Table S1. The profiles of porewater components of sediments GC02 (1)

Depth	S^{2-}	Cl^-	Br^-	SO_4^{2-}	NH_4^+	CH_4	DIC	$\delta^{13}C_{DIC}$
cm	μmol /L	mmol/L	mmol/L	mmol/L	mmol/L	μmol /L	mmol/L	‰
5	0.21875	543	0.8	26.390	1.2	0.451	1.84	-9.8
10	0.21875	547	0.8	26.552	1.3	0.459	2.12	-9.7
15	0.21875	548	0.8	26.686	1.4	0.327	1.78	-8.3
25	0.25224	547	0.9	26.436	1.7	0.279	2.33	-7.9
30	0.37501	546	0.8	26.583	1.7	0.393	2.25	-9.0
40	0.21875	544	0.8	26.822	1.2	0.557	2.12	-8.6
60	0.31250	545	0.8	26.865	1.8	0.356	2.31	-7.4
70	0.68751	547	0.9	26.827	1.1	0.484	2.28	-11.7
80	0.15625	540	0.8	26.505	1.0	0.426	2.05	-10.5
90	0.21875	549	0.8	26.698	1.4	0.371	2.12	-9.0
100	2.37502	546	0.9	26.763	1.3	0.334	2.42	-10.8
105	1.12500	551	0.9	26.740	1.4	0.323	0.55	-15.1
110	1.35512	543	0.9	26.623	1.3	0.422	0.54	-17.9
115	1.56251	550	0.8	26.896	1.3	0.415	2.57	-11.7
120	0.15625	544	0.9	26.419	1.2	0.466	1.74	-11.6
125	0.43750	552	0.8	26.945	1.6	0.287	1.53	-10.9
130	0.06251	565	0.9	28.117	1.9	0.700	1.38	-10.0
140	0.15320	541	0.9	26.547	1.8	0.400	1.52	-11.6
150	0.31251	561	0.9	28.037	1.6	0.579	0.76	-9.6

Table S2. The profiles of porewater components of sediments GC02 (2)

Depth	Fe^{2+}	Mn^{2+}	Ti^{2+}	Fe^{3+}	Co^{2+}	Cu^{2+}	Zn^{2+}	Al^{3+}
cm	μmol/L	μmol/L	μmol/L	μmol/L	nmol/L	μmol/L	μmol/L	mmol/L
5	10.32143	4.100	0.275	41.452	17.591	7.322	3.028	12.028
10	7.803571	3.747	0.293	42.728	15.872	8.827	2.450	10.421
15	5.071429	2.329	0.440	44.243	14.804	10.234	2.108	8.633
25	6.015235	3.908	0.380	40.655	12.766	10.124	4.404	18.092
30	6.946429	3.423	0.354	43.442	12.403	11.165	3.883	9.864
40	3.553571	0.639	0.297	32.091	7.389	10.007	1.366	6.180
60	5.215632	1.268	0.308	39.316	10.040	10.925	3.174	5.585
70	6.071429	1.698	0.302	36.754	9.175	10.992	1.253	3.866
80	8.732143	0.711	0.281	36.298	8.457	9.607	1.340	3.288
90	2.392857	0.871	0.311	34.699	8.405	9.813	2.591	13.135
100	5.50002	0.729	0.208	38.404	7.323	8.459	1.066	5.161
105	5.62451	0.940	0.325	35.301	8.706	10.443	1.824	9.930
110	5.78571	1.114	0.339	33.649	7.862	9.919	2.159	4.847
115	5.28571	1.279	0.333	38.211	8.916	11.216	2.481	5.500
120	10.17857	0.964	0.348	37.654	8.021	12.250	1.666	3.197
125	6.00120	1.753	0.352	37.389	8.682	11.691	2.388	6.883
130	8.232143	1.548	0.353	38.983	8.647	11.756	2.262	5.730
140	8.517857	4.491	0.389	43.163	11.704	13.032	5.750	10.595
150	6.714286	2.674	0.309	39.874	9.876	13.183	2.891	11.982

