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# Isochron $^{26}\text{Al}/^{10}\text{Be}$ burial dating reveals transient gorge incision in the Save River (French Pyrenees Foreland)

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## Abstract

Quantifying fluvial incision rates is key to understanding landscape evolution over Quaternary timescales, particularly in tectonically and climatically dynamic settings.  $^{26}\text{Al}/^{10}\text{Be}$  burial dating of alluvial endokarstic deposits preserved in cave systems provides a powerful tool to constrain such rates. We apply this approach to the  $\sim 80$  m-deep Save River gorges in the Pyrenees foreland (Haute-Garonne, France), where incision into Eocene limestones has generated a multi-level karst network. In this setting, however, clasts may have experienced (i) complex pre-burial exposure histories, including potential intermediate storage within the Lannemezan megafan, and/or (ii) post-depositional intra-karst reworking. To address these issues, we employ the isochron method, which enables robust identification and rejection of outliers and improves burial age estimates. Twenty-one quartz-bearing pebbles were collected from three cave levels spanning  $\sim 40$  m in elevation, with the highest and lowest caves located  $\sim 55$  m and  $\sim 20$  m above the modern river, respectively. After exclusion of a single outlier, isochron burial dating yields three consistent Middle Pleistocene ages ( $\sim 600$ – $700$  ka) despite the potential complexities noted above. These results suggest (i) peak incision rates exceeding  $0.2$  m/ka and (ii) that at least roughly half of the gorge depth formed during a single incision phase. They further imply a marked reduction in incision rates over the past  $\sim 600$  ka ( $\sim 0.03$  m/ka). We tentatively relate this incision pulse to a regional base-level fall in the Garonne-Save system associated with the Mid-Pleistocene Transition, although a contribution from post-orogenic uplift cannot be excluded.

**Keywords:** Isochron burial dating, multi, level cave system, river incision, gorge formation, Pyrenees foreland

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