

## SUPPORTING INFORMATION

### **Mobilization of Arsenic during One-Year Incubations of Grey Aquifer Sands from Araihasar, Bangladesh**

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Dissolved concentrations of Fe, As, Mn, S, P and the major cations (Na, Mg, K and Ca) are reported for both the site profiles and the incubations. Fe and As sediment concentrations from the HCl and phosphate extractions are given. The values used for the Langmuir calculations of increased surface site availability are reported.

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Table S1. Needle Sampler Profiles from Jan and April 2005

													Extractions		
	Depth m	Na mg/L	Mg mg/L	P mg/L	S mg/L	K mg/L	Ca mg/L	Mn mg/L	Fe mg/L	As ug/L	Major Cations meq/L	Depth m	As mg/kg	Fe(II)/tot Fe ratio	
Jan-05															
NS32-1	4.0	19.5	18.1	0.9	2.4	3.0	62.7	1.1	1.1	22.0	5.4	4.0	1.13	0.53	
NS32-2	4.3	19.6	18.1	0.9	3.8	2.8	62.8	1.6	0.0	39.8	5.4	4.3	1.49		
NS32-3	6.1	21.1	16.5	0.4	5.1	3.5	65.4	1.5	0.0	101.6	5.4	6.1	2.72	0.55	
NS32-4	6.4	29.3	14.5	0.1	9.8	3.1	60.7	1.2	0.0	68.1	5.4	6.4	2.02		
NS32-5	7.6	18.5	18.0	0.1	3.8	2.6	77.0	2.4	0.1	67.3	6.0	7.6	1.62	0.55	
NS32-6	7.9	18.8	17.8	0.1	4.1	2.8	76.0	2.4	0.1	67.5	5.9	7.9	1.03		
NS32-7	10.7	20.2	15.6	0.1	5.9	3.1	61.7	1.8	1.8	78.3	5.1	10.7	1.81	0.53	
NS32-8	11.0	21.2	15.4	0.1	5.5	3.5	56.6	1.4	0.0	74.6	4.9	11.0	0.14	0.60	
NS32-9	11.3	20.4	15.9	0.1	5.1	3.0	60.8	2.0	0.3	83.1	5.1	15.2		0.65	
NS32-10	15.2	22.5	14.6	0.1	6.8	3.3	59.0	1.0	0.3	56.1	5.0				
NS32-11	15.5	24.4	14.3	0.0	7.3	3.1	58.9	1.0	0.0	49.8	5.1				
NS32-12	21.3	29.8	12.9	0.1	8.2	5.3	51.2	0.5	0.0	105.0	4.9	21.3		0.71	
NS32-13	21.6	38.3	9.9	0.0	11.7	5.0	41.2	0.2	0.1	23.3	4.5				
NS32-16	57.9	55.8	11.0	0.1	13.0	7.6	25.7	0.1	0.0	7.0	4.7				
NS32-17	58.2	69.0	8.6	0.1	12.6	6.6	17.4	0.0	0.1	8.8	4.7				
Apr-05															
NS32B-11	4.6	23.6	20.8	1.1	3.6	3.6	140.4	2.7	0.5	39.3	9.4	4.6	0.51	0.63	
NS32B-12	4.9	22.9	20.4	1.1	3.3	3.2	139.4	2.8	0.0	40.7	9.3	11.6	1.42	0.67	
NS32B-13	11.6	17.4	14.2	0.2	4.2	3.2	104.7	2.3	0.7	72.5	6.9	37.5	0.29	0.84	
NS32B-14	11.9	17.8	14.0	0.2	4.2	3.2	105.9	2.3	0.8	71.4	6.9				
NS32B-15	37.5	17.1	15.8	0.1	3.0	6.2	62.8	0.1	0.0	75.6	5.1				
NS32B-16	37.8	16.8	15.5	0.4	3.2	5.8	56.9	0.1	0.9	100.6	4.8				
NS32B-17	38.2	17.4	52.2	0.7	1.6	11.1	84.2	0.1	0.0	162.3	9.3				
NS32B-PW		18.5	8.2	0.0	3.4	4.5	50.0	0.1	0.2	17.1	3.9				
NS32B-HW		19.4	8.5	0.0	3.9	4.8	45.6	0.1	0.1	19.9	3.8				

