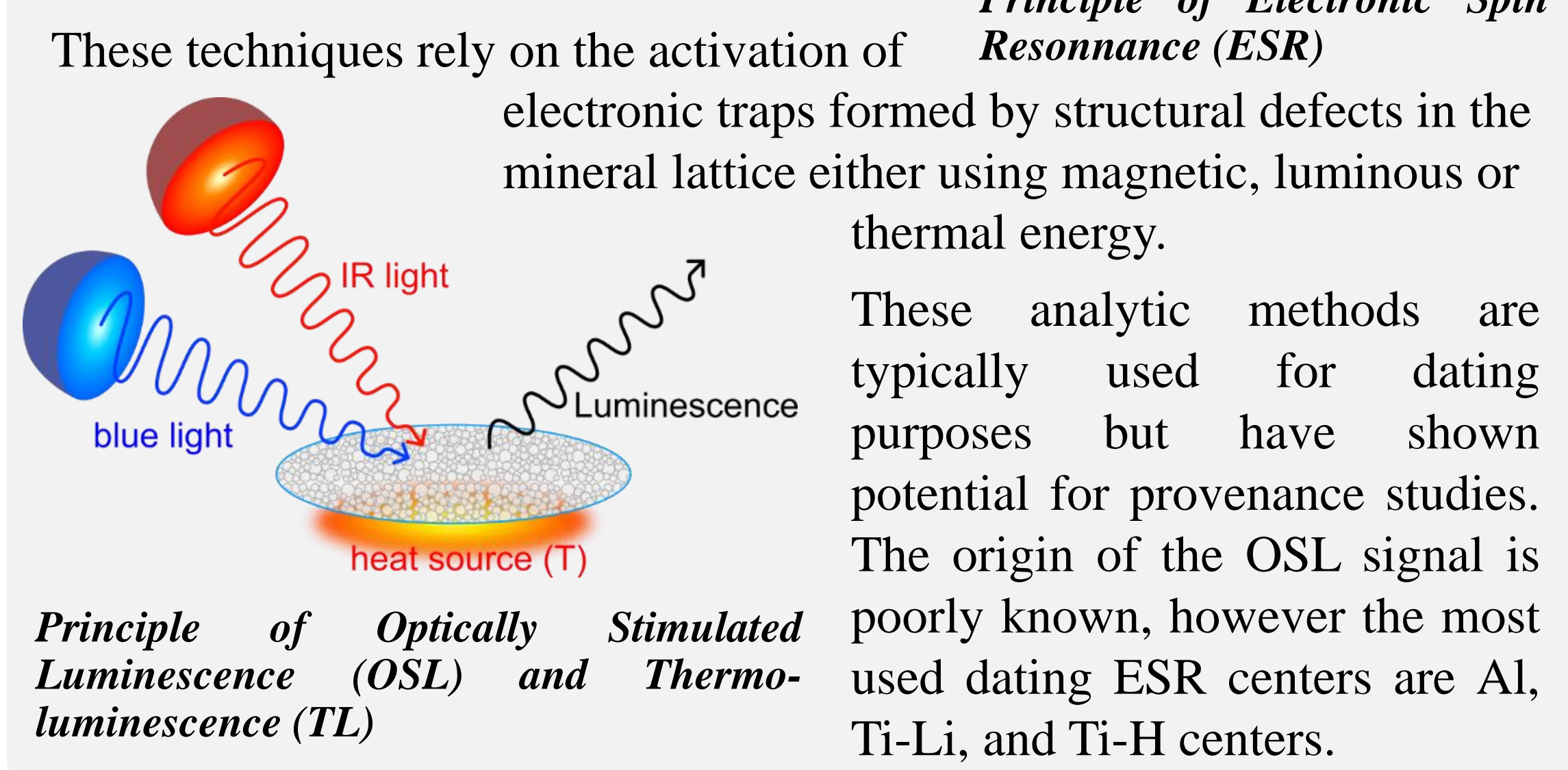
One of the main objectives of the French ANR Quartz project is to use the characteristics of quartz to trace its origin within fluvial sediments by combining conventional characterization methods with dosimetric methods such as Electronic Spin Resonance (ESR) and Optically Stimulated Luminescence (OSL) 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.

