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New advances on the magnetic chronostratigraphy of cave sediments in Atapuerca Gran Dolina, Spain

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Magnetostratigraphy has proven to be a powerful and versatile method as well the first line of defence for dating sediments. When properly anchored to the Geomagnetic Polarity Time Scale (GPTS), chron boundaries provide a basis for numerical dating by correlating the local magnetostratigraphy to the GPTS. A caveat and intrinsic limitation when anchoring magnetic stratigraphy to the GPTS is that we deal with essentially a binary code, a sequence of normal and reverse polarity zones. To overcome such limitation biostratigraphy or (ideally) numerical (absolute) age dating is required. Unfortunately, numerical dating of sediments is typically hampered by the lack of amenable minerals for the application of standard methods such as Ar-Ar, requiring thus the use of less conventional methods. Burial dating is possible using methods such as Electron Spin Resonance (ESR) on optically bleached quartz grains. Similar to luminescence, ESR is a paleodosimetric method that provides the time elapsed since the last exposure of quartz grains to natural sun light. Cave sediments are particularly amenable for paleodosimetric methods, as sediments are preserved in the dark and the ESR signal should survive over the geologic history of the deposits. On the down side, we date the moment when the quartz grain enters the karst system, not its deposition. If the transit time is too long, this might be an issue and we would be significantly overestimating the true burial age. Caves at Atapuerca (N Spain) hold the richest Quaternary paleontological record in Eurasia, including fossils and lithic tools. Sediments in these caves have been traditionally dated via magnetostratigraphy by identifying the Matuyama-Brunhes reversal (0.78 Ma) thus providing the Lower to Middle Pleistocene boundary. Nevertheless, the appearance of older sediments in the caves required the combination of paleomagnetism with methods such as ESR to interpret older intra-Matuyama Subchrons. In the deepest levels of the Gran Dolina cave, close to the floor of the cavity, a number of short intervals of normal polarity have been identified in the fluviatile sediments belonging to TD1 unit, which we interpret in terms of Subchrons using ESR ages of quartz grains. We will discuss both paleomagnetic data and interpret the magnetic polarity stratigraphy in the view of the ESR ages obtained from the Multiple Centre (MC) approach.