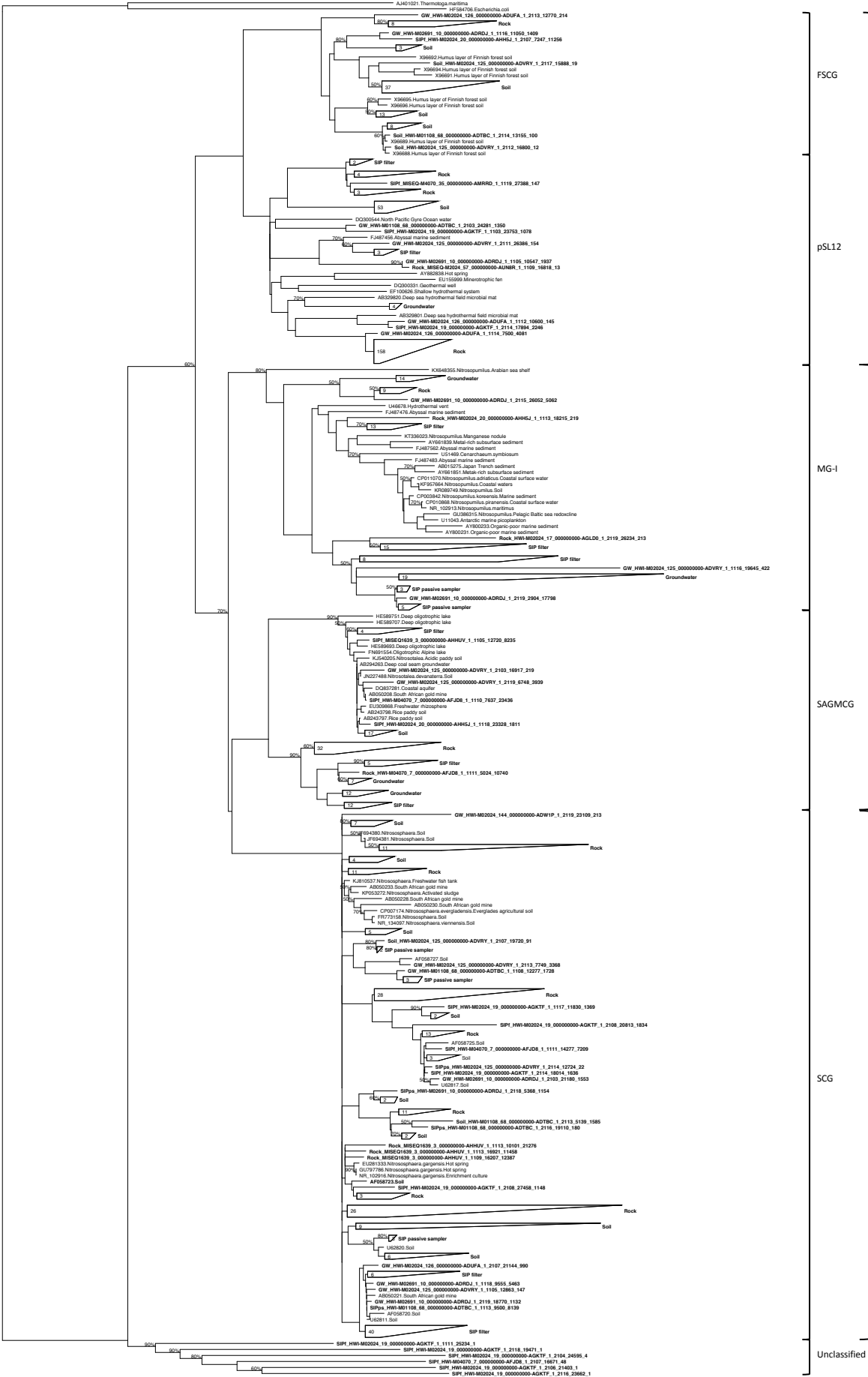


Figure S1.

(A)

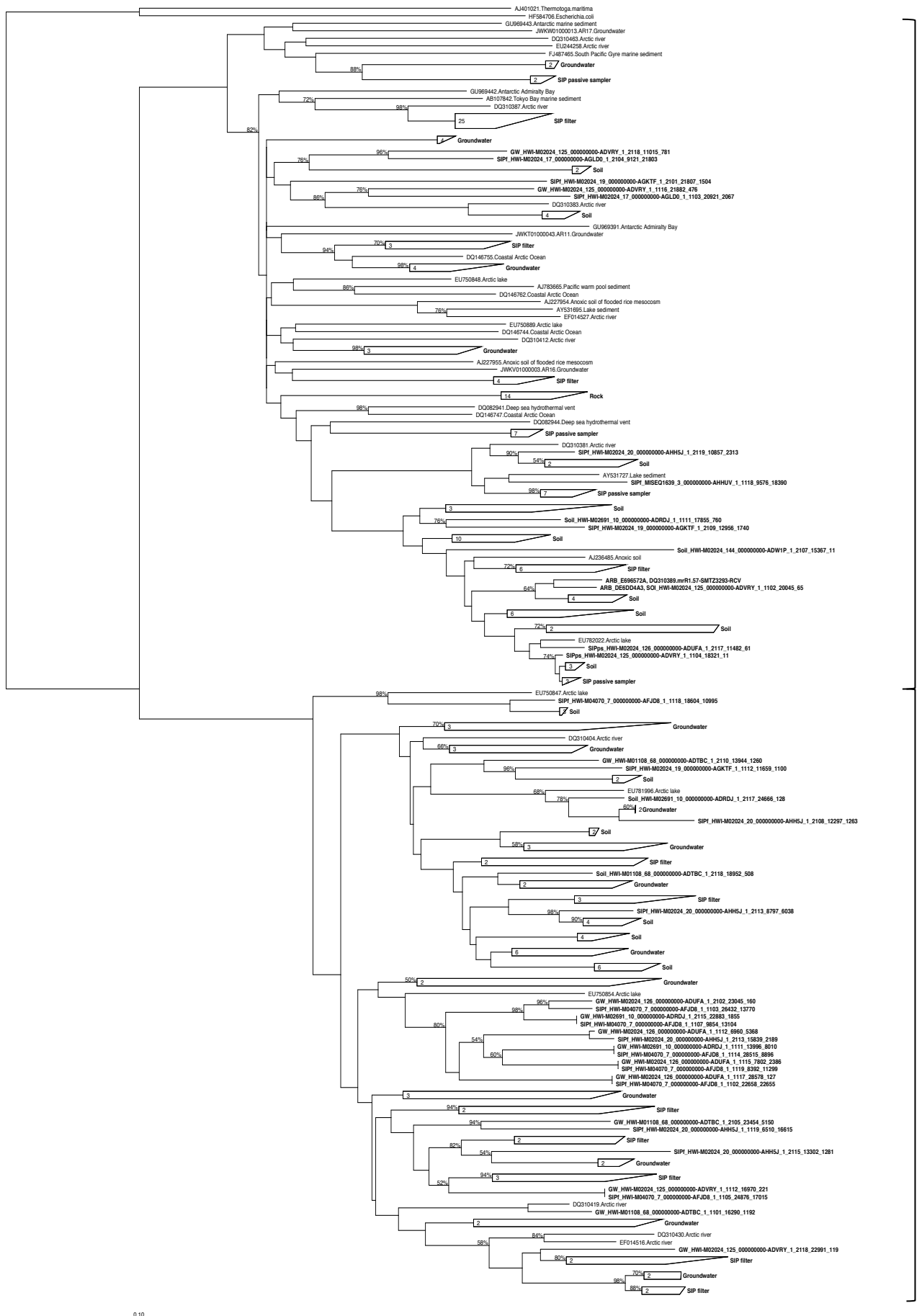


Phylogenetic tree of the 16S rRNA gene sequences of *Methanohalobium* and related genera. The tree is rooted at the top with A3401021 *Thermotoga maritima*. The sequences are labeled with accession numbers and sample identifiers. The tree is color-coded by clade: Methanosarcinales (green), Methanomicrobiales (blue), RC-III (orange), Thermoplasmatales (red), SITS412 (purple), VAL-III (brown), Methanobacteriales (pink), Hadesarchaea (grey), and VAL-II (yellow).