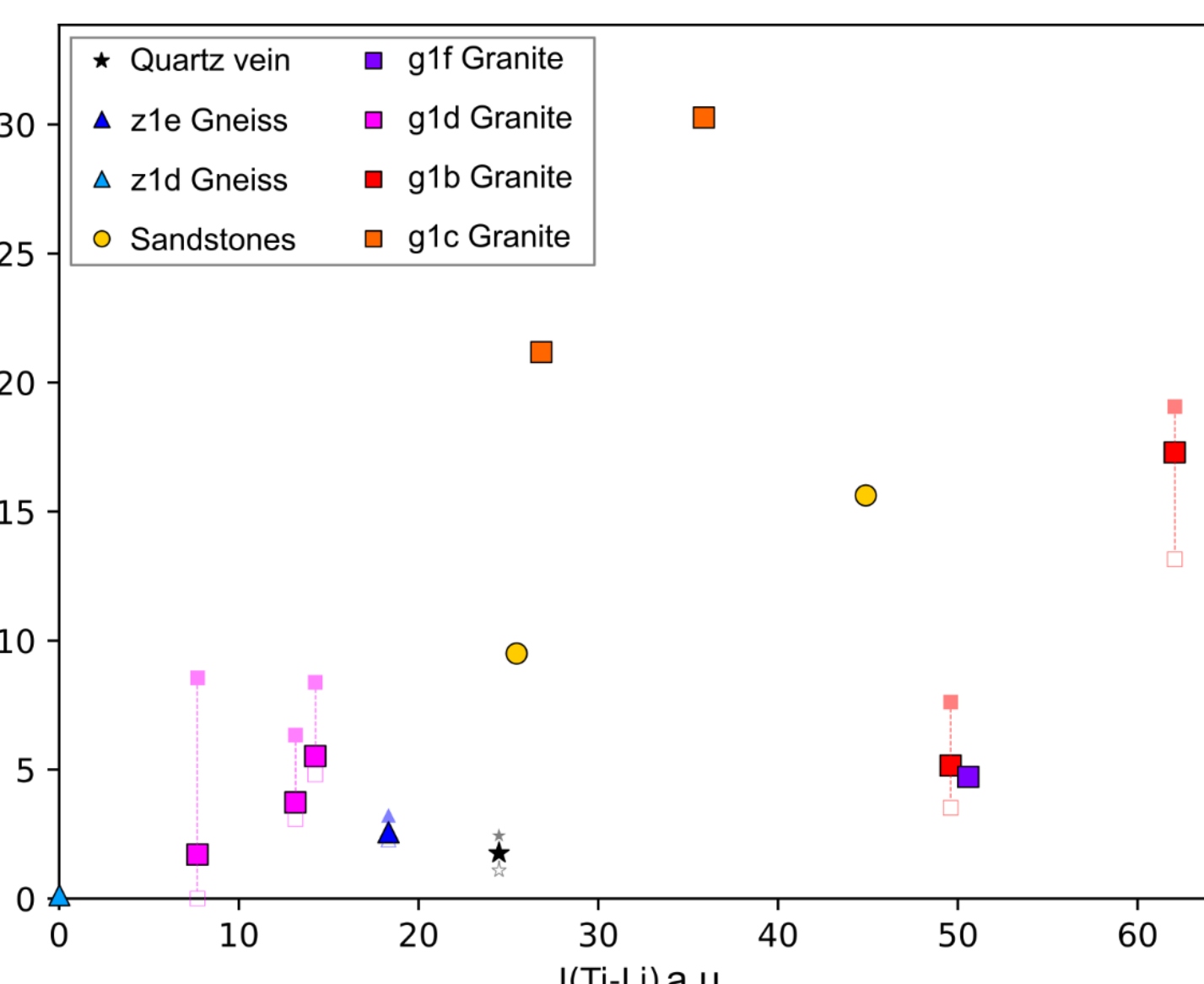
