Sedimentary record of paleokarsts : a patch on uncomplete continental stratigraphic records. Case study from Cretaceous to Neogene paleokarsts in Southern France

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PALEOKARST

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Continental erosion and weathering destroy parts of the stratigraphic record. Analyses of the sedimentary filling of paleokarsts help completing the geological record of regions that have been submitted to post-depositional, long-term, continental evolution.

Jurassic carbonate platform of Languedoc (South of France) has undergone several karstification phases from Cretaceous to Neogene. Later incision of canyons through the carbonate massifs allows to observe paleokarsts over 400m depth, within the massifs.

Paleokarsts are partly filled with sediments. Some have yielded marine bioclasts (echinoderms, radiolars), foraminifera and nannofossils; others are composed of polygenic detrital sediments, including sources from the upstream Paleozoic basement (Cevennes). The age of the filling of successive paleokarsts can be constrained by structural relationships and by biostratigraphy. These findings suggests 1) the marine elements of the karstic filling relate to a Late Cretaceous to Early Paleocene interval, while 2) the Paleozoic basement-sourced-sediments were trapped in the karst during Miocene to Present.

Karstic sediment containing Early Paleocene foraminifera and nannofossils are found in paleokarsts cavities distributed across the entire thickness of the carbonate massif (≥350m). This requires base-level lowering and associated karstification, followed by base-level rise and karst filling of at least 350 m amplitude, respectively. The time interval corresponding to the occurrence of foraminifera and nannofossils in karsts covers 10 Myrs ; surprisingly, no equivalent marine sediments are preserved on the surface. In addition, analyses of the different forams species suggests several (up to 3) distinct karstification and marine filling cycles. Finally, sedimentological facies analysis of the karst filling reveals the following succession of processes: low energy settling of mudstone, high energy reworking, transport and deposition of silts and sandstones within the karst system.

Integration of geological, paleontological and sedimentological data, leads to a polyphase scenario in response to repeated base-level variations, more than 350m amplitude. Such an amplitude excludes eustacy, and the improbable repeated sequence of uplift and subsidence rules out tectonics, as driving forces for base-level change, respectively. We propose that the high-amplitude base-level changes results from a succession of desiccation-flooding events of an endorheic, silled, basin during Early Paleogene.

The later detrital assemblage sourced in the Cevennes occurs on perched paleosurfaces and in karst cavities across the whole 350m-deep canyon walls. When found on paleosurfaces, they correspond to the south-flowing Early Miocene fluvial drainage, and can be correlated downstream with the marine, well dated, Early Miocene, sediments. When found within the karst cavities, they correspond to successive base-level surfaces connected to the progressive incision of the canyon. This canyon incision is coeval with a Late Miocene uplift of the hinterland.