Supplemental Table 1: Diversity indices of MGC from three Seamounts.

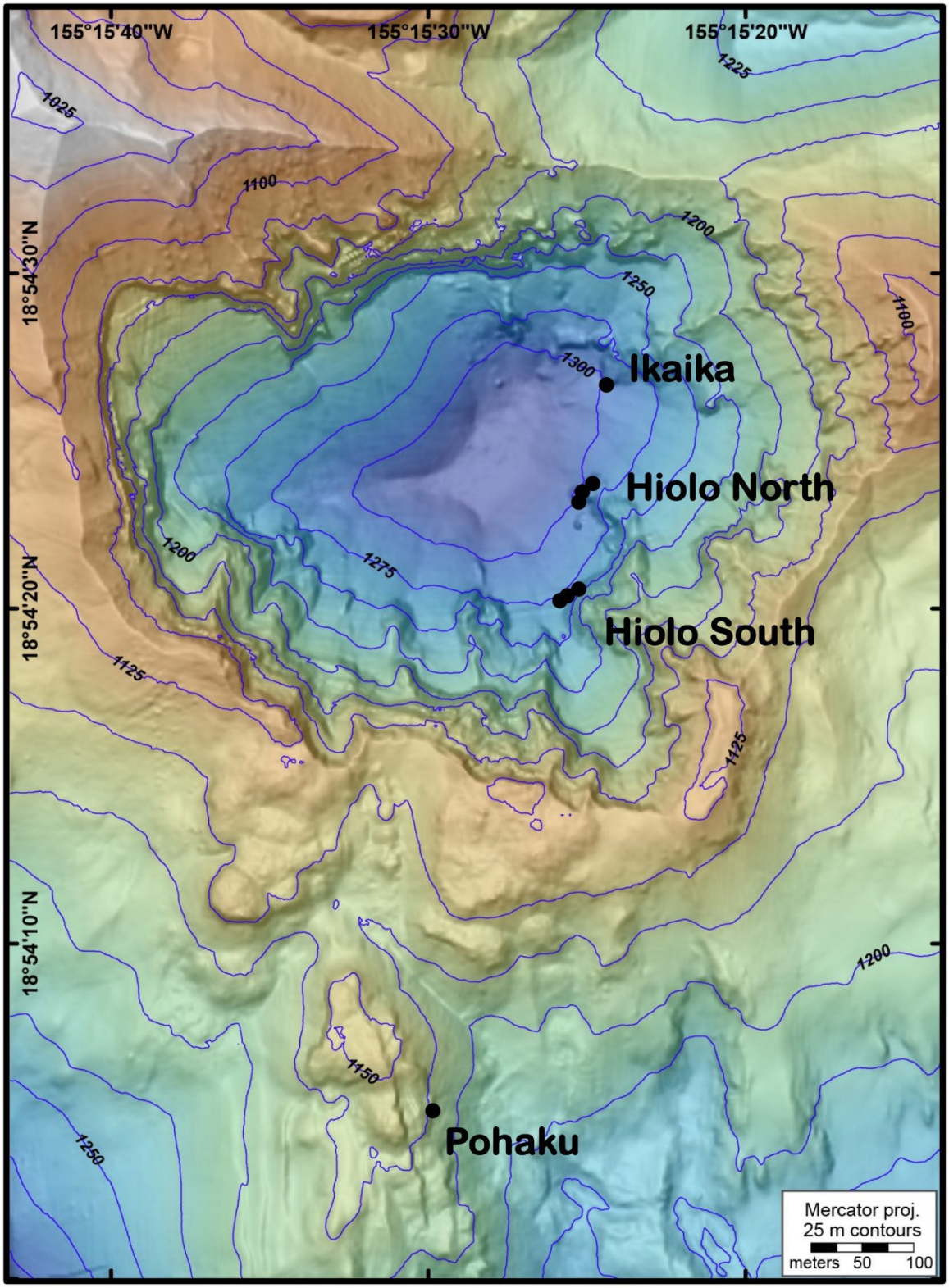
MGC	Duration	Observed	Chao1	ACE	Shannon	Simpson	InvSimpson	Fisher
AxMGC.01	2	117	117.0	117.2	2.2	0.7	2.9	13.5
AxMGC.03	4	1278	1300.8	1302.2	4.1	1.0	21.0	165.9
AxMGC.05	16	102	102.0	102.0	3.0	0.9	11.4	12.0
AxMGC.08	2	840	863.8	863.4	3.2	0.8	5.2	110.1
AxMGC.10	14	186	186.0	186.0	3.8	1.0	20.6	22.5
AxMGC.18	12	861	884.0	883.9	3.1	0.9	7.4	108.1
AxMGC.36	5	983	1005.2	1008.2	2.3	0.7	3.5	118.2
AxMGC.38	5	626	643.1	642.7	2.0	0.7	3.2	75.9
AxMGC.43	5	449	473.9	470.4	3.0	0.9	10.7	55.8
AxMGC.44	7	617	636.1	636.1	3.7	0.9	18.2	78.4
AxMGC.47	7	843	862.6	858.0	4.5	1.0	25.6	122.6
AxMGC.66	19	1144	1158.6	1159.3	4.8	1.0	33.3	165.1
ExMGC.03	4	544	554.3	555.1	3.8	0.9	15.4	70.8
ExMGC.04	4	140	140.0	140.0	3.5	0.9	18.8	16.0
LMGC.03	4	1791	1813.4	1812.6	4.1	0.9	16.0	266.7
LMGC.04	4	1012	1044.3	1041.8	3.6	0.9	14.5	144.6
LMGC.05	4	947	982.0	975.7	3.4	0.9	12.7	126.9
LMGC.07	4	1534	1557.3	1560.8	3.8	0.9	13.8	203.3
LMGC.08	4	1022	1065.5	1058.5	3.7	0.9	16.6	136.4
LMGC.09	4	1728	1767.5	1762.9	4.8	0.9	19.8	232.3