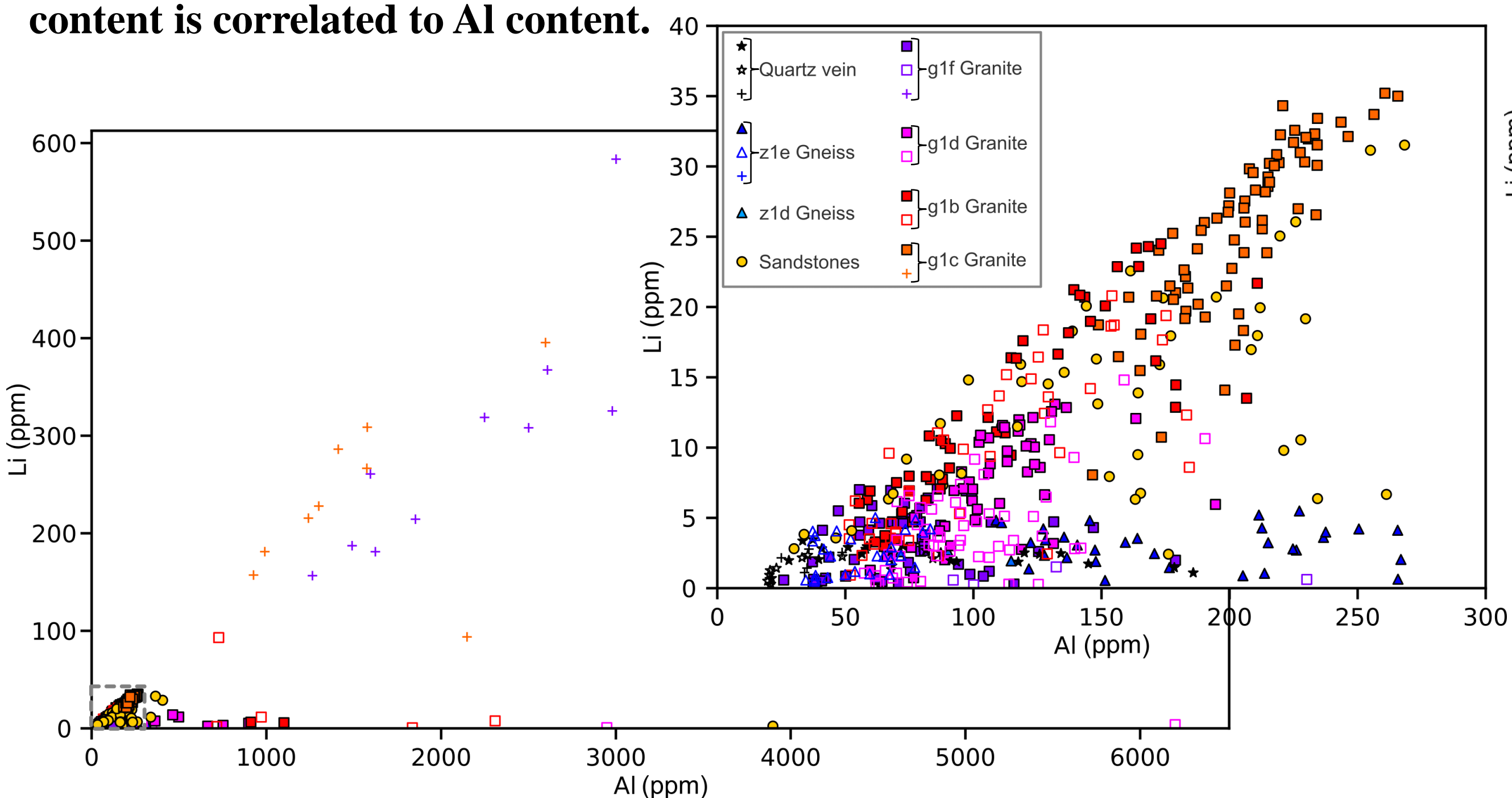