Table S3. The profiles of porewater components of sediments GC09 (1)

Depth	S^{2-}	Cl^-	Br^-	SO_4^{2-}	NH_4^+	CH_4	DIC	$\delta^{13}C_{DIC}$
cm	μmol /L	mmol/L	mg/L	mmol/L	mmol/L	μmol /L	mmol/L	‰
10	0.21875	544	0.8	27.182	1.5	0.396	2.23	-11.7
20	0.3125	545	0.8	27.087	0.9	0.429	3.04	-11.9
30	0.59375	540	0.9	26.775	1.1	0.360	3.15	-11.7
40	0.20128	544	0.8	26.951	1.0	0.290	3.42	-9.0
50	0.3125	550	0.9	27.287	1.7	0.389	3.13	-10.7
65	0.15625	561	0.9	27.649	1.0	0.481	3.54	-10.5
80	0.15266	553	0.9	27.149	1.0	0.448	3.55	-10.5
95	0.15625	552	0.8	27.000	1.2	0.649	3.78	-10.4
110	0.15625	556	0.8	27.021	1.4	0.429	3.81	-10.6
125	0.15625	556	0.8	26.719	0.7	0.689	4.00	-11.7
140	0.3125	553	0.8	26.453	0.7	0.631	4.07	-11.4
170	0.15625	548	0.8	25.962	1.8	0.363	4.45	-11.7
185	0.15625	553	0.8	25.936	1.8	0.554	4.95	-10.5
200	0.21875	550	0.9	25.304	1.1	0.583	5.58	-10.5
215	0.3125	553	0.8	24.869	1.2	0.415	5.21	-10.5
229	0.15625	559	0.8	24.657	0.9	0.301	6.47	-10.4

Table S4. The profiles of porewater components of sediments GC09 (2)

Depth cm	Fe^{2+} μmol/L	Mn^{2+} μmol/L	Ti^{2+} μmol/L	Fe^{3+} μmol/L	Co^{2+} nmol/L	Cu^{2+} μmol/L	Zn^{2+} μmol/L	Al^{3+} mmol/L
10	0.518	5.396	0.357	40.347	12.621	14.341	2.519	2.930
20	1.393	8.599	0.332	41.901	9.094	15.241	1.257	2.248
30	0.824	13.352	0.418	48.664	10.322	16.656	1.632	10.158
40	0.598	11.106	0.42	40.986	8.318	15.335	2.031	3.042
50	1.151	9.744	0.337	41.186	7.141	14.622	1.249	1.984
65	0.627	10.538	0.345	42.090	8.167	16.062	2.009	12.122
80	0.582	8.728	0.343	38.440	6.432	15.891	1.577	8.224
95	0.691	12.416	0.389	43.086	8.062	15.298	2.371	4.620
110	0.832	13.32	0.372	46.219	8.429	15.236	1.829	3.235
125	1.046	10.584	0.347	41.720	7.332	13.779	2.547	13.824
140	0.929	10.158	0.322	41.844	6.224	13.468	1.848	7.666
170	0.965	10.01	0.332	45.778	6.13	13.157	2.027	3.157
185	1.171	12.374	0.326	49.807	7.557	10.753	2.073	3.540
200	0.711	9.965	0.325	47.973	6.312	12.598	1.67	2.998
215	0.981	11.13	0.379	52.039	7.496	16.017	2.265	3.695
229	0.99	7.805	0.331	44.577	5.861	14.528	1.183	6.587

Table S5. Student's t-test of bacteria on OTU level.

Estimators indexs	GC02-Means	GC09-Means	GC04-Means	P-value (GC02-GC09)	P-value (GC02-GC04)	P-value (GC04-GC09)
shannon	3.3397	4.0352	3.3521	0.01251	0.956	0.002513
simpson	0.1245	0.0841	0.1053	0.05201	0.3742	0.2778
chao	1164.5	2004	1322.9	0.0001099	0.2563	0.0006925

Table S6. Student's t-test of archaea on OTU level.

