Supplementary Information

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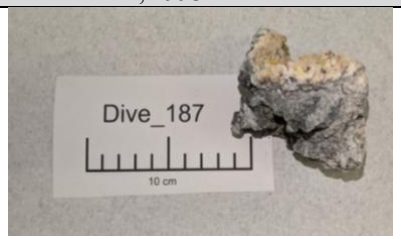
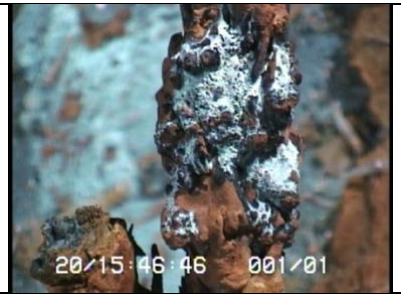
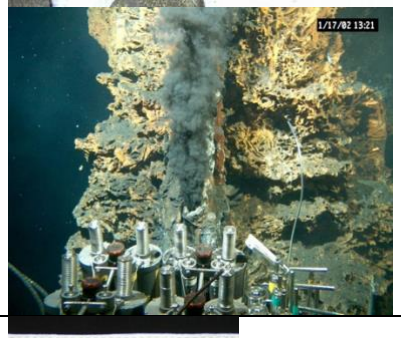
Table S2. Environmental metadata and sample features associated with the DSV70 metagenomes. Additional details are available in the metadata links and select cruise reports.

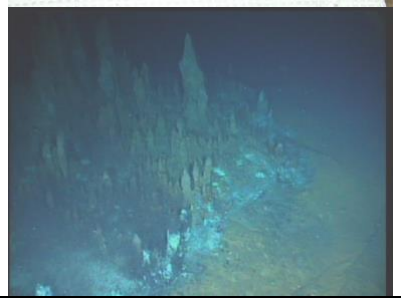
Metagenome ID	Image	Description	Other citation(s)	Metadata link(s)
Y93-03, Mariana Backarc Basin, 1993				
Dive_187		Iron sulfide chimney (black smoker)* with some barite and iron sulfide (chalcopyrite) minerals.	Martinez et al., 2007[1]	*Shinkai 6500* footage: https://www.godac.jamstec.go.jp/jedi/dive_view_main.jsf?SUB=6K&DIV=0187&TYPE=VIDEO&CAM=C1&kwd=&lang=EN
Microsmoke, Mid-Atlantic Ridge, 1995				
MS15-CHA3 Snake Pit	Photograph available in Harmsen et al., 1997	Porous diffuser*chimney of iron sulfide minerals.	Harmsen et al, 1997[2]	No links available.
AT03-03, Mid-Atlantic Ridge, 1997				
3119-7 Lucky Strike	No photograph available.	Chimney with iron sulfide minerals.	Smith et al., 2012[3] Yahagi et al., 2017[4]	Expedition: https://www.marine-geo.org/tools/entry/AT03-03
3133-4a Logatchev	No photograph available.	Iron sulfide chimney with iron oxyhydroxide crust.	Southward et al., 2001[5] Oliver & Homes, 2006[6] Krylova et al., 2010[7] Smith et al., 2012[3]	Expedition: https://www.marine-geo.org/tools/entry/AT03-03
AT03-30, Southern East Pacific Rise, 1998-1999				
3327-2 17° 25' S	No photograph available.	Iron sulfide chimney with chalcopyrite and pyrite minerals with some marcasite.	Longnecker & Reysenbach, 2001[8] Von Damm et al., 2003[9]	No links available.
3328-5 17° 25' S	No photograph available.	White microbial biofilm of filaments on active chimney.	Longnecker & Reysenbach, 2001[8] Von Damm et al., 2003[9]	No links available.
3336-2 21° 33' S	No photograph available.	Iron sulfide chimney with flaky outer iron oxyhydroxide crust.	Longnecker & Reysenbach, 2001[8] Von Damm et al., 2003[9]	No links available.

