10Be dating of the Main Terrace level in the Amblève valley (Ardennes, Belgium): new age constraint on the archaeological and palaeontological filling of the Belle-Roche palaeokarst

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It is still disputed whether very old archaeological and palaeontological remains found in the Belle-Roche palaeocave (eastern Belgium) pertain to the Early (∼1 Ma) or Middle (∼0.5 Ma) Pleistocene. Here, in situ-produced cosmogenic 10Be concentrations from a depth profile in nearby sediments of the Belle-Roche terrace (Amblève Main Terrace level) are used as an indirect solution of this chronological issue. The distribution of 10Be concentrations in the upper 3 m of this profile displays the theoretically expected exponential decrease with depth. Assuming a single exposure episode, we obtain a best fit age of 222.5 ± 31 ka for the time of terrace abandonment. However, below 3 m, the 10Be concentrations show a marked progressive increase with depth. This distinctive cosmogenic signal is interpreted as the result of slow aggradation of the fluvial deposits over a lengthy interval. Modelling of the whole profile thus suggests that the onset of the terrace formation occurred at around 550 ka, with a sediment accumulation rate of ∼20 mm/ka. Based on two slightly different reconstructions of the geomorphic evolution of the area and a discussion of the temporal link between the cave and Main Terrace levels, we conclude that the fossil-bearing layers in the palaeokarst pertain most probably to MIS 14–13 (or possibly MIS 12–11) and the artifact-bearing layer to MIS 13 (or possibly MIS 11). This age estimate for the large mammal association identified in the Belle-Roche palaeokarst and the attribution to MIS 14–13 of a similar fauna found in the lowermost fossiliferous layers of the Caune de l’Arago (Tautavel) are in mutual support. Our results therefore confirm the status of the Belle-Roche site as a reference site for the Cromerian mammal association and the Early Palaeolithic industry in NW Europe.