
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:11,940 --> 00:00:09,350
[Applause]

3
00:00:15,480 --> 00:00:11,950
okay so I was excited about this session

4
00:00:17,310 --> 00:00:15,490
because it seems timely there's been

5
00:00:18,840 --> 00:00:17,320
these great posters and lightning rounds

6
00:00:21,120 --> 00:00:18,850
throughout on the week so I'm so

7
00:00:21,929 --> 00:00:21,130
grateful to the session convenors for

8
00:00:23,820 --> 00:00:21,939
pulling this together

9
00:00:26,430 --> 00:00:23,830
and I think the topics are really

10
00:00:29,070 --> 00:00:26,440
interesting and challenging things like

11
00:00:31,290 --> 00:00:29,080
modeling Brian behavior Kyoto pissah t

12
00:00:32,519 --> 00:00:31,300
preservation of biomarkers I mean we

13
00:00:34,170 --> 00:00:32,529

have some great talks in this session

14
00:00:36,270 --> 00:00:34,180
that I'm looking forward to hearing I'm

15
00:00:38,850 --> 00:00:36,280
gonna try to touch on microbial ecology

16
00:00:40,200 --> 00:00:38,860
of this sublation O'Brien I'm gonna tell

17
00:00:42,240 --> 00:00:40,210
you about and also a little bit about

18
00:00:44,220 --> 00:00:42,250
how we're working to detect bio

19
00:00:46,440 --> 00:00:44,230
signatures I'd like to invite everybody

20
00:00:47,639 --> 00:00:46,450
to stick around for the discussion

21
00:00:50,819 --> 00:00:47,649
session it looks like we have one at

22
00:00:51,900 --> 00:00:50,829
11:00 as well as 11 to 3:15 here in this

23
00:00:53,030 --> 00:00:51,910
room so we can have a more open

24
00:00:56,430 --> 00:00:53,040
discussion about some of these topics

25
00:00:58,590 --> 00:00:56,440
okay so the aim of my talk first is to

26
00:01:00,000 --> 00:00:58,600
introduce you to a subway shal Brien

27
00:01:02,850 --> 00:01:00,010
ecosystem that I've been studying for

28
00:01:05,040 --> 00:01:02,860
some years now and describe some of its

29
00:01:07,080 --> 00:01:05,050
analog attributes it's known as blood

30
00:01:09,210 --> 00:01:07,090
falls it's located in the McMurdo Dry

31
00:01:10,710 --> 00:01:09,220
Valleys region of Antarctica which is

32
00:01:13,469 --> 00:01:10,720
the largest ice-free region of the

33
00:01:14,730 --> 00:01:13,479
continent it's found within the Taylor

34
00:01:17,280 --> 00:01:14,740
Valley of this McMurdo Dry Valleys

35
00:01:18,719 --> 00:01:17,290
complex and it's at the terminus of the

36
00:01:20,730 --> 00:01:18,729
Taylor glacier which is an outlet

37
00:01:22,880 --> 00:01:20,740
glacier of the East Antarctic Ice Sheet

38
00:01:26,520 --> 00:01:22,890

and it's it's quite a visceral feature a

39
00:01:29,010 --> 00:01:26,530
little can see it right down there okay

40
00:01:30,810 --> 00:01:29,020
and so the sub aims of my talk er to

41
00:01:33,270 --> 00:01:30,820
provide you with a discussion of some

42
00:01:34,920 --> 00:01:33,280
new insights into the physical structure

43
00:01:37,410 --> 00:01:34,930
of this ecosystem that we've been able

44
00:01:39,390 --> 00:01:37,420
to elucidate in order to inform what

45
00:01:41,130 --> 00:01:39,400
this microbial niche might be like since

46
00:01:42,690 --> 00:01:41,140
we for a long time just have been

47
00:01:44,789 --> 00:01:42,700
collecting samples at the surface so

48
00:01:46,710 --> 00:01:44,799
just scratching at the surface I mean

49
00:01:48,660 --> 00:01:46,720
this type of survey can also help inform

50
00:01:50,280 --> 00:01:48,670
sampling strategies I'm going to talk

51
00:01:52,499 --> 00:01:50,290
about some consequences right when

52
00:01:54,719 --> 00:01:52,509
subsurface brine is discharged to a

53
00:01:56,370 --> 00:01:54,729
surface there's gonna be some changes

54
00:01:58,230 --> 00:01:56,380
and so we've started to look at what's

55
00:02:00,719 --> 00:01:58,240
happening with this brine when it hits

56
00:02:02,340 --> 00:02:00,729
the surface I'm gonna share some musings

57
00:02:05,819 --> 00:02:02,350
on how we might be detecting bio

58
00:02:07,319 --> 00:02:05,829
signatures at the site and by special

59
00:02:10,280 --> 00:02:07,329
request I was going to do a little Don

60
00:02:14,340 --> 00:02:10,290
Juan pon teaser though some of the time

61
00:02:17,490 --> 00:02:14,350
oops okay alrighty so this is a distinct

62
00:02:20,610 --> 00:02:17,500
subglacial feature as I mentioned and I

63
00:02:22,630 --> 00:02:20,620

don't know if you can hear that

64
00:02:25,089 --> 00:02:22,640
can you guys hear that rustling so

65
00:02:27,670 --> 00:02:25,099
that's actually discharge of blood Falls

66
00:02:29,740 --> 00:02:27,680
coming out and it pours out over the

67
00:02:31,660 --> 00:02:29,750
surface here and you can see it starts

68
00:02:33,940 --> 00:02:31,670
to work its way down this terminal

69
00:02:35,740 --> 00:02:33,950
moraine and it'll leave some precipitous

70
00:02:37,870 --> 00:02:35,750
along the side and this is something

71
00:02:39,729 --> 00:02:37,880
that I call active discharge and so if

72
00:02:41,170 --> 00:02:39,739
you're able to hike up the glacier and I

73
00:02:42,460 --> 00:02:41,180
don't know it'll turn around a little

74
00:02:45,640 --> 00:02:42,470
bit you can see I'm pretty high up on

75
00:02:47,620 --> 00:02:45,650
this mound I don't know if there's a I'm

76
00:02:49,030 --> 00:02:47,630
probably at about up here and you can

77
00:02:51,160 --> 00:02:49,040
turn around and see if you can collect

78
00:02:53,800 --> 00:02:51,170
this discharge when it's first coming

79
00:02:56,440 --> 00:02:53,810
out you'll find that it's a very salty

80
00:02:57,699 --> 00:02:56,450
brine it's about two to three times the

81
00:03:00,220 --> 00:02:57,709
salinity of seawater it's calcium

82
00:03:02,949 --> 00:03:00,230
chloride dominated it's reducing so

83
00:03:05,590 --> 00:03:02,959
there's no detectable oxygen it has kind

84
00:03:06,190 --> 00:03:05,600
of a sub oxic eh value of about 80 to 90

85
00:03:08,770 --> 00:03:06,200
millivolts

86
00:03:10,809 --> 00:03:08,780
it's circum neutral and it's cold it's

87
00:03:13,090 --> 00:03:10,819
between minus 5 and minus 7 degrees

88
00:03:15,670 --> 00:03:13,100

Celsius I mean it contains iron and

89
00:03:17,590 --> 00:03:15,680
through extensive research or extensive

90
00:03:19,570 --> 00:03:17,600
studies by my colleague Barry Lyons over

91
00:03:22,030 --> 00:03:19,580
the years and trying to pull out this

92
00:03:23,620 --> 00:03:22,040
active discharge composition it appears

93
00:03:26,080 --> 00:03:23,630
to be that this is a concentrated

94
00:03:28,120 --> 00:03:26,090
seawater based on the ionic composition

95
00:03:30,240 --> 00:03:28,130
with some contributions of some

96
00:03:32,710 --> 00:03:30,250
weathering products over time

97
00:03:34,420 --> 00:03:32,720
there's also biology in this Brian when

98
00:03:37,509 --> 00:03:34,430
you collect this active discharge I can

99
00:03:40,090 --> 00:03:37,519
run this again if you're interested so

100