AT03-46, Guaymas Basin, 2000				
3517-1-1		Active flange*; some white microbial mats on top.	Longnecker, 2001[10] Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT03-46
3519-1-75		Black smoker chimney, with some anhydrite and outer Fe oxyhydroxide-sulfide mineral crust. Fluid temperature ~306 °C	Longnecker, 2001[10] Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT03-46

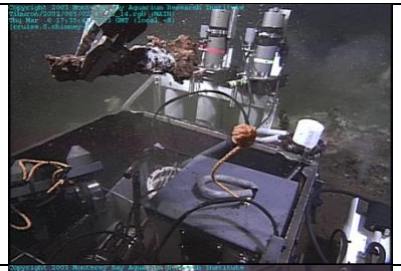
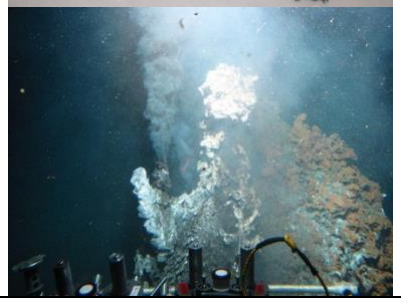
3523-3-203		Flange of predominantly sphalerite, pyrite and iron oxide crusts. Fluid temperature ~299 °C	Longnecker, 2001[10] Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT03-46
KN162-13, Central Indian Ridge, 2001				
296-6-3 Kairei		Hydrothermal chimney with Fe-oxyhydroxides, pyrite with pyrrhotite, no visible anhydrite or barite.	Van Dover et al., 2001[14] Gallant & Von Damm, 2006[15] Reysenbach et al., 2002[16]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html
CIR-33 Kairei	No photo available.	Hydrothermal chimney with predominantly chalcopyrite, pyrite- iron sulfide minerals. Fluid temperature ~335 °C	Van Dover et al., 2001[14] Reysenbach et al., 2002[16] Gallant & Von Damm, 2006[15]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html

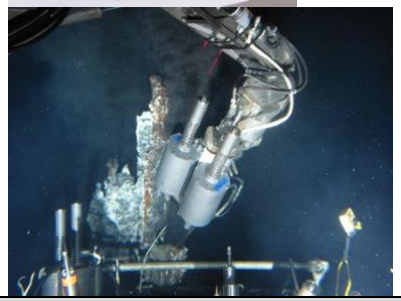
299-1b Kairei		Chalcopyrite-pyrite minerals lining channels with iron oxyhydroxide crust and white microbial mats. Fluid temperature ~296 °C	Van Dover et al., 2001[14] Reysenbach et al., 2002[16] Gallant & Von Damm, 2006[15]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html
301-2-1 Edmond	No photograph available.	Fe-oxyhydroxide crust and white microbial mats, internal pyrite channels.	Van Dover et al., 2001[14] Reysenbach et al., 2002[16] Gallant & Von Damm, 2006[15]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html
CIR-17 Edmond		Fe-oxyhydroxide, some white crust, internal iron-sulfide (pyrite, chalcopyrite) minerals.	Van Dover et al., 2001[14] Reysenbach et al., 2002[16] Hoek et al., 2003[17] Gallant & Von Damm, 2006[15]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html
CIR-21 Edmond	No photograph available.	Iron sulfide chimney with FeO(OH) on outer surface. Interior channels lined by pyrite and chalcopyrite.	Van Dover et al., 2001[14] Reysenbach et al., 2002[16] Gallant & Von Damm, 2006[15]	Expedition: https://www.marine-geo.org/tools/entry/KN162-13 Virtual *Jason* control van: http://4dgeo2.whoi.edu/webdata/virtualvan/html/VV-kn162-13/index.html

AT07-06, East Pacific Rise, 2002				
3753-1-204	 	Active sulfide chimney ~30 cm across. Extremely soft, porous, flaky, outer crust of white filaments and iron oxyhydroxides. Internal channel lined with chalcopyrite. Fluid temperature ~348 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT07-06
3769-1	 	Porous diffuser with pyrrhotite, wurtzite, pyrite and chalcopyrite; outer crust of marcasite. Diameter about 7.5 cm. Fluid temperature ~386 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT07-06

Adv9-150	 	Sulfide chimney-chalcopyite-pyrite inner channel, patches of white sulfur mineral precipitate outside. Fluid temperature ~345 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT07-06
Adv9-388	 	Porous diffuser with fine grained iron, zinc, copper sulfides. Fluid temperature ~292 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT07-06

Adv9-453		Extinct diffuser sulfide with thick pyrite layer (~1 cm) lining the orifice, and a distinct iron oxyhydroxide outer crust.	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT07-06
AT07-13, Galapagos Rift, 2002				
3795-28	No photograph available.	Extinct (inactive) chimney, sulfide minerals, outer iron oxide crust.	Rutherford, 2013[23] Pagé, 2008[24]	Expedition: https://www.marine-geo.org/tools/entry/AT07-13 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT07-13/Alvin-D3795/html/S0001.html
WF Expedition 2636 Leg 2, Guaymas Basin, 2003				
T521-G4B-3		Active flange. Iron-sulfide minerals. Upper surface with white sulfur-microbial precipitate and Fe oxides.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	No links available.
T526-G7-64		High temperature diffuser.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	No links available.

