AbSciCon 2019

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

2
00:00:11,400 --> 00:00:09,020
[Applause]

3
00:00:13,259 --> 00:00:11,410
all right thanks everyone I wasn't sure

4
00:00:16,769 --> 00:00:13,269
quite how many people to expect at the

5
00:00:18,480 --> 00:00:16,779
last talk of the conference but it looks

6
00:00:21,990 --> 00:00:18,490
like I don't get off easy with an empty

7
00:00:25,470 --> 00:00:22,000
room so let's go ahead so my talk is

8
00:00:28,409 --> 00:00:25,480
about a a couple of different microbial

9
00:00:30,870 --> 00:00:28,419
ecosystems I've been studying in sub

10
00:00:33,990 --> 00:00:30,880
glacial environments that we think are

11
00:00:35,550 --> 00:00:34,000
supported by Litha genic hydrogen I mean

12
00:00:37,260 --> 00:00:35,560
I wanted to you know I wasn't sure how

13
00:00:38,430 --> 00:00:37,270

much how short on time we'd be running

14
00:00:41,189 --> 00:00:38,440
by the end of the day so I want to make

15
00:00:41,939 --> 00:00:41,199
sure and get my thanks out here right

16
00:00:44,790 --> 00:00:41,949
away

17
00:00:46,500 --> 00:00:44,800
so dr. Eric Boyd is my PhD advisor and

18
00:00:49,319 --> 00:00:46,510
thanks to Mark who serves on my graduate

19
00:00:51,689 --> 00:00:49,329
committee melody and Rebecca are members

20
00:00:53,849 --> 00:00:51,699
of their respective labs who have each

21
00:00:56,340 --> 00:00:53,859
been helpful in the field work in the

22
00:01:00,299 --> 00:00:56,350
experimental work in the data analysis

23
00:01:02,369 --> 00:01:00,309
of these projects so one of the

24
00:01:04,920 --> 00:01:02,379
frameworks I like to approach this

25
00:01:06,300 --> 00:01:04,930
project through is you know an astro

26
00:01:09,180 --> 00:01:06,310
biological question of what makes a

27
00:01:12,600 --> 00:01:09,190
planet habitable and we can kind of go

28
00:01:13,950 --> 00:01:12,610
through a few first-order indicators of

29
00:01:16,050 --> 00:01:13,960
whether a planet may or may not be

30
00:01:18,420 --> 00:01:16,060
habitable so I've just taken these from

31
00:01:22,469 --> 00:01:18,430
the NASA NASA Astrobiology strategy

32
00:01:23,880 --> 00:01:22,479
document from 2015 and these are all you

33
00:01:26,490 --> 00:01:23,890
know these are important considerations

34
00:01:30,300 --> 00:01:26,500
to make in terms of narrowing our search

35
00:01:33,539 --> 00:01:30,310
for habitable worlds but in sort of a

36
00:01:35,850 --> 00:01:33,549
more through a more ecological lens we

37
00:01:37,620 --> 00:01:35,860
can think about more second-order

38
00:01:39,090 --> 00:01:37,630

constraints on microbial communities and

39
00:01:42,990 --> 00:01:39,100
the one I'd like to focus on today is

40
00:01:44,490 --> 00:01:43,000
that a microbial community needs a

41
00:01:46,620 --> 00:01:44,500
source of fixed carbon there has to be

42
00:01:48,709 --> 00:01:46,630
you know a base of the the trophic

43
00:01:51,990 --> 00:01:48,719
pyramid there has to be a population

44
00:01:53,880 --> 00:01:52,000
carrying out primary production and

45
00:01:55,139 --> 00:01:53,890
studying these environments on earth is

46
00:01:57,240 --> 00:01:55,149
sort of complicated by the fact that

47
00:02:00,209 --> 00:01:57,250
most primary production on our planet is

48
00:02:02,459 --> 00:02:00,219