00:03:41,680 --> 00:03:40,100
it contains detectable cells about 1 to

101
00:03:43,060 --> 00:03:41,690
the 5 cells per mil that's about 2

102
00:03:45,430 --> 00:03:43,070
orders of magnitude higher than the

103
00:03:47,319 --> 00:03:45,440
surrounding glacial ice there's

104
00:03:49,000 --> 00:03:47,329
measurable metabolic activity so you can

105
00:03:51,220 --> 00:03:49,010
feed labeled substrates to this water

106
00:03:53,319 --> 00:03:51,230
and over time it will be incorporated

107
00:03:56,319 --> 00:03:53,329
into cellular biomass you can cultivate

108
00:03:58,360 --> 00:03:56,329
some members of this community in the

109
00:04:00,460 --> 00:03:58,370
lab and they're represented in clone

110
00:04:03,039 --> 00:04:00,470
libraries as well or amplicon libraries

111
00:04:04,539 --> 00:04:03,049
and they seem to have lifestyles related

112
00:04:06,699 --> 00:04:04,549
to organisms with iron and sulfur

113
00:04:08,020 --> 00:04:06,709

metabolisms there's also multiple lines

114
00:04:12,430 --> 00:04:08,030
of evidence that the system is

115
00:04:15,210 --> 00:04:12,440
chemosynthetic so that its uptake of

116
00:04:16,930 --> 00:04:15,220
bicarbonate is enough to provide and

117
00:04:18,550 --> 00:04:16,940
sufficient fix carbon to the

118
00:04:20,259 --> 00:04:18,560
heterotrophic community and there's

119
00:04:21,310 --> 00:04:20,269
multiple lines of evidence of this so it

120
00:04:23,469 --> 00:04:21,320
seems like we're dealing with some type

121
00:04:26,140 --> 00:04:23,479
of metabolically active chemosynthetic

122
00:04:27,810 --> 00:04:26,150
briny subsurface discharge i'm at the

123
00:04:30,279 --> 00:04:27,820
terminus of the taylor glacier

124
00:04:31,960 --> 00:04:30,289
I hope I can convince you that there's

125
00:04:33,400 --> 00:04:31,970
some analog like attribute

126
00:04:36,670 --> 00:04:33,410
of this system and while there's no

127
00:04:38,320 --> 00:04:36,680
perfect analog and throughout this week

128
00:04:40,810 --> 00:04:38,330
we've heard talks about saturated

129
00:04:43,210 --> 00:04:40,820
groundwater sediments on Mars potential

130
00:04:45,850 --> 00:04:43,220
for some glacial lakes on Mars and today

131
00:04:48,190 --> 00:04:45,860
we heard some great talks on Europa and

132
00:04:50,110 --> 00:04:48,200
while we may or may not be able to get

133
00:04:51,370 --> 00:04:50,120
into the subsurface ocean in the near

134
00:04:53,500 --> 00:04:51,380
term there's a lot of interesting

135
00:04:55,390 --> 00:04:53,510
features potentially happening in these

136
00:04:57,490 --> 00:04:55,400
ice covers and so if Brian is working

137
00:05:00,220 --> 00:04:57,500
its way through and being stored in this

138
00:05:02,620 --> 00:05:00,230

ice shell and so blood falls provides a

139
00:05:04,210 --> 00:05:02,630
system that is sourced throughout this

140
00:05:06,700 --> 00:05:04,220
talk I'll explain how it's sourced from

141
00:05:08,770 --> 00:05:06,710
deep groundwater within permafrost so it

142
00:05:10,990 --> 00:05:08,780
can teach us lessons about that it's a

143
00:05:13,570 --> 00:05:11,000
cold brine below a glacier that hosts a

144
00:05:15,070 --> 00:05:13,580
microbial community it can teach us a

145
00:05:16,660 --> 00:05:15,080
little bit about what happens to an

146
00:05:18,730 --> 00:05:16,670
Glacial brine when it's stored within a

147
00:05:20,890 --> 00:05:18,740
conduit within ice for some period of

148
00:05:23,320 --> 00:05:20,900
time and we can also learn about how I'm

149
00:05:27,610 --> 00:05:23,330
discharged changes the microbial bio

150
00:05:29,520 --> 00:05:27,620
signatures okay so the first name was to

151
00:05:31,570 --> 00:05:29,530
talk about some of the new insights from

152
00:05:34,360 --> 00:05:31,580
physical structure we can learn from

153
00:05:35,650 --> 00:05:34,370
this ecosystem and so for a long time I

154
00:05:37,480 --> 00:05:35,660
wondered I was always sampling at the

155
00:05:38,890 --> 00:05:37,490
surface and I wondered what was the

156
00:05:40,510 --> 00:05:38,900
source to this feature rate is clearly

157
00:05:42,159 --> 00:05:40,520
different than the surrounding glacial

158
00:05:43,960 --> 00:05:42,169
ice and the melt that was occurring so

159
00:05:46,300 --> 00:05:43,970
is it some type of sub glacial lake on

160
00:05:48,760 --> 00:05:46,310
one hand or on the other extreme is it a

161
00:05:50,590 --> 00:05:48,770
Saba or some other salt deposit that's

162
00:05:53,140 --> 00:05:50,600
slowly rheda's all Ving under the

163
00:05:55,390 --> 00:05:53,150

glacier and creating this fluid and to

164
00:05:57,730 --> 00:05:55,400
put it in this is this is important

165
00:05:59,230 --> 00:05:57,740
because it can help us understand what

166
00:06:01,540 --> 00:05:59,240
controls in microbial community right

167
00:06:03,220 --> 00:06:01,550
hydrology impart strong controls it can

168
00:06:04,870 --> 00:06:03,230
help describe the microbial niche very

169
00:06:07,720 --> 00:06:04,880
different lifestyle if you're in a lake

170
00:06:09,250 --> 00:06:07,730
versus if you're in a salt deposit or

171
00:06:10,720 --> 00:06:09,260
something in between and it can also

172
00:06:12,730 --> 00:06:10,730
teach us something about the potential

173
00:06:15,070 --> 00:06:12,740
ecological history like where this

174
00:06:17,590 --> 00:06:15,080
system is on its trajectory from its

175
00:06:20,409 --> 00:06:17,600
origin and I was inspired by some of the

176
00:06:22,090 --> 00:06:20,419
oceans across space and time on themes

177
00:06:23,260 --> 00:06:22,100
where you know perhaps if it's a subway

178
00:06:26,080 --> 00:06:23,270
shell lake it's a more contemporary

179
00:06:28,330 --> 00:06:26,090
system if it's the salt flat it's

180
00:06:29,890 --> 00:06:28,340
perhaps a remnant system and what if

181
00:06:32,380 --> 00:06:29,900
it's something in between like a relic

182
00:06:34,720 --> 00:06:32,390
system some remains of this previous

183
00:06:38,500 --> 00:06:34,730
contemporary system you can also think

184
00:06:41,320 --> 00:06:38,510
of it as on the continuum of inhabited

185
00:06:42,969 --> 00:06:41,330
or uninhabited realm or somewhere in

186
00:06:45,820 --> 00:06:42,979
between that we've heard in some of the

187
00:06:46,180 --> 00:06:45,830
talks this week ok so how do we

188
00:06:47,620 --> 00:06:46,190

determine

189
00:06:49,390 --> 00:06:47,630
in the physical structure of the system

190
00:06:51,430 --> 00:06:49,400
being in a narrow walled valley radar

191
00:06:53,230 --> 00:06:51,440
was not super informative for describing

192
00:06:55,600 --> 00:06:53,240
the structure and so we collaborated

193
00:06:57,550 --> 00:06:55,610
with a geophysics group out of Aarhus

194
00:06:59,050 --> 00:06:57,560
and Denmark and they have a transient

195
00:07:00,700 --> 00:06:59,060
electromagnetic system that they're able

196
00:07:03,070 --> 00:07:00,710
to sling from a helicopter it's called

