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The influence of light attenuation on the biogeomorphology of a marine karst cave, the Puerto Princesa Underground River, Palawan, the Philippines.

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Karst caves are unique biogeomorphological systems. Cave walls offer novel habitat for microorganisms which in-turn have a geomorphological role via their involvement in rock weathering, erosion and mineralisation. The attenuation of light with distance into caves is known to affect ecology, but the implications of this for biogeomorphological processes and forms have seldom been examined. Here we describe a semi-quantitative microscopy study comparing the extent, structure, thickness and penetration depth of biocover for the Puerto Princesa Underground River system in Palawan, the Philippines. This extensive marine karst cave is composed of a main active river branch, ending directly in the sea and influenced by tidal movements up to 4 km distance from the coastline, and several fossil branches. It is a unique habitat for a multitude of cave-adapted fauna, and a natural UNESCO World Heritage Site chosen as one of the Seven Wonders of Nature in 2012.

Organic growth at the entrance of the cave was abundant (100% occurrence) and complex, dominated by phototrophic organisms (green microalgae, diatoms, cyanobacteria, mosses, actinobacteria, and lichens). Thickness of this layer was 0.28 ± 0.18 mm with active endolith penetration into the limestone (mean depth = 0.13 ± 0.03 mm). In contrast, phototrophs were rare 50 m into the cave and biofilm cover was very thin (0.01 ± 0.01 mm) and spatially patchy (33% occurrence). Endolithic growth here was also thin (< 0.01 mm) and non-uniform. No biocover was observed 250 m from the entrance. In addition to organic influences, micromorphologies of possible chemical origin were observed at all distances into the cave.

We attribute these differences to light-induced stress gradients, showing that light influences phototroph abundance that in turn has associated consequences for bioweathering and bioerosion in caves. This may also reflect the relative contributions of organic and inorganic processes in the development of distinct morphological features such as notches, for which variability in formation rates between locations is currently poorly understood.