University Valley

Air:
-45° to -3°C (-50° to 27°F)

Surface: mean: -26°C (-14°F)
-48° to 8°C (-54° to 46°F)

Glacier

Ice-cemented Ground

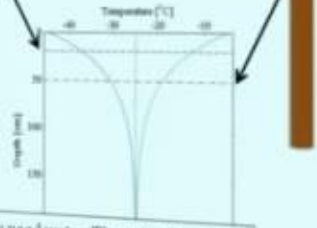
Dry Soil Permafrost

~2500 years

~120,000 years

Low Biomass:
10^3 cells/g

Neutral pH (7- 7.5)
Little nutrients (oligotrophic):
0.01-0.05 % C
undetectable- 0.09% N



Bugs need water. The colder the ice, the harder it is for them to use.

1
00:00:10,379 --> 00:00:08,400
alright so my name is Jackie cordial I'm

2
00:00:12,240 --> 00:00:10,389
a student here at McGill University and

3
00:00:13,830 --> 00:00:12,250
today I'm going to talk about university

4
00:00:17,160 --> 00:00:13,840
valley which is one of the McMurdo Dry

5
00:00:21,710 --> 00:00:17,170
Valleys on any McMurdo Dry Valleys which

6
00:00:23,790 --> 00:00:21,720
is classified SI hyper arid cold desert

7
00:00:25,109 --> 00:00:23,800
there you go so I'm going to knock often

8
00:00:27,120 --> 00:00:25,119
acknowledgments that's the first thing

9
00:00:28,980 --> 00:00:27,130
this is actually part of a very very big

10
00:00:30,359 --> 00:00:28,990
project with a lot of collaborators most

11
00:00:32,249 --> 00:00:30,369
of whom I'm not mentioning here these

12
00:00:34,710 --> 00:00:32,259
are kind of the collaborative in my

13
00:00:36,180 --> 00:00:34,720

immediate vicinity and I'd like to thank

14
00:00:37,500 --> 00:00:36,190
all of them especially margarita Mara

15
00:00:38,959 --> 00:00:37,510
Novak's I'm borrowing some of her

16
00:00:41,639 --> 00:00:38,969
figures and data for this presentation

17
00:00:43,529 --> 00:00:41,649
and then my financial support this is

18
00:00:45,599 --> 00:00:43,539
part of a NASA asked up funded project

19
00:00:47,040 --> 00:00:45,609
and I paid for my groceries on through

20
00:00:51,209 --> 00:00:47,050
the Canadian astrobiology training

21
00:00:52,740 --> 00:00:51,219
program so just to give this this talk a

22
00:00:55,650 --> 00:00:52,750
little bit of context I'll tell you what

23
00:00:57,119 --> 00:00:55,660
my the bigger context of my project I'm

24
00:01:00,270 --> 00:00:57,129
and so I'm part of a team that has

25
00:01:01,380 --> 00:01:00,280
designed a prototype Mars drill and so

26
00:01:03,240 --> 00:01:01,390
what they've designed is a drill that

27
00:01:06,030 --> 00:01:03,250
can drill one meter down into the frozen

28
00:01:07,710 --> 00:01:06,040
ground and it can be operated remotely

29
00:01:09,090 --> 00:01:07,720
which are two features that would be

30
00:01:11,130 --> 00:01:09,100
very nice for a drill that you're

31
00:01:13,350 --> 00:01:11,140
sending to Mars they're also doing all

32
00:01:15,899 --> 00:01:13,360
sorts of science around this and that's

33
00:01:17,999 --> 00:01:15,909
where I come in the microbiologist and

34
00:01:20,700 --> 00:01:18,009
so they were testing this in the in the

35
00:01:23,670 --> 00:01:20,710
upper Dry Valleys of the Antarctic and

36
00:01:24,899 --> 00:01:23,680
so why the Antarctic we guys we've we've

37
00:01:27,389 --> 00:01:24,909
talked about this already Mars is a

38
00:01:29,010 --> 00:01:27,399

really really cold and dry place and in

39
00:01:30,510 --> 00:01:29,020
fact it's actually the coldest and

40
00:01:31,590 --> 00:01:30,520
driest place we have on earth so we're

41
00:01:32,789 --> 00:01:31,600
going to hear a lot of talks about the

42
00:01:34,620 --> 00:01:32,799
Arctic and referred but coastal

43
00:01:35,910 --> 00:01:34,630
Antarctica but the upper dry Valley is

44
00:01:37,530 --> 00:01:35,920
in the McMurdo Dry Valleys are really

45
00:01:39,929 --> 00:01:37,540
about the best the best place we have on

46
00:01:42,749 --> 00:01:39,939
earth them to study that and so it's not

47
00:01:44,370 --> 00:01:42,759
quite as not quite as cold and dry as

48
00:01:46,230 --> 00:01:44,380
Mars is today but we think it might have

49
00:01:50,340 --> 00:01:46,240