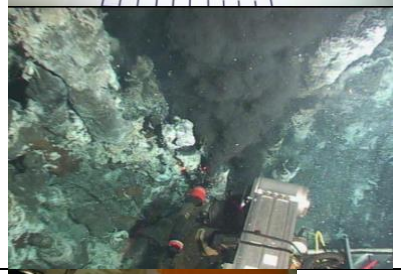
T527-G1-95		High-temp chimney with lots of aromatic hydrocarbons.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	No links available.
T528-G2-109		Iron sulfide chimney with microbial mat. Sample bathed in aromatic hydrocarbons.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	No links available.
AT11-09, East Pacific Rise, 2004				
3986-1-1	 	Chimney with channels lined with pyrite/chalcopyrite, and some anhydrite interspersed. Outer surface with patches of iron oxides, white mineral precipitates, and white filamentous bacteria. Fluid Temperature ~324 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT11-09 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0001Q7 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT11-09/Alvin-D3986/html/S0001.html

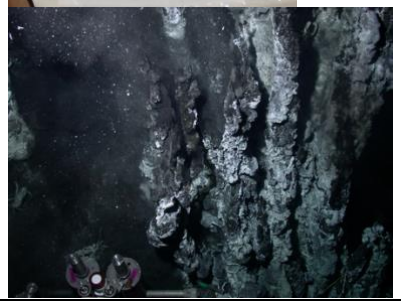
3987-4-1-104	 	Hydrothermal diffuser/chimney with chalcopyrite, anhydrite minerals. Outer crusts of iron oxides and white microbial mats. Fluid Temperature ~372 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT11-09 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0001R0 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT11-09/Alvin-D3987/html/S0001.html
TUIM05MV, Eastern Lau Spreading Center-Valu Fa Ridge, 2005				
124-5-R1-1-33 Kilo Moana	 	Diffuser deposit with porous iron sulfide minerals. Patches of white biofilm on outer crust. Structure had no clear orifice, but some of the channels within the porous matrix were lined with sphalerite.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD000333 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 2861

127-1-R1-1-172 Tow Cam	 	Diffuser/chimney with several small channels for fluid flow. The porous matrix consisted of friable Zn sulfide minerals and interspersed with coarse-grained and fine-grained chalcopyrite. Minor amounts of pyrite and some barite.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD000341 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 14062
128-2-R1-1-336 ABE		Active flange of iron sulfide (chalcopyrite) minerals. Soft iron oxide and sulfur mineral deposits interspersed with barite, amorphous silica and calcite.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD000347 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 19267

130-1-R2-1-408 Mariner		Complex sulfide deposit with multiple chalcopyrite lined channels inter-dispersed in amorphous silica-iron sulfide minerals. Iron oxyhydroxide layer on outer edges.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD000360 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 26687
138-7-R1-1-778 Tui Malila		Complex structure with two spires with multiple chalcopyrite lined channels. Additional Zn-sulfide minerals (wurtzite) inter-dispersed with barite, some pyrite.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0003A0 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 52446

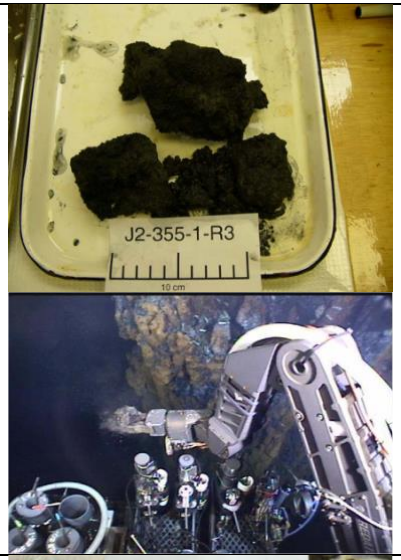
139-2-R1-1-818 Tow Cam		Complex diffuser with channels lined in chalcopyrite and Zn sulfides. Fine grained sulfide minerals and minor amounts of barite. Coated with a 2 mm white biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27]	Expedition: https://www.marine-geo.org/tools/entry/tuim05mv Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0003A3 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tuim05mv/index.html Virtual van event number: 54212
AT11-31, Juan de Fuca Ridge, 2005				
JdF3-4135	No photograph available.	Chimney with iron sulfide minerals and covered with white biofilm.	Pagé, 2008[24] Kelley et al., 2012[28] Rutherford, 2014[23]	Expedition: https://www.marine-geo.org/tools/entry/AT11-31 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT11-31/Alvin-D4135/html/S0001.html
JdF4-4136	No photograph available.	Low-temperature, diffuse flow, iron sulfide chimney with microbial mat.	Pagé, 2008[24] Wang et al., 2009[29] Kelley et al., 2012[28] Rutherford, 2014[23]	Expedition: https://www.marine-geo.org/tools/entry/AT11-31 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT11-31/Alvin-D4135/html/S0001.html