LMGC.10	4	996	1024.7	1025.1	3.3	0.9	9.4	132.7
LMGC.89	5	202	202.1	202.7	2.7	0.8	6.3	21.5
LMGC.90	8	1382	1421.1	1409.0	2.9	0.8	5.5	178.8
LMGC.91	5	107	107.5	107.5	3.2	0.9	13.4	13.0
LMGC.92	9	1074	1121.7	1105.4	2.4	0.8	4.4	134.7
LMGC.93	8	242	242.1	242.4	3.6	1.0	21.2	28.5
LMGC.94	8	931	954.5	950.9	2.7	0.8	5.5	115.2
LMGC.96	8	129	129.3	129.6	3.5	0.9	16.5	17.7
LMGC.97	9	756	785.1	777.6	2.8	0.8	6.1	98.5
LMGC.98	9	281	281.0	281.0	3.9	1.0	25.9	33.3
LMGC.L10	4	339	353.5	351.5	2.9	0.9	8.0	38.4
LMGC.L7	4	796	819.3	822.7	3.6	0.9	16.9	108.8
LMGC.L9A	4	207	226.9	226.7	2.9	0.9	9.7	24.2

Supplemental Table 2: Summary of the PERMANOVA analyses based on euclidean distance of ASVs for bacterial communities for the MGCs with associated geochemical measurements

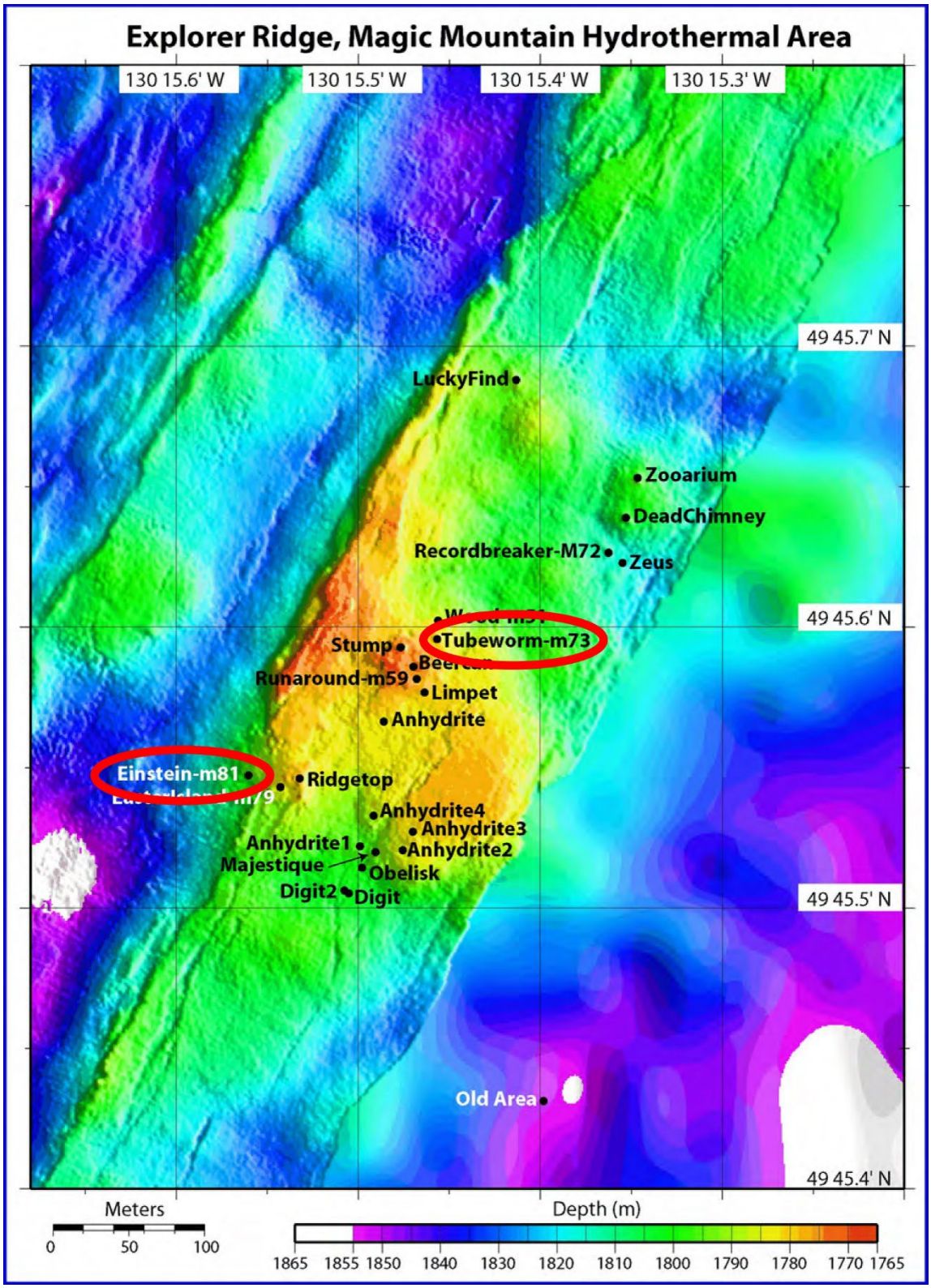
Factor	p-value for Group Dispersions	p-value for Permutational ANOVA
Duration	0.003**	NA
Seamount	0.206	0.001***
Year	0.367	0.001***
Marker	0.027*	NA
Temperature	0.23	0.007**
pH	0.163	0.07
H_2S	0.072	0.034*
dFe	0.154	0.001***
Mn	0.163	0.144

Supplemental Table 3: Taxomonic identification of most abundant taxa