it might be comparable to what Mars was

50
00:01:51,959 --> 00:01:50,350
in the past and so I we've seen a lot of

51
00:01:54,149 --> 00:01:51,969
pictures of the dr ali is already and i

52
00:01:57,120 --> 00:01:54,159
really like this photo that I've stolen

53
00:01:58,620 --> 00:01:57,130
from someone else's publication but I

54
00:02:01,200 --> 00:01:58,630
really like it because of this small box

55
00:02:02,700 --> 00:02:01,210
here and what it does is it divides the

56
00:02:04,410 --> 00:02:02,710
McMurdo Dry Valleys into different areas

57
00:02:06,749 --> 00:02:04,420
and McMurdo Dry Valleys are not just one

58
00:02:09,330 --> 00:02:06,759
homogeneous region and I want to just

59
00:02:11,670 --> 00:02:09,340
kind of point out this this grey or gray

60
00:02:14,100 --> 00:02:11,680
brown I'm not color blind this brown

61
00:02:16,400 --> 00:02:14,110
area which kind of which is the upper

62
00:02:18,800 --> 00:02:16,410
try values of the stable uplands

63
00:02:20,270 --> 00:02:18,810

of the McMurdo Dry Valleys and this part

64
00:02:22,100 --> 00:02:20,280
of the Dry Valleys differs from the rest

65
00:02:24,500 --> 00:02:22,110
of the Dry Valleys because this

66
00:02:27,080 --> 00:02:24,510
particular area is sublimation dominated

67
00:02:29,450 --> 00:02:27,090
so water in this area either exist

68
00:02:31,190 --> 00:02:29,460
that's ice or directly sublimates into

69
00:02:32,420 --> 00:02:31,200
vapor and this is this is in contrast to

70
00:02:34,160 --> 00:02:32,430
the other areas which do get a bit of

71
00:02:36,550 --> 00:02:34,170
precipitation they do get some flying in

72
00:02:39,350 --> 00:02:36,560
a bit of meltwater but in this area

73
00:02:41,720 --> 00:02:39,360
sublimation processes dominate and what

74
00:02:43,580 --> 00:02:41,730
happens is you end up getting a layer of

75
00:02:45,320 --> 00:02:43,590
dry soil where the sub where the water

76
00:02:47,720 --> 00:02:45,330
sublimates away and then underneath that

77
00:02:50,660 --> 00:02:47,730
the ground ice gets stable and so it's

78
00:02:53,470 --> 00:02:50,670
the only place on earth where you

79
00:02:56,090 --> 00:02:53,480
actually get a layer of dry permafrost

80
00:02:57,290 --> 00:02:56,100
overlaying I cemented permafrost which

81
00:02:58,520 --> 00:02:57,300
is similar to what Brandon's talking

82
00:03:00,920 --> 00:02:58,530
about yesterday when he was talking

83
00:03:03,050 --> 00:03:00,930
about the about the Arctic so the upper

84
00:03:04,400 --> 00:03:03,060
dry valleys are unique analog because

85
00:03:06,890 --> 00:03:04,410
they are the only place that has dry

86
00:03:09,680 --> 00:03:06,900
permafrost overlaying grounds overlaying

87
00:03:11,060 --> 00:03:09,690
I cemented permafrost temperatures air

88
00:03:14,270 --> 00:03:11,070

temperatures and some of the upper GI

89
00:03:16,670 --> 00:03:14,280
values never rise above zero and water

90
00:03:18,470 --> 00:03:16,680
exists this ice or vapor and we've seen

91
00:03:20,570 --> 00:03:18,480
this photo already with the phoenix's a

92
00:03:24,170 --> 00:03:20,580
little scoop and the ground ice

93
00:03:27,740 --> 00:03:24,180
underneath it I mean just to kind of

94
00:03:30,980 --> 00:03:27,750
Hammer this one point home so we have an

95
00:03:32,330 --> 00:03:30,990
active layer in permafrost or associated

96
00:03:34,580 --> 00:03:32,340
with permafrost which is a layer that

97
00:03:36,590 --> 00:03:34,590
seasonally goes above zero degrees and

98
00:03:37,670 --> 00:03:36,600
permafrost is defined as ground it's

99
00:03:39,590 --> 00:03:37,680
technically to find us ground that

100
00:03:41,330 --> 00:03:39,600
doesn't rise above zero it's every two

101
00:03:43,940 --> 00:03:41,340
years but we'll just say it's

102
00:03:46,130 --> 00:03:43,950
permanently frozen for our purposes and

103
00:03:48,500 --> 00:03:46,140
in a lot of the upper dry valleys and on

104