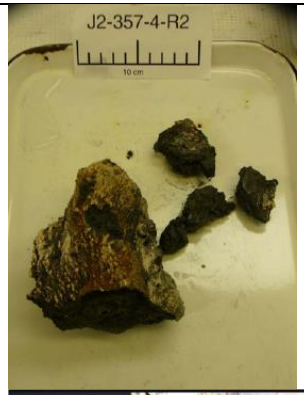
AT15-13, East Pacific Rise, 2006				
4274-2-1-4	 	Iron sulfide (chalcopyrite-pyrite minerals) chimney with some anhydrite veins. Outside white mineral crust covered with old *Alvinella* casings. Fluid temperature ~383 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-13 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008ZG *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-13/Alvin-D4274/html/S0001.html
4275-1-22	 	Black smoker with single orifice lined with pyrite and chalcopyrite. White biofilm crust on outer edges. Fluid temperature ~319 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-13 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD000907 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-13/Alvin-D4275/html/S0001.html

4279-1-1-88	 	Diffuser with some alvinellid worms, covered with white sulfur incrustations, inner soft spongy layer of chalcopyrite. Fluid temperature ~370 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-13 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008ZM *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-13/Alvin-D4279/html/S0001.html
AT15-27, East Pacific Rise, 2007				
4375-2-1-20	 	Black smoker with chalcopyrite-pyrite lined central conduit, few areas of anhydrite. Fluid temperature ~396 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-27 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009FT *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-27/Alvin-D4375/html/S0001.html

4375-3-32		Iron-sulfide chimney with distinct white/grey biofilm crust on outside. Fluid temperature ~354 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-27 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009FS *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-27/Alvin-D4375/html/S0001.html
4381-2-156		Large iron sulfide chimney with anhydrite-chalcopyrite-pyrite lined flow path, outer layers of patches of orange and white crusts. Fluid temperature ~ 365 °C	Von Damm 2000[18] Von Damm & Lilley, 2003[19] Von Damm 2004[20] Tivey, 2007[21] Fornari et al., 2012[22]	Expedition: https://www.marine-geo.org/tools/entry/AT15-27 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009FI *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-27/Alvin-D4381/html/S0001.html

KNOX18RR, Mid-Atlantic Ridge, 2008				
352-5-R1-1-3 Rainbow		Diffuser chimney, with fine-grained pyrite inner mineral mush. Outside softer black layer.	Flores et al., 2011[30] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009HH Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event code: 1920
353-5-R2-1-66 Rainbow		Double turret black smoker with pyrite-chalcopyrite lined channels. Thick outer iron oxyhydroxide crust. Very little anhydrite.	Flores et al., 2011[30] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009HQ Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 3144

355-1-R3-1-177 Rainbow		Chimney with chalcopyrite lined channel.	Flores et al., 2011[30] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009I1 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 5004
356-1-R2-1-304 Lucky Strike		Flange with soft iron sulfide minerals where the hydrothermal fluid pooled. Sulfur and iron oxyhydroxide biofilm crusts.	Flores et al., 2011[30] Pester et al., 2012[31] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009IB Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 6013

357-4-R2-2-365 Lucky Strike	 	Diffuser chimney with hard white and iron oxides crusts, larger pyrite crystals in fine grained pyrite matrix.	Flores et al., 2011[30] Pester et al., 2012[31] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009IL Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 7443
357-6-R1-1-358 Lucky Strike		Flange where flow channel and pools lined with pyrite and chalcopyrite. Cooler outside areas with thick sulfur-iron oxide crusts.	Flores et al., 2011[30] Pester et al., 2012[31] Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009IM Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 7524

