

Study of severe geomagnetic storm effects on the ionosphere over India using GPS TEC

RASHMI REKHA BORAH AND P. K. BHUYAN

Department of Physics, Dibrugarh University, Dibrugarh-786004 (rashmirekha_b@rediffmail.com, bhuyan@dibru.ernet.in)

The characteristics of the equatorial ionization anomaly (EIA) is studied by analyzing dual-frequency ($f_1=1575.42$ MHz, $f_2=1227.60$ MHz) signals from the Global Positioning System (GPS) satellites measured at 18 observational sites throughout India during the period 2003-2005. A detailed analysis of the responses of the equatorial ionosphere to a large number of magnetic storms shows the rapid and remarkable collapse of F-region ionization [1, 2]. The observed changes at low and equatorial latitudes are rather complex and are noted to be a function of location, the time of the storm onset and its intensity, and various other characteristics of the geomagnetic storms triggered by solar weather events. The aim of this analysis is to show the storm induced disturbance effect of 5 severe ($Dst < -200$ nT) geomagnetic storms on the growth and decay of the EIA during the period 2003-2005 over India.

Category	Study Period	Dst	A		Kp	
			p	p		
Severe Dst < -200 nT	October 27-31, 2003	- 401 nT	4	00	.0	
	November 20-22, 2003	- 472 nT	3	00	.7	
	November 7-11, 2004	- 373 nT	3	00	.7	
	May 13-16, 2005	- 263 nT	2	36	.3	
	August 23-25, 2005	- 216 nT	3	00	.7	

Table 1: Study periods, minimum Dst, maximum Ap and maximum Kp of severe storms studied within the period 2003 to 2005.

[1] Fuller-Rowell *et al.* (1997) *J. Atmos. S-P* **59**, 1533–1540.

[2] Basu *et al.* (2001) *J. Geophys. Res.* **106**, 30 389–30 413.

Phosphate interactions with iron (hydr)oxides: Mineralization pathways and phosphorus retention upon bioreduction

THOMAS BORCH^{1*}, YOKO MASUE²,
RAVI K. KUKKADAPU³ AND SCOTT FENDORF²

¹Soil and Crop Sciences, Colorado State University, Fort Collins, CO 80523-1170

(*correspondence: borch@colostate.edu)

²Environmental Earth System Science, Stanford University, Stanford, California 94305

³Pacific Northwest National Laboratory, Richland, Washington 99352

Dissimilatory iron reduction by *Shewanella* and *Geobacter* species has been extensively studied over the past two decades with pristine synthetic iron-(hydr)oxides serving as the electron acceptor. However, natural environments often include a complex interaction of numerous organic and inorganic constituents that may control the bioreducibility of iron-(hydr)oxides and the mineralization products formed. For instance, oxyanions are known to interact strongly with iron-(hydr)oxides and may therefore affect their reducibility and mineralization pathway. Accordingly, the objectives of this study are to (1) determine the impact of surface-associated oxyanions, using phosphate as a model compound, on the extent of iron-(hydr)oxide bioreduction and nature of the resulting mineralization products and (2) elucidate the impact of iron bioreduction on phosphate retention.

Batch and column studies show that alterations in surface composition have a profound impact on the bioreducibility and mineralization pathway of ferrihydrite. Phosphate induced a linear inhibition on the extent of biomineralization and resulted in a fivefold decrease in iron reduction at high surface-coverage. Magnetite was the most significant mineralization product formed while lepidocrocite and especially goethite formation was inhibited in the presence of phosphate. Minor amounts of vivianite and green rust like phases were also observed. Advective flow conditions also influenced the biomineralization pathway of ferrihydrite. Furthermore, decreased mobility of phosphate was observed under iron-reducing conditions when compared to column systems in the absence of the iron reducing bacterium *Shewanella putrefaciens*.

Our results reveal the importance of considering hydrodynamics and the molecular-scale heterogeneity of iron (hydr)oxides, inclusive of adsorbates, when evaluating dissimilatory iron reduction and biomineralization within soils and sediments.