00:03:49,670 --> 00:03:48,510
Mars you get this this active layer

105
00:03:52,550 --> 00:03:49,680
which in some places of the Dry Valleys

106
00:03:55,220 --> 00:03:52,560
can be as little lists five centimeters

107
00:03:57,290 --> 00:03:55,230
or cannot exist at all and then you get

108
00:04:01,370 --> 00:03:57,300
this dry permafrost layer that overlays

109
00:04:02,810 --> 00:04:01,380
your I cemented permafrost what does

110
00:04:04,760 --> 00:04:02,820
that look like so if you're on the

111
00:04:06,710 --> 00:04:04,770
ground you it literally just looks like

112
00:04:08,270 --> 00:04:06,720
a desert soil so this is maybe a day

113
00:04:09,860 --> 00:04:08,280

that's maybe you but mine is 20 you can

114
00:04:16,220 --> 00:04:09,870
literally just pick it up and it's just

115
00:04:18,560 --> 00:04:16,230
dry dry slow so life in the McMurdo Dry

116
00:04:20,180 --> 00:04:18,570
Valleys for a really long time the

117
00:04:22,250 --> 00:04:20,190
McMurdo Dry Valleys were just kind of

118
00:04:24,020 --> 00:04:22,260
presumed to be dead there's no plant

119
00:04:27,320 --> 00:04:24,030
life birds don't fly into it you can't

120
00:04:28,730 --> 00:04:27,330
really see a lot of bacterial life even

121
00:04:29,870 --> 00:04:28,740
I'm except for an end elliptic

122
00:04:31,250 --> 00:04:29,880
communities

123
00:04:33,590 --> 00:04:31,260
I know there were some early

124
00:04:36,350 --> 00:04:33,600
publications by Horowitz in 1972 where

125
00:04:37,880 --> 00:04:36,360
he concluded that the that the Dry

126
00:04:39,710 --> 00:04:37,890
Valleys were essentially sterile and

127
00:04:41,180 --> 00:04:39,720
this was because they did it based on

128
00:04:43,670 --> 00:04:41,190
culture based studies now we have a lot

129
00:04:45,710 --> 00:04:43,680
more molecular techniques but in what a

130
00:04:48,170 --> 00:04:45,720
line from his papers the Dry Valleys are

131
00:04:50,210 --> 00:04:48,180
essentially abiotic areas the microbial

132
00:04:51,710 --> 00:04:50,220
population of the region is probably in

133
00:04:53,840 --> 00:04:51,720
balanced between influx from the

134
00:04:55,250 --> 00:04:53,850
atmosphere and mortality on the ground

135
00:04:56,840 --> 00:04:55,260
essentially what he's saying is a bunch

136
00:04:58,010 --> 00:04:56,850
of bugs are just flying in there and

137
00:05:02,900 --> 00:04:58,020
that's what we're seeing nothing's

138
00:05:04,370 --> 00:05:02,910

actually living there so the upper jaw

139
00:05:06,200 --> 00:05:04,380
Valley permafrost what is what's this

140
00:05:08,120 --> 00:05:06,210
like if you're from the microbial point

141
00:05:09,800 --> 00:05:08,130
of view well it's really dry it's

142
00:05:13,310 --> 00:05:09,810
illegal traffic there's not a lot of

143
00:05:15,020 --> 00:05:13,320
nutrients here it's cold you're getting

144
00:05:16,820 --> 00:05:15,030
a lot of radiation background radiation

145
00:05:18,170 --> 00:05:16,830
and there's a high physical high

146
00:05:19,610 --> 00:05:18,180
physical disturbance there's a lot of

147
00:05:24,110 --> 00:05:19,620
wins there's strong cat abetik winds

148
00:05:27,290 --> 00:05:24,120
that are kicking up them the soil and so

149
00:05:28,730 --> 00:05:27,300
going back to this map the region that

150
00:05:30,980 --> 00:05:28,740
I'm going to be talking about is right

151
00:05:32,990 --> 00:05:30,990
there on that red arrow this is

152
00:05:35,360 --> 00:05:33,000
University Valley and it is one of those

153
00:05:38,870 --> 00:05:35,370
sub in that sublimation dominated area

154
00:05:40,730 --> 00:05:38,880
of Antarctic so this is what university

155
00:05:43,910 --> 00:05:40,740
Valley looks like on the ground there's

156
00:05:45,500 --> 00:05:43,920
a very old receding glacier at the head

157
00:05:48,320 --> 00:05:45,510
of the valley the valley is about a

158
00:05:52,610 --> 00:05:48,330
kilometer kilometer in length and half a