363-7-R1-3-628 TAG	 	Chimney with pyrite/chalcopyrite-lined channels. Outer layers predominantly iron oxyhydroxide crusts.	Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009JF Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 10526
363-7-R3-1-636 TAG	 	Beehive diffuser sulfide deposit, outer white crust, porous internal minerals of pyrite-chalcopyrite.	Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009JH Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 10572

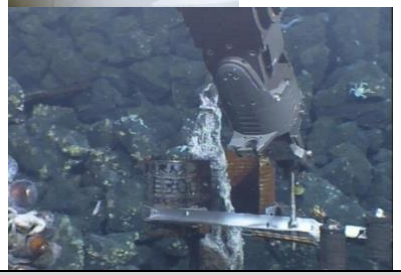
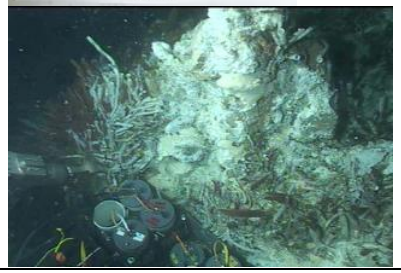
363-7-R4-1-593 TAG		Iron sulfide mineral (pyrite in silicious matrix) diffuser with white to grey to black hard outer crust, some, outer shell is fairly hard.	Smith et al., 2012[3] Reeves et al., 2014[11]	Expedition: https://www.marine-geo.org/tools/entry/KNOX18RR Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009JI Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-knox18rr/index.html Virtual van event number: 10587
TN236, Eastern Lau Spreading Center-Valu Fa Ridge, 2009				
434-2-R1-1-36 Kilo Moana	 	Chimney sampled from where the thermocouple array was deployed. Iron sulfide and zinc sulfide minerals in amorphous silica matrix. Trace barite. Some areas of white crust on outer surface.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008OM Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 314

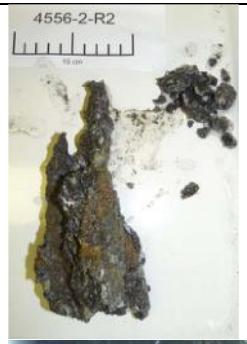
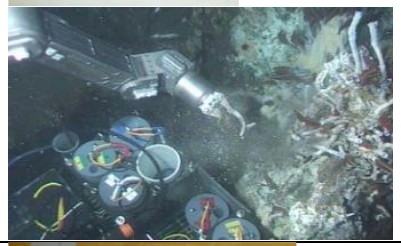
434-4-R1-2-67 Kilo Moana		Large flange of iron sulfide and since sulfide minerals, perhaps some calcite. Domes where some flow penetrated. White crust on upper surface.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008OP Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 610
435-20-R1-1-231 ABE		Chimney lined with chalcopyrite channels, some barite. Outer white biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008P5 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 2315

435-9-R1-1-283 ABE	 	Diffuser with multiple channels lined with chalcopyrite and some pyrite. Some Zn sulfide minerals. Outer crust white with patches of iron oxides. Fluid temperature ~217 °C	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008OX Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 1757
439-5-R1-1-672 Mariner	 	Flange with thick iron oxide and sulfur biofilm. Minerals include chalcopyrite, wurtzite and some barite.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008PR Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 5529

444-4-R1-1-1274 Tahi Moana	 	Large iron sulfide chimney with multiple smaller chalcopyrite lined channels. Thick outer white biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008QU Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 11066
444-23-R2-1-1360 Tahi Moana	 	Chimney-diffuser with small chalcopyrite lined channels. Thick outer orange and white biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008R8 Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 12167 to 12171

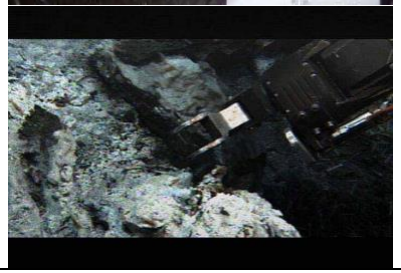
445-6-R1-1-1388 Tahi Moana		Iron sulfide diffuser-chimney with chalcopyrite lined channels. Distinct white biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008RF Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 12952
447-1-R1-1-1579 Tui Malila		Flange with soft sulfur-iron biofilm on the hard chalcopyrite, zinc sulfide, calcite/barite shelf.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008RQ Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 14243