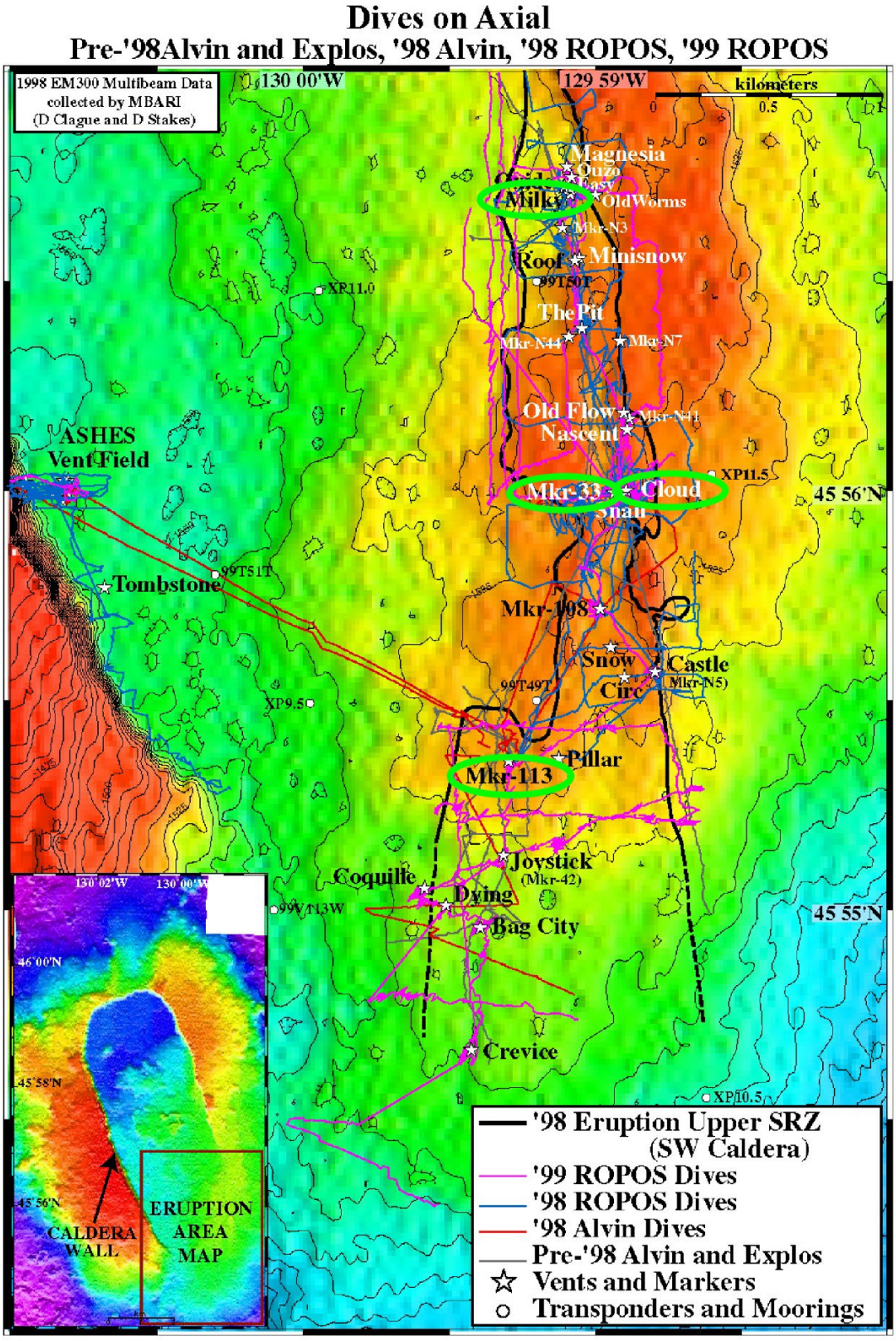
ASV	domain	phylum	class	order	family	genus	zOTU
ASV_1	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-02
ASV_10	Bacteria	Nitrospirota	Thermodesulfovibrionia	Thermodesulfovibrionales	Thermodesulfovibrionaceae	Thermodesulfovibrio	
ASV_11	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_12	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-01
ASV_13	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-11
ASV_14	Bacteria	Proteobacteria	Alphaproteobacteria	Rhodobacterales	Rhodobacteraceae	Roseobacter clade Marinomonas lineage	
ASV_15	Bacteria	NA	NA	NA	NA	NA	
ASV_16	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_17	Bacteria	Deinococcota	Deinococci	Thermales	Thermaceae	Vulcanithermus	
ASV_18	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_19	Bacteria	Proteobacteria	Gammaproteobacteria	Thiomicrospirales	Thiomicrospiraceae	Galenea	
ASV_2	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_20	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_21	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_22	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-02
