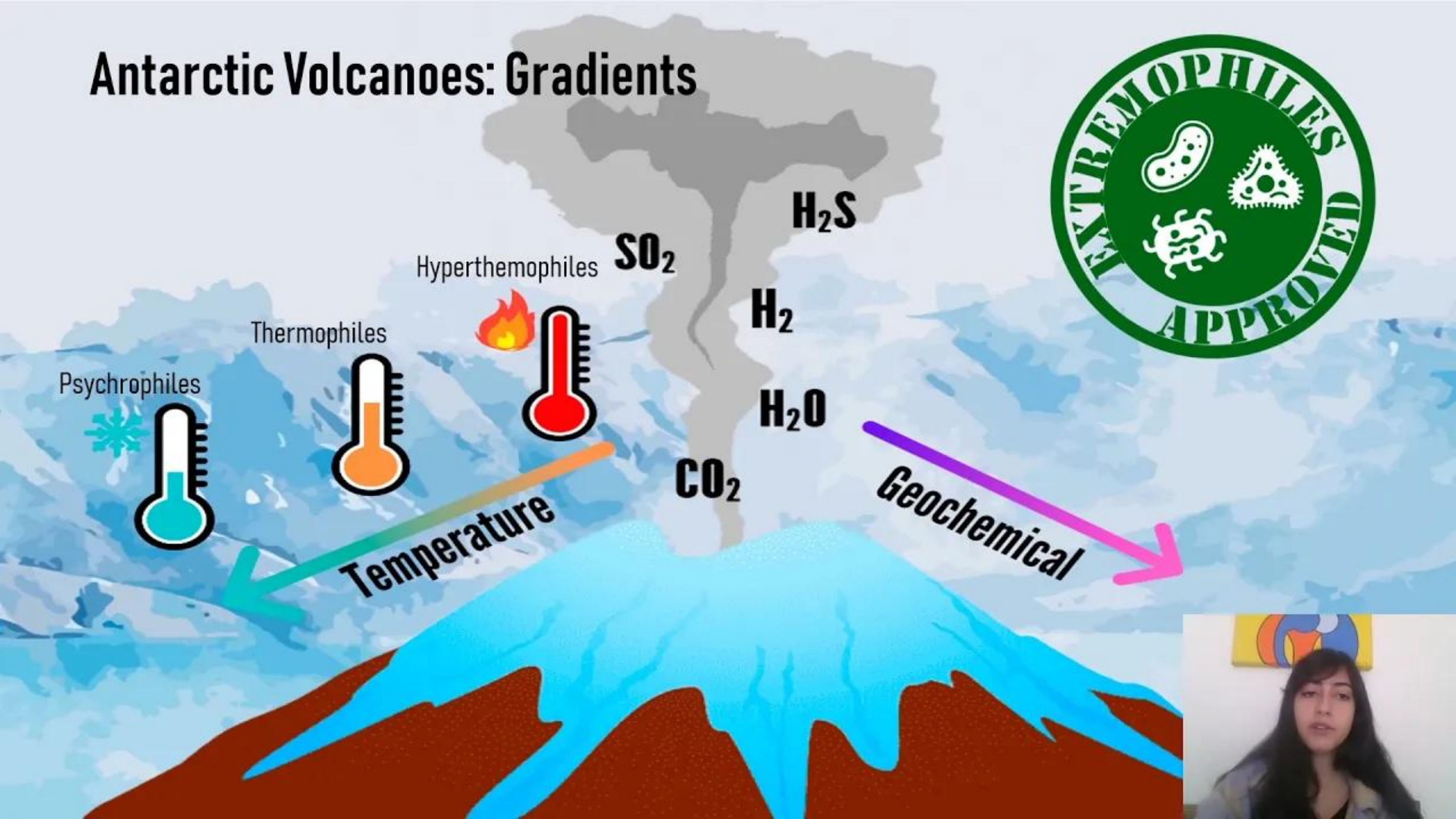
Antarctic Volcanoes: Gradients



1
00:00:04,870 --> 00:00:02,790
hello everyone my name is anna i'm a

2
00:00:07,349 --> 00:00:04,880
master student in oceanography from

3
00:00:09,430 --> 00:00:07,359
university of sao paulo in brazil

4
00:00:11,070 --> 00:00:09,440
and i appreciate the opportunity to talk

5
00:00:14,070 --> 00:00:11,080
here in epigratical

6
00:00:16,470 --> 00:00:14,080
2021. today i'm going to be talking

7
00:00:19,269 --> 00:00:16,480
about the chemosynthetic production

8
00:00:20,070 --> 00:00:19,279
in extreme temperature gradients from

9
00:00:22,710 --> 00:00:20,080
deception

10
00:00:26,150 --> 00:00:22,720
island antarctica and its implications

11
00:00:28,470 --> 00:00:26,160
for the limits of life

12
00:00:31,029 --> 00:00:28,480
the chemosynthesis is the process where

13
00:00:31,830 --> 00:00:31,039

organisms obtain the energy within the

14
00:00:34,630 --> 00:00:31,840
synthesis

15
00:00:35,270 --> 00:00:34,640
of organic compounds from chemical

16
00:00:37,990 --> 00:00:35,280
sources

17
00:00:40,630 --> 00:00:38,000
to redux reactions and not from the

18
00:00:42,630 --> 00:00:40,640
usual sunlight radiation

19
00:00:43,750 --> 00:00:42,640
it is a process that can be dominant in

20
00:00:47,029 --> 00:00:43,760
existence with

21
00:00:49,830 --> 00:00:47,039
a larger input of reduced compounds

22
00:00:51,510 --> 00:00:49,840
used as electron donors as the

23
00:00:54,709 --> 00:00:51,520
hydrothermal vents

24
00:00:55,430 --> 00:00:54,719
are called sips chemosynthetic organisms

25
00:00:59,270 --> 00:00:55,440
can be

26
00:01:01,590 --> 00:00:59,280
highly diverse in metabolisms phylogeny

27
00:01:02,790 --> 00:01:01,600
or optics which made a lot of

28
00:01:06,310 --> 00:01:02,800
chemosynthetic

29
00:01:12,870 --> 00:01:06,320
microorganisms to be also stromophiles

30
00:01:15,510 --> 00:01:12,880
living in harsh environmental conditions

31
00:01:17,270 --> 00:01:15,520
the deception island located in

32
00:01:19,109 --> 00:01:17,280
antarctica peninsula

33
00:01:20,550 --> 00:01:19,119
is one of these extremophiles

34
00:01:23,109 --> 00:01:20,560
environments

35
00:01:23,830 --> 00:01:23,119
in a unique aptitude on earth it is

36
00:01:26,870 --> 00:01:23,840
formed by

37
00:01:30,230 --> 00:01:26,880
avakinkiko that collapse

38
00:01:33,109 --> 00:01:30,240

with the ocean invading the conduit

39
00:01:35,109 --> 00:01:33,119
therefore an active doctrinal point with

40
00:01:37,429 --> 00:01:35,119
marine influence

41
00:01:38,469 --> 00:01:37,439
there are achievement roles reaching

42
00:01:41,510 --> 00:01:38,479
values of

43
00:01:44,789 --> 00:01:41,520
100 degrees celsius whereas

44
00:01:48,950 --> 00:01:44,799
around 60 of the island is covered by

45
00:01:55,190 --> 00:01:52,069
the interaction between ice ocean and

46
00:01:58,310 --> 00:01:55,200
volcanic activity creates pronounced

47
00:01:59,670 --> 00:01:58,320
temperature and biochemical gradients in

48
00:02:01,990 --> 00:01:59,680
a small distance

49
00:02:02,789 --> 00:02:02,000