Estimators indexs	GC02-Means	GC09-Means	GC04-Means	P-value (GC02-GC09)	P-value (GC02-GC04)	P-value (GC04-GC09)
shannon	3.5933	4.4282	3.4537	7.349e-08	0.2217	1.571e-13
simpson	0.0746	0.0635	0.1041	0.2961	0.009948	0.0001055
chao	710.35	1793	659.83	6.53e-15	0.4196	6.78e-21

Table S7. Sample information statistics of bacteria in GC02

Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	39942	16586329	415.260353	204	503
20	40610	16654789	410.115464	334	499
30	46901	19210085	409.587962	229	496
40	49671	20294881	408.586117	203	498
50	50202	20667205	411.680909	230	486
60	72321	29750967	411.373833	232	471
70	50624	20887950	412.609632	219	485
90	52655	21488091	408.092128	239	499
100	46338	19116639	412.547779	203	486
110	56909	23238340	408.34209	245	468
120	47537	19364292	407.351999	244	492
130	38225	15954832	417.392596	262	448
140	43386	17728520	408.623058	263	514
150	40865	16685646	408.311416	359	468
160	41789	17086479	408.875039	361	469

Table S8. Sample information statistics of bacteria in GC04

Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	73664	30816261	418.335428	270	517
20	62645	26431945	421.932237	270	503
30	66714	28382727	425.438843	208	504
40	64272	27380200	426.005103	270	503
50	54824	23231439	423.745787	245	527
60	64979	27419684	421.977624	277	469
70	44943	19013105	423.049307	235	468
80	40792	17303945	424.199475	385	505
90	59509	25362109	426.189467	270	435
100	47772	20302003	424.977037	385	516
110	58633	25031564	426.91938	200	439
120	66875	28245282	422.359357	260	503
130	68345	28978995	424.010462	262	470
140	57495	24617969	428.175824	367	471
150	68281	29049879	425.44601	334	480
160	61409	26143460	425.726848	336	503
170	47961	20501995	427.472217	318	503
180	54648	23351198	427.301969	367	503
190	59236	25326971	427.560453	385	503
200	60084	25647133	426.85462	337	503
210	63611	27144369	426.72445	270	466

Table S9. Sample information statistics of bacteria in GC09

Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	40442	16846731	416.565229	353	511
20	36209	15075898	416.357756	317	504
30	53234	22312636	419.142578	212	520
40	54097	22915178	423.594247	209	482
50	41794	17550621	419.931593	217	511
60	48158	20369513	422.972569	213	466
70	46419	19540469	420.958422	232	513
80	38447	16205530	421.503108	209	504
90	47200	20103983	425.931843	202	491
100	45554	19134266	420.034816	209	485
110	30999	12880655	415.518404	375	516
120	34382	14610781	424.954366	244	486
130	42888	18234357	425.162213	203	478
140	36593	15540572	424.687017	212	499
150	44372	18835894	424.499549	245	469
160	44644	18892231	423.175141	212	478
170	45783	18909598	413.026626	244	539
180	63030	26317967	417.546676	230	499
190	43414	18082029	416.502257	205	436
200	43903	18729380	426.608204	222	483
210	36034	15433280	428.297719	208	471
220	41096	17435451	424.2615	208	503

Table S10. Sample information statistics of archaea in GC02

Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	31107	13346080	429.037837	231	508
20	36267	15286588	421.50131	200	524
30	47345	20324776	429.290865	209	528
40	52231	22417042	429.190366	227	508
50	50686	21754162	429.194689	205	528
60	41414	17774838	429.198773	244	534
70	32984	14154721	429.139007	212	520
80	36579	15699960	429.206922	224	519
90	52756	22639444	429.134961	222	540
100	56756	24357738	429.165868	203	509
110	42745	18268911	427.392935	203	511
120	41963	18031265	429.694374	212	468
130	51897	22293387	429.56986	218	527
140	47407	20361122	429.496108	255	528
150	55768	23948746	429.435268	273	520
160	47871	20547628	429.229137	236	528