ASV_23	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_24	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Nitratiruptoraceae	Nitratiruptor	
ASV_25	Bacteria	Aquificota	Aquificae	Aquificales	Aquificaceae	Hydrogenivirga	
ASV_26	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-59
ASV_27	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-02
ASV_28	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-02
ASV_29	Bacteria	Proteobacteria	Gammaproteobacteria	Pseudomonadales	Pseudomonadaceae	Pseudomonas	
ASV_3	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_30	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_31	Bacteria	Proteobacteria	Gammaproteobacteria	Nitrococcales	Halorhodospiraceae	Sulfurivirga	
ASV_33	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_35	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_36	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-07
ASV_37	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_38	Bacteria	Aquificota	Aquificae	Aquificales	Aquificaceae	Aquifex	
ASV_39	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_4	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-02
ASV_40	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-37
ASV_42	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_43	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurovaceae	Sulfurovum	
ASV_5	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-01
ASV_56	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_6	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Sulfurimonadaceae	Sulfurimonas	
ASV_7	Bacteria	Proteobacteria	Zetaproteobacteria	Mariprofundales	Mariprofundaceae	Mariprofundus	zOTU-06
ASV_8	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Nitratiruptoraceae	Nitratiruptor	
ASV_9	Bacteria	Campilobacterota	Campylobacteria	Campylobacterales	Thioreductoraceae	Thioreductor	



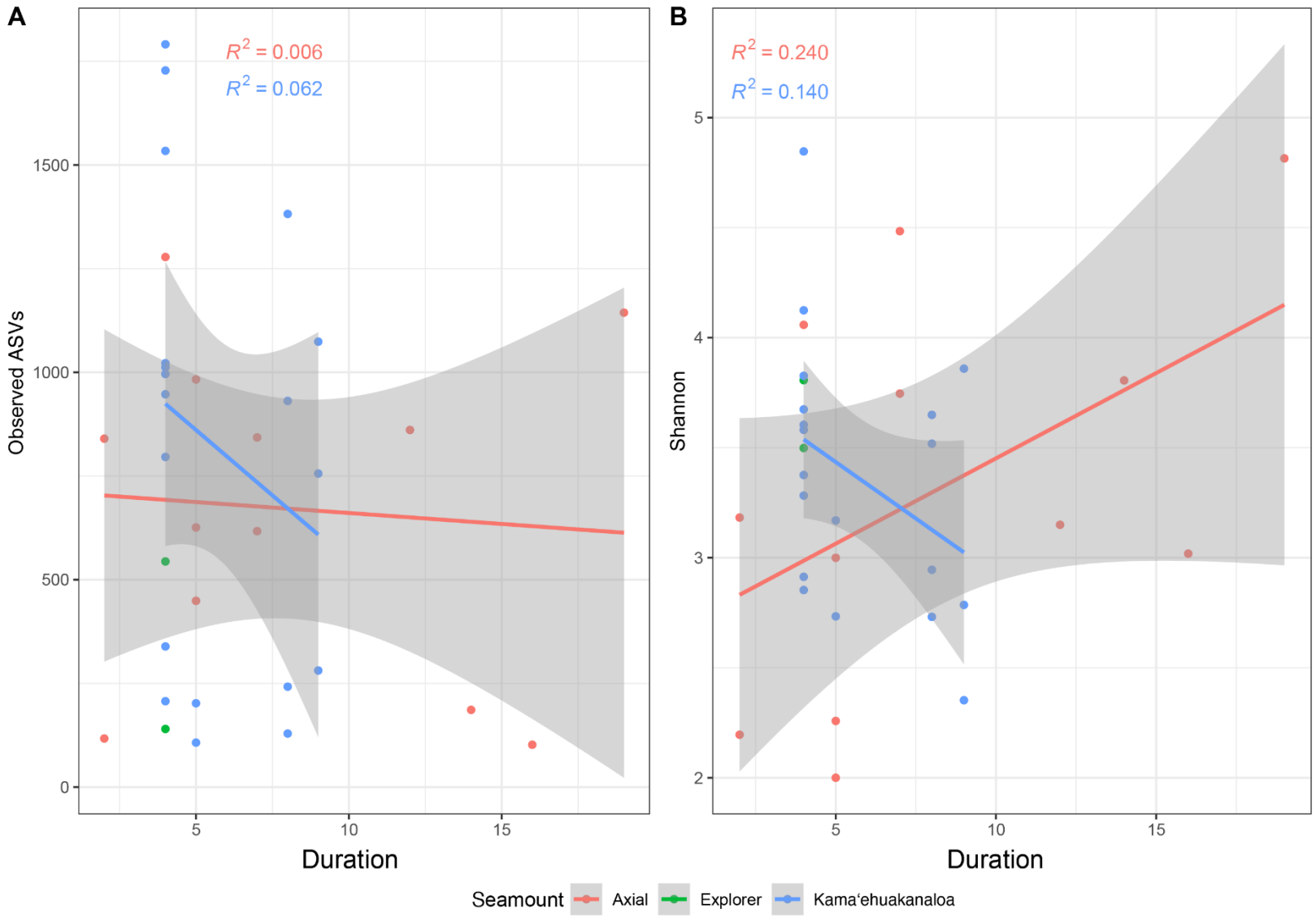
Supplemental Figure 1. Map of Kamaʻehuakanaloa Seamount. Markers 31, 36, and 39 make up Hiolo North, Markers 34 and 38 make up Hiolo South, Marker 11 is at Ikaika, and Pohaku is at Marker 57. Adapted from Fullerton et al., 2017.