197
00:07:05,980 --> 00:07:03,080
sky temme and what it does is it Maps

198
00:07:07,750 --> 00:07:05,990
resistivity so this is a brine that's

199
00:07:09,940 --> 00:07:07,760
about two and a half times the salinity

200
00:07:11,170 --> 00:07:09,950
of seawater it's a strong conductor and

201
00:07:12,940 --> 00:07:11,180
it would be a great candidate for this

202
00:07:15,010 --> 00:07:12,950
technique because we believe it's under

203
00:07:17,140 --> 00:07:15,020
a highly resistive glacier and so

204
00:07:19,180 --> 00:07:17,150
sky-tomb is a tool that you can sling

205
00:07:21,100 --> 00:07:19,190
from helicopter so you can cover much

206
00:07:24,340 --> 00:07:21,110
larger areas of terrain than you could

207
00:07:27,040 --> 00:07:24,350
by typical ground-based DC resistivity

208
00:07:29,140 --> 00:07:27,050
methods it can penetrate to about 350

209
00:07:30,790 --> 00:07:29,150
meters and what it does is it tells you

210
00:07:32,380 --> 00:07:30,800
something about the geological material

211
00:07:35,050 --> 00:07:32,390
that these electromagnetic signals are

212
00:07:37,510 --> 00:07:35,060
interacting with so this was actually

213
00:07:39,460 --> 00:07:37,520

highly productive in the Dry Valleys and

214
00:07:41,440 --> 00:07:39,470
it elucidated a lot more bribes than we

215
00:07:43,810 --> 00:07:41,450
were expecting to see but what I'm

216
00:07:45,630 --> 00:07:43,820
showing you here is a 3d image of the

217
00:07:50,380 --> 00:07:45,640
brine detected below the Taylor glacier

218
00:07:52,690 --> 00:07:50,390
and so you can see here is the glacier

219
00:07:54,880 --> 00:07:52,700
this is the profile line and then we did

220
00:07:57,070 --> 00:07:54,890
some cross-sections and this is the

221
00:07:58,810 --> 00:07:57,080
resistivity data it's a diffusive method

222
00:08:01,900 --> 00:07:58,820
so it says across between five and ten

223
00:08:04,180 --> 00:08:01,910
meters the bright purple is highly

224
00:08:05,980 --> 00:08:04,190
resistive the blue is very cool or

225
00:08:07,659 --> 00:08:05,990
conductive material and so you can

226
00:08:09,600 --> 00:08:07,669
remove all the resistive stuff which is

227
00:08:14,680 --> 00:08:09,610
the glacier and you can see this

228
00:08:16,630 --> 00:08:14,690
morphology of this brine anomaly if you

229
00:08:18,610 --> 00:08:16,640
will blow the glacier and so thus

230
00:08:21,460 --> 00:08:18,620
extensive network of these saturated

231
00:08:24,909 --> 00:08:21,470
sediments it's estimated to be about 1

232
00:08:27,070 --> 00:08:24,919
point or 0.18 kilometers cubed which of

233
00:08:28,600 --> 00:08:27,080
groundwater if you do some conservative

234
00:08:31,780 --> 00:08:28,610
estimates of the porosity of this

235
00:08:34,120 --> 00:08:31,790
sediment and that's pretty extensive

236
00:08:35,440 --> 00:08:34,130
here's the location of blood falls and

237
00:08:37,180 --> 00:08:35,450
there's all these surface lakes some

238
00:08:38,380 --> 00:08:37,190

folks might be familiar with and that's

239
00:08:41,170 --> 00:08:38,390
more volume than all these lakes

240
00:08:43,060 --> 00:08:41,180
combined it allows us to think of this

241
00:08:45,040 --> 00:08:43,070
microbial niche now as a groundwater

242
00:08:47,260 --> 00:08:45,050
aquifer system and what that might mean

243
00:08:49,720 --> 00:08:47,270
for the community with all this more

244
00:08:52,240 --> 00:08:49,730
rock water interaction time and it can

245
00:08:54,280 --> 00:08:52,250
also allow us to make estimates of if

246
00:08:56,530 --> 00:08:54,290
this microbial community is active what

247
00:08:59,139 --> 00:08:56,540
the flux of nutrients might be

248
00:09:01,030 --> 00:08:59,149
coming out of the system and it can also

249
00:09:03,579 --> 00:09:01,040
inform us about this larger system that

250
00:09:05,530 --> 00:09:03,589
we don't have access to this extensive

251
00:09:08,319 --> 00:09:05,540
Brian network that we see throughout the

252
00:09:10,360 --> 00:09:08,329
dry valley so pretty psyched about that

253
00:09:12,370 --> 00:09:10,370
um so here's my dawn mom pond teaser

254
00:09:14,319 --> 00:09:12,380
because I think this type of modeling

255
00:09:17,170 --> 00:09:14,329
can be applied to other elusive brines

256
00:09:19,030 --> 00:09:17,180
for example donjuan pond which is found

257
00:09:21,269 --> 00:09:19,040
in the right valley it's right adjacent

258
00:09:25,480 --> 00:09:21,279
here to where blood falls is located

259
00:09:27,490 --> 00:09:25,490
donjuan pond is pretty otherworldly and

260
00:09:29,559 --> 00:09:27,500
just a few details on it there hasn't

261
00:09:31,870 --> 00:09:29,569
been a ton of work done on it since the

262
00:09:34,900 --> 00:09:31,880
DVD prop P project the dry valley

263
00:09:36,189 --> 00:09:34,910

drilling project it's highly saline it's

264
00:09:38,079 --> 00:09:36,199
thought to be the second-most saltiest

265
00:09:40,059 --> 00:09:38,089
body on our planet

266
00:09:42,579 --> 00:09:40,069
it's a calcium chloride dominated Brian

267
00:09:44,199 --> 00:09:42,589
it's also nitrate rich it's intermittent

268
00:09:46,090 --> 00:09:44,209
so it's just and ephemeral feature that

269
00:09:49,360 --> 00:09:46,100
is driven a lot by evaporation and then

270
00:09:53,019 --> 00:09:49,370
recharged by processes of either surface

271
00:09:55,150 --> 00:09:53,029
flow or possibly groundwater and to date

272
00:09:58,120 --> 00:09:55,160
there has been no confirmed in-situ life

273
00:10:00,370 --> 00:09:58,130
spoiler alert I have no data on life

274
00:10:03,160 --> 00:10:00,380
detected in there I'm just going to talk

275
00:10:05,769 --> 00:10:03,170
to you about how we might better

276
00:10:06,910 --> 00:10:05,779
understand what to look for by better

277
00:10:09,160 --> 00:10:06,920
understanding the structure of that

278
00:10:10,750 --> 00:10:09,170
ecosystem so here's an old figure from

279
00:10:12,160 --> 00:10:10,760
Harrison Cartwright these guys are the

280
00:10:14,410 --> 00:10:12,170
leaders during the dry valley drilling

281
00:10:16,240 --> 00:10:14,420
project and they discussed the

282
00:10:18,790 --> 00:10:16,250
contribution of potential water tracks

283
00:10:19,870 --> 00:10:18,800
bringing either fresh water or salts

284
00:10:22,030 --> 00:10:19,880
that were dragged with these water

285
00:10:23,559 --> 00:10:22,040
tracks from the surrounding Valley to

286
00:10:26,439 --> 00:10:23,569
contribute to the salt balance of

287
00:10:28,090 --> 00:10:26,449
donjuan pond Jay Dixon and colleagues

288
00:10:30,430 --> 00:10:28,100

have done a lot of work since that time

289
00:10:32,259 --> 00:10:30,440
I also saw a great poster by Lynn and

290
00:10:33,910 --> 00:10:32,269
toner here looking at some of the

291
00:10:36,280 --> 00:10:33,920
hydrologic flux so it's still a really

292
00:10:38,800 --> 00:10:36,290
fascinating feature there's also been

293
00:10:40,480 --> 00:10:38,810