carried out by photosynthesizers so we

49
00:02:05,039 --> 00:02:02,469
can put up you know this very simplified

50
00:02:07,560 --> 00:02:05,049
schematic equation of photosynthesis in

51
00:02:09,420 --> 00:02:07,570
which co2 and water through the energy

52
00:02:14,280 --> 00:02:09,430
supplied by photons are transformed into

53
00:02:17,040 --> 00:02:14,290
both reduced organic matter biomass and

54
00:02:19,979 --> 00:02:17,050
oxygen which is then you know the the

55
00:02:21,630 --> 00:02:19,989
oxygen is used to oxidize some of that

56
00:02:23,850 --> 00:02:21,640
photosynthate for

57
00:02:26,100 --> 00:02:23,860
energy and so the photosynthetic plants

58
00:02:29,460 --> 00:02:26,110
algae cyanobacteria are using energy

59
00:02:32,910 --> 00:02:29,470
from the Sun and co2 and water to get

60
00:02:35,400 --> 00:02:32,920
both reduced biomass and their carry out

61
00:02:36,840 --> 00:02:35,410
their energy metabolism if we look at

62
00:02:39,449 --> 00:02:36,850
something like an icy world habitat

63
00:02:41,940 --> 00:02:39,459

where we have no current indications of

64
00:02:44,040 --> 00:02:41,950
ongoing photosynthesis if we want to

65
00:02:45,180 --> 00:02:44,050
find microbial communities in this kind

66
00:02:47,100 --> 00:02:45,190
of an environment we're going to be

67
00:02:49,070 --> 00:02:47,110
having to look for those supported by

68
00:02:51,590 --> 00:02:49,080
geochemical sources of energy

69
00:02:56,970 --> 00:02:51,600
something like methanogenesis in which

70
00:02:58,800 --> 00:02:56,980
hydrogen and co2 may react to form again

71
00:03:02,400 --> 00:02:58,810
reduced carbon that can be assimilated

72
00:03:04,740 --> 00:03:02,410
into biomass and energy for metabolism

73
00:03:06,330 --> 00:03:04,750
so you know this this metabolism has

74
00:03:08,610 --> 00:03:06,340
been described as a free lunch that

75
00:03:13,470 --> 00:03:08,620
microbes are paid to eat as it produces

76
00:03:15,509 --> 00:03:13,480
both energy and organic matter so again

77
00:03:16,740 --> 00:03:15,519
just sort of the the complication here

78
00:03:18,320 --> 00:03:16,750
is that it's difficult to find

79
00:03:21,140 --> 00:03:18,330
environments on earth that are not

80
00:03:25,080 --> 00:03:21,150
supported on photosynthetically derived

81
00:03:27,690 --> 00:03:25,090
energy and organic matter and so kind of

82
00:03:30,420 --> 00:03:27,700
a refinement of our search for analog

83
00:03:32,039 --> 00:03:30,430
environments on our own planet would be

84
00:03:33,960 --> 00:03:32,049
to look for those that favor communities

85
00:03:38,009 --> 00:03:33,970
supported by chemo litho autotrophic

86
00:03:39,720 --> 00:03:38,019
primary production and so I've looked

87
00:03:42,930 --> 00:03:39,730
for these communities in sublation

88
00:03:44,250 --> 00:03:42,940

environments so beneath you know belief

89
00:03:46,380 --> 00:03:44,260
beneath hundreds of metres of ice you

90
00:03:48,720 --> 00:03:46,390
can reasonably assume that the influence

91
00:03:51,090 --> 00:03:48,730
of sunlight and photosynthesis have been

92
00:03:52,710 --> 00:03:51,100
excluded and depending on the bedrock

93
00:03:55,020 --> 00:03:52,720
beneath these glaciers there's not a

94
00:03:58,020 --> 00:03:55,030
whole lot of buried organic matter to

95
00:04:00,479 --> 00:03:58,030