Key clades and sequences shown include:

- Methanosarcinales:** *Methanosarcina* species (e.g., NR_074232, NR_028042, SIP1_HWI-M02024_19_000000000-AGKTF_1_1118_19642_7352).
- Methanomicrobiales:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_17_000000000-AGLDO_1_2118_19993_2018, SIP1_HWI-M02024_19_000000000-AGKTF_1_1102_22854_1851).
- RC-III:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_15802_1862, SIP1_HWI-M02024_17_000000000-AGLDO_1_2103_14705_1921).
- Thermoplasmatales:** *Thermoplasma* species (e.g., AF050618, FJ484274).
- SITS412:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2119_12699_2127, HMI187523.SIT3412.Hanford formation saturated zone).
- VAL-III:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397, SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397).
- Methanobacteriales:** *Methanobacterium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397, SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397).
- Hadesarchaea:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397, SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397).
- VAL-II:** *Methanohalobium* species (e.g., SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397, SIP1_HWI-M02024_19_000000000-AGKTF_1_2117_26677_1397).

(C)



RC-V

DHVE-6

(D)

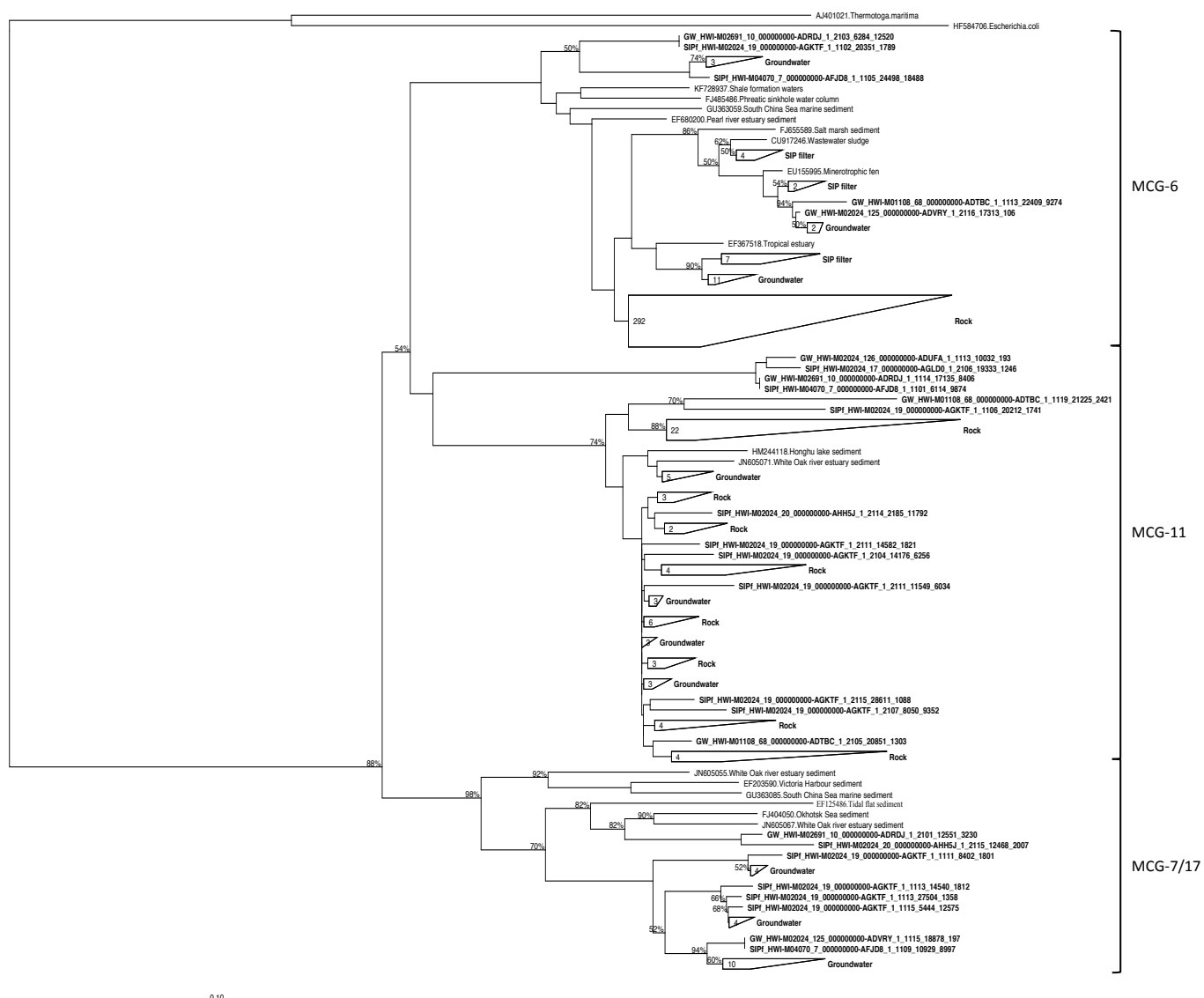
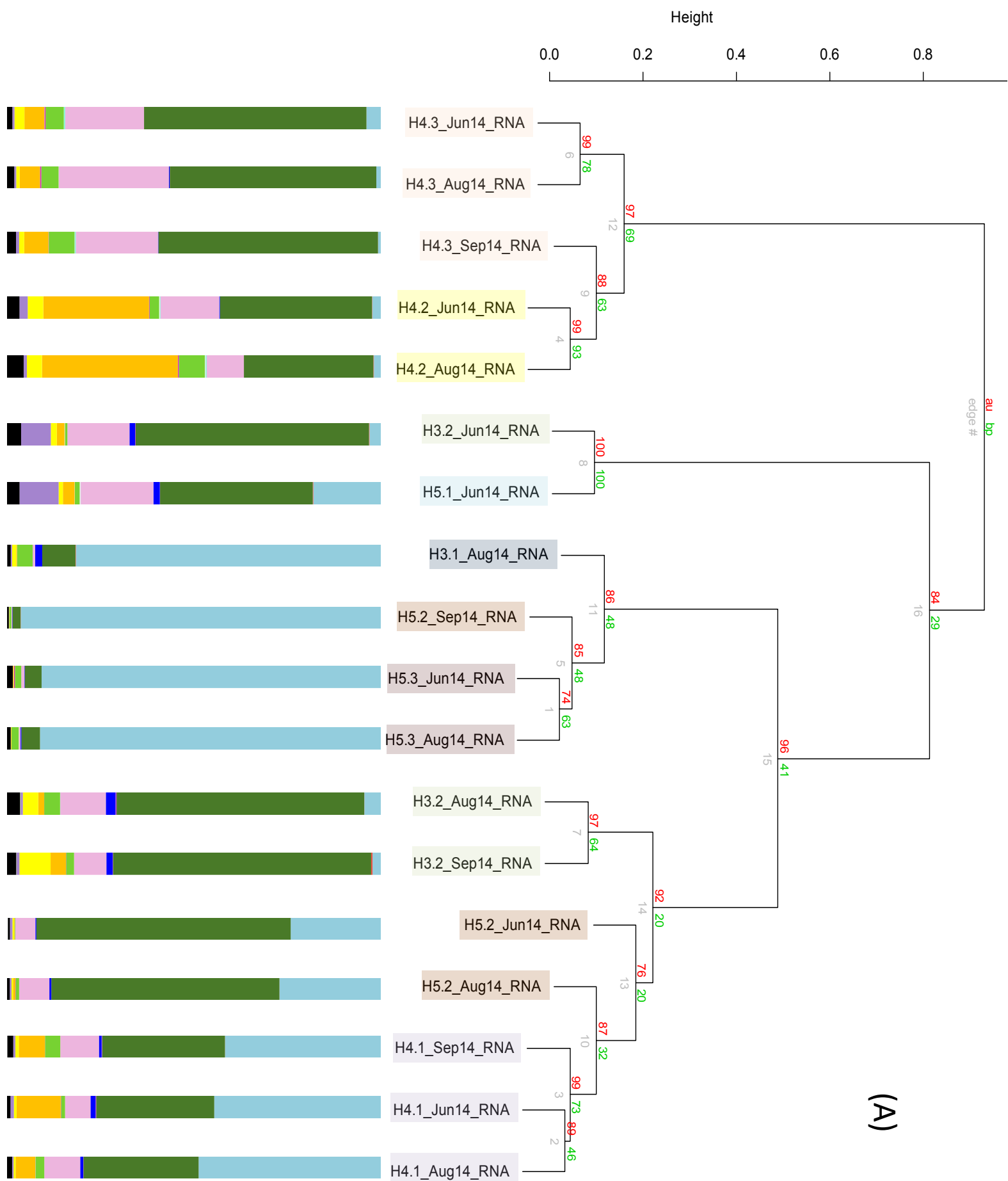