Analyses are made on purified quartz grains to remove any foreign mineral signature. Especially feldspar, that has a strong OSL signature overprinting quartz signal. This is less critical for ESR.



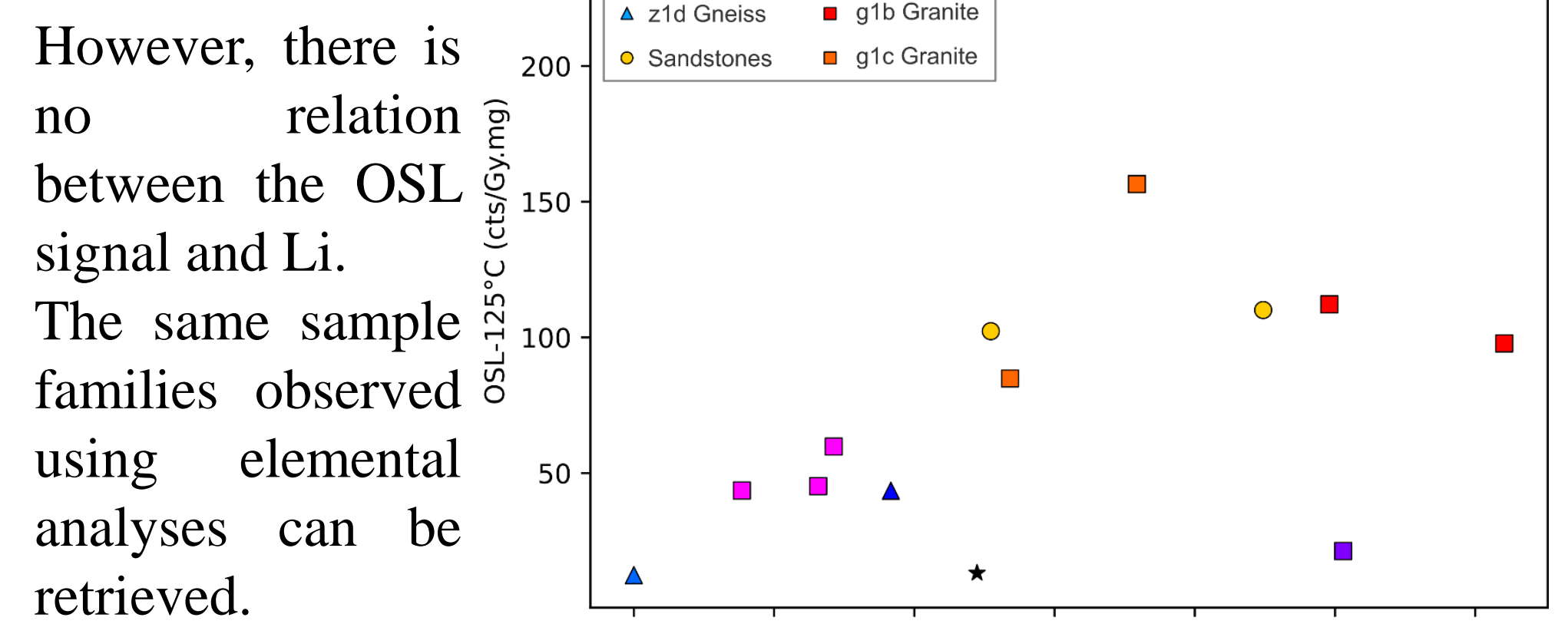
First results:

Li is critical to identify families of quartz types and origin. Its maximum content is correlated to Al content.



