

### O.9-3: Dating pre-Quaternary sediments using ESR: some attempts

Tissoux, H. <sup>1\*</sup>, Duval, M. <sup>2,3</sup>, Braucher, R. <sup>4</sup>, Voinchet, P. <sup>5</sup>, Quesnel, F. <sup>1</sup>, Dupuis, C. <sup>6</sup>, Benito-Calvo, A. <sup>2</sup>, Muñoz, A. <sup>7</sup>

<sup>1</sup> BRGM, French Geological Survey, DGR/CGEO, 45060 Orléans, France.

<sup>2</sup> Centro Nacional de Investigación sobre la Evolución Humana, 09002 Burgos, Spain.

<sup>3</sup> Australian Research Centre for Human Evolution (ARCHE), Griffith University, Brisbane, Australia.

<sup>4</sup> CEREGE, Europole Méditerranéen de l'Arbois BP80, 13545 Aix-en-Provence, France.

<sup>5</sup> UMR 7194 HNHP, MNHN, Département Homme et Environnement, 75013, Paris, France

<sup>6</sup> UMONS, Polytech, Geology and Applied Geology, 7000 Mons, Belgium

<sup>7</sup> Departamento de Ciencias de la Tierra, Univ. Zaragoza, E-50009 Zaragoza, Spain;

\*Presenting Author: [h.tissoux@brgm.fr](mailto:h.tissoux@brgm.fr)

Dating of Quaternary sediments is now well constrained by numerical methods such as electron spin resonance (ESR) among others, which can cover the last 2.6 Ma. Nevertheless, beyond the Quaternary timescale, the application of ESR becomes extremely challenging. At earth surface, some deposits exist, such as alluvial outwash, fluvio-lacustrine fillings or marine beaches whose age could be earlier than the Quaternary and for which dating is currently very complicated in the absence of faunal remains, plants or volcanic effluents.

In ESR dating of optically-bleached quartz, the two most commonly used paramagnetic centres are [AlO4] and [TiO4/Li+]0, usually named Al and Ti-Li centres, respectively. Whether these centres can provide accurate dating results is mostly conditioned by their thermal stability and saturation to the received radiation dose. The thermal stabilities of the Al and Ti-Li centers were studied very early in the development of the method and were back then estimated to be of ca.  $7.4 \times 10^9$  and  $8 \times 10^6$  years respectively [1]. Similarly, the apparent saturation of the signal with the radiation dose may be reached > 10,000 Gy for both Al and Ti-Li centres [2, 3]. Consequently, this combined evidence suggests that there is no theoretical obstacle to date pre-Quaternary silico-clastic sediments by ESR.

We report here a series of dating attempts performed on quartz samples whose expected age ranges from about 50 Ma to the earliest part of the Pleistocene. These samples come from various types of depositional environments (e.g. marine, fluvio-deltaic, fluvial), and independent, numerical or (bio)-stratigraphic age control is sometimes available. In all the dated samples, the multiple aliquot additive dose method was applied, while the regeneration approach was also tested for a few of them.

Our preliminary result show that that these quartz samples overall display a very good dose response curve to irradiation, and do not reach apparent saturation. However, if a good adequacy is obtained between calculated ages and the preliminary estimate given by the geology for marine sediments aged between 5 and 2 Ma, a great majority of the ESR ages are younger than expected. Moreover, dating tests performed on sediment from the Miocene and Paleocene-Eocene boundaries show significant age underestimations. These dating results will be discussed in relation to the expected ages, depositional environments or the composition and geochemical history of the sediment from which the dated quartz was extracted.

**Keywords:** ESR dating; quartz; Pre-Quaternary; thermal stability

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