support microbial communities either and

96
00:04:02,990 --> 00:04:00,489
we know that some of these communities

97
00:04:06,539 --> 00:04:03,000
are supported by chemo Luther autotrophs

98
00:04:08,420 --> 00:04:06,549
so Eric and Mark have done work over

99
00:04:11,100 --> 00:04:08,430
several years demonstrating

100
00:04:15,210 --> 00:04:11,110
methanogenesis in some sub glacial

101
00:04:18,300 --> 00:04:15,220
environments we can we can see through

102
00:04:22,830 --> 00:04:18,310
c14 tracer experiments that these

103
00:04:24,719 --> 00:04:22,840
organisms are indeed fixing co2 and we

104
00:04:26,760 --> 00:04:24,729
can show that comminution

105
00:04:28,890 --> 00:04:26,770
of sub glacial rock is enough to produce

106
00:04:32,310 --> 00:04:28,900
the hydrogen needed as a reductant to

107
00:04:34,840 --> 00:04:32,320
support these communities and so my

108
00:04:37,150 --> 00:04:34,850
thesis work is really focused on

109
00:04:39,610 --> 00:04:37,160
trying to identify whether differences

110
00:04:43,030 --> 00:04:39,620
in the underlying geology of a glacial

111
00:04:44,830 --> 00:04:43,040
system can influence the abundance and

112
00:04:48,490 --> 00:04:44,840
structure of the microbial communities

113
00:04:50,500 --> 00:04:48,500

in these systems and so I'm getting at

114
00:04:53,080 --> 00:04:50,510
that through the lens of hydrogen

115
00:04:55,300 --> 00:04:53,090
production again a key it's V key

116
00:04:58,830 --> 00:04:55,310
reductant for methanogenesis and heceta

117
00:05:03,400 --> 00:04:58,840
genesis in there fully autotrophic

118
00:05:05,080 --> 00:05:03,410
iterations and in a sub glacial

119
00:05:06,700 --> 00:05:05,090
environment or in water rock

120
00:05:09,190 --> 00:05:06,710
interactions there are a few different

121
00:05:10,720 --> 00:05:09,200
ways of generating hydrogen I think you

122
00:05:12,430 --> 00:05:10,730
know we've heard some at this conference

123
00:05:13,690 --> 00:05:12,440
about how some of these mechanisms are

124
00:05:15,070 --> 00:05:13,700
still under investigation

125
00:05:19,540 --> 00:05:15,080
but I just want to focus your attention

126
00:05:21,670 --> 00:05:19,550
on two key mechanisms one is silica

127
00:05:25,000 --> 00:05:21,680
shearing by glacial comminution can

128
00:05:26,650 --> 00:05:25,010
generate silica radicals which can you

129
00:05:27,970 --> 00:05:26,660
know split water and generate hydrogen

130
00:05:31,360 --> 00:05:27,980
radicals which will react with each

131
00:05:32,770 --> 00:05:31,370
other to produce hydrogen gas and there

132
00:05:36,490 --> 00:05:32,780
are also mechanisms by which ferrous

133
00:05:38,710 --> 00:05:36,500
iron can reduce water and Stevens and

134
00:05:41,410 --> 00:05:38,720
McKinley did some some work in the early

135
00:05:44,410 --> 00:05:41,420
late 90s early 2000s on you know low

136
00:05:49,330 --> 00:05:44,420
temperature water reduction by ferrous

137
00:05:51,700 --> 00:05:49,340
iron and so regardless of you know our

138
00:05:53,410 --> 00:05:51,710

understanding of you know the exact

139
00:05:56,590 --> 00:05:53,420
mechanisms by which these processes

140
00:05:59,080 --> 00:05:56,600
happen I think it's safe to build a

141
00:06:01,960 --> 00:05:59,090
hypothesis around the idea that in a

142
00:06:03,820 --> 00:06:01,970
system with higher silica content higher

