Accumulation and dissolution of magnetite crystals in a magnetically responsive ciliate

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Magnetotactic bacteria (MTB) represent a group of microorganisms that are widespread in aquatic habitats and thrive at oxic-anoxic interfaces. They are able to scavenge high concentrations of iron thanks to the biomineralization of magnetic crystals in their unique organelles, the so-called magnetosome chains. Although their biodiversity has been intensively studied in recent years, their ecology and impact on iron cycling remain largely unexplored. Predation by protozoa was suggested as one of the ecological processes that could be involved in the release of iron back into the ecosystem. Magnetic protozoa were previously observed in aquatic environments, but their diversity and the fate of particulate iron during grazing are poorly documented. In this study, we report the morphological and molecular characterizations of a magnetically responsive MTB-grazing protozoan able to ingest high quantities of MTB. This protozoan is tentatively identified as *Uronema marinum*, a ciliate known to be a bacterium predator. Using light and electron microscopy, we investigated in detail the vacuoles in which the lysis of phagocytized prokaryotes occurs. We carried out high-resolution observations of aligned magnetosome chains and ongoing dissolution of crystals. Particulate iron in the ciliate represented approximately 0.01% of its total volume. We show the ubiquity of this interaction in other types of environments and describe different grazing strategies. These data contribute to the mounting evidence that the interactions between MTB and protozoans might play a significant role in iron turnover in microaerophilic habitats.