Bioavailability of nanoparticulate iron derived from atmospheric mineral dusts

ENIKÖ KADAR[1], JONATHAN J. POWELL[3] AND ZONGBO SHI[2]

[1]Plymouth Marine Laboratory, Prospect Place, the Hoe, Plymouth PL1 3DH, UK email: enik@pml.ac.uk
[2]School of Geography, Earth and Environmental Sciences, University of Birmingham, B15 2TT, U.K email: z.shi@bham.ac.uk
[3]Biomineral Research Section, Medical Research Council - Human Nutrition Research, Elsie Widdowson Laboratory, Fulbourn Road, Cambridge CB1 9NL email: Jonathan.Powell@mrc-hnr.cam.ac.uk

We have studied the composition, Fe dissolution/Fe lability, particle aggregation/size distribution, surface topology and zeta potential (i.e. colloidal stability) of Fe-rich nanoparticles (NPs) formed during simulated atmospheric processing of dust in contact with seawater under a range of environmentally realistic conditions typical in oceanic waters to shed light on putative relationships between NP structure and water parameters. These laboratory studies showed that: (i) despite the close resemblance in micromorphology, NPs formed from mineral dusts have distinct aggregation behaviour from ferrihydrite NPs; (ii) the relatively stable and mondosiperse aggregates of NPs formed during simulated cloud processing of mineral dust become more polydisperse and unstable in seawater; (iii) exopolymeric substances (EPS) extracted from phytoplankton seem to "stabilise" the aggregates of dust derived NPs; iv) dissolved Fe concentration from NPs, is consistently higher in seawater in the presence of EPS and is also affected by sunlight; v) EPS-mediated Fe uptake may be responsible for enhanced bioavailability in phytoplankton.

To test the hypothesis that nanoparticulate Fe is more bioavailable than the bulk analogue we have grown marine microalgae on synthetic nano-iron substrates. Algal growth was significantly enhanced when the nanomaterials were added in equimolar concentration compared to Fe-EDTA in the optimised algal growth medium (f/2). NP addition influenced cellular fatty acid composition compared to control treatments, but this was significant only in haptophytes. The NP uptake mechanism proposed is via secretion of an extracellular matrix that binds NPs through which Fe is bioavailable via fagocytotic membrane processes and/or NP dissolution. The implications of the use of such engineered nanomaterials as Fe substrate in algal culture are discussed.

Determination the step of karst formation using GPR and Raman Spectroscopy Methods, South East Anatolia, Turkey

SELMA KADIOGLU[12] AND YUSUF KAĞAN KADIOĞLU[2]

[1]Ankara University Faculty of Engineering Department of Geopgysical Engineering, Ankara, Turkey
[2]Ankara University Earth Sciences Application and Research Center, Ankara, Turkey (kadi@ankara.edu.tr)

Ground Penetrating Radar (GPR) is used to identify the relatively shallow subsurface features at scale from centimeter up to meter. In this study dissolution of soluble rocks (Karst) including limestone and dolomitic limestone are examined using GPR and Raman spectroscopy methods around Adiyaman City in East Anatolia Turkey. Karstification led to form sinkholes, caves, and underground drainage systems. Rainwater becomes acidic as it comes in contact with carbon dioxide in the atmosphere and the soil. As it drains into fractures in the rock, the water begins to dissolve away the rock creating a network of passages. The step of the karst formation towards the inner parts of the surface of the limestone is determined using 250 and 500 Mhz GPR antenna. GPR attribute volumes is sensible and suggests that the formation of the cavities along the fracture packets exist over cavity floors elsewhere but that there is also variation in fracture intensity and in orientation over the whole system. The matrix consolidation and dissolution of the rocks are observed through the processing of the radar data.
The microscopically examination and Confocal Raman spectroscopy determination studies show the degree of the dissolution is increased towards the crack and aid to form ankerite, siderite, limonite, hydrous carbonate-sulfates, vermiculite clay minerals with rare amount of albite and pyrite.

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