# DIVERSITY OF MICROCRYSTALLINE FABRICS IN CALCITE MOONMILK SPELEOTHEMS

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Petrographic analysis of moonmilk speleothems from caves in Slovenia has shown a wide diversity of microcrystalline textures, including several microfabrics typically found in carbonate microbialites.

Moonmilk speleothems are very porous microcrystalline aggregates that can contain up to 95% of interstitial water and show a distinctive soft and plastic consistency. They are composed of needle fibre calcite (NFC), nanofibrous calcite, mineralised and non-mineralised microbial features and microbial exopolymeric substances (EPS). Although some authors attributed its origin to purely physicochemical processes, most research suggests that microbes play an active role in the precipitation of calcite in moonmilk. Some of the studies rely on molecular and classic microbiology and geochemistry, however, the current biogenic hypotheses are largely based on SEM observations showing association of moonmilk with organic matrix and microbial communities and morphological similarities of calcite fibres to fungal hyphae and filamentous bacteria.

While most of the studies have thoroughly illustrated moonmilk microstructure under the SEM, only few have tackled the characterisation of the moonmilk microfabrics under optical microscope, possibly due to the difficulties to prepare good quality thin sections without collapse of the 3D, highly hydrated structure. As part of our project on the biogenicity of fibrous microcrystalline calcite in moonmilk we have prepared thin sections of moonmilk stalactites, multilayered moonmilk crusts and cave pearls from Snežna Jama Cave and Košelevka Cave in Slovenia, to understand the internal structure and growth patterns of different morphological moonmilk types.

Multilayered crusts are formed by alternation of laminae of dense, clotted and laminated micrite, columnar calcite and detrital layers, surrounded by a very porous layer showing alveolar septal structure with aggregates of NFC crystals filling the spaces. The studied stalactite has an internal area composed of laminae of columnar and columnar microcrystalline fabric, typical of sparitic speleothems, while the outer moonmilk layers are composed of peloidal micrite, shrubs (clotted peloidal dendritic) and microsparitic cements. Pearls can consist of a single nucleus and a cortex formed by concentric laminae of different textures or grape-like aggregates of coated grains weakly cemented by NFC surrounded by a single or multilayer cortex. Most commonly cortex textures are laminated micrite and dendritic crystalline. All studied microcrystalline textures display a bright green luminescence under UV light, indicating the presence of organic matter.

This wide variety of microcrystalline fabrics reflects the complex interplay between microbial communities, organic matrix, water chemistry, hydrology and environmental parameters. Understanding the genesis and distribution of each fabric type can help to determine the role of microbes in the depositional mechanisms of moonmilk.