favoring the growth of metabolically

50
00:02:05,990 --> 00:02:02,799
diverse

51
00:02:06,950 --> 00:02:06,000
stromophilic microorganisms and allowing

52
00:02:09,469 --> 00:02:06,960
all temperature

53
00:02:10,790 --> 00:02:09,479
adaptated microorganisms as

54
00:02:14,710 --> 00:02:10,800
epitomophiles

55
00:02:17,750 --> 00:02:14,720
thermophiles mesophiles and sucrofiles

56
00:02:20,790 --> 00:02:17,760
coexisting and possible interacting

57
00:02:23,830 --> 00:02:20,800
in the same environment

58
00:02:26,470 --> 00:02:23,840
all these characteristics make deception

59
00:02:27,910 --> 00:02:26,480
a possible analogy of outer earth

60
00:02:30,710 --> 00:02:27,920
environments

61
00:02:32,229 --> 00:02:30,720
not for the environment itself but

62
00:02:36,309 --> 00:02:32,239
whether for them parameters

63
00:02:38,949 --> 00:02:36,319

that can be limiting for life as well as

64
00:02:41,030 --> 00:02:38,959
chemism chemosynthetic production in a

65
00:02:43,190 --> 00:02:41,040
planetary context

66
00:02:44,390 --> 00:02:43,200
for example they create volcanoes in

67
00:02:48,150 --> 00:02:44,400
enceladus or

68
00:02:50,790 --> 00:02:48,160
the extinct volcanoes in mars

69
00:02:52,630 --> 00:02:50,800
the main goal of this study was to

70
00:02:55,670 --> 00:02:52,640
understand the limits for life

71
00:02:58,229 --> 00:02:55,680
and for chromosomatic production in one

72
00:03:02,390 --> 00:02:58,239
of these parameters in this case the

73
00:03:09,750 --> 00:03:06,149
so the samples were collected in 2018

74
00:03:10,390 --> 00:03:09,760
austral summer during the 27th brazilian

75
00:03:13,509 --> 00:03:10,400
antarctic

76
00:03:14,710 --> 00:03:13,519
expedition in the scope of microsphere

77
00:03:16,830 --> 00:03:14,720
project

78
00:03:18,470 --> 00:03:16,840
we collect sediment samples in

79
00:03:21,589 --> 00:03:18,480
republicans

80
00:03:22,149 --> 00:03:21,599
from two geothermal sites on deception

81
00:03:25,430 --> 00:03:22,159
island

82
00:03:26,309 --> 00:03:25,440
in part keeping in seoul call it wallers

83
00:03:30,550 --> 00:03:26,319
bay

84
00:03:35,110 --> 00:03:33,430
as you can see on this map in each one

85
00:03:38,630 --> 00:03:35,120
of these geothermal sites

86
00:03:42,550 --> 00:03:38,640
it was defined at a transect containing

87
00:03:46,229 --> 00:03:45,589
one for a glacier here represented by

88
00:03:49,509 --> 00:03:46,239

the blue

89
00:03:52,630 --> 00:03:49,519
collar and two for

90
00:03:57,190 --> 00:03:52,640
uh from former roles the yellow

91
00:04:01,429 --> 00:03:57,200
and red ones the female samples of

92
00:04:02,630 --> 00:04:01,439
waters bay reached 60 and 53 degrees

93
00:04:07,910 --> 00:04:02,640
celsius

94
00:04:14,550 --> 00:04:11,190
and from other samples of formula bay

95
00:04:17,909 --> 00:04:14,560
were hotter reaching 97

96
00:04:21,030 --> 00:04:17,919
and 98 degrees celsius

97
00:04:21,590 --> 00:04:21,040
the glacier point in both locals are

98
00:04:24,950 --> 00:04:21,600
reaching

99
00:04:27,710 --> 00:04:24,960
around zero degrees celsius

100
00:04:28,950 --> 00:04:27,720