143
00:06:05,710 --> 00:06:03,830
ferrous iron content with more of these

144
00:06:08,200 --> 00:06:05,720
potential mechanisms for hydrogen

145
00:06:10,510 --> 00:06:08,210
production we may see indeed higher

146
00:06:13,630 --> 00:06:10,520
levels of hydrogen dissolved in the sub

147
00:06:15,610 --> 00:06:13,640
glacial fluids and melt waters and we

148
00:06:17,860 --> 00:06:15,620
might expect that this environment would

149
00:06:19,840 --> 00:06:17,870
favor hydrogen atrophic primary

150
00:06:23,080 --> 00:06:19,850
production in the microbial communities

151
00:06:25,420 --> 00:06:23,090
associated with these environments so in

152
00:06:28,060 --> 00:06:25,430
order to try and demonstrate this

153
00:06:30,430 --> 00:06:28,070
phenomenon I'm looking at a pair of

154
00:06:33,460 --> 00:06:30,440
glaciers that differ in their bedrock

155
00:06:36,640 --> 00:06:33,470
geology so one is Robertson glacier here

156
00:06:38,500 --> 00:06:36,650
in the Canadian Rockies in the local

157
00:06:40,390 --> 00:06:38,510
bedrock is primarily carbonates there's

158
00:06:42,250 --> 00:06:40,400
some shales there's a decent amount of

159
00:06:45,730 --> 00:06:42,260
iron in the sediments beneath Robertson

160
00:06:48,159 --> 00:06:45,740
but low silica content and so this will

161
00:06:48,730 --> 00:06:48,169
be my model system of a sort of an

162
00:06:50,409 --> 00:06:48,740
environment

163
00:06:52,809 --> 00:06:50,419

low potential for hydrogen production

164
00:06:55,210 --> 00:06:52,819
and I'll be comparing these to a glacier

165
00:06:58,450 --> 00:06:55,220
in Iceland this is cot leocal which is

166
00:07:00,219 --> 00:06:58,460
in southern Iceland and overlays you

167
00:07:02,890 --> 00:07:00,229
know geologically speaking relatively

168
00:07:05,740 --> 00:07:02,900
fresh basalt so with a high silica

169
00:07:07,930 --> 00:07:05,750
content high in ferrous iron we might

170
00:07:10,390 --> 00:07:07,940
expect to see more hydrogen production

171
00:07:14,230 --> 00:07:10,400
after combination of this basaltic

172
00:07:17,469 --> 00:07:14,240
bedrock than we would at Robertson and

173
00:07:19,480 --> 00:07:17,479
so Everett shock was kind enough to

174
00:07:21,100 --> 00:07:19,490
provide some hydrogen data from the

175
00:07:24,899 --> 00:07:21,110
Robertson system and we can see there

176
00:07:26,950 --> 00:07:24,909
was about you know 40 to 50 nano molar

177
00:07:29,409 --> 00:07:26,960
hydrogen in the outflow waters at the

178
00:07:32,649 --> 00:07:29,419
time his group measured it here's our

179
00:07:35,140 --> 00:07:32,659
mobile geochemistry lab in Iceland and

180
00:07:38,020 --> 00:07:35,150
at Kotla local I was able to measure

181
00:07:40,149 --> 00:07:38,030
somewhere on the order of 400 to 500

182
00:07:42,520 --> 00:07:40,159
nanometer j'en in the outflow water so

183
00:07:46,120 --> 00:07:42,530
roughly one order of magnitude increase

184
00:07:48,580 --> 00:07:46,130
and this evidence was enough for me to

185
00:07:50,920 --> 00:07:48,590
continue with some cultivation work to

186
00:07:52,839 --> 00:07:50,930
look at whether these differences in

187
00:07:54,610 --> 00:07:52,849
available hydrogen between the two

188
00:07:56,649 --> 00:07:54,620

catchments actually translate to

189
00:07:59,140 --> 00:07:56,659
