Holocene microbialites from Lake Sevan (Armenia): sedimentary and geochemical archives of paleoenvironmental fluctuations

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Résumé

Organo-sedimentary structures, such as microbialites, are recognized as valuable records of past environmental conditions. However, their extreme sensitivity to even slight environmental changes give each microbialite highly specific sedimentary and geochemical characteristics, making it difficult to identify general features that could be associated with well-defined sets of past conditions. At Lake Sevan, in Armenia, Holocene microbialites have been discovered both along the shores and underwater, following a recent 20-meter drop in lake level. The exposed microbialites form linear arrangements at various altitudes, indicating former lake-level fluctuations. These structures thus provide a unique opportunity to explore the relationships between their sedimentary and geochemical features and the environmental settings in which they developed, as inferred from other proxies.

Field, petrographic, and geochemical analyses (including isotopes, PLFAs, and alkanes) were carried out on both subaerial and submerged microbialites. Radiocarbon dating helped to place them within a chronological framework. In parallel, sedimentological and stratigraphic studies were conducted on outcrops, sections, and cores. These investigations enabled the construction of a high-resolution spatial and temporal framework, revealing multiple orders

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of lake-level fluctuations, some of which are interpreted as responses to tectonic events, including earthquakes.

The microbialites were grouped based on their current altitude or depth, their age, and their position within lake-level fluctuation cycles. The sedimentary and geochemical features of each group were then compared to identify common traits that could be linked to specific paleoenvironmental conditions, as defined or described in the literature.
This study identified the main environmental factors that influenced the formation, composition, and preservation of microbialites. It highlights that a thorough understanding of these complex yet invaluable natural archives requires extensive sampling and a detailed, multi-proxy analytical approach.

Mots-Clés: Holocene, Lake Sevan, microbialites, sedimentology, geochemistry, paleoenvironment