**Table S2. Results of the HCl and phosphate sediment extractions.**

		Day 17	Day 340		
		All	Unamended	Acetate	Oxygen
5 m	HCl-ext Fe g/kg	1.9	6.4	6.6	4.7
	Fe(II)/Fe(tot)	0.63	0.59	0.62	0.47
	HCl-ext As mg/kg		1.3	1.5	0.8
	P-ext As mg/kg	0.5	0.44	0.38	0.25
12 m	HCl-ext Fe g/kg	2.9	5.9	5.7	6.2
	Fe(II)/Fe(tot)	0.67	0.47	0.65	0.47
	HCl-ext As mg/kg		1.5	1.2	1.14
	P-ext As mg/kg	1.4	0.56	0.54	0.42
38 m	HCl-ext Fe g/kg	6.6	8.6	9.7	7.5
	Fe(II)/Fe(tot)	0.84	0.76	0.77	0.43
	HCl-ext As mg/kg		1.4	0.93	0.5
	P-ext As mg/kg	0.3	0.24	0.24	0.36

Table S3. Dissolved Fe concentrations throughout incubation.

Depth	Day Amendment	Sample A		Sample B							in mg/L
		0	0	17	23	40	99	160	252	340	
5m	Unamended	0.48	0.10	0.10	0.10	0.14	0.07	0.14	1.03	0.24	
	Acetate				0.10	0.10	0.10	0.11	4.58	6.37	
	Oxygen			1.39	0.24	0.10	0.10	0.10	0.10	0.10	
12m	Unamended	0.73	0.77	0.28	0.13	0.23	0.06	1.23	14.80	0.88	
	Acetate				0.17	0.23	0.19	0.56	21.51	0.15	
	Oxygen				0.10	0.30	0.10	0.10	0.25	0.10	
38m	Unamended	0.10	0.88	1.31	0.30	0.42	0.55	0.73	33.03	3.09	
	Acetate				0.38	0.82	0.42	0.58	32.48	0.41	
	Oxygen				0.33	0.54	0.10	0.10	0.10	0.10	