differential abilities of the community

190
00:08:01,240 --> 00:07:59,150
to utilize hydrogen as a reductant and

191
00:08:04,810 --> 00:08:01,250
to use hydrogen to fuel primary

192
00:08:07,200 --> 00:08:04,820
production and so in my activity assays

193
00:08:09,969 --> 00:08:07,210
I used a microcosm based approach I

194
00:08:12,510 --> 00:08:09,979
inoculated these with sediment slurry

195
00:08:14,800 --> 00:08:12,520
and a medium designed to mimic the

196
00:08:16,570 --> 00:08:14,810
composition of the pore water the

197
00:08:18,760 --> 00:08:16,580
outflow water at each of these glaciers

198
00:08:21,059 --> 00:08:18,770
I made them anoxic and gave them a 20

199
00:08:24,990 --> 00:08:21,069
percent co2 atmosphere to favor

200
00:08:28,240 --> 00:08:25,000
autotroph II added 500 ppm hydrogen and

201
00:08:30,100 --> 00:08:28,250
then as near as I could get to a 1

202
00:08:32,230 --> 00:08:30,110
millimolar concentration of various

203
00:08:36,190 --> 00:08:32,240
oxidants utilized in chemo litho

204
00:08:37,510 --> 00:08:36,200
autotrophic metabolisms and so the

205
00:08:39,850 --> 00:08:37,520
output from this experiment as I'm

206
00:08:41,620 --> 00:08:39,860
sampling the headspace and using a gas

207
00:08:43,300 --> 00:08:41,630
chromatograph to measure the total

208
00:08:46,360 --> 00:08:43,310
amount of hydrogen in these microcosms

209
00:08:48,220 --> 00:08:46,370
over time and you know I would expect to

210
00:08:50,139 --> 00:08:48,230
see in an abiotic control or a

211
00:08:51,699 --> 00:08:50,149
heat-killed control that the level of

212
00:08:53,350 --> 00:08:51,709
hydrogen stays relatively constant

213
00:08:55,449 --> 00:08:53,360

decreasing only to the extent that I'm

214
00:08:58,300 --> 00:08:55,459
pulling it out during sampling and that

215
00:09:00,519 --> 00:08:58,310
in a and inoculated experimental

216
00:09:02,410 --> 00:09:00,529
microcosm I should see maybe after a

217
00:09:06,009 --> 00:09:02,420
short lag period start to see hydrogen

218
00:09:07,870 --> 00:09:06,019
oxidation and so I have charts of this

219
00:09:09,190 --> 00:09:07,880
for each of the oxidants in each of the

220
00:09:11,230 --> 00:09:09,200
glaciers and those just get really

221
00:09:12,819 --> 00:09:11,240
complicated to look at so on the next

222
00:09:15,370 --> 00:09:12,829
slides the charts you're going to see

223
00:09:17,290 --> 00:09:15,380
are I've taken the maximum rate of

224
00:09:19,870 --> 00:09:17,300
hydrogen oxidation in terms of nano

225
00:09:22,540 --> 00:09:19,880
moles oxidize over the number of days in

226
00:09:24,579 --> 00:09:22,550
the measurement interval and I'll just

227
00:09:27,069 --> 00:09:24,589
jump to that so first here are the

228
00:09:29,470 --> 00:09:27,079
results for hydrogen there for Robertson

229
00:09:33,850 --> 00:09:29,480
excuse me so this is hydrogen oxidation

230
00:09:35,290 --> 00:09:33,860
and in across the x-axis I have my my

231
00:09:39,189 --> 00:09:35,300
control conditions my experimental

232
00:09:42,009 --> 00:09:39,199
conditions with the oxidant arranged by

233
00:09:43,569 --> 00:09:42,019
relative redox potential and then you

234
00:09:45,460 --> 00:09:43,579
can see on the y-axis the maximum rate

235
00:09:47,500 --> 00:09:45,470
of hydrogen oxidation observed in

236
00:09:51,160 --> 00:09:47,510
