



Potential and limitations of the ESR dating method applied to Lower Pleistocene epoch: some examples from Orce (Guadix-Baza basin, Andalusia, Spain)

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The range of absolute dating methods potentially applicable in archaeological and/or geological context appears quite limited for the Lower Pleistocene epoch. Indeed, their use is constrained by several factors such as the sedimentary context, the kind of material in situ available or the studied time range. Among these methods, Electron Spin Resonance (ESR) is undoubtedly the most commonly used for ancient archaeological sites, mainly because it can be applied to a large range of material: flowstone, sedimentary quartz and fossil teeth for example. The development of this method is therefore really crucial in order to complete the chronostratigraphical framework of the first human settlement in Europe.

To illustrate this, we worked on several sites in the Guadix-Baza basin (Andalusia, Spain), one of the foremost places in Europe with evidence of early human occupation. The basin has accumulated a massive sequence of Neogen-Quaternary sediments which contains a detailed archive of palaeoenvironmental and palaeoclimatic changes since the Miocene. The numerous palaeontological remains discovered from more than a hundred sites, together with a well-defined magnetostratigraphical framework, have established the basin as a reference sequence for the European Pliocene-Quaternary period.

The most famous Plio-Pleistocene localities are located in the eastern part of the basin, near the village of Orce. The sites of Fuente Nueva III and Barranco León have delivered an archaic lithic industry associated with Early Pleistocene fauna, indicating one of the oldest occupations of Western Europe. A third site, Venta Micena, which contained large and detailed palaeontological assemblages (several thousands of remains), has become a reference locality for the Early Pleistocene biochronology.

The chronostratigraphical framework of these sites was established mainly by the combination of several methods: biochronology (small and large-mammals) and palaeomagnetism. In order to complement this framework and to test the reliability of the ESR dating method, fossil teeth and sedimentary quartz recovered from these three localities were analysed. Our results unambiguously demonstrate the antiquity of the sites and their Early Pleistocene ages, but show also some methodological limits of the ESR method for such ancient periods in fluvio-lacustrine sedimentary environments.