159
00:05:54,710 --> 00:05:52,620
kilometer in width and temperatures in

160
00:05:57,350 --> 00:05:54,720
University Valley air temperatures never

161
00:06:00,470 --> 00:05:57,360
go above zero degrees so these are this

162
00:06:02,750 --> 00:06:00,480
is a weather station data for a year and

163
00:06:04,790 --> 00:06:02,760

as you can see at 20 centimeters theft

164
00:06:07,460 --> 00:06:04,800
into the permafrost for the majority of

165
00:06:10,280 --> 00:06:07,470
the year it's actually quite cold some

166
00:06:12,770 --> 00:06:10,290
losses at the minus 45 degrees Celsius

167
00:06:16,540 --> 00:06:12,780
and about the only place that we ever

168
00:06:19,640 --> 00:06:16,550
see it ever go above zero degrees then

169
00:06:21,170 --> 00:06:19,650
there we go above zero degrees is in the

170
00:06:23,180 --> 00:06:21,180
summer times and that's at the surface

171
00:06:25,610 --> 00:06:23,190
the surface temperatures and that's when

172
00:06:31,220 --> 00:06:25,620
the Sun is is heating up the soil

173
00:06:34,640 --> 00:06:31,230
surface okay and if you appreciate my ms

174
00:06:36,320 --> 00:06:34,650
paint skills and we have x-ray vision so

175
00:06:38,719 --> 00:06:36,330
this is just a cross section of that

176
00:06:40,010 --> 00:06:38,729
Valley and so these these are to

177
00:06:41,120 --> 00:06:40,020
represent the cores these are the

178
00:06:42,620 --> 00:06:41,130
samples that I've been working with

179
00:06:43,610 --> 00:06:42,630
that's the glacier at the head of the

180
00:06:46,219 --> 00:06:43,620
valley

181
00:06:48,409 --> 00:06:46,229
and this this value is actually really

182
00:06:51,320 --> 00:06:48,419
really neat because as a function of

183
00:06:53,659 --> 00:06:51,330
distance from this glacier the dry soil

184
00:06:55,400 --> 00:06:53,669
permafrost actually has a gradient in

185
00:06:57,230 --> 00:06:55,410
terms of depth from the surface to depth

186
00:07:00,110 --> 00:06:57,240
to the permafrost we're not actually

187
00:07:01,490 --> 00:07:00,120
sure why this happens or how how this

188
00:07:04,100 --> 00:07:01,500

was actually formed in the first place

189
00:07:06,379 --> 00:07:04,110
but it's it's a really neat place to

190
00:07:09,680 --> 00:07:06,389
test out some hypotheses because if

191
00:07:12,980 --> 00:07:09,690
we're looking for liquid water ice is a

192
00:07:15,260 --> 00:07:12,990
potential source of liquid water and the

193
00:07:16,939 --> 00:07:15,270
closer this available liquid water is to

194
00:07:19,909 --> 00:07:16,949
the surface and more likely we made have

195
00:07:22,520 --> 00:07:19,919
liquid water at this dry soil I cement

196
00:07:25,360 --> 00:07:22,530
to ground interface and so we do have

197
00:07:27,800 --> 00:07:25,370
temperature data from here and over here

198
00:07:30,920 --> 00:07:27,810
and even though this is closer to the

199
00:07:33,680 --> 00:07:30,930
surface this actually never rises above

200
00:07:34,969 --> 00:07:33,690
zero degrees and so I think it's sort of

201
00:07:37,100 --> 00:07:34,979
like a freeze it's essentially sitting

202
00:07:39,020 --> 00:07:37,110
on a block of ice whereas over here this

203
00:07:40,909 --> 00:07:39,030
is where we get that maximum of eight

204
00:07:45,590 --> 00:07:40,919
degrees Celsius so the Sun is able to

205
00:07:49,070 --> 00:07:45,600
heat this up except unfortunately it it

206
00:07:52,310 --> 00:07:49,080
doesn't this this area here never rises

207
00:07:55,310 --> 00:07:52,320
to a above zero degrees even though this

208
00:07:56,659 --> 00:07:55,320
gets to 8 degrees Celsius and so what

209
00:07:59,180 --> 00:07:56,669
this mean what does this mean for life

210
00:08:02,690 --> 00:07:59,190
it means that in the permafrost it gets

211
00:08:04,640 --> 00:08:02,700
colder with depth and we know that life

212
00:08:08,480 --> 00:08:04,650
