学 术 报 告

From *Alcheringa* to beyond: 50 years of microbialite research in Western Australia



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报告简介：

As the earliest recognised textural biosignatures on Earth, microbialites are central to understanding the origin, evolution and persistence of life on our planet. Nowhere is the record of microbialites more extensive or continuous than in Western Australia, spanning at least 3.48 billion years—from the Paleoarchean stromatolitic successions of the Pilbara Craton to modern systems including the UNESCO World Heritage-listed Shark Bay microbialites and the thrombolites of Lake Clifton. The more than 1000 localities documented in thousands of associated publications have fundamentally transformed scientific understanding of microbialites through geological time.

Early microbialite research in Western Australia was primarily descriptive, with fossil stromatolites used for regional correlation, and modern microbialites investigated as analogues for ancient systems. As late 20th-century discoveries in the Pilbara region progressively extended the known record of life deeper into the Archean, research on fossil microbialites shifted toward broader questions concerning the co-evolution of life and habitable surface environments, the recognition of biosignatures, and applications to the search for extraterrestrial life. In parallel, investigations of modern microbialite systems have increasingly incorporated microbiological, geochemical, and molecular approaches, transforming these sites from simple analogues of ancient systems into process-based laboratories for understanding microbialite accretion, ecology, and their vulnerability to environmental change. Concurrent studies of Phanerozoic microbialites have also helped to highlight the ecological resilience and adaptive significance of microbial communities during intervals of environmental stress and biotic crisis, particularly following mass extinction events. Today, Western Australia's expanding fossil and modern microbial datasets and the corresponding improvements in analytical techniques have drawn attention to key challenges remaining within microbialite research, including the need for robust criteria for demonstrating biogenicity, understanding biological, environmental and taphonomic controls on microbialite morphology, and delineating the spatial and temporal range of microbialites. Growing recognition of the scientific and heritage significance of microbialite localities has also highlighted the vulnerability of many ancient and modern sites to anthropogenic disturbance and environmental degradation, and the subsequent importance of robust long-term protections.