Biosphere –Atmosphere Interactions in Insuyu Cave System as inferred from secondary mineral formation

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The secondary mineral formation in caves system (e.g speleothems) often considered as archives for microclimatic changes can involve several complex processes such as CO_2 degassing, re-precipitation/ dissolution, evaporation and temperature changes. Fluctuation and changes in these processes can be recorded in properties such as microbial diversity, trace element contents and stable isotope properties of carbonate minerals. However, our understanding about these complex physico-chemical systems is still limited.

Locating in the SW of Turkey the Insuyu cave system, a karstic cave located near the center of Burdur Province, may provide opportunity to investigate such dynamics (microbe-mineral interactions) via geochemical, microbiological and molecular biology techniques. In this study, for the first time we identified archaeal and bacterial community profile of the speleothems collected from Insuyu cave. Microbial community profile dendrograms were obtained using Minitab 17 software based on the similarities between the HRM profiles. Subsequently, bacterial and archaeal community profile of Insuyu Cave has identified by next generation sequence (NGS) based on 16S rRNA metagenomics from the samples marked as the ones which the microbial community best represented regarding to HRM results. Sequences were grouped with their most closely related class/genus using SILVA database. Mothur Version 1.36.1 genetic analysis software was used to produce the phylogenetic three of OTUs of the 16S clones from Insuyu Cave, after the elimination of chimeras with the implanted code UCHIME. A total of nine known bacterial class were found within the context of this research. The most prevalent class is alphaproteobacteria with 89.2 % of the total bacteria, into four order with the most abundant ones: Rhizobiales and Sphingomonadales. The followings, ordered by abundancy, are Actinobacteria, Bacilli, Gammaproteobacteria and Betaproteobacteria. Also, a total of fourteen genera from ten order were identified in this study. The most dominant is Methylobacterium with 88.8%. The followings are Propionibacterium, Dolosigranulum, Streptococcus and Pseudomonas. In addition to microbial community profile, geochemical properties of sediment and water were analyzed. Geochemical analysis of sediments and water samples revealed that cave water and sediments are rich in Mg (5.2 g), Ca (385 g), Si (80.31 g), Sr (140 mg) and Fe (16.9 g) in addition to Na, Al, K . All these preliminary results indicate that chemolithotrophic based geomicrobiological and biogeochemical reactions may dominate process that control formation of secondary minerals in the cave.