Numbers in red indicate below the detection limit

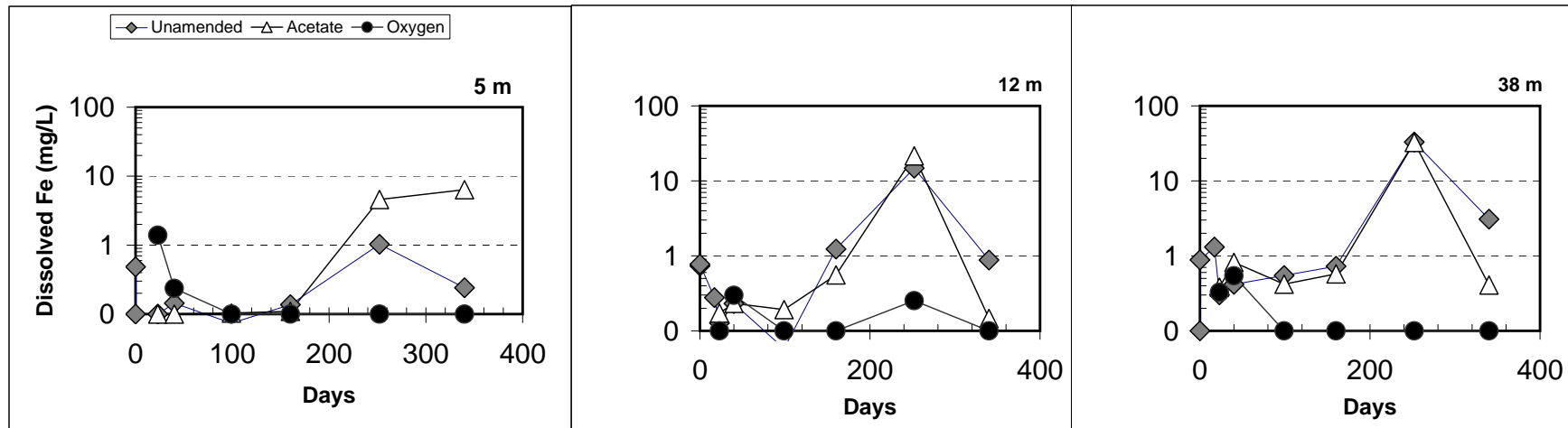
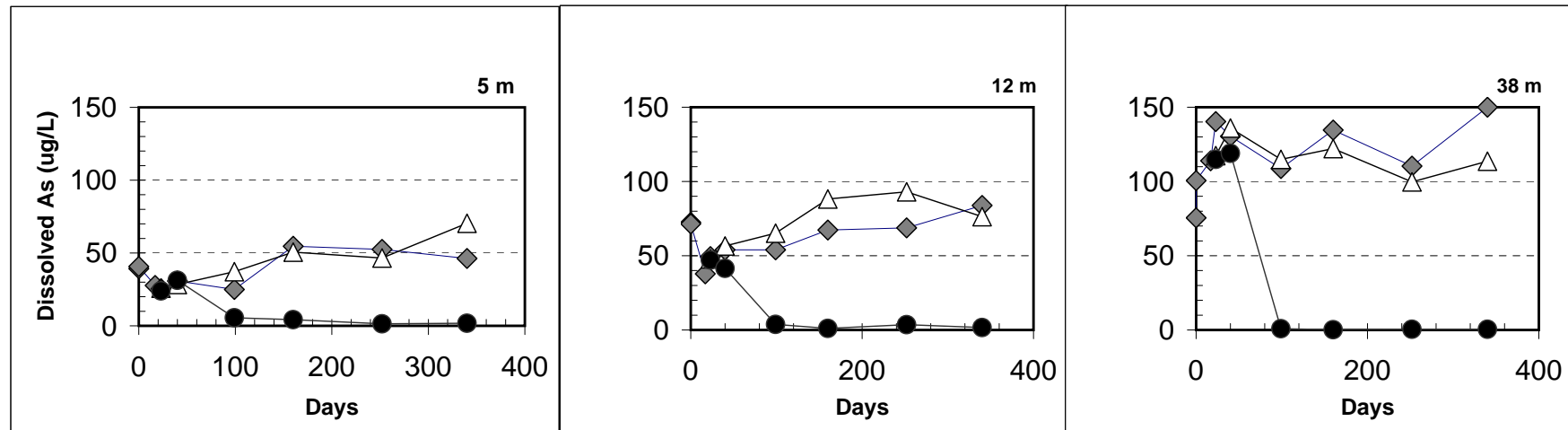


Figure S1. Dissolved Fe concentrations throughout incubation by depth and amendment type.

**Table S4. Dissolved As concentrations throughout incubation.**

Depth	Day Amendment	Sample A		Sample B		in ug/L					
		0	0	17	23	40	99	160	252	340	
5m	Unamended	39.30	40.72	27.70	25.47	30.74	24.94	54.68	52.46	46.30	
	Acetate				25.87	28.37	37.18	50.59	46.52	70.44	
	Oxygen				23.96	31.30	5.55	4.24	1.36	1.82	
12m	Unamended	72.47	71.42	37.80	49.40	53.97	53.92	67.32	68.73	83.89	
	Acetate				47.91	56.60	65.14	88.23	92.99	76.32	
	Oxygen				47.08	41.45	3.73	1.11	3.62	1.60	
38m	Unamended	75.58	100.61	113.90	140.34	130.48	108.71	134.59	110.33	149.98	
	Acetate				117.45	136.00	114.90	122.17	99.68	113.63	
	Oxygen				114.93	118.94	0.86	0.15	0.45	0.51	

Numbers in red indicate below the detection limit



**Figure S2. Dissolved As concentrations throughout incubation by depth and amendment type.**

Table S5. Dissolved Mn concentrations throughout incubation.