451-1-R1-2-1768 Tow Cam	 	Diffuser of iron and zinc sulfide minerals in an amorphous silica matrix, with distinct white to pink microbial biofilm crust.	Mottl et al., 2011[25] Beinart et al., 2012[26] Tivey et al., 2012[27] Flores et al., 2012[32]	Expedition: https://www.marine-geo.org/tools/entry/TN236 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0008SQ Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn236/index.html Virtual van event number: 17477
AT15-55, Guaymas Basin, 2009				
4556-1-31	 	Flange with chalcopyrite, calcite or anhydrite Pooled fluid temperature ~242 °C	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009V1 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4556/html/S0001.html

4556-2-45	 	Chimney spire with sphalerite and chalcopyrite. Some calcite.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009V4 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4556/html/S0001.html
4556-2-56	 	Chimney spire with white and iron oxide microbial biofilms. Aromatic hydrocarbons. Fluid temperature ~244 °C	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009V3 *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4556/html/S0001.html

4558-2-173	 	Oily diffuser spire. Iron sulfide minerals. Microbial biofilm.	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009VA *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4558/html/S0001.html
4558-3-205	 	Diffuser spire. Iron sulfide minerals bathed in aromatic hydrocarbons. Iron oxide and white microbial biofilm. Fluid temperature ~138 °C	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009VB *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4558/html/S0001.html

59-3-258	 	Iron sulfide-calcite flange, amorphous silica, with soft orange and white crust Pooled fluid temperature ~153 °C	Reeves et al., 2014[11] Teske et al., 2016[12] Seewald et al., 2024[13]	Expedition: https://www.marine-geo.org/tools/entry/AT15-55 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009VL *Alvin* frame-grabber: http://4dgeo.whoi.edu/webdata/DAQ/AT15-55/Alvin-D4559/html/S0001.html
TN234, Northeastern Lau Spreading Center, 2009				
416-9-R1-1-3	 	Black smoker chimney with thick chalcopyrite layer and small conduits. Outer white biofilm crust. Some wurtzite.	Resing et al., 2011[33] Baker et al., 2019[34]	Expedition: https://www.marine-geo.org/tools/entry/TN234 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009UE Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn234/index.html Virtual van event number: 3673

416-10-R1-2-21	 	Diffuser chimney with hard iron-oxide rich outer layer, and chalcopyrite lined inner conduits with some anhydrite.	Resing et al., 2011[33] Baker et al., 2019[34]	Expedition: https://www.marine-geo.org/tools/entry/TN234 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009UF Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn234/index.html Virtual van event number: 3765
416-21-R1-1-10	 	Iron sulfide chimney with conduits lined with hard chalcopyrite and some areas of soft mushy chalcopyrite/pyrite minerals. Outer white biofilm crust.	Resing et al., 2011[33] Baker et al., 2019[34]	Expedition: https://www.marine-geo.org/tools/entry/TN234 Sample: https://app.geosamples.org/sample/igsn/10.58052/MGD0009UH Virtual *Jason* control van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn234/index.html Virtual van event number: 4121

*Black smoker/chimney, flange and diffuser are names given for the type of sulfide deposit, summarized in Tivey, 2007[21].

Additional Supplementary Information

Two example workflows are shown for parsing read coverage summaries output by the jgi_summarize_bam_contig_depths v2.17 script released with MetaBAT v2:2.17[35]. The output of the jgi_summarize_bam_contig_depths script is referred to hereafter as the "depth file", or shown as DEPTH.txt. Referenced scripts are available at https://github.com/ALR-Lab/MAG-coverage.

Example workflow to generate an abundance input for MaxBin v2.2.7[36] from a depth file.
$ awk '{print $1"\t"$3}' DEPTH.txt | tail -n +2 >> OUTPUT.txt

Example workflow for generating normalized read coverage for metagenome-assembled genomes (MAGs) using a depth file. Note that all contig names must be unique across the entire MAG dataset.

```
# Generate matched coverage table from depth file.
$ awk '{print $1"\t"$2"\t"$1,$3}' DEPTH.txt | tail -n +2 >> MATCHED_COVERAGE.txt

# Generate table linking contigs to MAGs (ending .fa shown here).
$ grep  ">" *.fa >> BINS_TO_CONTIGS.txt

# Match contigs, length, coverage and MAG information.
$ match_files_by_id_for_coverages.pl -s 1 -in1 MATCHED_COVERAGE.txt -id1 1 -in2
BINS_TO_CONTIGS.txt -id2 2 -out MATCHED2.txt

# Generate normalized read coverage for each MAG.
$ rc_bin_summary_updated.pl -i MATCHED2.txt -o BIN_COVERAGES.txt
```

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