Figure S2.



(B)

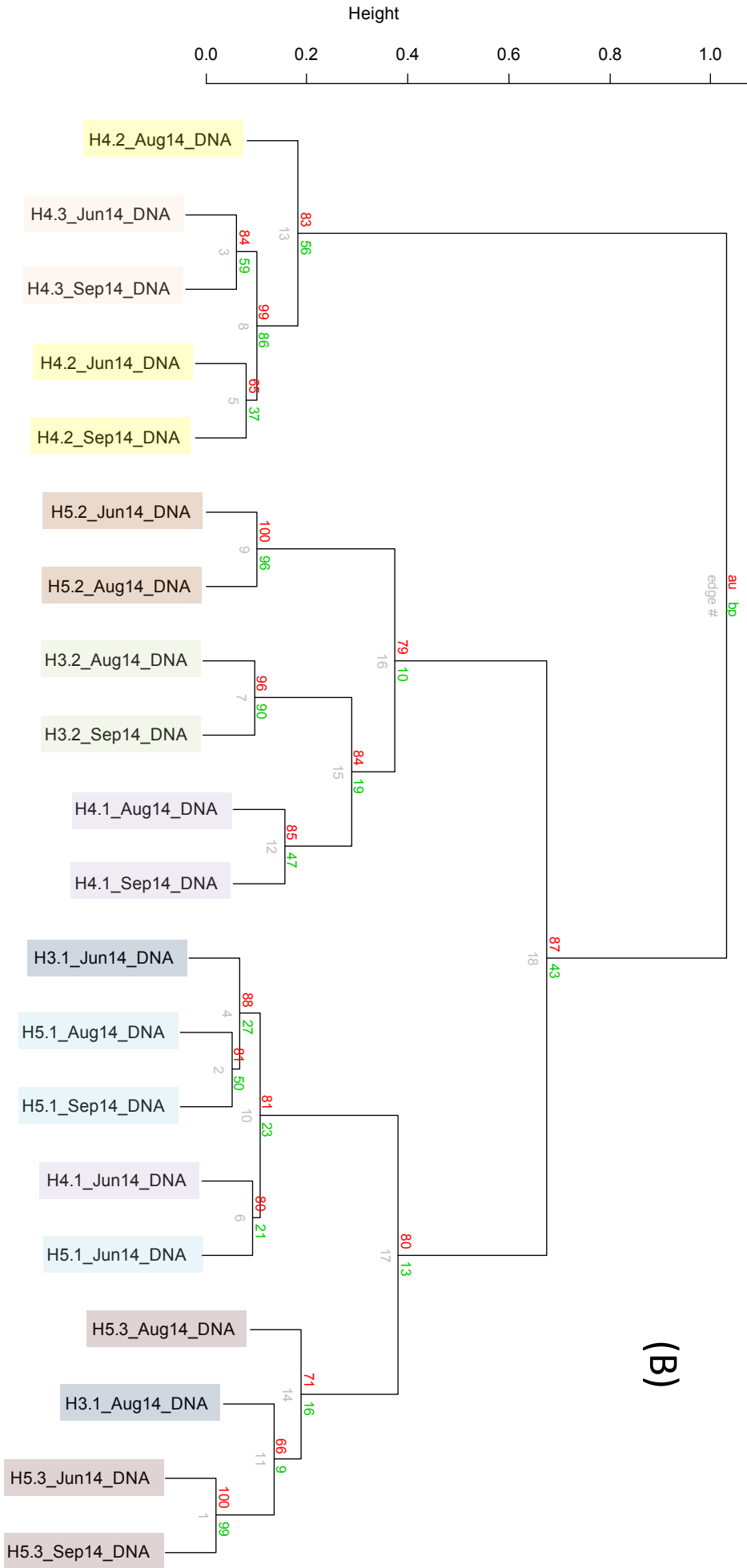
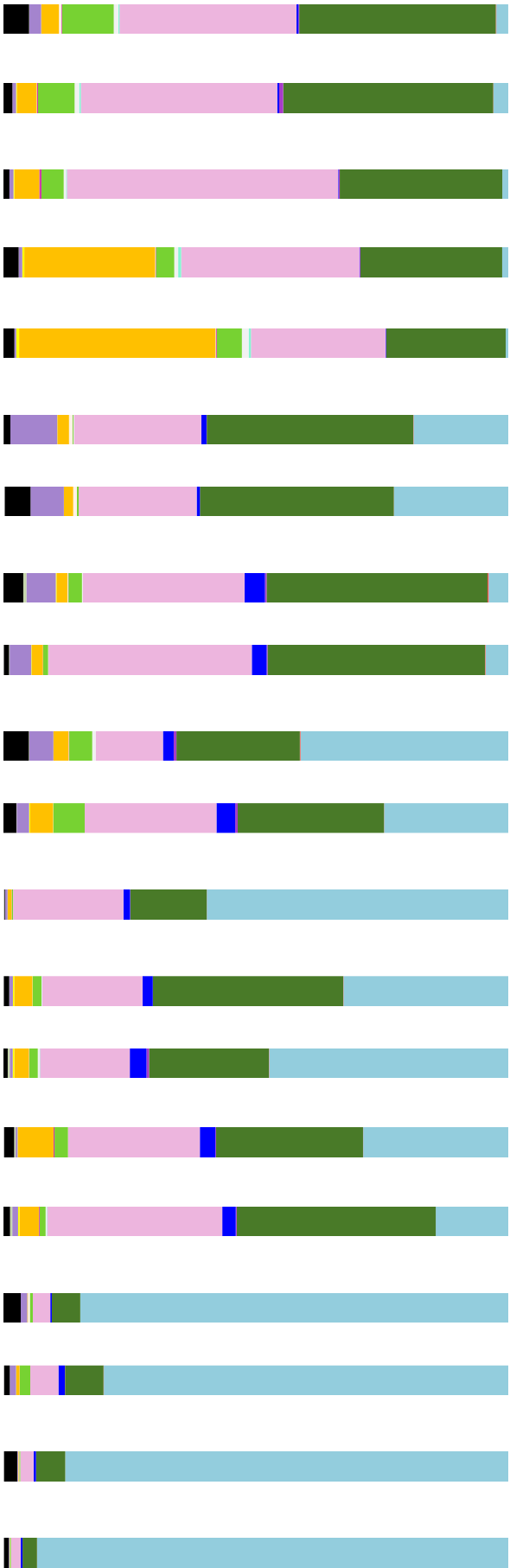


