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Isolation of iron bacteria from terrestrial and aquatic environments

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Bacteria, which are capable of iron oxidation or at least iron deposition are widely distributed in environments where zones of dissolved ferrous iron and oxygen gradients are overlapping [1]. They take part in the biological cycling of iron and influence other cycles of elements for example carbon [2]. Manganese can be used for similar metabolic purposes as iron, because it can be biologically oxidized by chemolithotrophs or can be reduced by respirating bacteria as well [3, 4]. Bacterial activity is responsible for the accumulation of ferric iron compounds in their surroundings. The formation of bog ore is a well known example for a soil horizon, with an extreme enrichment of biogenic ferric iron [5].
We focused on the isolation of neutrophilic iron bacteria and bacteria capable of manganese oxidation. We used samples from Tierra del Fuego (Argentina) the National Park "Unteres Odertal" (Germany) and Berlin ground water wells. Microscopic examination of the samples revealed a considerable diversity of iron encrusted structures of bacterial origin. Most of these morphologic types are already well known. The taxonomic classification of many of these organisms is based on morphologic features and is not reliable compared to recent methods of molecular biology. That is mainly due to the fact, that most of these bacteria are hardly culturable or do not show their characteristic morphologic features under culture conditions. We established a collection of more than 300 iron depositing strains. Phylogenetic analyses showed that we have many yet uncultured strains in pure culture. We obtained many isolates which form distinct branches within long known iron bacteria groups like the Sphaerotilus-Leptothrix cluster. But some of the strains belong to groups, which have not yet been associated with iron oxidation activity. The strains deposit high amounts of oxidized iron and manganese compounds under laboratory conditions. However it is unclear if these precipitations are due to biological oxidation or biological deposition of chemically oxidized iron. We examined the morphologic characteristics of selected isolates under near-natural conditions to assign them to morphologic structures which occur in native samples. Our aim for the future is to describe several strains.

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