some work done thinking about whether or

294
00:10:41,920 --> 00:10:40,490
not there's a subsurface aquifer that's

295
00:10:44,050 --> 00:10:41,930
actually feeding this brine like an

296
00:10:46,780 --> 00:10:44,060
artesian well there was some water

297
00:10:51,009 --> 00:10:46,790
discovered and a 75 meter deep borehole

298
00:10:54,280 --> 00:10:51,019
drill during the dvdp project and so

299
00:10:57,280 --> 00:10:54,290
this is a tool or application of this

300
00:10:58,480 --> 00:10:57,290
tool that might help us reveal what is

301
00:11:01,480 --> 00:10:58,490
below and this is just some preliminary

302
00:11:04,030 --> 00:11:01,490
data from our sky temp service this past

303
00:11:05,830 --> 00:11:04,040
November so here are the lines we flew

304
00:11:07,960 --> 00:11:05,840
this is about three and a half column

305
00:11:10,120 --> 00:11:07,970
and I'm gonna take you through 20 meter

306
00:11:13,000 --> 00:11:10,130
depth slices and you can see here is a

307
00:11:14,890 --> 00:11:13,010
resistive terrain around on one pond

308
00:11:17,140 --> 00:11:14,900
that I have circled here and you can see

309
00:11:20,200 --> 00:11:17,150
this shines up in that cool really

310
00:11:21,850 --> 00:11:20,210
conductive color versus the highly

311
00:11:25,000 --> 00:11:21,860
resistive permafrost that surrounds it

312
00:11:26,860 --> 00:11:25,010
so down 20 to 40 meters you can still

313
00:11:28,540 --> 00:11:26,870

see this Brian that's that to me was

314
00:11:30,880 --> 00:11:28,550
pretty amazing that this is the the

315
00:11:32,860 --> 00:11:30,890
brine at the top the pond is 30

316
00:11:34,960 --> 00:11:32,870
centimeters and so going down the steep

317
00:11:36,910 --> 00:11:34,970
suggests there's at least very salty

318
00:11:39,280 --> 00:11:36,920
potentially saturated sediments some 40

319
00:11:43,090 --> 00:11:39,290
meters below this is down to 60 meters

320
00:11:44,890 --> 00:11:43,100
this is down to 80 down to 100 it's

321
00:11:49,810 --> 00:11:44,900
starting to disappear

322
00:11:51,640 --> 00:11:49,820
so in conclusion on the donjuan pond bit

323
00:11:54,730 --> 00:11:51,650
I'd say there's evidence for a finite

324
00:11:57,820 --> 00:11:54,740
confined aquifer it's not necessarily

325
00:12:00,370 --> 00:11:57,830
all that extensive but it's it's there

326
00:12:02,740 --> 00:12:00,380
donjuan pond is a dynamic feature where

327
00:12:04,560 --> 00:12:02,750
evaporation seems to dominate you do

328
00:12:07,510 --> 00:12:04,570
have evidence for recharge over these

329
00:12:09,220 --> 00:12:07,520
water track like features as well as

330
00:12:11,050 --> 00:12:09,230
this feature right here that you can't

331
00:12:12,850 --> 00:12:11,060
see that well as a rock glacier that

332
00:12:14,860 --> 00:12:12,860
contributes some fresh water and there

333
00:12:18,340 --> 00:12:14,870
also is groundwater that could be

334
00:12:20,170 --> 00:12:18,350
recharging the system as well what does

335
00:12:22,870 --> 00:12:20,180
this knowledge do when we think about

336
00:12:24,790 --> 00:12:22,880
the iconic ology of this feature are you

337
00:12:26,170 --> 00:12:24,800
interested in what accumulates in this

338
00:12:27,670 --> 00:12:26,180

pond at the surface or are you more

339
00:12:29,530 --> 00:12:27,680
interested in the subsurface brine that

340
00:12:30,730 --> 00:12:29,540
feeds it or the communities and the

341
00:12:33,580 --> 00:12:30,740
water track so it's one way to maybe

342
00:12:35,830 --> 00:12:33,590
frame your research questions and it got

343
00:12:38,260 --> 00:12:35,840
me thinking is this relic feature on its

344
00:12:40,720 --> 00:12:38,270
way to being remnant is it habitable but

345
00:12:44,170 --> 00:12:40,730
uninhabitable or is it on inhabited some

346
00:12:46,000 --> 00:12:44,180
but back to blood Falls because blood

347
00:12:48,460 --> 00:12:46,010
Falls is sourced by a much more

348
00:12:49,930 --> 00:12:48,470
extensive aquifer right so you have all

349
00:12:52,360 --> 00:12:49,940
of this below this is about five

350
00:12:54,400 --> 00:12:52,370
kilometers up from the terminus of the

351
00:12:57,460 --> 00:12:54,410
glacier and this is where our sensor

352
00:13:01,690 --> 00:12:57,470
probably dropped out over about 350

353
00:13:03,640 --> 00:13:01,700
meters of glacial ice and so with this

354
00:13:05,650 --> 00:13:03,650
new insight we can say something that

355
00:13:07,360 --> 00:13:05,660
like I think this is probably somewhere

356
00:13:10,180 --> 00:13:07,370
along the line of relic and that you

357
00:13:11,800 --> 00:13:10,190
have these saturated sediments and that

358
00:13:14,230 --> 00:13:11,810
what we're looking at here is an aquifer

359
00:13:17,250 --> 00:13:14,240
you would expect extensive Rock water

360
00:13:22,830 --> 00:13:20,460
and the microbial niche seems to reflect

361
00:13:24,990 --> 00:13:22,840
this physical setting so what we find

362
00:13:28,410 --> 00:13:25,000
when we do sequencing and this is

363
00:13:29,640 --> 00:13:28,420

amplicon sequencing here we find some

364
00:13:32,190 --> 00:13:29,650
phyla types that are similar to

365
00:13:34,530 --> 00:13:32,200
groundwater marine sediments and other

366
00:13:36,180 --> 00:13:34,540
deep subsurface environments we do not

367
00:13:38,100 --> 00:13:36,190
find chloroplasts we do not find

368
00:13:39,180 --> 00:13:38,110
eukaryotes doesn't mean they're not

369
00:13:41,870 --> 00:13:39,190
there but we have not been able to

370
00:13:44,190 --> 00:13:41,880
detect them by our methods and we find

371
00:13:46,440 --> 00:13:44,200
organisms that are chemosynthetic and

372
00:13:48,960 --> 00:13:46,450
actively involved in iron and sulfur

373
00:13:51,210 --> 00:13:48,970
cycling so it seems to make sense the

374
00:13:53,130 --> 00:13:51,220
ecology that we're seeing with what we

375
00:13:55,050 --> 00:13:53,140
think this feature is now like we also

376
00:13:57,450 --> 00:13:55,060
have chemical evidence for extended

377
00:13:59,610 --> 00:13:57,460
Rockwater interactions including really

378
00:14:06,320 --> 00:13:59,620
high silica concentrations as well as a

379
00:14:07,890 --> 00:14:06,330
radiogenic strontium signature but

380
00:14:10,290 --> 00:14:07,900
surface collection is really

381
00:14:12,570 --> 00:14:10,300
unpredictable so this is chloride

382
00:14:14,190 --> 00:14:12,580
concentration here on the y axis and

383
00:14:15,960 --> 00:14:14,200
these are just discrete dates this is

384
00:14:18,330 --> 00:14:15,970
not a continuum of sampling this is a

385
00:14:19,650 --> 00:14:18,340
challenging place to get to and so you

386
00:14:21,690 --> 00:14:19,660
know you have moments of high chloride

387
00:14:23,400 --> 00:14:21,700
concentration at a lot of moments of you

388
00:14:26,490 --> 00:14:23,410

know lo times which were the majority of

389
00:14:27,810 --> 00:14:26,500
the time that I'm down there and so many

390