the depth of the sediment recover was

101
00:04:32,150 --> 00:04:28,960
approximately

102
00:04:33,270 --> 00:04:32,160
five centimeters and the distance

103
00:04:35,629 --> 00:04:33,280
between from rows

104
00:04:36,870 --> 00:04:35,639
and glasses at each side were

105
00:04:40,390 --> 00:04:36,880
approximately

106
00:04:46,629 --> 00:04:44,150
after the sampling we performed in situ

107
00:04:47,909 --> 00:04:46,639
simulated dark carbon fixation

108
00:04:51,830 --> 00:04:47,919
incubations

109
00:04:55,670 --> 00:04:51,840
with c14 sodium recarbonated

110
00:04:58,870 --> 00:04:55,680
for a period of 36 hours in 3

111
00:05:02,550 --> 00:04:58,880
temperatures 4 60

112
00:05:06,230 --> 00:05:02,560
90 degrees after the incubation period

113
00:05:09,270 --> 00:05:06,240

the samples were exposed to hydrochloric

114
00:05:12,390 --> 00:05:09,280
acid to

115
00:05:14,469 --> 00:05:12,400
remove the remaining carbon and then

116
00:05:17,189 --> 00:05:14,479
they were transferred to values with

117
00:05:18,150 --> 00:05:17,199
stimulation cocktail and left in the

118
00:05:21,350 --> 00:05:18,160
dark for

119
00:05:21,830 --> 00:05:21,360
12 hours before the reading calcine

120
00:05:25,909 --> 00:05:21,840
through

121
00:05:28,390 --> 00:05:25,919
liquid scintillator by 30 minutes

122
00:05:29,110 --> 00:05:28,400
the results given in these integrations

123
00:05:32,070 --> 00:05:29,120
per minute

124
00:05:35,430 --> 00:05:32,080
were converted into production rates of

125
00:05:39,830 --> 00:05:38,790
as a result we observed that the dcf

126
00:05:44,070 --> 00:05:39,840
rates varied

127
00:05:47,189 --> 00:05:44,080
from 0.07

128
00:05:49,990 --> 00:05:47,199
to 0.69 microgram

129
00:05:51,350 --> 00:05:50,000
of carbon by cubic meter by hour in

130
00:05:56,230 --> 00:05:51,360
wallers bay

131
00:05:59,350 --> 00:05:56,240
and from 0.12 to 1.79

132
00:06:04,230 --> 00:05:59,360
in formula b so the highest

133
00:06:06,710 --> 00:06:04,240
dcf values were found in formal bay

134
00:06:07,590 --> 00:06:06,720
where our localized the whole dish from

135
00:06:10,150 --> 00:06:07,600
roads

136
00:06:12,629 --> 00:06:10,160
which display high hydrogenous sulfur

137
00:06:15,029 --> 00:06:12,639
emissions

138
00:06:16,629 --> 00:06:15,039

when we look at the average of chemical

139
00:06:19,830 --> 00:06:16,639
touch production

140
00:06:20,390 --> 00:06:19,840
we got some interesting results in this

141
00:06:23,670 --> 00:06:20,400
graph

142
00:06:24,870 --> 00:06:23,680
the colors represent the temperatures of

143
00:06:28,150 --> 00:06:24,880
incubation

144
00:06:33,350 --> 00:06:28,160
so blue is 4 degrees celsius

145
00:06:36,710 --> 00:06:33,360
the yellow is 60 and the red is 90.

146
00:06:39,749 --> 00:06:36,720
and we found 0.27

147
00:06:44,070 --> 00:06:39,759
of chemosynthetic production

148
00:06:47,749 --> 00:06:44,080
in a glacier sample for from wallers bay

149
00:06:50,280 --> 00:06:47,759
when incubated and 90 degrees

150
00:06:51,629 --> 00:06:50,290
conversely we found um

151
00:06:56,070 --> 00:06:51,639
[Music]