Figure S3.

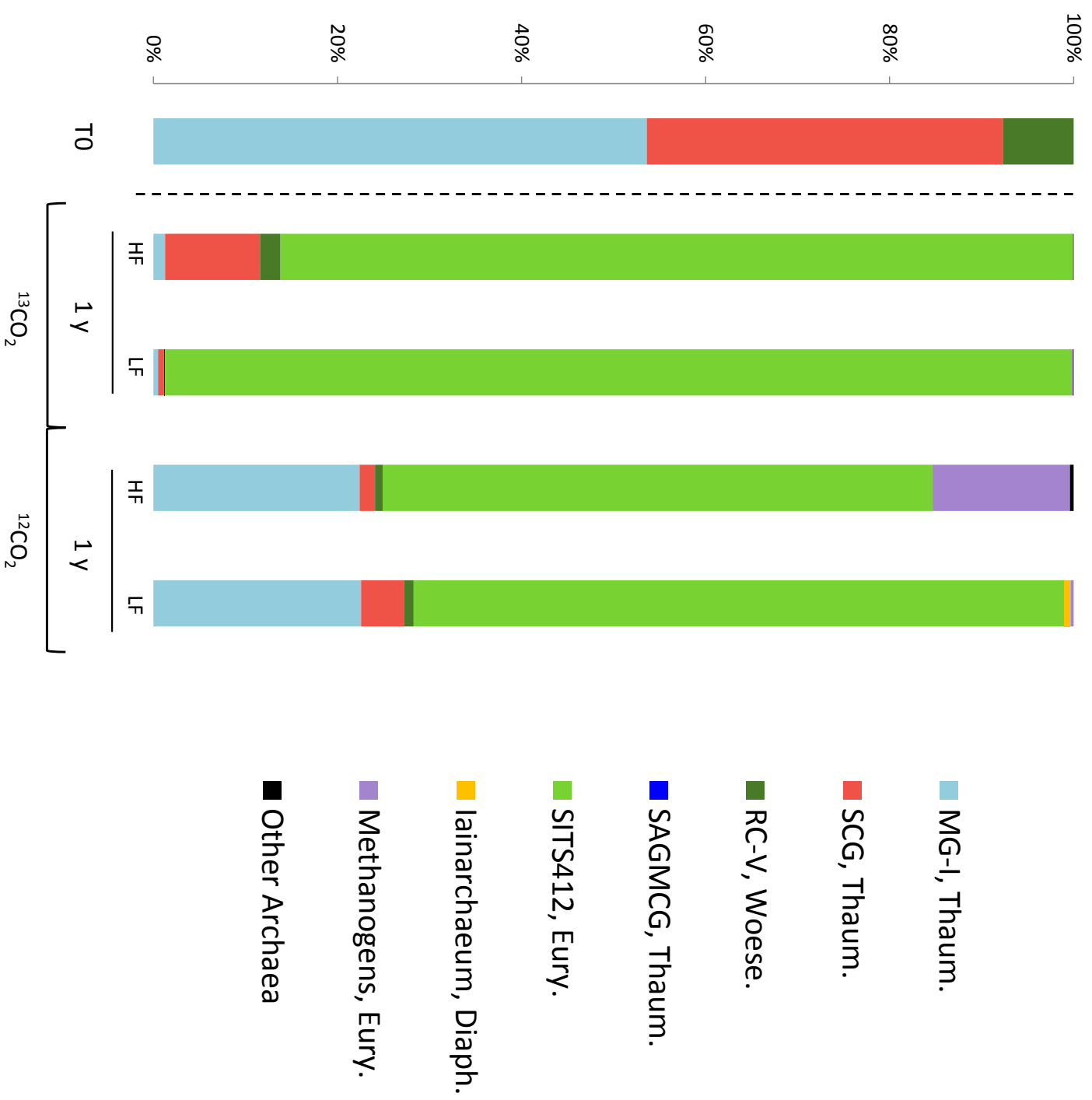


Figure S4.

Rock core sample ID	Site	Well	Depth (drilling meter below surface)	Lithostratigraphic unit	Rock type (limestone type)	Aquifer type
KS-20	H3	H3-1	1.70 - 1.80	Quaternary	Loess	Aquitard
KS-38	H3	H3-2	12.5 – 12.72	Upper Muschelkalk, Meissner formation	Limestone (grainstone)	Joint aquifer
KS-41	H5	H5-2/3	5.40 – 5.50	Lower Keuper, Erfurt formation	Siltstone	Aquitard
KS-3	H5	H5-1	7.24 – 7.35	Lower Keuper, Erfurt formation	Limestone-marlstone (mudstone)	Aquitard
KS-8	H5	H5-1	21.30 – 21.60	Lower Keuper, Erfurt formation	Silty sandstone, dolomitic	Porous aquifer
KS-51	H5	H5-2/3	50.40 – 50.53	Upper Muschelkalk, Meissner formation	Limestone (wackestone)	Joint aquifer

Table S1.