needs water the colder it is the harder

213
00:08:10,100 --> 00:08:08,490

it is for water to exist another point I

214
00:08:11,960 --> 00:08:10,110
wanted to kind of drop on is we're

215
00:08:15,560 --> 00:08:11,970
actually dealing with really really old

216
00:08:18,710 --> 00:08:15,570
sediment here or soil sorry so it ages

217
00:08:20,870 --> 00:08:18,720
about 200 to 2,500 years with every

218
00:08:22,339 --> 00:08:20,880
centimeter that you go down so this is a

219
00:08:25,550 --> 00:08:22,349
really really great place to look for

220
00:08:27,830 --> 00:08:25,560
preserve biomolecules just in terms of

221
00:08:29,629 --> 00:08:27,840
some direct cell counts on average I'm

222
00:08:33,440 --> 00:08:29,639
seeing 10 to the 3 cells per gram this

223
00:08:35,449 --> 00:08:33,450
is very very low biomass neutral pH very

224
00:08:38,409 --> 00:08:35,459
little nutrients and some most of my

225
00:08:44,029 --> 00:08:38,419
samples sexually undetectable nitrogen

226
00:08:45,560 --> 00:08:44,039
organic nitrogen and organic carbon and

227
00:08:46,519 --> 00:08:45,570
so if you're microbiologist there's some

228
00:08:47,780 --> 00:08:46,529
common questions that you're going to

229
00:08:49,640 --> 00:08:47,790
ask you're even asking you know who's

230
00:08:51,829 --> 00:08:49,650
who's there what bugs are actually there

231
00:08:54,710 --> 00:08:51,839
where is the source where do these bugs

232
00:08:56,840 --> 00:08:54,720
come from an important question to ask

233
00:08:58,430 --> 00:08:56,850
is activity

234
00:08:59,960 --> 00:08:58,440
are these microbes actually live do they

235
00:09:01,790 --> 00:08:59,970
represent just woolly mammoths did they

236
00:09:03,769 --> 00:09:01,800
just get deposited in the atmosphere and

237
00:09:05,030 --> 00:09:03,779
get frozen into the ground are they

238
00:09:08,210 --> 00:09:05,040

actually doing something in this

239
00:09:09,680 --> 00:09:08,220
environment and another another thing

240
00:09:11,090 --> 00:09:09,690
that you could look for our signs of

241
00:09:14,689 --> 00:09:11,100
life because we're dealing with really

242
00:09:16,610 --> 00:09:14,699
old old soil that's very good for

243
00:09:17,870 --> 00:09:16,620
preservation this is a good place to

244
00:09:19,460 --> 00:09:17,880
look for biomolecules and we're doing

245
00:09:22,100 --> 00:09:19,470
really really interesting research in

246
00:09:24,769 --> 00:09:22,110
this but I'm not going to talk about it

247
00:09:27,889 --> 00:09:24,779
today so you can ask me later if that's

248
00:09:29,930 --> 00:09:27,899
something you're interested in so one of

249
00:09:31,759 --> 00:09:29,940
one of the things microbiologist do is

250
00:09:32,809 --> 00:09:31,769
they try to culture bacteria and general

251
00:09:34,490 --> 00:09:32,819
writer you mentioned this morning that

252
00:09:36,230 --> 00:09:34,500
ninety-nine point nine percent of

253
00:09:38,660 --> 00:09:36,240
bacteria are not actually culturable but

254
00:09:41,480 --> 00:09:38,670
we spend many months of our lives doing

255
00:09:43,670 --> 00:09:41,490
it anyway and out of out of these soils

256
00:09:46,340 --> 00:09:43,680
I've only gotten six isolates to date

257
00:09:48,850 --> 00:09:46,350
and that's out of maybe eight months of

258
00:09:51,740 --> 00:09:48,860
trying very hard to get more isolates

259
00:09:53,540 --> 00:09:51,750
three of them i would i would say are

260
00:09:55,699 --> 00:09:53,550
particularly interesting and they were

261
00:09:57,920 --> 00:09:55,709
there interesting because they grow at

262
00:09:59,930 --> 00:09:57,930
very low temperatures so one mithila

263
00:10:02,179 --> 00:09:59,940

bacterium i have that grows at minus 10

264
00:10:04,160 --> 00:10:02,189
another rhodococcus like rosa minus 10

265
00:10:05,929 --> 00:10:04,170
and i just discovered that as

266
00:10:08,600 --> 00:10:05,939
sphingomonas grows at minus-5 because i

