First quantitative evidences of ghost-rock karstification controlling regional karst geometry

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Although more and more processes are discussed and discovered on the genesis and evolution of cave systems, the tiered karsts are often explained by a control of the base level evolution. In this classical model, the horizontal galleries are explained by a stability of the base level elevation. To the contrary, the shafts and network segments with steep slopes are related to incision periods with a base level lowering.

We use Terrestrial Cosmogenic Nuclide Geochronology to estimate burial ages of alluvium trapped in several caves of the Larzac plateau in Southern France. All the samples are collected in horizontal cave levels, sometimes located between steeper segments. Some caves are opened in river gorge walls, while others are located below the Larzac plateau not farther than 5km away from the river gorges.

The burial ages for the caves opening in the gorges are consistent with the incision rates given for the area and could be interpreted using the classical model. However, the cave within the plateau show a horizontal level with alluvium deposited 200m above the caves in the gorge with the same burial ages (~1 Myr). Since then, new shafts have been opened without alluvium and are hydrologically connected to the river by deeper hypogenic galleries. The cave morphologies and the geochronological data suggest that the classical model fails to explain the horizontal levels in cave below the plateau. We postulate that the geometry of the caves in these limestone and dolomite plateaus are related to a previous period of ghost-rock and alteration roots formations. Without the opening of an efficient connection between this primokarst and the valley, no alluvium can flow through the cave. Therefore, we think that our burial ages constrain the emptying of the ghost-rocks leading to the genesis of the cave where water and possibly alluvium can flow through. Furthermore, these new findings explain why the horizontal levels in the caves are not clearly related to horizontal markers in the surface geomorphology and why large shafts (>100m) exist in the area without evidences of long periods of base level stability followed by large drop of the regional base level.