animals per day normalized to grams

237
00:09:52,930 --> 00:09:51,170
dry-weight sediment and so these are I

238
00:09:56,079 --> 00:09:52,940

don't see really any significant

239
00:09:57,490 --> 00:09:56,089
patterns in differences among the

240
00:09:59,350 --> 00:09:57,500
various supplied oxidants in this

241
00:10:02,439 --> 00:09:59,360
pattern or in the in this set of

242
00:10:04,360 --> 00:10:02,449
microcosms but what I did see is a major

243
00:10:05,980 --> 00:10:04,370
difference between the Robertsons

244
00:10:08,889 --> 00:10:05,990
sediments and the cotton local sediments

245
00:10:12,910 --> 00:10:08,899
so this suggests to me that indeed at

246
00:10:15,519 --> 00:10:12,920
this basalt based system where we

247
00:10:17,800 --> 00:10:15,529
observe higher hydrogen production we

248
00:10:19,870 --> 00:10:17,810
seem to see a community that is better

249
00:10:22,480 --> 00:10:19,880
adapted to take advantage of this geo

250
00:10:26,139 --> 00:10:22,490
genic energy source as a reductant

251
00:10:28,389 --> 00:10:26,149
fueling microbial metabolism and the

252
00:10:30,069 --> 00:10:28,399
story turns out to be pretty similar if

253
00:10:31,720 --> 00:10:30,079
I look at co2 fixation in these

254
00:10:34,509 --> 00:10:31,730
communities so again a microcosm based

255
00:10:39,970 --> 00:10:34,519
approach and to these microcosms i've

256
00:10:41,860 --> 00:10:39,980
added a small spike of 14c and again the

257
00:10:46,960 --> 00:10:41,870
same set of oxidants and I'll be looking

258
00:10:50,199 --> 00:10:46,970
in the next slide and again a maximum

259
00:10:52,689 --> 00:10:50,209
rate per day maximum rate in terms of

260
00:10:57,340 --> 00:10:52,699
nano moles fixed carbon per day and

261
00:10:58,990 --> 00:10:57,350
these again are a subset of the the

262
00:11:01,600 --> 00:10:59,000
rates that I observed over time as these

263
00:11:03,639 --> 00:11:01,610

experiments progressed and so if we look

264
00:11:07,650 --> 00:11:03,649
at the hydrogen or the co2 fixation

265
00:11:10,809 --> 00:11:07,660
results we can see with Robertson again

266
00:11:13,360 --> 00:11:10,819
predominantly low rates of co2 fixation

267
00:11:16,290 --> 00:11:13,370
with the notable exception of microcosms

268
00:11:19,590 --> 00:11:16,300
amended with nitrate as an ox and

269
00:11:21,840 --> 00:11:19,600
and I interestingly see the same pattern

270
00:11:25,350 --> 00:11:21,850
with the Katya locale loo yokel

271
00:11:28,260 --> 00:11:25,360
sediments excuse me again you can see if

272
00:11:30,330 --> 00:11:28,270
you look at on a pairwise basis at each

273
00:11:32,400 --> 00:11:30,340
of the oxidants that caught leocal

274
00:11:35,220 --> 00:11:32,410
consistently supports higher rates of

275
00:11:37,860 --> 00:11:35,230
co2 fixation and again we see this

276
00:11:42,150 --> 00:11:37,870
massive spike when nitrate is provided

277
00:11:44,220 --> 00:11:42,160
as the oxidant and so you know I'm still

278
00:11:45,240 --> 00:11:44,230
in the process of sorting of working

279
00:11:47,519 --> 00:11:45,250
through these results and in particular

280
00:11:49,740 --> 00:11:47,529
what it might mean that nitrate seems to

281
00:11:51,810 --> 00:11:49,750
support the highest rates of co2

282
00:11:53,340 --> 00:11:51,820
fixation and one hypothesis may be that

283