267
00:10:10,189 --> 00:10:08,610
left the culture at minus five and then

268
00:10:13,280 --> 00:10:10,199
check on it a year later it's growing

269
00:10:14,990 --> 00:10:13,290
but but these are also particularly

270
00:10:17,150 --> 00:10:15,000
interesting because they're there salt

271
00:10:18,259 --> 00:10:17,160
tolerant and this is this is a trait

272
00:10:20,420 --> 00:10:18,269
that you're going to see with permafrost

273
00:10:21,769 --> 00:10:20,430
some bacteria in general and i know jen

274
00:10:23,629 --> 00:10:21,779
jen is going to be talking about that a

275
00:10:29,360 --> 00:10:23,639
little bit later and elaborating on that

276
00:10:31,189 --> 00:10:29,370
more so besides the culturing to get a

277
00:10:33,110 --> 00:10:31,199
bit more of a holistic view of the bugs

278
00:10:35,150 --> 00:10:33,120
that are in there we can do 16s

279
00:10:37,490 --> 00:10:35,160
pyrosequencing so we just suck at all

280
00:10:39,710 --> 00:10:37,500
the DNA and we sequence it and we can

281
00:10:43,189 --> 00:10:39,720
identify identify the microbes this way

282
00:10:45,889 --> 00:10:43,199
and this is really really small and you

283
00:10:48,079 --> 00:10:45,899
can't read it and that's okay because

284
00:10:49,519 --> 00:10:48,089
the only point I wanted to say is these

285
00:10:50,780 --> 00:10:49,529
samples are actually very diverse

286
00:10:52,850 --> 00:10:50,790
there's that there's a lot of bugs in

287
00:10:55,100 --> 00:10:52,860
here in fact a lot of these samples

288
00:10:56,990 --> 00:10:55,110

don't share families between the samples

289
00:10:59,509 --> 00:10:57,000
even though these are these are scores

290
00:11:00,920 --> 00:10:59,519
with depth and two centimeters away from

291
00:11:02,600 --> 00:11:00,930
each other you'll find samples that

292
00:11:04,129 --> 00:11:02,610
don't share any bacterial family so

293
00:11:06,530 --> 00:11:04,139
these are very very diverse samples I'm

294
00:11:09,650 --> 00:11:06,540
just to kind of draw your attention to

295
00:11:11,030 --> 00:11:09,660
some some sample or some like aspect

296
00:11:14,509 --> 00:11:11,040
iria that I'm finding

297
00:11:17,509 --> 00:11:14,519
so it's so cyanobacteria some affilliate

298
00:11:19,910 --> 00:11:17,519
ropes décor amonos which is perchlorate

299
00:11:21,620 --> 00:11:19,920
reducing Falacci bacteria that's a

300
00:11:25,129 --> 00:11:21,630
common of fairly ubiquitous marine

301
00:11:27,319 --> 00:11:25,139
bacterium tons of actinobacteria I've

302
00:11:28,670 --> 00:11:27,329
replicated this particular sample and it

303
00:11:31,129 --> 00:11:28,680
turns out that I think this just

304
00:11:32,389 --> 00:11:31,139
happened to be the 5 grams of soil I

305
00:11:34,309 --> 00:11:32,399
sample just happened to have a lot of

306
00:11:39,079 --> 00:11:34,319
spirit key so they're they're extremely

307
00:11:40,850 --> 00:11:39,089
heterogeneous soils Wow all right I'm

308
00:11:43,220 --> 00:11:40,860
gonna all right there's bacteria in

309
00:11:45,230 --> 00:11:43,230
there there's also RK in there this is

310
00:11:46,699 --> 00:11:45,240
really special because the archaea were

311
00:11:48,290 --> 00:11:46,709
not really known to be in the upper dry

312
00:11:50,059 --> 00:11:48,300
valleys until very recently so this is

313
00:11:53,600 --> 00:11:50,069

really interesting they're not that

314
00:11:57,590 --> 00:11:53,610
similar to what we known GenBank already

315
00:12:00,199 --> 00:11:57,600
but I did do some Institute work in the

316
00:12:01,670 --> 00:12:00,209
Dry Valleys I tried to measure any gas

317
00:12:03,110 --> 00:12:01,680
flux coming off with the permafrost and

318
00:12:05,300 --> 00:12:03,120
turns out there's not a lot of guests

319
00:12:07,220 --> 00:12:05,310
flux to measure so in the lab one thing

320
00:12:09,620 --> 00:12:07,230
that we can do is we can feed our soil