No strong correlation between ESR Ti-Li intensity and Li concentration.
 → Li not limited to being a compensator for Ti in Ti-Li ESR centers

The best correlation between OSL and ESR signals is obtained with the Ti-Li center intensities.

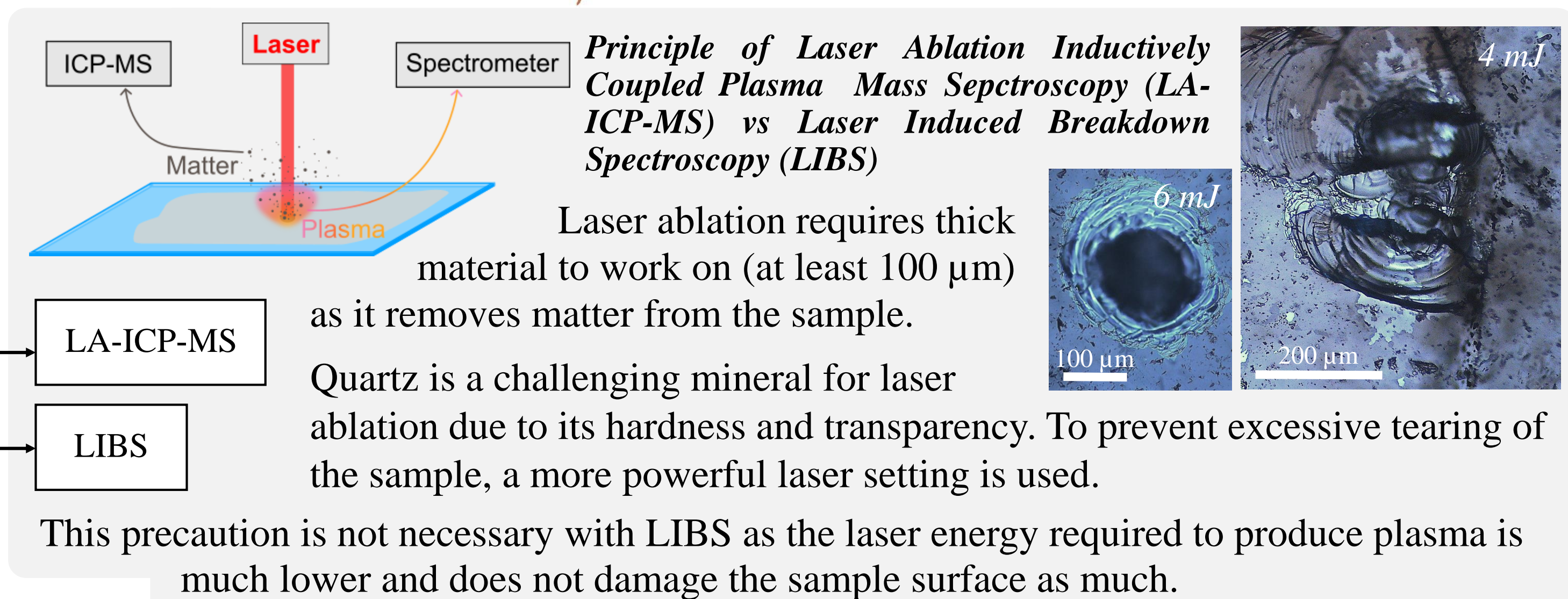
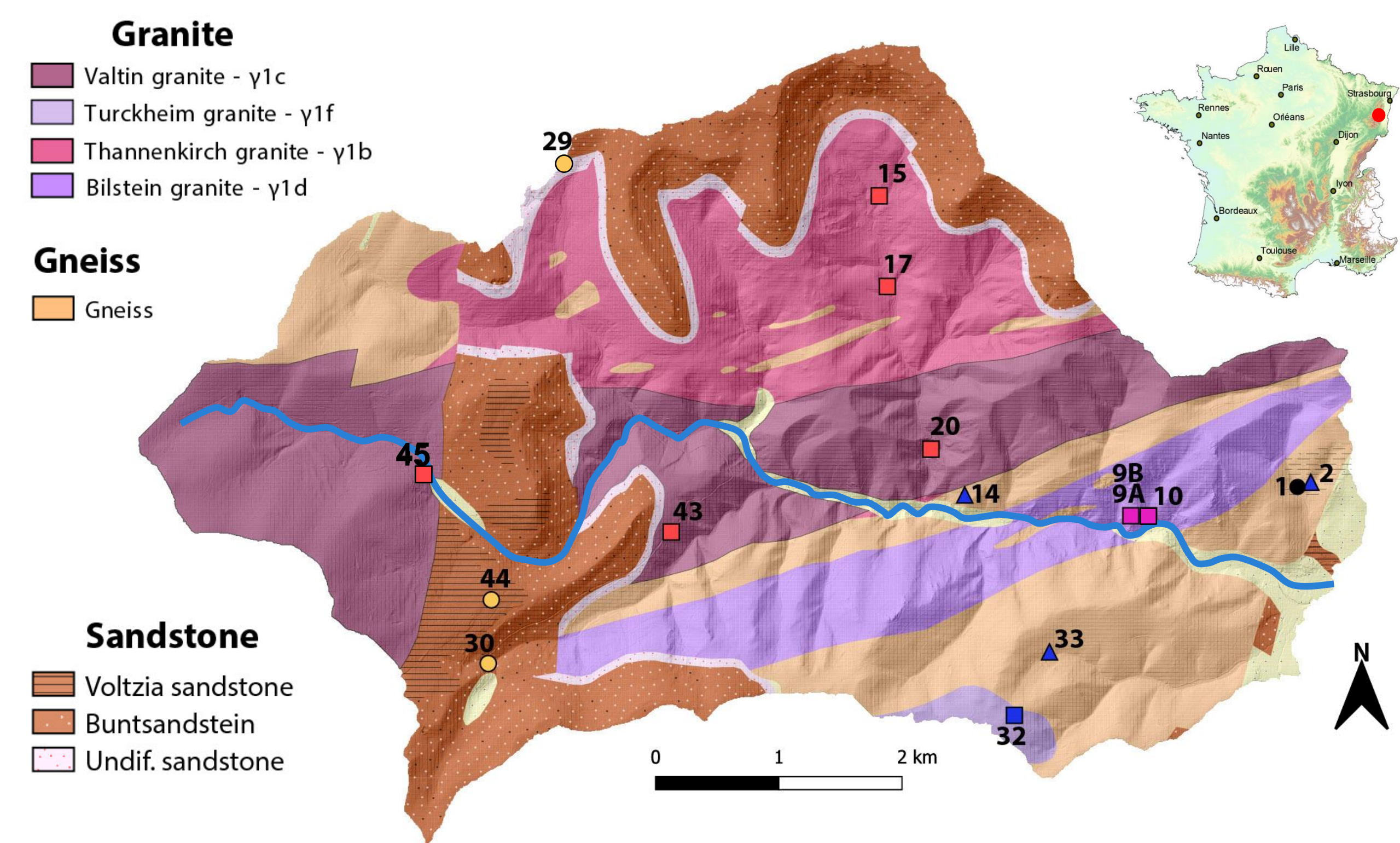