Well sampled	Material incubated	Substrate used for incubation	Time of incubation	Incubation conditions	Sample ID (bottle #)	# fractions obtained
H4-3	Filter	¹³ C-CO ₂	1 month	Anoxic	B1_4w (Duplicate 1)	11
H4-3	Filter	¹³ C-CO ₂	1 month	Anoxic	B2_4w (Duplicate 2)	11
H4-3	Filter	¹² C-CO ₂	1 month	Anoxic	B3_4w (Control)	11
H4-3	Filter	¹³ C-CO ₂	2 months	Anoxic	B1_8w (Duplicate 1)	11
H4-3	Filter	¹³ C-CO ₂	2 months	Anoxic	B2_8w (Duplicate 2)	11
H4-3	Filter	¹² C-CO ₂	2 months	Anoxic	B3_8w (Control)	11
H4-3	Filter	¹³ C-CO ₂	3 months	Anoxic	B1 (Duplicate 1)	12
H4-3	Filter	¹³ C-CO ₂	3 months	Anoxic	B2 (Duplicate 2)	12
H4-3	Filter	¹² C-CO ₂	3 months	Anoxic	B3 (Control)	12
H4-1	Filter	¹³ C-CO ₂	1 month	Oxic	B9_4w (Duplicate 1)	11
H4-1	Filter	¹³ C-CO ₂	1 month	Oxic	B10_4w (Duplicate 2)	11
H4-1	Filter	¹² C-CO ₂	1 month	Oxic	B11_4w (Control)	11
H4-1	Filter	¹³ C-CO ₂	2 months	Oxic	B9_8w (Duplicate 1)	11
H4-1	Filter	¹³ C-CO ₂	2 months	Oxic	B10_8w (Duplicate 2)	11
H4-1	Filter	¹² C-CO ₂	2 months	Oxic	B11_8w (Control)	11
H4-1	Filter	¹³ C-CO ₂	3 months	Oxic	B9 (Duplicate 1)	12
H4-1	Filter	¹³ C-CO ₂	3 months	Oxic	B10 (Duplicate 2)	12
H4-1	Filter	¹² C-CO ₂	3 months	Oxic	B11 (Control)	12
H4-1	Filter	¹³ C-Veratric acid	3 months	Oxic	B17 (Duplicate 1)	11
H4-1	Filter	¹³ C-Veratric acid	3 months	Oxic	B18 (Duplicate 2)	11
H4-1	Filter	¹² C-Veratric acid	3 months	Oxic	B19 (Control)	11
H4-1	Passive sampler	¹³ C-CO ₂	1 year	Oxic	B2p (Duplicate 1)	11
H4-1	Passive sampler	¹³ C-CO ₂	1 year	Oxic	B6p (Duplicate 2)	11
H4-1	Passive sampler	¹² C-CO ₂	1 year	Oxic	B12p (Control)	11
H5-2	Filter	¹³ C-CO ₂	5 weeks	Anoxic	B11_H5 (Duplicate 1)	12
H5-2	Filter	¹³ C-CO ₂	5 weeks	Anoxic	B12_H5 (Duplicate 2)	12
H5-2	Filter	¹² C-CO ₂	5 weeks	Anoxic	B13_H5 (Control)	12
H5-1	Filter	¹³ C-CO ₂	5 weeks	Oxic	B1_H5 (Duplicate 1)	12
H5-1	Filter	¹³ C-CO ₂	5 weeks	Oxic	B2_H5 (Duplicate 2)	12
H5-1	Filter	¹² C-CO ₂	5 weeks	Oxic	B3_H5 (Control)	12

Table S2.

		Top soil samples							
	H1	H2a	H2b	H3					
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	
FSCG	n.a.	96.83	28.33	79.6	0	0.04	0	0.01	
SCG	n.a.	0.45	59.38	3.65	99.87	97.72	99.94	99.14	
MG-I	n.a.	0	0	0.04	0.01	0	0	0	
RC-V	n.a.	1.59	3.91	4.07	0.05	0.84	0.02	0.12	
DHVE-6	n.a.	0	0	0	0.03	0.42	0	0.03	
Cand. lainarchaeum	n.a.	0.23	0	0	0	0	0	0	
SITS412	n.a.	0.11	7.74	12.35	0.05	0.52	0.04	0.12	
Hadesarchaea	n.a.	0.45	0	0.19	0	0.39	0	0	
PSL12	n.a.	0.06	0	0	0	0	0	0	
VAL-III	n.a.	0	0	0	0.01	0	0	0	
Methanogens	n.a.	0.17	0.4	0.08	0	0.06	0	0.57	
VAL-II	n.a.	0.11	0.24	0.04	0	0.01	0	0	
Total # sequences	258	1766	1257	2635	19982	14223	35985	23694	

Rock core samples						
	H3_1.7-1.8 m Aquitard DNA (%)	H3_12.5-12.72 m Joint aquifer DNA (%)	H5_3.5-4.5-5 m Aquitard DNA (%)	H5_7.24-7.35 m Aquitard DNA (%)	H5_21.16-21.3 m Porous aquifer DNA (%)	H5_50.4-50.53 m Joint aquifer DNA (%)
FSCG	0.66	0	0	0	0	0
SCG	91.21	0	0.87	0.58	0.19	77.9
MG-I	1.33	0.09	0.01	0	0	0
RC-V	0	0	0	0.04	0	0
SITS412	0.09	0	2.86	0	0	0
Hadesarchaea	0	0	0.27	0	0	21.54
MBG-A	0.08	0	0.24	56.43	25.07	0
PSL12	0.28	0	34.06	2.65	1.96	0
SAGMCG	5.13	99.91	0.02	0	0	0
MCG-6	0	0	0	39.66	0	0
MCG-11	0	0	0	0	72.03	0
VAL-III	0	0	12.32	0	0	0.01
Methanogens	0	0	0.34	0	0	0.17
DSEG	0	0	39.49	0	0	0
MBG-E	0	0	8.57	0	0	0
Group_1.1c	0	0	0.2	0.22	0.59	0
Unclassified	1.22	0	0.75	0.42	0.16	0.38
Total # sequences	11802	77103	50566	12551	61237	86725

Groundwater samples – August 2014									
	H3-1		H4-1		H5-1		H3-2		
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	
FSCG	0	0.02	0	0.1	n.a.	0.04	0.14	0.21	0.61
SCG	0.09	0.06	0	0.13	n.a.	0.04	0.02	0.21	
MG-I	81.71	80.29	48.85	41.36	n.a.	32.94	4.94	4.33	
RC-V	8.87	7.6	30.74	24.33	n.a.	37.6	65.81	43.56	
DHVE-6	0.68	5.57	9.58	13.27	n.a.	19.82	12.11	31.92	
Cand. Iainarchaeum	0.21	0.67	5.26	2.99	n.a.	3.6	1.58	2.16	
SITS412	4.17	2.06	2.35	4.54	n.a.	1.76	4.2	2.67	
Hadesarchaea	0	0.02	0.03	0.07	n.a.	0.04	0	0.16	
MBG-A	0	0	0	0.4	n.a.	0	0.04	0	
PSL12	0	0.04	0.05	0.13	n.a.	0	0.27	0.33	
SAGMCG	1.87	1.26	0.81	2.12	n.a.	2.04	2.55	4.02	
MCG-6	0	0	0	0	n.a.	0.04	0.05	0	
MCG-11	0	0	0	0.67	n.a.	0.08	0	0.14	
VAL-III	1.1	0.02	0.52	0	n.a.	0.25	4.09	0.16	
Methanogens	0.34	1.21	0.39	4.74	n.a.	0.69	0.59	5.79	
DSEG	0	0.04	0.03	0.07	n.a.	0	0.02	0.03	
MBG-E	0	0	0.47	0.87	n.a.	0	0.26	0.21	
MG-IV	0	0.02	0	0.34	n.a.	0	0.04	0.34	
VAL-II	0.71	0.67	0.65	0.74	n.a.	0.37	2.93	0.89	
RC-III	0.21	0	0.21	0.64	n.a.	0	0	0	
Group_1.1c	0	0.17	0	0.44	n.a.	0.16	0.02	0.95	
Unclassified	0.04	0.28	0.06	2.05	0	0.53	0.34	1.52	
Total # sequences	3258	4617	3822	2976	182	2447	9350	7046	