00:14:29,970 --> 00:14:27,820
of the samples are collected during

391
00:14:31,470 --> 00:14:29,980
these really low salinity times and you

392
00:14:33,150 --> 00:14:31,480
can see here I'm looking disappointed

393
00:14:34,980 --> 00:14:33,160
there's not a lot of stuff coming out of

394
00:14:36,390 --> 00:14:34,990
blood Falls and this would be a year

395
00:14:38,640 --> 00:14:36,400
that I would say there's non discharge

396
00:14:40,820 --> 00:14:38,650
there's just surface melt happening if

397
00:14:43,080 --> 00:14:40,830
you see anything that looks like flow

398
00:14:45,180 --> 00:14:43,090
versus those active discharge events

399
00:14:47,130 --> 00:14:45,190
like I showed you in that video and

400
00:14:48,690 --> 00:14:47,140
there were two years that I obtained

401
00:14:51,150 --> 00:14:48,700
some of this active discharge that I'm

402
00:14:53,280 --> 00:14:51,160
going to talk about here and you can see

403
00:14:55,520 --> 00:14:53,290
there's a visible manifestation of

404
00:14:58,050 --> 00:14:55,530
having some discharge at the surface and

405
00:14:59,520 --> 00:14:58,060
so the sneaky little feature what's it

406
00:15:01,140 --> 00:14:59,530
doing there was often seasons that I

407
00:15:03,420 --> 00:15:01,150
would come back and it was clear that

408
00:15:07,800 --> 00:15:03,430
something happened I mean how do you go

409
00:15:12,570 --> 00:15:07,810
from this somewhat frowny face front - I

410
00:15:14,880 --> 00:15:12,580
mean this like amazing feature here and

411
00:15:17,070 --> 00:15:14,890
so we set we decide to spy on blood

412
00:15:19,020 --> 00:15:17,080
falls over the winter and so we put up

413
00:15:20,850 --> 00:15:19,030

some cameras over the winter there's

414
00:15:22,110 --> 00:15:20,860
time when this starts to black out I

415
00:15:23,790 --> 00:15:22,120
should probably have to set this up

416
00:15:24,870 --> 00:15:23,800
better and run it again but I don't know

417
00:15:27,090 --> 00:15:24,880
if you can see here some discharge

418
00:15:29,680 --> 00:15:27,100
happening while it's dark so this is in

419
00:15:31,900 --> 00:15:29,690
the Austral winter and so

420
00:15:34,360 --> 00:15:31,910
around May that you're starting to see

421
00:15:35,470 --> 00:15:34,370
on this discharge event let's see if I

422
00:15:37,180 --> 00:15:35,480
can run this again because it's really

423
00:15:42,850 --> 00:15:37,190
dark up on the screen that you guys see

424
00:15:44,080 --> 00:15:42,860
whoops or not okay so you can see here

425
00:15:46,090 --> 00:15:44,090
right around May you start to have a

426
00:15:47,800 --> 00:15:46,100
little bit of squirt squirt more squirts

427
00:15:50,260 --> 00:15:47,810
right so it's coming out and then when

428
00:15:52,840 --> 00:15:50,270
you arrive in November so clearly there

429
00:15:56,350 --> 00:15:52,850
was a discharge event in the winter

430
00:15:58,450 --> 00:15:56,360
prior to us arriving in November okay so

431
00:16:00,550 --> 00:15:58,460
since the surface is unpredictable and

432
00:16:01,840 --> 00:16:00,560
when you can plan your trips to this

433
00:16:03,640 --> 00:16:01,850
feature you kind of have to go with what

434
00:16:04,990 --> 00:16:03,650
you get at the time our goal is to see

435
00:16:06,370 --> 00:16:05,000
if we could obtain a more pristine

436
00:16:08,680 --> 00:16:06,380
sample by actually drilling into the

437
00:16:10,630 --> 00:16:08,690
glacier and so for that we employed a

438
00:16:13,840 --> 00:16:10,640

collaboration with a German engineering

439
00:16:15,700 --> 00:16:13,850
group called the ice mall was their NX

440
00:16:18,430 --> 00:16:15,710
or Enceladus Explorer project and they

441
00:16:19,990 --> 00:16:18,440
were funded by the DLR we had a

442
00:16:21,940 --> 00:16:20,000
fantastic collaboration with them this

443
00:16:24,760 --> 00:16:21,950
is a thermo mechanical drill it was

444
00:16:26,680 --> 00:16:24,770
designed to melt and also turn in the

445
00:16:28,780 --> 00:16:26,690
ice what we liked about it as

446
00:16:30,490 --> 00:16:28,790
microbiologist is we could practice our

447
00:16:32,770 --> 00:16:30,500
cleaning techniques in the field so here

448
00:16:34,540 --> 00:16:32,780
we are in our tyv x cleaning it prior to

449
00:16:36,580 --> 00:16:34,550
deployment in addition to planetary

450
00:16:38,110 --> 00:16:36,590
protection like protocols we also have a

451
00:16:39,850 --> 00:16:38,120
code of conduct for dipping into

452
00:16:43,300 --> 00:16:39,860
pristine subglacial environments as part

453
00:16:46,330 --> 00:16:43,310
of the Antarctic Treaty okay so how did

454
00:16:48,220 --> 00:16:46,340
we know where to go well here's a cart

455
00:16:49,870 --> 00:16:48,230
our cartoon schematic of what we think

456
00:16:52,780 --> 00:16:49,880
is happening at the interface between

457
00:16:55,660 --> 00:16:52,790
the sublation aquifer and this little

458
00:16:57,340 --> 00:16:55,670
crevasse where blood Falls discharges it

459
00:16:59,320 --> 00:16:57,350
appears to be this weak spot that the

460
00:17:01,000 --> 00:16:59,330
brine tends to move its way out of so

461
00:17:02,890 --> 00:17:01,010
you have this pressurized brine that's

462
00:17:04,780 --> 00:17:02,900
working its way through it cause it's

463
00:17:06,520 --> 00:17:04,790

basically sorry basal crevasse thing at

464
00:17:08,679 --> 00:17:06,530
the base of the glacier and then this

465
00:17:11,170 --> 00:17:08,689
opens up and initiates subglacial

466
00:17:13,960 --> 00:17:11,180
discharge and so while we weren't able

467
00:17:15,970 --> 00:17:13,970
to go deep enough into the subway shoal

468
00:17:17,980 --> 00:17:15,980
aquifer we wanted to try to get into

469
00:17:20,050 --> 00:17:17,990
this conduit here to see if this was

470
00:17:22,420 --> 00:17:20,060
representative of what was deeper in the

471
00:17:24,189 --> 00:17:22,430
glacier and so we use some temperature

472
00:17:25,600 --> 00:17:24,199
measurements right this is the mean

473
00:17:28,360 --> 00:17:25,610
annual temperature of the glacier around

474
00:17:30,430 --> 00:17:28,370
minus 15 minus 17 and so this Brian is

475
00:17:32,110 --> 00:17:30,440
actual a thermal anomaly right at minus

476
00:17:34,030 --> 00:17:32,120
five minus seven it's a warm fluid

477
00:17:36,280 --> 00:17:34,040
moving through this colder ice and so we

478
00:17:39,280 --> 00:17:36,290
can model where we expect to first hit

479
00:17:41,590 --> 00:17:39,290
this brine at about 17 meters so that is

480
00:17:43,009 --> 00:17:41,600
where we drill down to and as we drilled

481
00:17:45,139 --> 00:17:43,019
through we found that

482
00:17:46,940 --> 00:17:45,149
conductivity at about 11 meters really

483
00:17:48,560 --> 00:17:46,950
started to increase so it looked like

484
00:17:51,019 --> 00:17:48,570
you had a lot of refreezing on of this

485
00:17:53,600 --> 00:17:51,029
brine from historic movements throughout

486
00:17:55,430 --> 00:17:53,610