Table S11. Sample information statistics of archaea in GC04

Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	66036	28339216	429.14798	201	522
20	60077	25780102	429.117666	214	501
30	53190	22814725	428.92884	260	515
40	40925	17557810	429.024068	202	509
50	70580	30283127	429.061023	201	493
60	61740	26498087	429.188322	248	520
70	61206	26227963	428.519475	234	502
70	39635	17007097	429.092898	207	528
80	72085	30932375	429.109732	284	490
90	70229	30124319	428.944154	223	523
100	65130	27939119	428.974651	207	483
110	40027	17176105	429.112974	275	501
120	49805	21375871	429.191266	220	486
130	59167	25388197	429.09387	203	500
140	49784	21355314	428.959385	259	528
150	62520	26830779	429.155134	217	493
160	53675	23028883	429.043	203	493
180	54125	23219390	428.995658	201	534
190	49966	21435492	429.001561	207	518
200	46444	19912112	428.733787	213	534
210	54344	23293859	428.637182	291	508

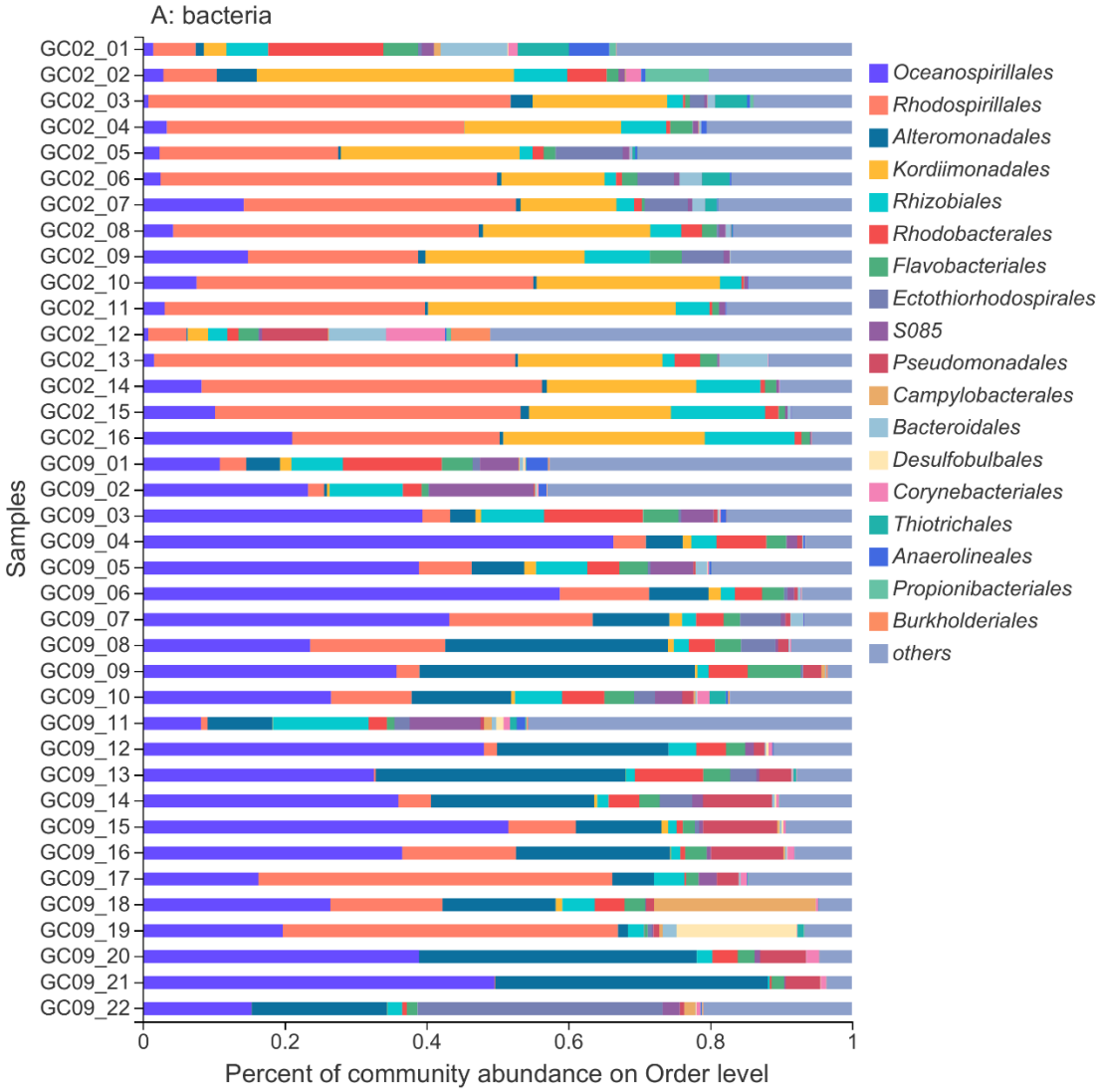
Table S12. Sample information statistics of archaea in GC09