00:11:58,410 --> 00:11:53,350
these systems are nitrate nitrogen

284
00:12:00,600 --> 00:11:58,420
limited but in any case I think I hope

285
00:12:02,460 --> 00:12:00,610
I've been able to convince you that we

286
00:12:05,100 --> 00:12:02,470
may be able to correlate the abundance

287
00:12:07,320 --> 00:12:05,110
of minerals high in silicates and

288
00:12:10,200 --> 00:12:07,330

ferrous iron with the potential for an

289
00:12:12,000 --> 00:12:10,210
environment to produce hydrogen and we

290
00:12:14,010 --> 00:12:12,010
can use this potential for hydrogen

291
00:12:17,370 --> 00:12:14,020
production as a proxy for where we may

292
00:12:19,440 --> 00:12:17,380
find chemo litho autotrophic microbial

293
00:12:23,280 --> 00:12:19,450
populations supporting broader microbial

294
00:12:25,880 --> 00:12:23,290
communities so again I've shown that in

295
00:12:27,900 --> 00:12:25,890
a basalt hosted system we see

296
00:12:29,880 --> 00:12:27,910
populations of microbes that are better

297
00:12:32,930 --> 00:12:29,890
able to utilize hydrogen as a reductant

298
00:12:36,450 --> 00:12:32,940
and they're better able to couple that

299
00:12:39,660 --> 00:12:36,460
reductive or this hydrogen oxidizing

300
00:12:42,750 --> 00:12:39,670
metabolism with the ability to fix co2

301
00:12:44,670 --> 00:12:42,760
from the atmosphere thus serving as sort

302
00:12:47,940 --> 00:12:44,680
of a base of a trophic pyramid for a

303
00:12:50,070 --> 00:12:47,950
microbial ecosystem so in terms of

304
00:12:53,670 --> 00:12:50,080
future work on this project we're

305
00:12:56,670 --> 00:12:53,680
working with the skidmore lab on looking

306
00:12:58,410 --> 00:12:56,680
at the production rates of hydrogen from

307
00:13:00,960 --> 00:12:58,420
each of these sedimentary systems and I

308
00:13:03,329 --> 00:13:00,970
believe that paper has been accepted is

309
00:13:03,800 --> 00:13:03,339
that right mark it's so it's it's on its

310
00:13:07,050 --> 00:13:03,810
way

311
00:13:09,449 --> 00:13:07,060
you can talk to mark about that that

312
00:13:10,530 --> 00:13:09,459
project and then I'm in the process of

313
00:13:12,269 --> 00:13:10,540

working through the last set of

314
00:13:16,050 --> 00:13:12,279
experiments I have going with these

315
00:13:20,160 --> 00:13:16,060
sediments is most probable number array

316
00:13:22,350 --> 00:13:20,170
this is a monster set of inoculations in

317
00:13:25,350 --> 00:13:22,360
which I'm estimating the number of

318
00:13:27,360 --> 00:13:25,360
hydrogen atrophic and autotrophic cells

319
00:13:28,660 --> 00:13:27,370
in the sediments from each of these

320
00:13:30,820 --> 00:13:28,670
glaciers

321
00:13:32,650 --> 00:13:30,830
I'll be extracting DNA from these

322
00:13:36,010 --> 00:13:32,660
microcosms attempting to correlate it

323
00:13:37,810 --> 00:13:36,020
with the meta genome data we have from

324
00:13:39,850 --> 00:13:37,820
each of these sublation systems to learn

325
00:13:41,470 --> 00:13:39,860
more about the proportion of hydrogen

326
00:13:44,710 --> 00:13:41,480
atrophic in each of these microbial

327
00:13:47,260 --> 00:13:44,720
communities and you know try to get some

328
00:13:50,320 --> 00:13:47,270
more information about the structure and

329
00:13:52,810 --> 00:13:50,330
assembly of such communities so I'll

330
00:13:55,330 --> 00:13:52,820