152
00:06:59,430 --> 00:06:56,080
0.16 of chemosynthetic production rate

153
00:07:06,150 --> 00:06:59,440
in formula sample from formula bay

154
00:07:10,309 --> 00:07:09,189
we also found that the glycerin sample

155
00:07:14,390 --> 00:07:10,319
from waters bay

156
00:07:17,990 --> 00:07:17,110
from a glacier present more chemistry

157
00:07:22,230 --> 00:07:18,000
production

158
00:07:24,629 --> 00:07:22,240
when incubated at six degrees celsius

159
00:07:26,150 --> 00:07:24,639
then when incubated at four degrees

160
00:07:29,110 --> 00:07:26,160
celsius

161
00:07:29,550 --> 00:07:29,120
the stranger high temperature production

162
00:07:32,629 --> 00:07:29,560
in

163
00:07:35,430 --> 00:07:32,639

wbc could be due a process

164
00:07:36,710 --> 00:07:35,440
of dispersing of the microbial cells in

165
00:07:39,350 --> 00:07:36,720
the environment

166
00:07:41,430 --> 00:07:39,360
allowing the presence of microbes

167
00:07:45,909 --> 00:07:41,440
adapted for a hotter temperature

168
00:07:48,070 --> 00:07:45,919
in this sample as i mentioned before

169
00:07:49,270 --> 00:07:48,080
the high-skill synthetic production

170
00:07:53,430 --> 00:07:49,280
rates

171
00:07:55,830 --> 00:07:53,440
do a pre at formula

172
00:07:56,710 --> 00:07:55,840
but more specifically we observe such

173
00:07:59,270 --> 00:07:56,720
rates

174
00:08:00,230 --> 00:07:59,280
in the sample recovery from the glacier

175
00:08:03,909 --> 00:08:00,240
sediments

176
00:08:08,550 --> 00:08:03,919
when incubated at four degrees celsius

177
00:08:10,469 --> 00:08:08,560
so uh the environment of a polar volcano

178
00:08:11,589 --> 00:08:10,479
also favors the eclipse attached

179
00:08:14,950 --> 00:08:11,599
reduction

180
00:08:17,990 --> 00:08:14,960
from microbes living in the ice and snow

181
00:08:19,110 --> 00:08:18,000
which shows the huge importance of this

182
00:08:21,510 --> 00:08:19,120
ecosystem

183
00:08:22,390 --> 00:08:21,520
not only for the microbial communities

184
00:08:25,510 --> 00:08:22,400
living near

185
00:08:28,390 --> 00:08:25,520
the source of reduced compounds

186
00:08:31,029 --> 00:08:28,400
but also for that one's more distant

187
00:08:33,750 --> 00:08:31,039
unfortunately the dark carbon fixation

188
00:08:34,469 --> 00:08:33,760

analysis gives us the information about

189
00:08:36,949 --> 00:08:34,479
the process

190
00:08:39,029 --> 00:08:36,959
of chemosynthesis and not about the

191
00:08:40,630 --> 00:08:39,039
taxonomy of microbial communities

192
00:08:43,829 --> 00:08:40,640
present in the samples

193
00:08:46,070 --> 00:08:43,839
so to better understand the why

194
00:08:48,230 --> 00:08:46,080
we found the skin with synthetic grades

195
00:08:50,470 --> 00:08:48,240
more analysis is necessary

196
00:08:53,030 --> 00:08:50,480
and this will be the future steps of

197
00:08:55,350 --> 00:08:53,040
this project

198
00:08:57,509 --> 00:08:55,360
and we also performed a statistical

199
00:09:00,790 --> 00:08:57,519
analysis in the data

200
00:09:03,430 --> 00:09:00,800
uh an anova between the temperatures

201
00:09:05,269 --> 00:09:03,440