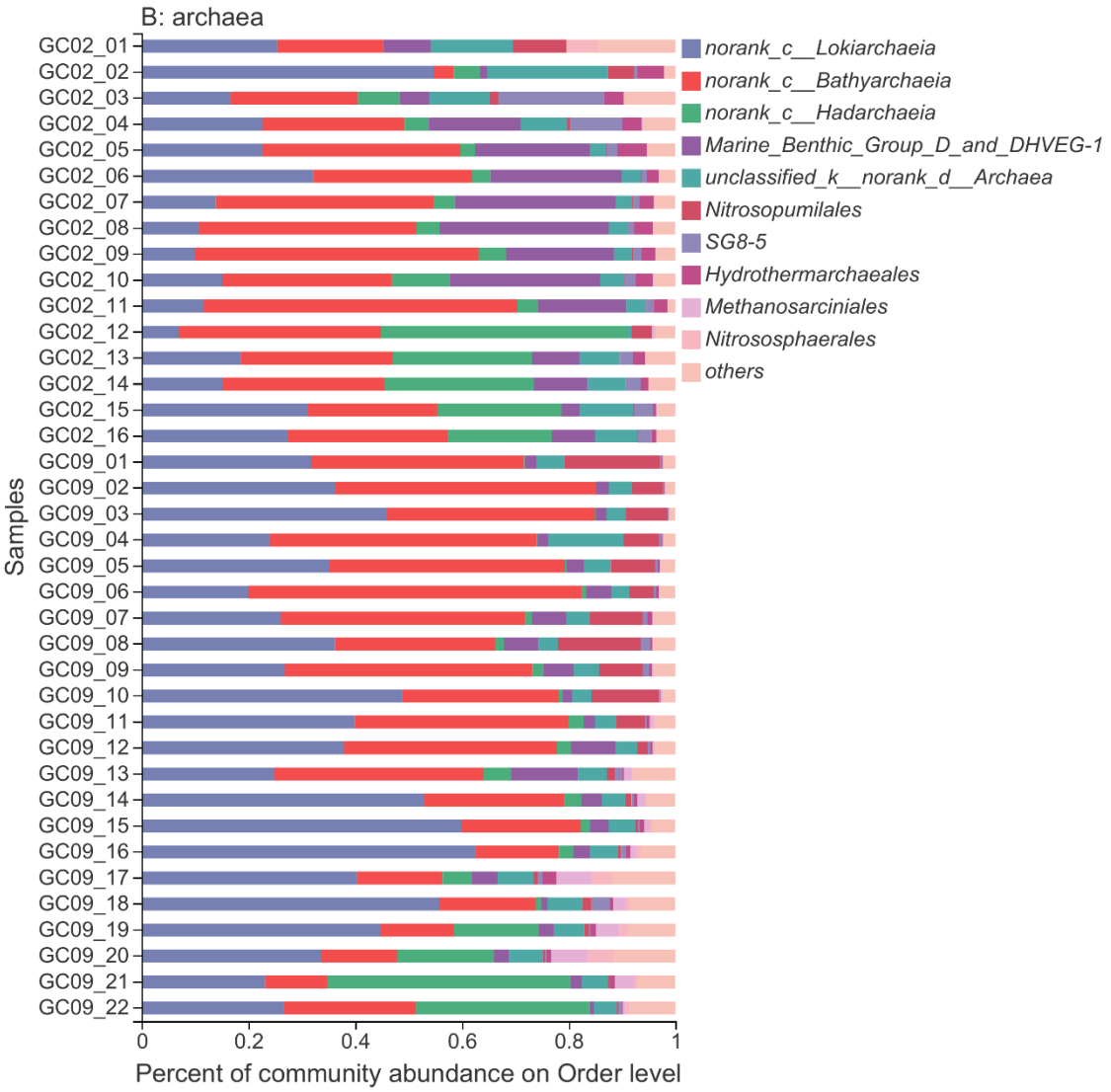
Depth	Seq-num	Base-num	Mean-length	Min-length	Max-length
10	45018	19311869	428.981052	268	528
20	60925	26144371	429.123857	217	516
30	63440	27212131	428.942796	284	509
40	49393	21011200	425.388213	223	513
50	50615	21719212	429.106233	246	504
60	48424	20778324	429.091442	219	521
70	43405	18624783	429.093031	211	539
80	45804	19663038	429.286482	272	530
90	32657	13991679	428.443488	201	525
100	48763	20932343	429.266924	211	505
110	53526	22979545	429.315566	258	526
120	73468	31525133	429.100193	220	536
130	38546	16540564	429.112333	207	539
140	56189	24110725	429.100447	207	516
150	44071	18919838	429.303578	200	539
160	41051	17620370	429.2312	260	514
170	41497	17815273	429.314722	200	516
180	36624	15718122	429.175459	202	534
190	50327	21607670	429.345481	204	523
200	54600	23418056	428.902125	211	528
210	41754	17936452	429.57446	209	529
220	32356	13888182	429.2305	222	520

