

## Implications of Intrastratal Complexities on finite Luminescence Ages: the case of Galería, Sierra de Atapuerca, Spain

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The Sierra de Atapuerca Complex, in North-Central Spain, is well known for its rich hominid skeletal fossils, abundant lithic artefacts, synchronous mammal remains and micro-vertebrate assemblages. This Cave Complex is composed by a three-level Pleistocene karst system with an intricate array of cavities of which one of the most significant ones is the Galería Site. Over the last 30 years, this Acheulean site has been dated by multiple methods, including palaeomagnetic measurements and independent numerical chronologies such as luminescence (i.e. Thermo-Luminescence – TL, Optically Stimulated Luminescence – OSL, Infrared Stimulated Luminescence – IRSL), Electron Spin Resonance (ESR) and Uranium-Thorium (U-Th) applied to both clastic sediments and speleothems. Despite the abundance of methodologies, a conspicuous inconsistency between previously published ages has been observed in the area of Galería, which sedimentary record barely exceeds 17 m in length and where the different sampled sites are on similar and/or juxtaposed lithological levels/units, only a few centimeters apart.

A detailed intrastratal analysis of lateral sedimentological variations was recently carried out in Unit G.III, one of the most interesting yet complex lithological units within the infilled cavity of Galería. Three major facies comprise this unit, varying distinctively laterally. To better elucidate the complexities of the palaeo-evolution of this unit, a multi-parameter approach was taken: the combination of multi-sample analyses such as particle size, textural maturity, grain micro-morphology, mineralogical composition, magnetic properties, dosimetry, and for the first time, latero-vertical luminescence profiles. In addition, five samples across Unit G.III were dated. In our case, the new Single Grain Thermally-Transferred TT-OSL ages showed ~100,000 years difference from one end of the studied unit to the other, confirming different age values due to marked lateral variations of facies, most likely associated to different mineral provenances and variable environmental conditions along very short distances within the cavity.

This novel intra-stratigraphic, multi-proxy analytical approach showed the need to carry out more detailed geological and stratigraphical work prior to any detailed geochronological endeavour, as ages are intrinsically related to depositional clusters. Moreover, it exposed the potential danger of assigning singular numerical ages to unique levels/units, demonstrating that more care should be taken when selecting sampling locations for age determination in areas of complex stratigraphies and levels/units of intricate sedimentology and variable depositional patterns.

*Presentation Type:* Oral

### *Highlights:*

- Novel intrastratal, latero-vertical luminescence profiling, multi-proxy analytical approach.
- Finite TT-OSL ages from a single stratigraphical unit show lateral variations of ~100,000 years.
- Complex multi-facies deposits require detailed understanding prior to any geo-chronological dating.