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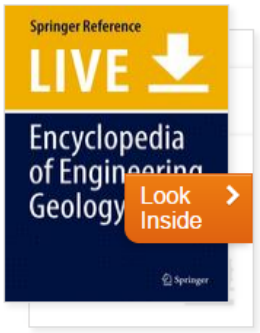

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Biological Weathering

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Synonyms

Biodeterioration; Organic weathering; Weathering by organisms

Definition

Mineralogical components of rocks are altered and modified when exposed to Earth surface conditions in response to different atmospheric agents and insolation that may result in the disaggregation (physical weathering) or the decomposition (chemical weathering) of the rock. When these processes are assisted by biologic action they are called biological weathering.

Organisms may alter rock by both mechanical and chemical actions. The penetrating and expanding pressure of plant roots in cracks, fractures, pores, and other discontinuities may cause the rupture and disaggregation of the rock, if there are favorable conditions and the strength of the rock is lower than that applied by the roots (Fig. 1). Penetration and expansion of lichen thalli have a similar behavior to that of the roots since some thalli may expand up to 3900 per cent due to their high content of gelatine (Bland and Rolls 1998).

Organic activity, mainly caused by microscopic organisms as bacteria, fungi, lichens, mosses, algae, etc. and also by animals, plays an important role in the decomposition of the rock. Attack is by chemical means, with the segregation of compounds as CO_2, nitrates, and organic acids as metabolic products, resulting eventually in the total alteration of the rock and soil formation.

The presence of water is essential to enable the growth of microorganisms and plants. Production of CO_2 and organic acids and nitrification increase the dissolution capacity of soil water.

Heavy metals (copper and zinc or even metal alloys, such as bronze) may inhibit biological growth.

An overview of biological weathering is presented in Yatsu (1988) where the general aspects and the contribution of microorganisms, plants, and animals are described.

Biological weathering is also observed in natural stone used for buildings and monuments (Caneva et al. 2009) where the damage caused by microorganisms depends on the species, fixation mode, and rock type, as well as the local climate, degree of pollution, maintenance, and other anthropogenic factors. In this case, the term biodeterioration is applied, which is the physical, chemical, and/or biological damage effected by organisms on an object of historic, cultural, artistic, or economic importance (Griffin et al. 1991). Hueck (2001) defines biodeterioration as any undesirable change in the properties of materials caused by the vital activities of organisms.

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Biological Weathering, Fig. 1 Example of biological weathering by growth of tree roots in granite

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