Table S13. The screening results of environmental factors

environmental factors values	bacteria of GC02	environmental factors values	bacteria of GC09	environmental factors values	archaea of GC02	environmental factors values	archaea of GC09
Cl^-	2.91	SO_4^{2-}	2.23	Cl^-	2.23	SO_4^{2-}	2.73
SO_4^{2-}	4.96	Mn^{2+}	2.10	SO_4^{2-}	1.53	Mn^{2+}	1.51
DIC	1.50	S^{2-}	2.43	DIC	1.60	S^{2-}	3.46
NH_4^+	5.96	CH_4	1.59	NH_4^+	4.47	CH_4	4.65
CH_4	2.20	Fe^{2+}	1.50	CH_4	1.98	Fe^{2+}	2.31
Fe^{2+}	3.98	Fe^{3+}	4.41	Fe^{2+}	3.42	Fe^{3+}	3.38
Ti^{2+}	4.57	DIC	2.51	Mn^{2+}	4.98	DIC	2.67
Co^{2+}	3.87	Cu^{2+}	2.05	Ti^{2+}	3.87	Cu^{2+}	3.88
Zn^{2+}	5.68	-	-	Br^-	4.72	-	-

Fig. S1 Relative abundances of major (A) bacterial and (B) archaeal groups on Order level.

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GC02_02
GC02_03
GC02_04
GC02_05
GC02_06
GC02_07
GC02_08
GC02_09
GC02_10
GC02_11
GC02_12
GC02_13
GC02_14
GC02_15
GC02_16
GC09_01
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GC09_13
GC09_14
GC09_15
GC09_16
GC09_17
GC09_18
GC09_19
GC09_20
GC09_21
GC09_22
Samples
0
0.2
0.4
0.6
0.8
1
Percent of community abundance on Order level
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norank_c__Bathyarchaeia
norank_c__Hadarchaeia
Marine_Benthic_Group_D_and_DHVEG-1
unclassified_k__norank_d__Archaea
Nitrosopumilales
SG8-5
Hydrothermarchaeales
Methanosarciniales
Nitrososphaerales
others