Groundwater samples – August 2014									
	H4-2		H4-3		H5-2		H5-3		
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	
FSCG	0	0.07	0	n.a.	0	0	0	0	
SCG	0.12	0.11	0	n.a.	0.01	0.04	0	0	
MG-I	1.98	2.35	1.56	n.a.	27.25	23.07	91.11	84.78	
RC-V	34.68	38.74	55.01	n.a.	60.92	38.32	4.96	5.61	
DHVE-6	9.98	34.89	29.31	n.a.	8.08	23.32	0.45	3.44	
Cand. Iainarchaeum	36.37	3.46	5.44	n.a.	0.64	1.84	0.14	0.13	
SITS412	6.95	10.2	4.6	n.a.	0.92	0.35	1.9	0.59	
Hadesarchaea	0	0.46	0	n.a.	0	0.74	0	0.39	
MBG-A	0	0.14	0.02	n.a.	0	0	0	0	
SAGMCG	0	0.39	0.23	n.a.	0.52	0.64	0.23	0.31	
MCG-6	0.29	0.25	0	n.a.	0	0	0	0	
MCG-11	0.18	0.89	0.05	n.a.	0	0	0.05	0	
VAL-III	4.03	0.04	0.88	n.a.	0.38	0	0.05	0	
Methanogens	0.88	2.32	0.52	n.a.	0.47	6.58	0.05	1.28	
DSEG	0.29	0.14	0.36	n.a.	0.08	0	0	0	
MBG-E	0	0.29	0.05	n.a.	0.07	0	0	0	
MG-IV	0	0.11	0	n.a.	0	0.18	0	0.14	
VAL-II	0.82	3.46	1.42	n.a.	0.41	1.17	0.99	1.01	
RC-III	1.69	0.39	0.2	n.a.	0	0.46	0	0	
Group_1.1c	0	0.29	0	n.a.	0	1.13	0	0.1	
Unclassified	1.74	1.01	0.35	n.a.	0.25	2.16	0.07	2.22	
Total # sequences	1717	2803	4433	188	7293	2827	2216	7131	

		Groundwater samples – June 2014							
		H3-1		H4-1		H5-1		H3-2	
		RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)
FSCG	0.03	0.04	0	0.29	0.01	0.44	0	0.13	0.01
SCG	0	0.02	0	0.03	0.13	0	0	0.13	0.01
MG-I	63.29	59.98	44.60	29.08	18.22	14.71	3.41	10.68	
RC-V	26.67	15.08	31.49	29.02	40.65	39.28	62.11	47.35	
DHVE-6	5.01	21.78	6.78	26.05	19.34	34.55	16.51	31.37	
Cand. lajnarchaeum	1.05	0.78	11.78	6.99	3.10	3.81	2.04	2.17	
SITS412	0.69	0.23	1.07	2.65	1.28	1.16	0.68	0.91	
Hadesarchaea	0	0.01	0	0	0.05	0.03	0.10	0	
MBG-A	0.01	0	0.09	0.13	0	0.13	0.06	0.08	
PSL12	0.05	0.06	0.09	0	0.06	0.06	0.06	0.10	
SAGMCG	0.61	1.32	1.34	3.07	1.71	2.65	1.49	4.39	
MCG-6	0	0.01	0	0	0.02	0.07	0	0	
MCG-11	0.01	0.01	0	0	0.26	0.24	0	0.03	
VAL-III	0.85	0.03	0.71	0.10	1.15	0.30	1.59	0.06	
Methanogens	0.24	0.47	0.89	0.39	10.38	1.14	7.91	1.53	
DSEG	0.03	0.04	0.09	0.20	0.02	0.15	0	0.13	
MBG-E	0.01	0.03	0.27	0.75	0.01	0.04	0.13	0.09	
VAL-II	1.37	0.10	0.80	0.52	2.69	0.86	2.47	0.50	
Unclassified	0.08	0.01	0	0.73	0.92	0.38	1.31	0.34	
Total # sequences	14333	11863	1121	3060	8190	6752	3083	10001	

Groundwater samples – June 2014									
	H4-2		H4-3		H5-2		H5-3		
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	
SCG	0.07	0	0	0.06	0	0.05	0	0	
MG-I	2.88	1.67	4.01	3.32	24.24	18.93	90.67	87.87	
RC-V	40.45	27.92	59.36	41.44	68.13	40.85	4.48	5.78	
DHVE-6	15.63	35.10	21.05	38.74	5.40	25.11	0.84	2.62	
Cand. laimarchaeum	28.11	25.76	5.27	3.89	0.14	2.30	0.19	0.09	
SITS412	2.53	3.61	4.85	7.21	0.14	0.18	1.68	0.18	
Hadesarchaea	0	0.08	0.05	0.06	0	0.71	0	0.12	
MBG-A	0	0.13	0	0.73	0	0.03	0	0	
PSL12	0	0.01	0	0.06	0	0.03	0	0	
SAGMCG	0.19	0.08	0	0.39	0.27	1.03	0.09	0.48	
MCG-6	0.19	0.59	0.33	0.34	0	0	0	0	
MCG-11	0.16	0.78	0.05	0.90	0	0.15	0	0.03	
VAL-III	4.15	0.40	2.66	0.17	0.47	0.03	0.09	0.03	
Methanogens	2.18	0.70	0.56	0.73	0.68	9.26	0	0.15	
DSEG	0.16	0.09	0.33	0.23	0	0.03	0.28	0.03	
MBG-E	0	0.18	0	0.06	0	0.10	0	0	
VAL-II	0.79	0.59	0.61	0.51	0.34	0.63	1.59	2.35	
Unclassified	2.51	2.31	0.87	1.16	0.19	0.58	0.09	0.27	
Total # sequences	4312	7736	2143	1776	1481	3963	1072	3355	

Groundwater samples – September 2014									
	H3-1		H4-1		H5-1		H3-2		
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	
FSCG	n.a.	n.a.	0.02	0.06	0.03	0.40	0.09	0.12	
SCG	n.a.	n.a.	0.02	0.03	0.05	0.04	0.36	0.10	
MG-I	n.a.	n.a.	41.90	25.01	30.72	47.76	2.47	4.66	
RC-V	n.a.	n.a.	32.80	28.79	46.16	23.57	68.85	43.05	
DHVE-6	n.a.	n.a.	10.31	25.94	14.47	17.67	8.63	40.26	
Cand. lainarchaeum	n.a.	n.a.	6.98	4.50	2.19	2.89	4.09	2.16	
SITS412	n.a.	n.a.	4.07	6.20	0.88	1.64	2.11	0.99	
Hadesarchaea	n.a.	n.a.	0	0.03	0.01	0.04	0	0	
MBG-A	n.a.	n.a.	0.04	0.03	0.03	0.04	0	0	
PSL12	n.a.	n.a.	0.09	0.46	0.01	0.44	0.09	0.17	
SAGMCG	n.a.	n.a.	0.72	3.69	1.71	3.28	1.66	2.93	
MCG-6	n.a.	n.a.	0	0	0.02	0.09	0	0	
MCG-11	n.a.	n.a.	0	0	0.05	0.36	0	0.07	
VAL-III	n.a.	n.a.	0.89	0.23	0.90	0.31	8.31	0.12	
Methanogens	n.a.	n.a.	0.56	2.45	0.81	0.58	0.76	4.29	
DSEG	n.a.	n.a.	0.04	0	0.11	0.04	0.04	0.05	
MBG-E	n.a.	n.a.	0.45	0.69	0.01	0	0.09	0.07	
VAL-II	n.a.	n.a.	0.96	0.78	1.71	0.44	2.34	0.36	
Unclassified	n.a.	n.a.	0.15	1.11	0.13	0.41	0.11	0.6	
Total # sequences	n.a.	n.a.	5528	3470	15822	2253	2225	4123	