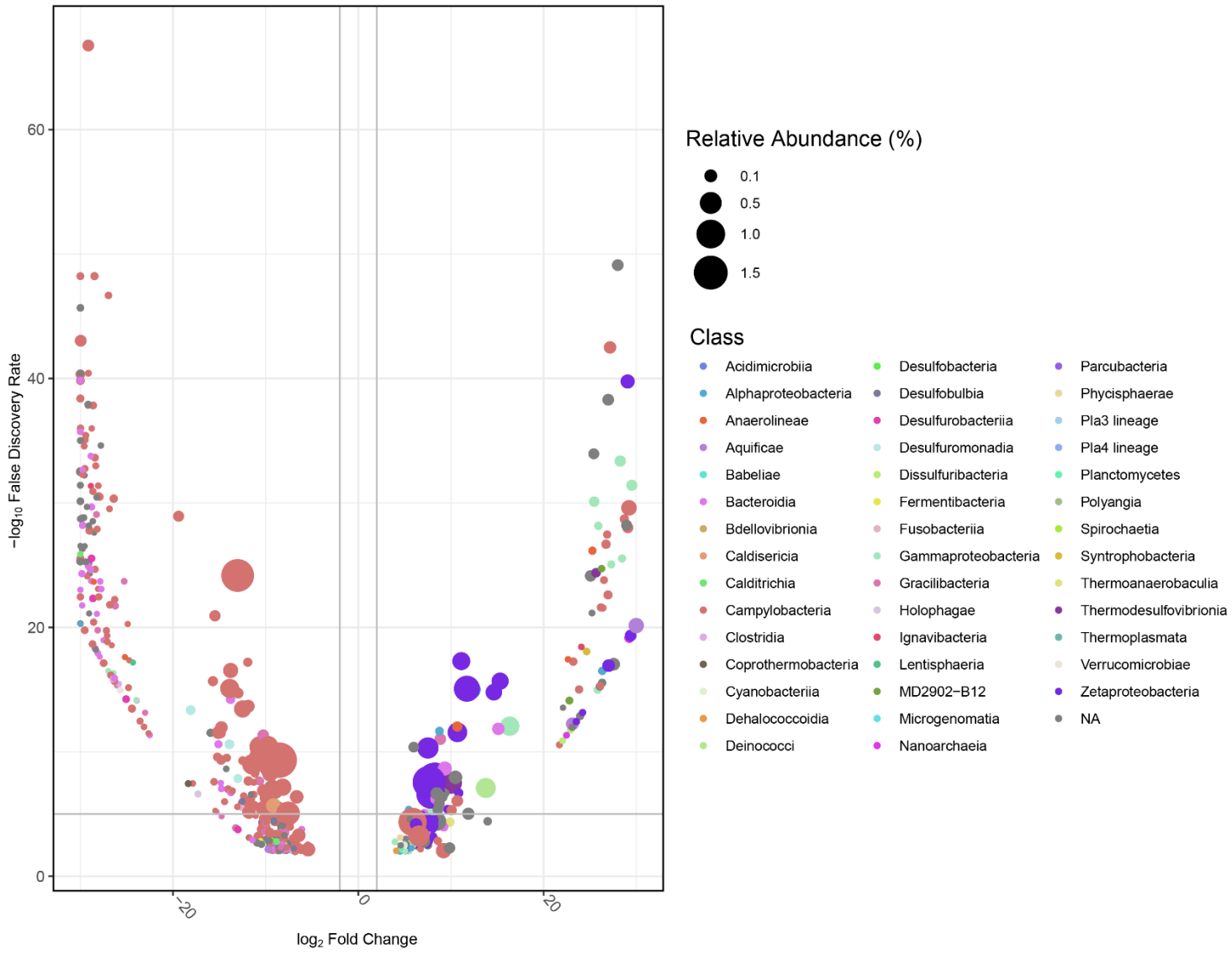
Supplemental Figure 2. Map of the Magic Mountain Hydrothermal Areas of Explorer Ridge with Markers 73 and 81 highlighted.



Supplemental Figure 3. Map of Axial Seamount with Marker 33, Cloud, Milky, and Marker 113 highlighted.



Supplemental Figure 4. Observed ASVs (A) and Shannon (B) as a function of MGC incubation duration at Axial, Magic Mountain, and Kama‘ehuakanaloa Seamount sites.



Supplemental Figure 5. Differentially abundant ASVs as determined by DeSEQ2. The size of the dot corresponds to the relative abundance of the ASV across all MGCs and the color corresponds to taxonomic class.