

Mineral Composition

Mineral composition encompasses the identity, structure, and properties of crystalline (and some amorphous) materials, which may reflect direct or indirect interactions with biological processes.

Life can influence mineral formation through biomineralization, biologically mediated precipitation, or selective concentration of certain elements. These interactions can lead to distinctive mineral assemblages, unusual crystal habits, fine-scale layering, or compositional anomalies. Biological materials may also be preserved within or templated by minerals, especially in aqueous or hydrothermal environments where minerals such as silica, carbonates, and phosphates readily precipitate. The presence of mineral phases like magnetite, apatite, or carbonates in association with biological textures or isotopic signatures can provide key biosignature evidence. Grain size, crystallinity, and impurity content may further reflect biological modulation, particularly when deviating from expected abiotic patterns. Thus, understanding mineral composition—and its context—is essential in evaluating potential mineralogical biosignatures.