Depth	Day Amendment	Sample A		Sample B							in mg/L
		0	0	17	23	40	99	160	252	340	
5m	Unamended	2.73	2.83	1.50	0.59	0.53	0.28	0.29	0.28	0.18	
	Acetate				0.56	0.51	0.34	0.32	1.25	4.78	
	Oxygen				0.64	1.02	0.41	0.01	0.02	0.01	
12m	Unamended	2.33	2.32	1.17	0.49	0.50	0.31	0.54	1.92	0.68	
	Acetate				0.50	0.56	0.38	0.40	2.28	0.22	
	Oxygen				0.54	0.81	0.37	0.03	0.90	0.20	
38m	Unamended	0.08	0.06	0.11	0.07	0.12	0.15	0.19	1.46	0.68	
	Acetate				0.06	0.08	0.08	0.13	1.03	0.11	
	Oxygen				0.09	0.08	0.01	0.02	0.02	0.01	

Numbers in red indicate below the detection limit

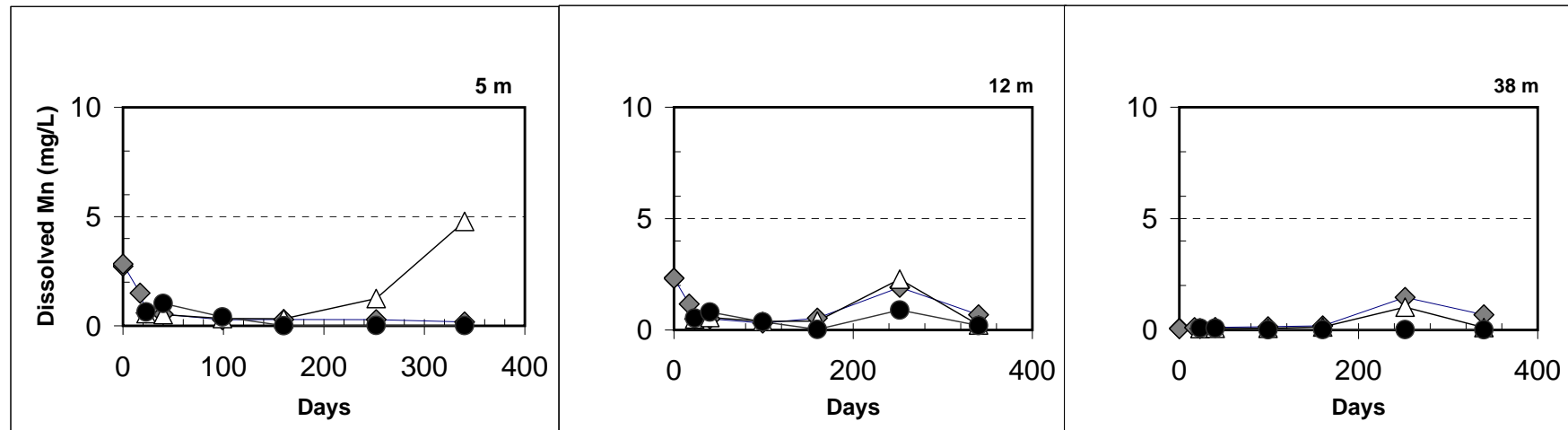
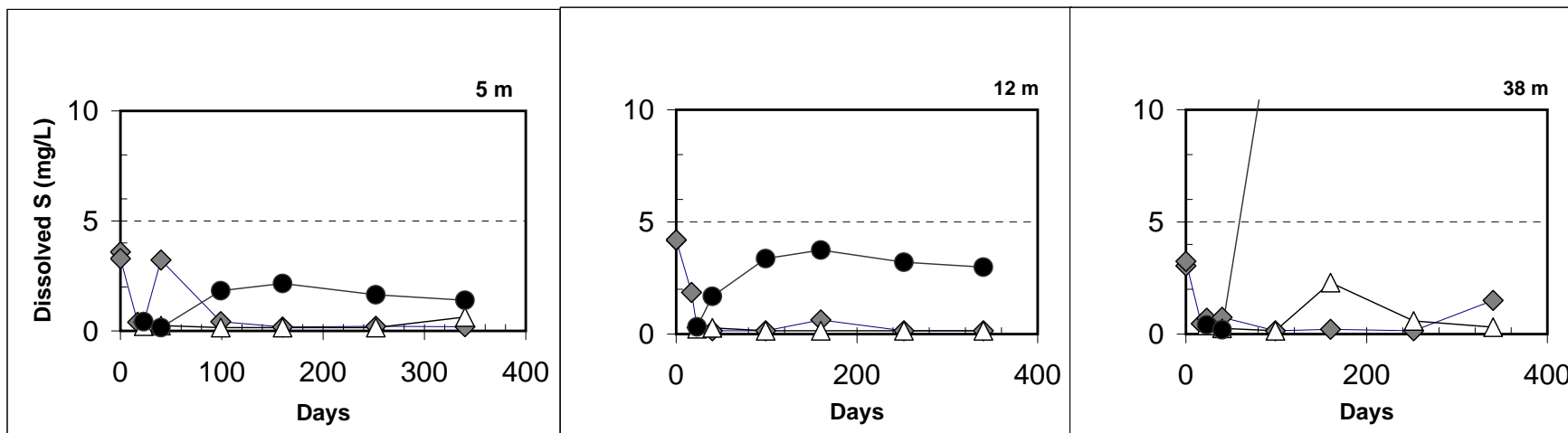