321
00:12:11,840 --> 00:12:09,630
samples some radioactive food and then

322
00:12:14,360 --> 00:12:11,850
measure the radioactive carbon dioxide

323
00:12:15,650 --> 00:12:14,370
that comes off of those samples and this

324
00:12:17,030 --> 00:12:15,660
is this is what that data looks like

325
00:12:19,460 --> 00:12:17,040
this is about a year a year long

326
00:12:20,990 --> 00:12:19,470
experiment and so I'm if I'm looking at

327
00:12:22,790 --> 00:12:21,000
University Valley there's a shallow I

328
00:12:24,620 --> 00:12:22,800
stable in the mid I stable that I table

329
00:12:26,120 --> 00:12:24,630
I just mean that how close it is to the

330
00:12:28,670 --> 00:12:26,130
surface I was showing in that diagram

331
00:12:30,259 --> 00:12:28,680
earlier and what we see is at five

332
00:12:32,480 --> 00:12:30,269
degrees Celsius we do get some

333
00:12:34,910 --> 00:12:32,490
mineralization in this shallow a stable

334
00:12:37,819 --> 00:12:34,920
core but it's sub-zero temperatures we

335
00:12:40,189 --> 00:12:37,829
don't actually see anything and these

336
00:12:41,629 --> 00:12:40,199
are these my control samples are coastal

337
00:12:43,370 --> 00:12:41,639
Antarctic sample which I thought I'd

338
00:12:46,250 --> 00:12:43,380

have better better luck in to just make

339
00:12:48,410 --> 00:12:46,260
sure my my experiment was working so in

340
00:12:49,819 --> 00:12:48,420
the case of the shallow I stable core at

341
00:12:52,250 --> 00:12:49,829
five degrees Celsius we do some

342
00:12:54,079 --> 00:12:52,260
mineralization it's about after 150 days

343
00:12:55,400 --> 00:12:54,089
this is a temperature that these bugs

344
00:12:57,410 --> 00:12:55,410
would never see at their site and

345
00:13:02,720 --> 00:12:57,420
certainly would not see it for 150

346
00:13:04,970 --> 00:13:02,730
consecutive days if you were to ask are

347
00:13:06,319 --> 00:13:04,980
these results because you know let's

348
00:13:07,639 --> 00:13:06,329
make things a little bit more favorable

349
00:13:08,929 --> 00:13:07,649
for any potential microbes in there

350
00:13:10,910 --> 00:13:08,939
let's throw some nutrients in there

351
00:13:12,439 --> 00:13:10,920
let's make it a little bit warmer at 10

352
00:13:14,540 --> 00:13:12,449
degrees Celsius and adding some yeast

353
00:13:16,400 --> 00:13:14,550
extract that actually has no effect

354
00:13:18,860 --> 00:13:16,410
whatsoever on my University Valley soils

355
00:13:20,329 --> 00:13:18,870
but with my coastal Antarctic soils it

356
00:13:25,090 --> 00:13:20,339
actually increases the middle or the

357
00:13:31,310 --> 00:13:28,460
so so is anything actually alive in your

358
00:13:34,100 --> 00:13:31,320
inner University Valley in the

359
00:13:35,810 --> 00:13:34,110
permafrost their / they're not happy and

360
00:13:37,100 --> 00:13:35,820
if anything is alive I'm not able to

361
00:13:40,250 --> 00:13:37,110
detect it using the methods that i'm

362
00:13:44,360 --> 00:13:40,260
using right now but it turns out that

363
00:13:46,340 --> 00:13:44,370

there is life here it's just hidden and

364
00:13:49,040 --> 00:13:46,350
so if you look at these these valley

365
00:13:53,000 --> 00:13:49,050
walls and it's a tough job but someone

366
00:13:54,530 --> 00:13:53,010
gets to do it and if you you go up those

367
00:13:57,410 --> 00:13:54,540
sandstone walls and you just whack a

368
00:13:59,630 --> 00:13:57,420
rock you can actually almost any rock

369
00:14:00,910 --> 00:13:59,640
there you can see you can see microbial

370
00:14:02,840 --> 00:14:00,920
life and you can see evidence

371
00:14:05,870 --> 00:14:02,850
unfortunately you can't see how green

372
00:14:07,460 --> 00:14:05,880
this is looked great on my laptop but

373
00:14:09,199 --> 00:14:07,470
you'll see some photosynthetic crypto

374
00:14:10,610 --> 00:14:09,209
and elliptic communities and they're

375