Groundwater samples – September 2014								
	H4-2		H4-3		H5-2		H5-3	
	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)	RNA (%)	DNA (%)
FSCG	n.a.	0	0	0	0	0.03	n.a.	0
SCG	n.a.	0	0.03	0	0.05	0	n.a.	0.04
MG-I	n.a.	1.07	0.87	1.61	96.35	39.91	n.a.	93.44
RC-V	n.a.	23.43	58.65	32.02	2.17	32.62	n.a.	2.85
DHVE-6	n.a.	26.39	21.95	53.45	0.20	23.47	n.a.	1.92
Cand. laimarchaeum	n.a.	38.54	6.47	4.90	0.05	0.94	n.a.	0.06
SITS412	n.a.	4.92	6.87	4.38	0.53	0.26	n.a.	0.22
Hadesarchaea	n.a.	0.08	0	0	0	0.06	n.a.	0.02
MBG-A	n.a.	0.08	0.03	0.15	0.01	0.03	n.a.	0
PSL12	n.a.	0	0	0.06	0	0	n.a.	0
SAGMCG	n.a.	0.10	0.10	0.11	0.09	0.91	n.a.	0.38
MCG-6	n.a.	0.44	0.27	0.15	0	0	n.a.	0
MCG-11	n.a.	1.33	0.05	0.47	0	0.06	n.a.	0
VAL-III	n.a.	0.56	1.35	0.18	0.05	0.09	n.a.	0
Methanogens	n.a.	0.36	0.83	0.80	0.02	0.88	n.a.	0.12
DSEG	n.a.	0.18	0.10	0.44	0.02	0.09	n.a.	0
MBG-E	n.a.	0.08	0.18	0.11	0	0	n.a.	0
VAL-II	n.a.	0.56	1.22	0.54	0.43	0.35	n.a.	0.89
Unclassified	n.a.	1.88	1.03	0.63	0.03	0.3	n.a.	0.06
Total # sequences	n.a.	4964	7321	6649	13327	3400	n.a.	8324

Table S3.

Month sampled	Well	Oxygen saturation (%)	NO ₃ ⁻ (mg/L)	NH ₄ (mg/L)
June 2014	H3-2	27.1	27.72	0.04
	H4-2	0	0	0.20
	H4-3	0	0	0.12
	H5-2	0	9.56	0.43
	H5-3	0	0	0.75
	H3-1	31.9	28.53	0.01
	H4-1	37.4	14.50	0.11
	H5-1	25.3	12.21	0.10
August 2014	H3-2	21.7	40.21	0.08
	H4-2	0	0	0.31
	H4-3	0	0	0.20
	H5-2	0	0	0.47
	H5-3	0.2	0	0.77
	H3-1	43.3	32.69	0.12
	H4-1	43.6	17.06	0.23
	H5-1	29.1	15.46	0.01
September 2014	H3-2	17.2	32.33	0
	H4-2	0	0	0.15
	H4-3	0	0	0.05
	H5-2	0	0	0.51
	H5-3	0	0	0.77
	H4-1	51	9.84	0.13
	H5-1	30.3	8.45	0.03

Table S4.

SIP using filtered groundwater from site H4 (wells H4-1 and H4-3)

	¹³ CO ₂ _Duplicate 1_4 weeks_H41 (B9_4w)				¹³ CO ₂ _Duplicate 2_4 weeks_H41 (B10_4w)				¹² CO ₂ _Control 4 weeks_H41 (B11_4w)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction	
MG-I (Group 1.1a)_Thaumarchaeota	0.71	1.14	590	2227	0.81	1.30	297	966	1.61	206	1354	
RC-V_Woesearchaeota	1.32	0.89	44	192	0.76	0.51	17	111	0.67	19	201	
DHVE-6_Woesearchaeota	2.07	3.44	64	77	1.3	2.16	24	40	1.66	8	36	
SAGMCG (Group 1.1a)_Thaumarchaeota	0.91	1.18	47	156	2.04	2.66	36	50	1.31	20	115	
Total # reads	na	na	764	2974	na	na	387	1347	na	258	1903	

		¹³ CO2_Duplicate 1_4 weeks_H41 (B9_8w)				¹³ CO2_Duplicate 2_4 weeks_H41 (B10_8w)				¹² CO2_Control 4 weeks_H41 (B11_8w)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction		
MG-I (Group 1.1a)_Thaumarchaeota	0.06	0.37	1076	4193	0.11	0.69	455	1323	6.16	224	63		
DHVE-6_Woeseearchaeota	50.19	18.02	53	11	22.66	8.13	25	9	0.36	5	5		
SAGMCG (Group 1.1a)_Thaumarchaeota	4.19	1.52	43	103	2.76	1.00	16	45	0.36	5	5		
Total # reads	na	na	1230	4413	na	na	514	1441	na	239	89		

¹³ CO2_Duplicate 1_12 weeks_H41 (B9)												¹³ CO2_Duplicate 2_12 weeks_H41 (B10)						¹² CO2_Control_12 weeks_H41 (B11)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction										
MG-I (Group 1.1a)_Thaumarchaeota	0.21	0.24	1842	9972	0.14	0.16	427	1827	1.11	845	723										
RC-V_Woesearchaeota	5.23	3.39	425	548	6.29	4.08	134	101	0.65	71	92										
DHVE-6_Woesearchaeota	6.57	7.83	493	290	5.98	7.13	132	58	1.19	34	25										
SAGMCG (Group 1.1a)_Thaumarchaeota	0.91	0.99	45	178	1.38	1.51	19	34	1.09	35	28										
Total # reads	na	na	2884	11301	na	na	771	2060	na	1021	890										

¹³ C-V _A _Duplicate 1_12 weeks_H41 (B17)				¹³ C-V _A _Duplicate 2_12 weeks_H41 (B18)				¹² C-V _A _Control_12 weeks_H41 (B19)			
	ROOR	OR	Heavy Fraction	Light Fraction	ROOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction
MG-I (Group 1.1a)_Thaunarchaeota		na	na	na	6.26	3.94	310	325	0.63	103	425
RC-V_Woeseearchaeota		na	na	na	0.78	0.42	20	58	0.54	6	39
Total # reads	na	na	na	na	na	na	340	449	na	148	542

¹³ CO ₂ Duplicate 1.4 weeks_H43 (B1_4w)			¹³ CO ₂ Duplicate 2.4 weeks_H43 (B2_4w)			¹² CO ₂ Control_4 weeks_H43 (B3_4w)		
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction
MG-I (Group 1.1a)_Thaumarhaeota	0.77	1.79	170	138	0.98	2.3	187	368
RC-V_Woesearchaeota	1.87	1.43	436	468	1.43	1.09	409	2002
SITS412_Euryarchaeota	0.90	0.13	84	610	1.41	0.20	197	3194
DHVE-6_Woesearchaeota	0.68	2.62	406	269	1.70	6.54	366	384
Methanogens_Euryarchaeota	0.40	0.53	7	18	2.00	2.61	13	26
Subgroup 11 (MCG-11)_Bathyarchaeota					0.90	1.05	18	89
Subgroup 6 (MCG-6)_Bathyarchaeota	8.09	1.48	13	12	5.89	1.08	11	53
Total # reads	na	na	1173	1599	na	na	1277	6632