A lot more to do:

- LIBS data, spectral CL data to acquire and treat
- Statistical treatment (ACP)
- Identify trace elements responsible for OSL and ESR signal
- Application to Strengbach fluvial sediments for provenance study

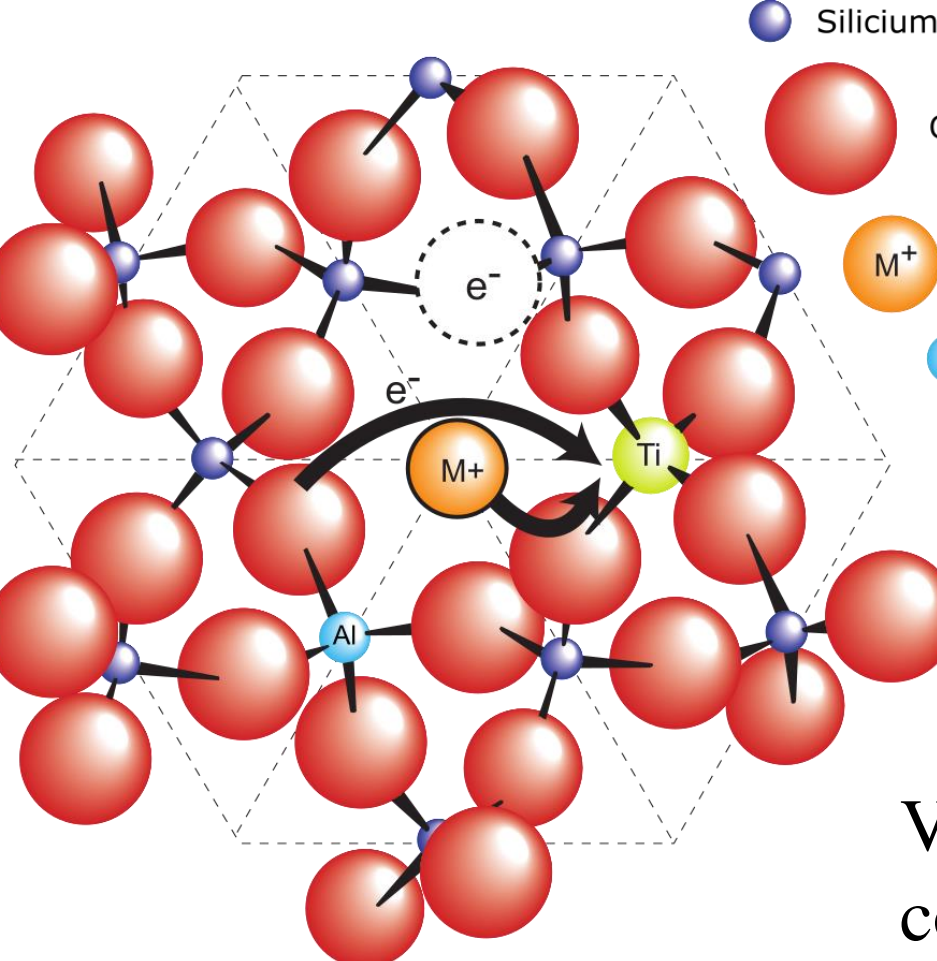
The Strengbach Watershed:

The Strengbach is a small river from the Vosges Moutains (France). It has a relatively small catchment (ca. 40 km²) with a relatively simple bedrock lithology.



LIBS and LA-ICP-MS are complementary techniques. LIBS is more sensitive to light and volatile elements while LA-ICP-MS is most performant with heavy elements. LIBS produces quick elemental maps while LA-ICP-MS is best at punctual analyses.

Lithium in quartz:



Ideal quartz structure is network of SiO₄ tetrahedra linked together by their oxygen atoms. Tetrahedra are arranged in helicoidal structures that create channels parallel to the crystallographic c-axis.