the conduits you have layers of brine as

487
00:17:57,529 --> 00:17:55,440
this materials refreezing maybe even a

488
00:18:01,070 --> 00:17:57,539

new layer from this discharge event in

489
00:18:03,049 --> 00:18:01,080
the spring and then we were able to tap

490
00:18:06,049 --> 00:18:03,059
into this little Brian pocket where it's

491
00:18:07,850 --> 00:18:06,059
actually still liquid and I'm not going

492
00:18:10,399 --> 00:18:07,860
to go over details of the geochemistry

493
00:18:11,960 --> 00:18:10,409
there for the most part it was very

494
00:18:13,820 --> 00:18:11,970
similar geo chemically to the active

495
00:18:15,799 --> 00:18:13,830
discharge we get it was slightly more

496
00:18:17,269 --> 00:18:15,809
concentrated so I do think there was

497
00:18:19,430 --> 00:18:17,279
some unfreeze concentration that

498
00:18:20,810 --> 00:18:19,440
occurred over those few months but I

499
00:18:22,369 --> 00:18:20,820
will show you some of the sequence data

500
00:18:23,359 --> 00:18:22,379
that we have and I know this is a busy

501
00:18:26,930 --> 00:18:23,369
figure so I'm just gonna try to

502
00:18:29,930 --> 00:18:26,940
highlight some of the data here this is

503
00:18:31,489 --> 00:18:29,940
our aluminum iseek amplicon data looking

504
00:18:33,680 --> 00:18:31,499
at relative abundance of the different

505
00:18:35,389 --> 00:18:33,690
phyla types that we see in our various

506
00:18:38,450 --> 00:18:35,399
samples from a brine and around the

507
00:18:40,759 --> 00:18:38,460
glacier so when we look at samples that

508
00:18:42,109 --> 00:18:40,769
come from this conduit or from active

509
00:18:45,169 --> 00:18:42,119
discharge events like that video I

510
00:18:48,019 --> 00:18:45,179
showed you what we see here is very

511
00:18:49,749 --> 00:18:48,029
consistent abundances and diversity in

512
00:18:53,480 --> 00:18:49,759
the sample so these would be these

513
00:18:55,220 --> 00:18:53,490

high-salt samples that we have and so

514
00:18:57,379 --> 00:18:55,230
the conclusion there is that this end

515
00:18:59,149 --> 00:18:57,389
glacial brine and the active discharge

516
00:19:00,799 --> 00:18:59,159
appeared to be stable even though they

517
00:19:02,659 --> 00:19:00,809
were sampled over a decade apart and so

518
00:19:04,580 --> 00:19:02,669
this is I think kind of interesting it's

519
00:19:06,230 --> 00:19:04,590
like the second sub or the first sub

520
00:19:08,889 --> 00:19:06,240
glacial feature to be sampled twice and

521
00:19:12,289 --> 00:19:08,899
we're seeing the same relative abundance

522
00:19:14,119 --> 00:19:12,299
and we were able to pick out from this

523
00:19:16,999 --> 00:19:14,129
limited data set what we consider a core

524
00:19:19,129 --> 00:19:17,009
microbiome so of these samples on there

525
00:19:25,009 --> 00:19:19,139
were 66 ot use that were common between

526
00:19:26,720 --> 00:19:25,019
them that made up 92% of the data moving

527
00:19:28,249 --> 00:19:26,730
on to the surface events that this is

528
00:19:29,269 --> 00:19:28,259
during those frownie years when it's a

529
00:19:31,820 --> 00:19:29,279
little bit well it's not fine it's fine

530
00:19:33,259 --> 00:19:31,830
it's just it's it's different so it's

531
00:19:35,720 --> 00:19:33,269
I'm getting I'm getting I'm warming up

532
00:19:37,609 --> 00:19:35,730
to it so the the salt content is very

533
00:19:39,440 --> 00:19:37,619
low you're collecting samples from the

534
00:19:41,509 --> 00:19:39,450
surface and you can see there they're

535
00:19:44,299 --> 00:19:41,519
really different from what we what we

536
00:19:45,710 --> 00:19:44,309
see in the end glacial brine and these

537
00:19:47,720 --> 00:19:45,720
are there's high variation between

538
00:19:51,619 --> 00:19:47,730

samples collected and they're dominated

539
00:19:53,149 --> 00:19:51,629
by chloroplasts we can use some

540
00:19:55,159 --> 00:19:53,159
bioinformatics techniques this was work

541
00:19:57,030 --> 00:19:55,169
led by my postdoc Richard camp in his

542
00:19:58,800 --> 00:19:57,040
paper has just come out

543
00:20:01,620 --> 00:19:58,810
but here he was using these taxonomic

544
00:20:03,450 --> 00:20:01,630
biomarkers to identify different

545
00:20:05,550 --> 00:20:03,460
differentially abundant taxa using a

546
00:20:07,020 --> 00:20:05,560
program called leaf C and some of the

547
00:20:08,970 --> 00:20:07,030
biomarkers we found that are indicative

548
00:20:10,350 --> 00:20:08,980
so if you get a sample and you're like

549
00:20:11,760 --> 00:20:10,360
oh is this Brian or not you would want

550
00:20:13,110 --> 00:20:11,770
to look for these organisms first you'd

551
00:20:14,910 --> 00:20:13,120
want to see there's no chloroplasts in

552
00:20:16,170 --> 00:20:14,920
there but then you would also look for

553
00:20:19,230 --> 00:20:16,180
some of these organisms such as the a

554
00:20:22,710 --> 00:20:19,240
tractor this is a Bacteroides that has

555
00:20:24,810 --> 00:20:22,720
only 86% sequence identity to an

556
00:20:27,600 --> 00:20:24,820
organism from a marine salt urn and our

557
00:20:30,390 --> 00:20:27,610
first identification of archaea

558
00:20:34,110 --> 00:20:30,400
the pcr kyouda group are present in the

559
00:20:36,420 --> 00:20:34,120
sample yes so there's the it seems

560
00:20:38,340 --> 00:20:36,430
through sequence diversity you can

561
00:20:41,310 --> 00:20:38,350
differentiate between on these two

562
00:20:43,320 --> 00:20:41,320
samples which is kind of cool okay but

563
00:20:45,120 --> 00:20:43,330

now the brine is out on the surface and

564
00:20:47,310 --> 00:20:45,130
how does this change we see this strong

565
00:20:48,810 --> 00:20:47,320
community shift and it makes me think of

566
00:20:50,610 --> 00:20:48,820
ocean worlds and what you might get on

567
00:20:52,620 --> 00:20:50,620
the surface and how different what we're

568
00:20:54,450 --> 00:20:52,630
seeing at this really beautiful surface

569
00:20:57,840 --> 00:20:54,460
feature is from where it actually

570
00:20:59,550 --> 00:20:57,850
sourced from okay so when if we go back

571
00:21:01,320 --> 00:20:59,560
and look at this discharge if I were to

572
00:21:03,030 --> 00:21:01,330
follow it down the glacier and start

573
00:21:05,550 --> 00:21:03,040
sampling I'd start with something that

574
00:21:08,700 --> 00:21:05,560
had no detectable oxygen I'd move on to

575
00:21:10,260 --> 00:21:08,710
something that had increasing levels of

576
00:21:13,680 --> 00:21:10,270
oxygen as you go down the glacier

577
00:21:15,510 --> 00:21:13,690
terminus this year we stuck a co2 flux

578
00:21:19,110 --> 00:21:15,520
sensor out there and you can see you're

579
00:21:21,750 --> 00:21:19,120
also gassing a lot of co2 from the

580
00:21:23,970 --> 00:21:21,760
system and this is a really traumatic

581
00:21:27,060 --> 00:21:23,980
event for a microorganism you're

582
00:21:28,590 --> 00:21:27,070