¹³ CO ₂ Duplicate 1.8 weeks_H43 (B1_8w)				¹³ CO ₂ Duplicate 2.8 weeks_H43 (B2_8w)				¹² CO ₂ Control_8 weeks_H43 (B3_8w)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction
MG-I (Group 1.1a)_Thaumarhaeota	0.06	1.10	164	310	0.15	2.87	669	378	18.95	277	96
RC-V_Woesearchaeota	0.07	0.83	322	726	0.14	1.74	947	869	12.66	389	227
SITS412_Euryarchaeota	0.07	0.07	11	280	0.09	0.08	246	2176	0.90	62	343
DHVE-6_Woesearchaeota	0.23	6.01	202	89	0.19	5.13	800	276	26.44	309	80
MCG subgroups_Bathyarchaeota	0.37	0.48	5	21	0.58	0.76	35	63	1.32	6	23
Total # reads	na	na	738	1508	na	na	2927	4037	na	1124	812

¹³ CO ₂ Duplicate 1.12 weeks_H43 (B1)				¹³ CO ₂ Duplicate 2.12 weeks_H43 (B2)				¹² CO ₂ Control_12 weeks_H43 (B3)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction
MG-I (Group 1.1a)_Thaumarhaeota	na	na	na	na	0.94	1.37	252	749	1.46	48	15
RC-V_Woesearchaeota	na	na	na	na	1.04	0.66	519	2685	0.63	168	100
SITS412_Euryarchaeota	na	na	na	na	2.65	0.30	159	1739	0.11	17	54
DHVE-6_Woesearchaeota	na	na	na	na	0.79	4.41	713	909	5.59	270	36
Cand. laiarhaeum_Diapherotrites	na	na	na	na	1.84	1.56	30	76	0.85	25	13
Total # reads	na	na	na	na	na	na	1824	7161	na	549	244

SIP using passive sampler material exposed in well H4-1

	¹³ CO ₂ _Duplicate 1 (B2p)				¹³ CO ₂ _Duplicate 2 (B6p)				¹² CO ₂ _Control (B12p)		
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction
SITS412_Euryarchaeota	na	na	na	na	1.68	0.09	1354	4595	0.05	144	210
MG-I (Group 1.1a)_Thaumarchaeota	na	na	na	na	5.06	2.60	20	23	0.51	54	67
SCG (Group 1.1b)_Thaumarchaeota	na	na	na	na	87.46	17.74	162	30	0.20	5	14
Total # reads	na	na	na	na	na	na	1572	4662	na	297	222

SIP using filtered groundwater from site H5 (wells H5-1 and H5-2)

	¹³ CO ₂ _Duplicate 1_5 weeks_oxic (B1_H5)				¹³ CO ₂ _Duplicate 2_12 weeks_oxic (B2_H5)				¹² CO ₂ _Control_12 weeks_oxic (B3_H5)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction	
MG-I (Group 1.1a)_Thaumarchaeota	0.03	0.16	24264	53577	0.03	0.17	31738	44817	5.5	28165	12779	
Unclassified Thaumarchaeota	1858.15	4.39	163	81	2148.11	5.07	971	258	0.0024	6	1297	
SAGMCG (Group 1.1a)_Thaumarchaeota	6899.15	8.20	158	42	3738.53	4.45	258	286	0.0012	5	2040	
Total # reads	na	na	24791	53763	na	na	34537	45483	na	29619	16408	

	¹³ CO ₂ _Duplicate 1_5 weeks_anoxic (B11_H5)				¹³ CO ₂ _Duplicate 2_5 weeks_anoxic (B12_H5)				¹² CO ₂ _Control_5 weeks_anoxic (B13_H5)			
	RoOR	OR	Heavy Fraction	Light Fraction	RoOR	OR	Heavy Fraction	Light Fraction	OR	Heavy Fraction	Light Fraction	
MG-I (Group 1.1a)_Thaumarchaeota	0.01	0.04	26136	27132	0.23	1.16	16703	19562	5.06	29793	50545	
Unclassified Thaumarchaeota	943.96	443.93	2766	6	1.93	0.91	422	548	0.47	8	29	
Total # reads	na	na	31131	27321	na	na	17898	21179	na	29832	50871	

Table S5.

			DOC (mg/L)		DIC (mg/L)		O ₂ (mg/L)		NH ₄ ⁺ (mg/L)		NO ₃ ⁻ (mg/L)		SO ₄ ²⁻ (mg/L)		
Well	Substrate	Sample	TO	Te	TO	Te	TO	Te	TO	Te	TO	Te	TO	Te	
H4-3	13CO2_1	Anoxic	B1	4.3	2.5	na	na	na	na	0.1	nd	0.4	<0.1	39.3	39.2
H4-3	13CO2_2	Anoxic	B2	4.3	2.7	na	na	na	na	0.1	nd	0.4	nd	39.3	37.8
H4-3	12CO2	Anoxic	B3	4.3	2.3	na	na	na	na	0.1	nd	0.4	<0.1	39.3	41.1
H5-2	13CO2_1	Anoxic	B1_H5	0.7	0.9	na	na	na	na	0.4	nd	3.1	1.3	95.3	89.7
H5-2	13CO2_2	Anoxic	B2_H5	0.7	1.8	na	na	na	na	0.4	<0.1	3.1	1.8	95.3	86.4
H5-2	12CO2	Anoxic	B3_H5	0.7	1.3	na	na	na	na	0.4	<0.1	3.1	0.7	95.3	89
H4-1	13CO2_1	Oxic	B9	1.4	2.2	na	na	8.6	7.9	<0.1	<0.1	11.6	13.4	104.7	111.6
H4-1	13CO2_2	Oxic	B10	1.4	2.5	na	na	8.6	7.8	<0.1	<0.1	11.6	13.7	104.7	115.2
H4-1	12CO2	Oxic	B11	1.4	2.2	na	na	8.2	6.8	<0.1	<0.1	11.6	12.9	104.7	109.6
H4-1	13C-VA_1	Oxic	B17	na	na	72.2	65.4	8.9	7.9	<0.1	<0.1	11.6	11.8	104.7	110.5
H4-1	13C-VA_2	Oxic	B18	na	na	72.2	66.4	8.8	7.8	<0.1	<0.1	11.6	10.9	104.7	107.7
H4-1	12C-VA	Oxic	B19	na	na	72.2	50.2	8.8	7.8	<0.1	<0.1	11.6	10.3	104.7	107.2
H5-1	13CO2_1	Oxic	B11_H5	0.9	1.4	na	na	8.	7.4	<0.1	<0.1	7	6.8	316.4	296.1
H5-1	13CO2_2	Oxic	B12_H5	0.9	1.6	na	na	8.2	7.4	<0.1	<0.1	7	7	316.4	303.1
H5-1	12CO2	Oxic	B13_H5	0.9	1.8	na	na	8.2	8	<0.1	<0.1	7	6.9	316.4	297.8

Table S6.