Figure S3. Dissolved Mn concentrations throughout incubation by depth and amendment type.

**Table S6. Dissolved S concentrations throughout incubation.**

Depth	Day Amendment	Sample A		Sample B							in mg/L
		0	0	17	23	40	99	160	252	340	
5m	Unamended	3.59	3.29	0.39	0.40	3.22	0.42	0.18	0.21	0.19	
	Acetate				0.22	0.24	0.15	0.15	0.15	0.63	
	Oxygen				0.42	0.15	1.83	2.16	1.64	1.39	
12m	Unamended	4.19	4.20	1.86	0.29	0.15	0.15	0.63	0.15	0.15	
	Acetate				0.24	0.27	0.15	0.15	0.15	0.15	
	Oxygen				0.32	1.68	3.36	3.75	3.20	2.99	
38m	Unamended	3.04	3.24	0.46	0.71	0.75	0.15	0.21	0.15	1.50	
	Acetate				0.39	0.26	0.15	2.30	0.58	0.31	
	Oxygen				0.42	0.19	14.98	41.32	46.90	53.47	

Numbers in red indicate below the detection limit



**Figure S4. Dissolved S concentrations throughout incubation by depth and amendment type.**

Table S7. Dissolved P concentrations throughout incubation.

Depth	Day Amendment	Sample A		Sample B							in mg/L
		0	0	17	23	40	99	160	252	340	
5m	Unamended	1.12	1.10	2.02	2.45	2.44	0.02	3.16	41.92	2.32	
	Acetate				2.32	2.17	1.89	2.37	9.43	0.88	
	Oxygen				2.43	2.19	0.38	0.32	0.06	0.05	
12m	Unamended	0.16	0.19	0.44	0.72	2.09	0.65	1.25	4.64	1.53	
	Acetate				0.62	0.78	0.80	1.08	3.94	1.45	
	Oxygen				0.66	0.37	0.02	0.02	0.08	0.04	
38m	Unamended	0.06	0.38	1.36	1.86	1.83	1.08	2.05	4.36	1.75	
	Acetate				1.57	1.93	1.55	0.02	0.02	2.50	
	Oxygen				1.36	1.13	0.02	0.02	0.02	0.04	

Numbers in red indicate below the detection limit

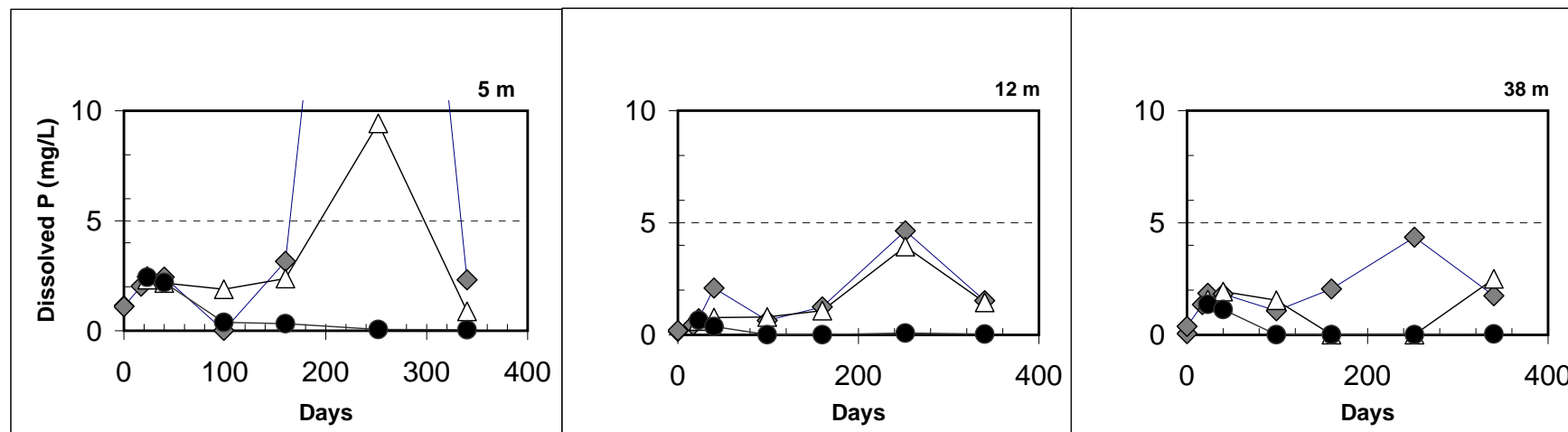


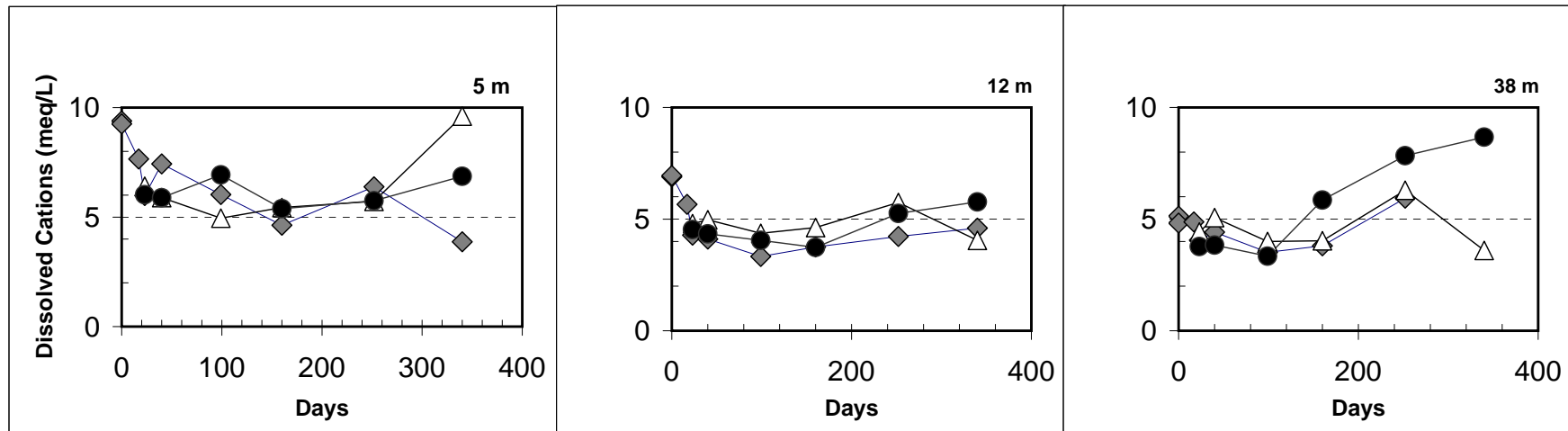
Figure S5. Dissolved P concentrations throughout incubation by depth and amendment type.