leave you with with a question I'm

331
00:13:57,460 --> 00:13:55,340
looking for a name for my superhero

332
00:13:59,800 --> 00:13:57,470
alter ego this is the suit you can see

333
00:14:01,300 --> 00:13:59,810
here if you have any suggestions or

334
00:14:09,370 --> 00:14:01,310
other questions about the work I'd be

335
00:14:14,770 --> 00:14:09,380
happy to hear them except we have time

336
00:14:20,050 --> 00:14:14,780
for some questions already Eric I think

337
00:14:23,770 --> 00:14:20,060
there's one how do I saw a hand go up

338
00:14:25,930 --> 00:14:23,780

there I have a quick question for you

339
00:14:27,460 --> 00:14:25,940
Eric regarding your results that you saw

340
00:14:30,370 --> 00:14:27,470
the highest rates of carbon dioxide

341
00:14:33,160 --> 00:14:30,380
fixation in the nitrate reducing

342
00:14:34,300 --> 00:14:33,170
populations and do you think that's

343
00:14:36,100 --> 00:14:34,310
possible it's just sort of a

344
00:14:38,050 --> 00:14:36,110
thermodynamic ladder thing and nitrates

345
00:14:41,380 --> 00:14:38,060
a really good oxidant you know in turn

346
00:14:43,600 --> 00:14:41,390
relative to sulfate well I mean that

347
00:14:46,030 --> 00:14:43,610
that is one hypothesis that sort of

348
00:14:49,960 --> 00:14:46,040
immediately jumps out and I'm not sure

349
00:14:51,940 --> 00:14:49,970
how that relates to the rates we see for

350
00:14:55,360 --> 00:14:51,950
under oxide conditions in each of these

351
00:14:57,940 --> 00:14:55,370
in each of these sediment sets you know

352
00:15:01,000 --> 00:14:57,950
when idea is that we may be seeing

353
00:15:02,770 --> 00:15:01,010
evidence that these are ecosystems in

354
00:15:05,890 --> 00:15:02,780
which the microbes are adapted to

355
00:15:10,900 --> 00:15:05,900
anaerobic Kanak set conditions and

356
00:15:14,200 --> 00:15:10,910
perhaps nitrate is just serving as sort

357
00:15:16,950 --> 00:15:14,210
of sort of releasing nitrogen limitation

358
00:15:19,170 --> 00:15:16,960
in these systems it may be serving as

359
00:15:23,620 --> 00:15:19,180
primary oxidant for dissimilatory

360
00:15:26,170 --> 00:15:23,630
metabolism as well but yeah I'm not sure

361
00:15:29,770 --> 00:15:26,180
that I could say that it's just in

362
00:15:32,530 --> 00:15:29,780
relation to the redox ladder judging by

363
00:15:34,510 --> 00:15:32,540

the fact that the oxygen oxygen ik rates

364
00:15:43,720 --> 00:15:34,520
of hydrogen a trophy and carbon fixation

365
00:15:48,970 --> 00:15:45,760
that's always a possibility one thing I

366
00:15:51,670 --> 00:15:48,980
would like to do in terms of rerunning

367
00:15:53,740 --> 00:15:51,680
this co2 fixation experiment is to run

368
00:15:56,380 --> 00:15:53,750
some extra controls in which I don't

369
00:15:59,410 --> 00:15:56,390
provide any hydrogen because I think

370
00:16:01,600 --> 00:15:59,420
that may help tease apart some of the

371
00:16:03,220 --> 00:16:01,610
patterns I'm seeing especially with

372
00:16:06,070 --> 00:16:03,230
regard to early results of my most

373
00:16:08,350 --> 00:16:06,080
probable number experiments but yeah I

374
00:16:11,470 --> 00:16:08,360
would like to be able to at least

375
00:16:13,540 --> 00:16:11,480
confirm that this co2 fixation is or is

376
00:16:18,910 --> 00:16:13,550
not related to hydrogen a trophy