00:14:14,180 --> 00:14:10,620
actually fairly ubiquitous and dry

376
00:14:15,319 --> 00:14:14,190
valleys and at the site so this is one

377
00:14:17,540 --> 00:14:15,329
in the lab and you can stick them under

378
00:14:19,460 --> 00:14:17,550
a microscope and you can see see the

379
00:14:20,690 --> 00:14:19,470
microorganisms there's algae and there's

380
00:14:23,660 --> 00:14:20,700
Santa bacteria and there's plenty of

381
00:14:25,790 --> 00:14:23,670
fungi I pretty much just starting the

382
00:14:27,350 --> 00:14:25,800
activity work on this now I have some

383
00:14:29,389 --> 00:14:27,360
cultures in the lab they are growing at

384
00:14:31,160 --> 00:14:29,399
zero degrees Celsius I'm having a lot

385
00:14:32,960 --> 00:14:31,170
better luck with the trip toilets and I

386
00:14:34,610 --> 00:14:32,970
did with the permafrost islip source

387
00:14:36,800 --> 00:14:34,620
only got six primer crossed eye slits I

388
00:14:41,120 --> 00:14:36,810

have over 40 I slips from the crypto and

389
00:14:43,010 --> 00:14:41,130
lifts already today and so so it's a lot

390
00:14:45,620 --> 00:14:43,020
to work with but they're a lot easier to

391
00:14:47,660 --> 00:14:45,630
work with and so why is that well the

392
00:14:50,840 --> 00:14:47,670
crypto and ellipse besides having access

393
00:14:53,300 --> 00:14:50,850
to the Sun on us an energy source there

394
00:14:54,860 --> 00:14:53,310
it's also a little bit of a warmer and

395
00:14:56,810 --> 00:14:54,870
wetter place so these rocks actually get

396
00:14:58,760 --> 00:14:56,820
heated up by the Sun almost 20 degrees

397
00:15:01,880 --> 00:14:58,770
warmer than avith in the air

398
00:15:03,380 --> 00:15:01,890
temperatures but it also it's it's very

399
00:15:05,840 --> 00:15:03,390
porous in there so that's provides a

400
00:15:07,790 --> 00:15:05,850
surface area for any available water in

401
00:15:09,470 --> 00:15:07,800
that atmosphere to condense upon so it's

402
00:15:10,880 --> 00:15:09,480
a little bit wetter and it's a little

403
00:15:15,110 --> 00:15:10,890
bit warmer and this provides a place for

404
00:15:18,079 --> 00:15:15,120
bacteria for bacteria to thrive so is

405
00:15:29,540 --> 00:15:18,089
anything alive they're not to be cliche

406
00:15:33,900 --> 00:15:31,740
thanks Jackie and we have maybe time for

407
00:15:47,009 --> 00:15:33,910
one question does anyone have a question

408
00:15:49,019 --> 00:15:47,019
for Jackie ok so you fed him yeast

409
00:15:50,449 --> 00:15:49,029
extract and they didn't grow and you're

410
00:15:52,499 --> 00:15:50,459
giving them acetate you're seeing low

411
00:15:54,329 --> 00:15:52,509
remineralization rates do you think

412
00:15:55,439 --> 00:15:54,339
that's just an effective they're not

413
00:15:57,150 --> 00:15:55,449

happy that you're feeding maybe tried

414
00:15:58,470 --> 00:15:57,160
like maybe 14 glucose to see if

415
00:16:02,819 --> 00:15:58,480
different substrate gives you a better

416
00:16:04,110 --> 00:16:02,829
yield um I can't shine 14 glucose this

417
00:16:05,730 --> 00:16:04,120
actually took me a really long time to

418
00:16:07,079 --> 00:16:05,740
do and it's it's worth doing but to be

419
00:16:09,600 --> 00:16:07,089
honest I don't think it's I don't think

420
00:16:13,290 --> 00:16:09,610
it's an issue of the carbon source i

421
00:16:15,569 --> 00:16:13,300
think he was either nothing there to to

422
00:16:17,160 --> 00:16:15,579
actual actively metabolize i just think

423
00:16:19,949 --> 00:16:17,170
its or they're taking a really long time

424
00:16:21,990 --> 00:16:19,959
to recover but that one the one that did

425
00:16:24,030 --> 00:16:22,000
show mineralization at five degrees and

426
00:16:26,129 --> 00:16:24,040
i wish i had more time to kind of dwell

427
00:16:28,110 --> 00:16:26,139
on that image there was a really long

428
00:16:35,490 --> 00:16:28,120
lag period before it started