Supplementary information

Table S1: Elemental concentrations of precipitate 1 and 4 in mol% as estimated by SEM-EDS. The locations of the spot analysis (1-3 for precipitate 1 and 1-5 for precipitate 4) are indicated in Fig. 10.

	Precipitate 1				Precipitate 4					
	1	2	3	MEAN	1	2	3	4	5	MEAN
Na	1.35	2.29	4.64	2.76	14.33	2.73	3.37	0.66	0.00	4.22
Mg	4.52	5.05	4.80	4.79	8.82	39.29	9.77	12.00	7.04	15.38
P	46.00	42.67	38.39	42.35	38.57	47.56	39.30	42.84	25.57	38.77
S	1.68	1.97	4.18	2.61	9.64	2.44	2.67	1.13	18.97	6.97
Cl	0.32	0.95	0.46	0.58	1.10	0.38	0.47	0.13	0.00	0.42
Mn	0.00	0.00	0.00	0.00	13.50	2.63	18.26	13.20	23.85	14.29
Fe	46.13	47.08	47.52	46.91	14.05	4.98	26.16	30.04	24.57	19.96
Fe/P	1.00	1.10	1.24	1.11	0.36	0.10	0.67	0.70	0.96	0.51
Mn/P	0.00	0.00	0.00	0.00	0.35	0.06	0.46	0.31	0.93	0.37
Mg/P	0.10	0.12	0.13	0.11	0.23	0.83	0.25	0.28	0.28	0.40

Table S2. Additional governing equations

Property	Governing equation
Tortuosity	$\theta^2 = 1 - 2\ln(\phi)$
Molecular diffusion coefficient corrected for tortuosity	$D' = \frac{D_m}{\theta^2}$
Advective velocity at depth	$v_\infty = \frac{F_{sed}}{\rho(1-\phi_\infty)}$

Table S3. Environmental parameters used by the diagenetic model.

Parameter	Symbol	Value	Units
Porosity at surface	ϕ_0	0.880	-
Porosity at depth	ϕ_∞	0.704	-
Porosity e-folding distance	γ	2506	cm
Sediment density	ρ	2.65	g cm^{-3}
Temperature	T	9	^oC
Sediment accumulation rate	F_{sed}	0.1809	g cm^{-2} yr^{-1}
C:N ratio of OM	C/N	106/16	-
C:P ratio of $OM^{\alpha,\beta}$	C/P	106/1	-
C:P ratio of OM^{γ}	C/P	250/1	-
P:Fe ratio of $Fe(OH)_3^{\alpha,\beta,\gamma}$	$\chi^{\alpha,\beta,\gamma}$	0.02	-

Table S4. Boundary conditions at the sediment-water interface.

Time-independent boundary conditions		
Parameter	**Value**	**Unit**
J_{FeCO_3}	0	mol m^{-2} yr^{-1}
J_{S_0}	0	mol m^{-2} yr^{-1}
J_{CaP}	0.003926	mol m^{-2} yr^{-1}
$J_{Fe_3(PO_4)_2}$	0	mol m^{-2} yr^{-1}
J_{FeS}	0	mol m^{-2} yr^{-1}
$[Fe^{2+}]$	0	µmol L^{-1}
$[CH_4]$	0.1	µmol L^{-1}
$[\sum NH_4^+]$	100	µmol L^{-1}
$[NO_3^-]$	4.53	µmol L^{-1}
$[DIC]$	3500	µmol L^{-1}
$[\sum PO_4^{3-}]$	0	µmol L^{-1}
Initial values of transient boundary conditions		
Parameter	**Value**	**Unit**
J_{FeS_2}	0	mol m^{-2} yr^{-1}
$J_{Fe(OH)_3^{\alpha}}$	0.0004254	mol m^{-2} yr^{-1}
$J_{Fe(OH)_3^{\beta}}$	0	mol m^{-2} yr^{-1}
$J_{Fe(OH)_3^{\gamma}}$	0.1155	mol m^{-2} yr^{-1}
$J_{C_{org}^{\alpha}}$	0.00000796	mol m^{-2} yr^{-1}
$J_{C_{org}^{\beta}}$	0.00000375	mol m^{-2} yr^{-1}
$J_{C_{org}^{\gamma}}$	0.1406	mol m^{-2} yr^{-1}
$[\sum H_2S]$	0	µmol L^{-1}
$[O_2]$	100	µmol L^{-1}
$[Ca^{2+}]$	0.00294	µmol L^{-1}
$[Cl^-]$	0.1561	µmol L^{-1}
$[SO_4^{2-}]$	0.00806	µmol L^{-1}

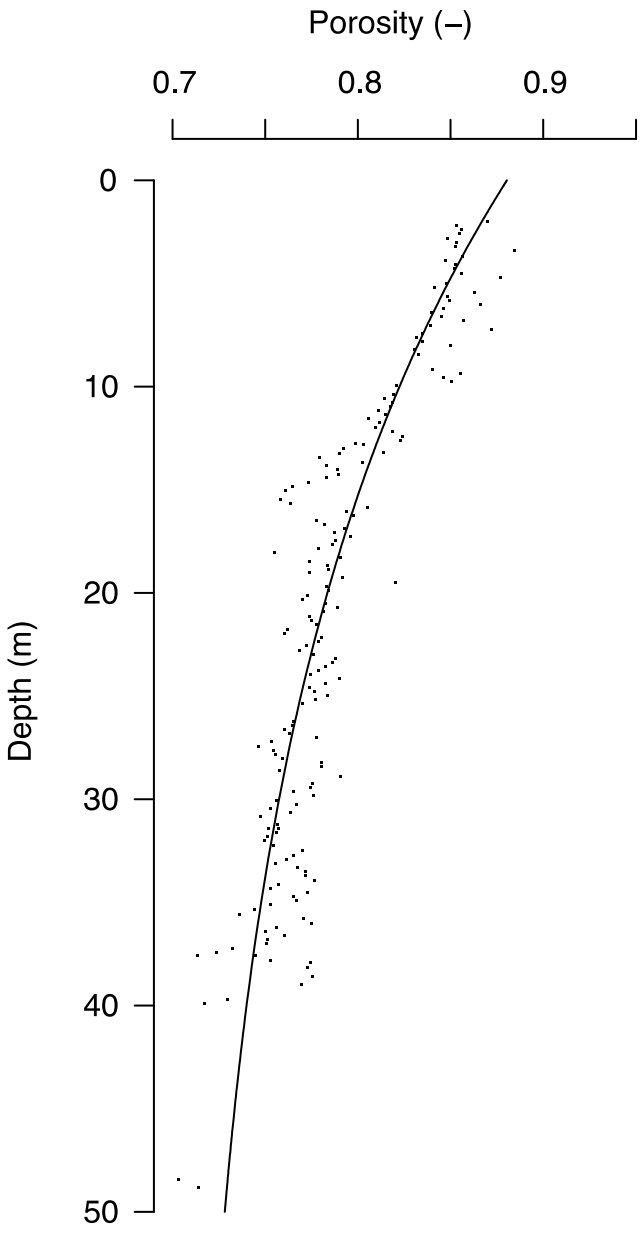

Figure S1: Measured porosity data (dots) and fitted model profile (solid line) at site M0065. Corresponding fitting parameters are given in Table S3.