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Release of Protons and Organic Acids by Shewanella putrefaciens

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Production and consumption of protons, alkalinity and organic acids by soil microorganisms exert a major influence on biomineralisation and bioweathering processes. The type of organisms, the metabolic pathways and the environmental conditions, including pH, redox state and temperature, regulate the microbial release of inorganic carbon and organic acids. The aim of this study was to quantify the release of protons and organic acids by a heterotrophic organism under variable pH and redox conditions. Suspensions of *Shewanella putrefaciens* were incubated in the presence or absence of oxygen, at pH 4, 7 and 8, and temperatures of 12, 22 and 32 ˚C. At pH 4, acid was consumed rapidly by live cells of *S. putrefaciens* during the first few minutes, followed by a more gradual acid consumption. After 50 minutes acid consumption stopped. Under acid conditions, protonation of cell wall functional groups appears to be the only process contributing to the buffer capacity of the live cells. In contrast, at pH 7 and 8, an initially rapid base consumption was followed by a continuous base consumption during the entire duration of the experiment (five hours). Thus, in addition to deprotonation of cell wall functional groups, the metabolic activity of live cells of *S. putrefaciens* acted as a source of protons at pH 7 and 8. The temperature dependency of proton production was larger under oxic conditions than under anoxic conditions. The experimental solutions were therefore screened for the build-up of products indicative of metabolic acitivity, especially fatty acids. In the presence of oxygen increasing concentrations of succinate were measured, whereas in the absence of oxygen acetate release was detected. The results of this study illustrate the large variability of effects of live organisms on the acid-base chemistry of the aqueous medium.