increasing in pH you're getting exposed

583
00:21:29,850 --> 00:21:28,600
to sunlight after you've potentially

584
00:21:32,850 --> 00:21:29,860
been under a glacier for millions of

585
00:21:35,280 --> 00:21:32,860
years your oxygen which is a stressor

586
00:21:36,780 --> 00:21:35,290
pressure changes you're getting diluted

587
00:21:38,880 --> 00:21:36,790
so whatever it was that you became

588
00:21:43,170 --> 00:21:38,890

comfortable with in this like incredibly

589
00:21:47,340 --> 00:21:43,180
stable mellow dark environment it's now

590
00:21:48,750 --> 00:21:47,350
like so this can be traumatic alright so

591
00:21:50,510 --> 00:21:48,760
this is where I move into the last step

592
00:21:53,280 --> 00:21:50,520
talking about how we might use this

593
00:21:54,990 --> 00:21:53,290
surface stuff we collect as a bio

594
00:21:56,640 --> 00:21:55,000
signature and I think this is an

595
00:21:58,860 --> 00:21:56,650
evolving understanding I'm finding

596
00:22:01,980 --> 00:21:58,870
myself even in Peru okay I'll just

597
00:22:03,570 --> 00:22:01,990
breeze through this one you know we we

598
00:22:05,940 --> 00:22:03,580
first looked at Mars we saw a face on

599
00:22:08,430 --> 00:22:05,950
Mars now we can do some really advanced

600
00:22:08,740 --> 00:22:08,440
spectroscopy and actually so in the same

601
00:22:10,090 --> 00:22:08,750
thing

602
00:22:12,760 --> 00:22:10,100
happens down there blood falls when you

603
00:22:14,200 --> 00:22:12,770
first saw it the first explorers heroic

604
00:22:17,860 --> 00:22:14,210
though they were they thought this was

605
00:22:20,710 --> 00:22:17,870
snow algae at the surface later in the

606
00:22:22,420 --> 00:22:20,720
60s during the determined age they did

607
00:22:25,030 --> 00:22:22,430
some analysis and found there was Haley

608
00:22:26,980 --> 00:22:25,040
aragonite etc so they were starting to

609
00:22:29,650 --> 00:22:26,990
do some of the mineralogy but weren't

610
00:22:31,120 --> 00:22:29,660
necessarily sure of the biology so for

611
00:22:32,530 --> 00:22:31,130
our future directions we'd like to

612
00:22:34,210 --> 00:22:32,540
characterize this a bit more I've

613
00:22:36,190 --> 00:22:34,220

collaborated with Darby Dyer and Eli

614
00:22:38,230 --> 00:22:36,200
scold at Planetary Science Institute and

615
00:22:39,580 --> 00:22:38,240
PD Lee to look at some of the volatile

616
00:22:40,510 --> 00:22:39,590
Spectras that will be coming out of this

617
00:22:43,870 --> 00:22:40,520
feature as well as some of the

618
00:22:45,580 --> 00:22:43,880
mineralogy of the surface one minute and

619
00:22:48,340 --> 00:22:45,590
I just wanted to highlight so there is

620
00:22:50,200 --> 00:22:48,350
some hope in this diversity data so in

621
00:22:51,100 --> 00:22:50,210
the conduit sample which is this last

622
00:22:53,170 --> 00:22:51,110
one right here

623
00:22:55,630 --> 00:22:53,180
you see there is some shift in abundance

624
00:22:56,950 --> 00:22:55,640
and one of them in particular was this

625
00:22:59,650 --> 00:22:56,960
thio micro spire which is a

626
00:23:01,870 --> 00:22:59,660
chemosynthetic sulfur oxidizer was six

627
00:23:03,370 --> 00:23:01,880
times higher in the conduit sample again

628
00:23:04,720 --> 00:23:03,380
you need replicates to think anything

629
00:23:06,310 --> 00:23:04,730
about it but maybe there's some

630
00:23:08,980 --> 00:23:06,320
community shifts that we can predict in

631
00:23:10,180 --> 00:23:08,990
the conduit there also seems to be some

632
00:23:12,610 --> 00:23:10,190
remnants that might be left at the

633
00:23:15,250 --> 00:23:12,620
surface we had one nan al flow sample

634
00:23:17,440 --> 00:23:15,260
that I hiked up high to get and it had

635
00:23:19,240 --> 00:23:17,450
some of the core brine members but they

636
00:23:20,950 --> 00:23:19,250
were poorly represented and it didn't

637
00:23:23,590 --> 00:23:20,960
have some of those indicator microbes

638
00:23:25,270 --> 00:23:23,600

but there was still some of the dominant

639
00:23:29,110 --> 00:23:25,280
features in there so perhaps there's

640
00:23:31,240 --> 00:23:29,120
some remnants that we can pick up in the

641
00:23:32,740 --> 00:23:31,250
essence of time I won't go through this

642
00:23:35,170 --> 00:23:32,750
except just to say that we've been

643
00:23:37,570 --> 00:23:35,180
collecting samples collecting cultures

644
00:23:39,760 --> 00:23:37,580
from the surface and we're using some of

645
00:23:41,800 --> 00:23:39,770
these text techniques such as ramen and

646
00:23:44,590 --> 00:23:41,810
FTIR to look at the mineral composition

647
00:23:46,720 --> 00:23:44,600
of both the surface and pure cultures to

648
00:23:48,400 --> 00:23:46,730
see if we can validate what we see using

649
00:23:51,280 --> 00:23:48,410
various electron donor and minerals as

650
00:23:52,600 --> 00:23:51,290
well as use it looking at different

651
00:23:53,950 --> 00:23:52,610
stages of the growth phase because I

652
00:23:57,150 --> 00:23:53,960
think that's important as well as

653
00:23:59,560 --> 00:23:57,160
various temperatures so in conclusion

654
00:24:02,080 --> 00:23:59,570
physical structure of these systems can

655
00:24:05,590 --> 00:24:02,090
tell us about ecosystem status it can

656
00:24:09,040 --> 00:24:05,600
help inform what the ecology might be it

657
00:24:10,840 --> 00:24:09,050
can be a good target looking at sorry we

658
00:24:13,690 --> 00:24:10,850
were able to deduce Brian a core

659
00:24:16,570 --> 00:24:13,700
microbiome the discharge is dramatically

660
00:24:18,760 --> 00:24:16,580
dramatic and rapidly shifts but there

661
00:24:21,500 --> 00:24:18,770
may be some little remnants in this

662
00:24:23,810 --> 00:24:21,510
discharge that we can tease out

663
00:24:26,210 --> 00:24:23,820

some fodder for discussion I'm inspired

664
00:24:27,410 --> 00:24:26,220
to see so many talks on cold organisms

665
00:24:29,180 --> 00:24:27,420
I'm expecially looking forward to some

666
00:24:30,470 --> 00:24:29,190
of them in this session is it the Golden

667
00:24:32,750 --> 00:24:30,480
Age these were always underrepresented

668
00:24:35,690 --> 00:24:32,760
in culture collections and not as

669
00:24:37,520 --> 00:24:35,700
abundant in our genome libraries but

670
00:24:38,540 --> 00:24:37,530
I've really seen a change in that over

671
00:24:40,580 --> 00:24:38,550
the time and I'm so excited because

672
00:24:42,680 --> 00:24:40,590
these are fabulous organisms look at

673
00:24:44,330 --> 00:24:42,690
this guy oh my goodness this is a Xuan

674
00:24:47,300 --> 00:24:44,340
Ella collected from the surface of blood

675
00:24:48,860 --> 00:24:47,310
Falls membrane vesicles oh man this is

676
00:24:51,260 --> 00:24:48,870
lovely and then this little EPS in this

677
00:24:53,900 --> 00:24:51,270
tail I mean he's it's really attractive

678
00:24:55,100 --> 00:24:53,910
um but if you were to look at it she it

679
00:24:56,960 --> 00:24:55,110
