ORAL SESSION

Day 1 (09.22.^{MON})

Keynote Lecture

Rethinking quartz ESR dating of sediments: Addressing key challenges and potential solutions

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Electron spin resonance (ESR) dating of quartz has the significant potential for dating early to middle Pleistocene sediments and rocks. The last decades, ESR dating method has demonstrated its reliability to constrain the chronology of Quaternary deposits in Europe, Asia, and Africa, often yielding results in good agreement with independent age controls. However, the method still faces several unresolved challenges. In this presentation, we review the key unanswered questions on quartz ESR dating of sediments and discuss possible solutions to address them. 1) What is the true limit of quartz ESR dating? The laboratory dose response curves often display peculiar shapes (exponential plus linear for the Al centre or the signal decreasing at high doses for the Ti centre), which are not expected in nature, and therefore the upper limit of the quartz ESR signals is difficult to evaluate from the laboratory dose response. 2) Is a preheat necessary for ESR dating? One argument against preheating is that the ESR signal originates from a single, thermally stable trap. However, experimental results suggest that preheating may still be required. Additionally, no systematic comparison was made between the two common protocols used in ESR dating (multiple aliquot additive dose and single aliquot regenerative dose protocols) in the equivalent dose determination. 3) What is the unbleachable Al centre, and why cannot the signal be regenerated by laboratory irradiation? 4) How bleachable is the Ti centre? The bleachability of the Ti centre appears to be comparable or better than the feldspar post-IR IRSL signal. However, some sediments show significant residual doses for the Ti centre, sometimes exceeding several hundred grays, when the ages are compared with independent ages. 5) Can the relative bleachability of ESR signals vary depending on the sample, and can agreement between different centres truly be taken as evidence of complete bleaching? A better understanding of these challenges will refine ESR dating protocols and enhance robustness in age estimates for Quaternary sediments.

Keywords (max. 5): ESR dating, Quartz, dating protocol, residual, thermal stability