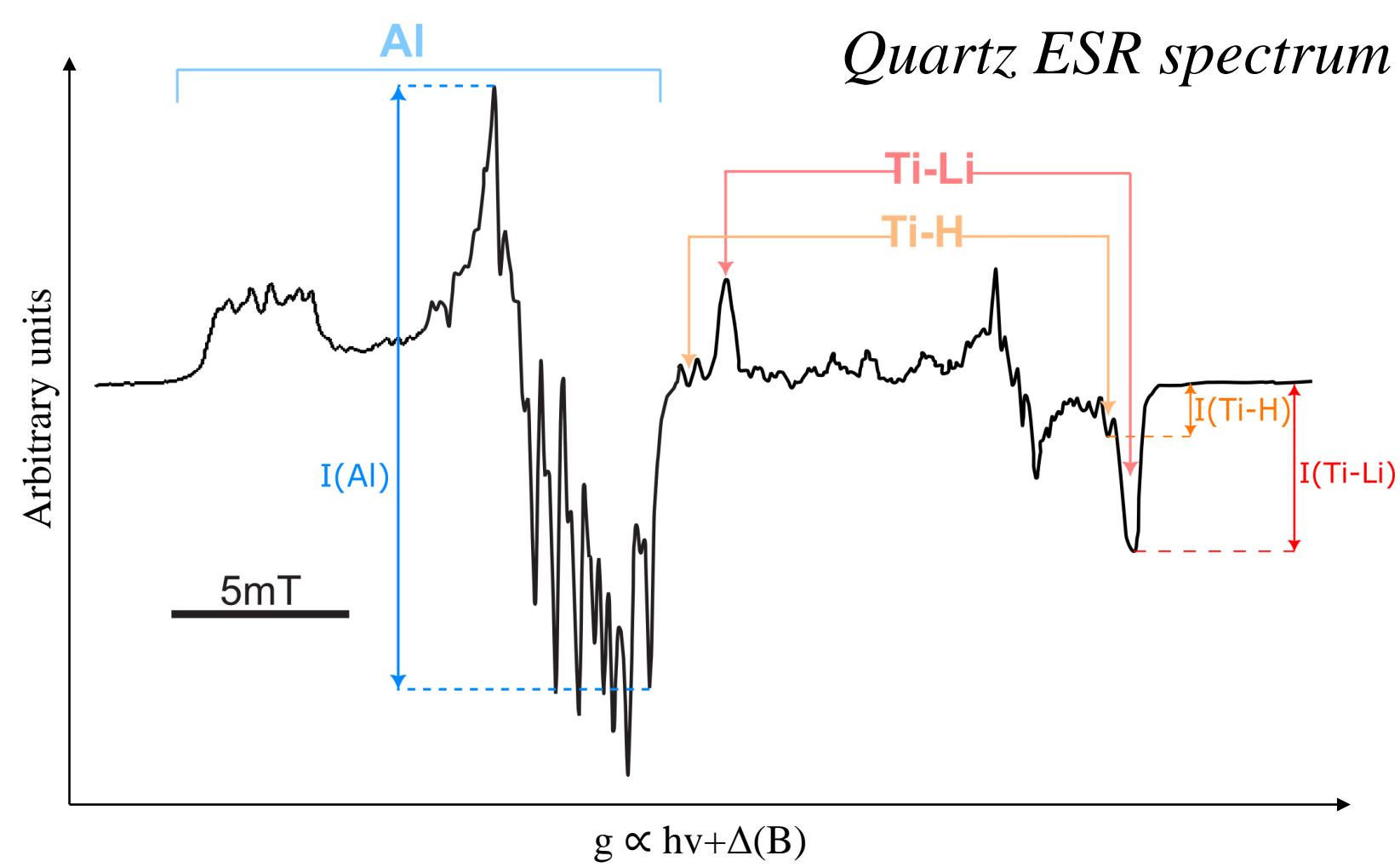
Some of the most common defects of the quartz lattice are atom vacancies and Si substitution.

Common substituting atoms in quartz: Al, Ti, Ge.

Vacancies and substituting atoms may require a charge compensation to keep electronic neutrality.

This role is taken by foreign cation circulating through the quartz structure in the c-axis channels.

Li is a common charge compensating ion. As such, it contributes to one of the main ESR centers used for dating.



The authors acknowledge the support of the French Agence Nationale de la Recherche (ANR) under reference ANR-21-CE01-0014