Can Mycorrhizal Fungi Stimulate Mineral Weathering and Soil Formation in Fe Ore Tailings?

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Iron (Fe) ore tailings are strongly alkaline (pH > 9.5), with abundant primary phyllosilicates (like biotite), low organic matter and poor physical structure that hinder direct rehabilitation. Eco-engineering tailings into soil-like substrates is an emerging technology to rehabilitate the tailings landscapes, which accelerates bioweathering of primary phyllosilicates, formation of secondary Fe rich minerals and organo-mineral association, as well as water-stable aggregation. Our previous studies found that exogenous organic matter (OM) amendment and tolerant plant colonization could neutralize the tailings' alkaline pH and facilitated water stable aggregate formation [1]. However, this may not be dominant process under semi-arid climatic conditions. Our preliminary field investigation at an Fe-ore mine site in Western Australia discovered several arbuscular mycorrhizal fungal species (dominated by *Paraglomus* sp., *Ambispora* sp., *Glomus* sp. etc) associated with a native pioneer plant species *Maireana* spp. which was directly growing in the tailings [2]. The analysis of crumbs or assemblages of tailings particles adhered to its roots suggested the mycorrhizosphere interactions had induced the bioweathering and aggregation of Fe-bearing minerals. Mycorrhizal fungi usually survive in adverse environmental conditions, such as drought and low fertility, which are typical of Fe-ore mining landscapes. Mycorrhizal root networks may intensively interact with primary phyllosilicates for generating secondry minerals under field conditions. The subsequent secondary minerals could associate with the fungal exudates (protein rich), forming organo-mineral associaiton for water stable aggregation. It is thus proposed that mycorrhizal fungi assisted mineral weathering would be an important process to accelerate soil structure development in Fe ore tailings, under semi-arid climatic conditions.

References:

[1] Wu et al. (2019) *Environ Sci Technol* **53,** 13720-13731

[2] Wu et al., (2020) *Environ. Sci. Pollut. Res.* https://doi.org/10.1007/s11356-020-07780-x