really is but if you were to look in its

680
00:25:00,710 --> 00:24:56,970
genome you would see things like it has

681
00:25:02,510 --> 00:25:00,720
the ability to bind to ice and so it has

682
00:25:03,830 --> 00:25:02,520
these different adhesion properties how

683
00:25:05,720 --> 00:25:03,840
is this gonna affect mineral

684
00:25:07,640 --> 00:25:05,730
precipitation in an ice environment as

685
00:25:10,730 --> 00:25:07,650
opposed to in some other type of

686
00:25:15,290 --> 00:25:10,740
environment so with that I'd like to

687
00:25:16,400 --> 00:25:15,300
thank my fantastic lab group uh this

688
00:25:17,060 --> 00:25:16,410

obviously wouldn't be worth it without

689
00:25:19,640 --> 00:25:17,070
them

690
00:25:22,280 --> 00:25:19,650
as well as our funding agencies that

691
00:25:26,150 --> 00:25:22,290
help support us and all my amazing

692
00:25:27,470 --> 00:25:26,160
collaborators so frost flower that's the

693
00:25:30,620 --> 00:25:27,480
only type of ice we tend to get in

694
00:25:36,419 --> 00:25:30,630
Tennessee okay thank you

695
00:25:39,100 --> 00:25:36,429
[Applause]

696
00:25:41,049 --> 00:25:39,110
this is working yeah so we have a few

697
00:25:42,460 --> 00:25:41,059
minutes for questions if someone could

698
00:25:44,440 --> 00:25:42,470
come up to the microphone rather than

699
00:25:45,010 --> 00:25:44,450
shouting from your seat that'd be great

700
00:25:52,180 --> 00:25:45,020
thank you

701
00:25:54,520 --> 00:25:52,190
come on up no no you made this nice

702
00:25:59,049 --> 00:25:54,530
teaser about the Tong Huan pond right

703
00:26:01,750 --> 00:25:59,059
and well with the modeling and you know

704
00:26:03,610 --> 00:26:01,760
remote sensing of that I mean you know

705
00:26:06,520 --> 00:26:03,620
if you do astrobiology you have to get

706
00:26:08,710 --> 00:26:06,530
close and personal right yeah so when

707
00:26:10,750 --> 00:26:08,720
you swing by platfor can you also swing

708
00:26:12,700 --> 00:26:10,760
by at the don't want want and get

709
00:26:14,740 --> 00:26:12,710
sampled so yeah so we did this season

710
00:26:17,289 --> 00:26:14,750
yeah and maybe I should have teased a

711
00:26:18,850 --> 00:26:17,299
little more than I did but so the this

712
00:26:21,370 --> 00:26:18,860
was just the survey but we also

713
00:26:22,990 --> 00:26:21,380

collected some samples and so we can do

714
00:26:25,210 --> 00:26:23,000
a little more work my I guess what I was

715
00:26:27,880 --> 00:26:25,220
trying to set up is that it's gonna be

716
00:26:29,620 --> 00:26:27,890
hard to tease out what is in situ versus

717
00:26:31,480 --> 00:26:29,630
what may have been blown in or what may

718
00:26:34,000 --> 00:26:31,490
have been dragged in along the

719
00:26:36,820 --> 00:26:34,010
permafrost boundary and so I think these

720
00:26:39,190 --> 00:26:36,830
complicated bio signatures like pulling

721
00:26:41,230 --> 00:26:39,200
out what is contamination versus what is

722
00:26:43,659 --> 00:26:41,240
truly subsurface Brian I'm an advocate

723
00:26:45,250 --> 00:26:43,669
of finding a way to drill again much

724
00:26:46,780 --> 00:26:45,260
like they did in the dry Valley drilling

725
00:26:50,169 --> 00:26:46,790
project if we really want to know what

726
00:26:59,620 --> 00:26:50,179
uncontaminated features are okay so but

727
00:27:01,600 --> 00:26:59,630
yeah yes I'm Zack Cooper from the

728
00:27:03,669 --> 00:27:01,610
University of Washington I I wanted to

729
00:27:05,140 --> 00:27:03,679
ask you about a microbial activity in

730
00:27:08,049 --> 00:27:05,150
the subway shal brines and what you

731
00:27:11,020 --> 00:27:08,059
think about like growth rates based on

732
00:27:13,390 --> 00:27:11,030
the you know like Sub Zero hyper saline

733
00:27:15,220 --> 00:27:13,400
and opposite conditions and like what

734
00:27:16,780 --> 00:27:15,230
the carbon utilization in residence

735
00:27:19,030 --> 00:27:16,790
times of these communities might look

736
00:27:21,730 --> 00:27:19,040
like yeah so I think it's probably

737
00:27:23,830 --> 00:27:21,740
really slow and we've incubated these at

738
00:27:25,360 --> 00:27:23,840

non in situ temperature so like zero

739
00:27:27,100 --> 00:27:25,370
degrees is the best we can do in the

740
00:27:28,870 --> 00:27:27,110
field and you have really slow rates

741
00:27:30,730 --> 00:27:28,880
some of our turnover times for certain

742
00:27:33,340 --> 00:27:30,740
substrates are 300 days some are even

743
00:27:36,010 --> 00:27:33,350
higher so I mean these are really slow

744
00:27:37,360 --> 00:27:36,020
growing systems and these may not be the

745
00:27:38,860 --> 00:27:37,370
best measurements like giving them a

746
00:27:40,659 --> 00:27:38,870
labeled substrate is probably not the

747
00:27:43,060 --> 00:27:40,669
way to go and so that's one of our

748
00:27:45,370 --> 00:27:43,070
challenges as people who study cold

749
00:27:46,810 --> 00:27:45,380
systems is how can you better track

750
00:27:48,970 --> 00:27:46,820
turnover time and I don't know

751
00:27:54,370 --> 00:27:48,980
in your group you're doing some cool new

752
00:27:55,779 --> 00:27:54,380
methods to look at that but yeah

753
00:27:56,950 --> 00:27:55,789
definitely and also think that that's

754
00:27:59,230 --> 00:27:56,960
why we've switched a little bit to

755
00:28:01,120 --> 00:27:59,240
laboratory cultures that you can they're

756
00:28:02,950 --> 00:28:01,130
not necessarily growing optimally they

757
00:28:04,960 --> 00:28:02,960
might be growing faster at these higher

758
00:28:06,999 --> 00:28:04,970
temperatures but you can it's a starting

759
00:28:08,320 --> 00:28:07,009
point to help you pinpoint what to look

760
00:28:09,960 --> 00:28:08,330
for when you're doing these really

761
00:28:13,509 --> 00:28:09,970
challenging long-term in-situ

762
00:28:16,029 --> 00:28:13,519
experiments you just really quick

763
00:28:17,320 --> 00:28:16,039

question oh I was just gonna draw your

764
00:28:19,450 --> 00:28:17,330
attention you may have seen there was a

765
00:28:21,639 --> 00:28:19,460
talk earlier this week so you can

766
00:28:26,200 --> 00:28:21,649
measure biomass in subsurface Wars with

767
00:28:29,619 --> 00:28:26,210
polo metric is that the seismic bio

768
00:28:31,899 --> 00:28:29,629
geophysics talk hasn't he

769
00:28:33,129 --> 00:28:31,909
it may be something leave absolutely on

770
00:28:35,799 --> 00:28:33,139
what do you know what type of technique

771
00:28:37,749 --> 00:28:35,809
they were using was it somebody was

772
00:28:40,180 --> 00:28:37,759
using doing sonar or something they were

773
00:28:41,440 --> 00:28:40,190
using anyway if anyone has any

774
00:28:43,840 --> 00:28:41,450
information on that I think there's a

775
00:28:44,680 --> 00:28:43,850
paper I think if you say yeah that

776
00:28:46,869 --> 00:28:44,690
sounds fascinating

777
00:28:48,669 --> 00:28:46,879
thank you for your age everybody could