**Table S8. Dissolved concentrations of the major cations (Na, Mg, K and Ca) throughout incubation.**

Depth	Day Amendment	Sample A		Sample B							in meq/L
		0	0	17	23	40	99	160	252	340	
5m	Unamended	9.39	9.26	7.65	5.98	7.43	6.03	4.63	6.38	3.87	
	Acetate				6.41	5.89	4.95	5.44	5.72	9.61	
	Oxygen				6.02	5.88	6.93	5.39	5.75	6.86	
12m	Unamended	6.89	6.95	5.66	4.28	4.11	3.33	3.75	4.22	4.60	
	Acetate				4.80	4.97	4.37	4.62	5.75	4.05	
	Oxygen				4.53	4.34	4.05	3.73	5.26	5.77	
38m	Unamended	5.13	4.82	4.88	4.06	4.42	3.51	3.80	5.94		
	Acetate				4.43	5.07	4.00	4.03	6.30	3.60	
	Oxygen				3.77	3.84	3.34	5.85	7.84	8.67	

Numbers in red indicate below the detection limit



**Figure S6. Dissolved concentrations of the major cations throughout incubation by depth and amendment type.**

**Langmuir calculations**

$$K(\text{abs}) = \frac{[SA]}{([S]*[A])}$$

K(abs) is constant

$$K(\text{abs}) = \frac{[SA(0)]}{([S(0)]*[A(0)])} \quad \text{where (0) is for day 0}$$

$$= \frac{[SA(17)]}{([S(17)]*[A(17)])} \quad \text{where (17) is for day 17}$$

<b>Known</b>		5 m	12 m	38m	in unamended samples
[A(0)]	ug/L	40	72	88	
[A(17)]	ug/L	28	38	114	
[SA(17)]	mg/kg	0.5	1.4	0.3	

Assuming that the change in As all is due to adsorption [A(0)]-[A(17)]

[SA(0)]	mg/kg	0.491	1.368	0.363
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solve equation for [S(17)]/[S(0)]

<b>[S(17)]/[S(0)] ratio</b>	<b>1.45</b>	<b>1.94</b>	<b>0.64</b>
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**Table S9. Groundwater volume changes for each amendment.**

<b>Depth</b>	<b>Amendment</b>	<b>Sediment g</b>	<b>Starting Volume mL</b>	<b>End Volume mL</b>
5m	Unamended	11.20	8.4	2.4
	Acetate	9.82	7.9	1.9
	Oxygen	7.67	8.9	2.9
12m	Unamended	10.92	10.4	4.4
	Acetate	9.11	12.0	5.9
	Oxygen	8.51	8.4	2.4
38m	Unamended	6.16	14.9	8.9
	Acetate	8.19	13.4	7.4
	Oxygen	5.01	10.9	4.9