of incubation and that detached between

202
00:09:08,310 --> 00:09:05,279
female versus glaciers

203
00:09:09,990 --> 00:09:08,320
that is the environment and the t-test

204
00:09:12,790 --> 00:09:10,000
between this sample's location

205
00:09:13,670 --> 00:09:12,800
for marijuana bay versus waters bay

206
00:09:16,150 --> 00:09:13,680
considering

207
00:09:17,389 --> 00:09:16,160
a significant difference a few value

208
00:09:19,910 --> 00:09:17,399
less than

209
00:09:21,590 --> 00:09:19,920
0.05 with this

210
00:09:23,430 --> 00:09:21,600
we noticed that there were no

211
00:09:26,310 --> 00:09:23,440
significant difference between

212
00:09:27,670 --> 00:09:26,320
the environment and nor in the

213
00:09:30,790 --> 00:09:27,680

incubation temperature

214
00:09:31,509 --> 00:09:30,800
however we do observe a significant

215
00:09:34,070 --> 00:09:31,519
difference

216
00:09:34,949 --> 00:09:34,080
when compared to the sample's location

217
00:09:38,389 --> 00:09:34,959
from our bay

218
00:09:38,710 --> 00:09:38,399
versus wallersby this could be due to

219
00:09:41,350 --> 00:09:38,720
the

220
00:09:42,470 --> 00:09:41,360
presence of hottest females in from

221
00:09:44,870 --> 00:09:42,480
earlier bay

222
00:09:46,230 --> 00:09:44,880
they give the local more chemistry

223
00:09:49,350 --> 00:09:46,240
production rates

224
00:09:49,750 --> 00:09:49,360
as we had already seen before and also

225
00:09:54,310 --> 00:09:49,760
the

226
00:09:56,710 --> 00:09:54,320
temperature of incubation

227
00:09:57,670 --> 00:09:56,720
we're not significant parameters for the

228
00:10:01,910 --> 00:09:57,680
chemosynthesis

229
00:10:07,750 --> 00:10:05,110
therefore we conclude that extremely low

230
00:10:09,030 --> 00:10:07,760
and high temperatures were non-limiting

231
00:10:12,230 --> 00:10:09,040
factors for the

232
00:10:14,389 --> 00:10:12,240
chemostatic production furthermore the

233
00:10:15,910 --> 00:10:14,399
geochemistry of a volcanic polar

234
00:10:18,550 --> 00:10:15,920
environment selects

235
00:10:21,030 --> 00:10:18,560
active chemistry type communities and

236
00:10:23,430 --> 00:10:21,040
both morals and glycostatements

237
00:10:24,150 --> 00:10:23,440
and besides that the dark harbor

238
00:10:27,509 --> 00:10:24,160

fixation

239
00:10:30,949 --> 00:10:27,519
analysis could be a simple and novel

240
00:10:32,550 --> 00:10:30,959
tool for life detection on astrobiology

241
00:10:35,030 --> 00:10:32,560
research

242
00:10:36,150 --> 00:10:35,040
in the future we plan to perform the

243
00:10:39,110 --> 00:10:36,160
metagenomic

244
00:10:41,670 --> 00:10:39,120
and metatranscriptomic analysis to

245
00:10:43,030 --> 00:10:41,680
discover which microorganisms compose

246
00:10:46,550 --> 00:10:43,040
the microbial communities

247
00:10:49,269 --> 00:10:46,560
in each one of the samples and which

248
00:10:50,470 --> 00:10:49,279
of them are the actual responsible for

249
00:10:53,350 --> 00:10:50,480
the chemist

250
00:10:53,829 --> 00:10:53,360
chemosynthesis process that occurs here

251
00:10:56,870 --> 00:10:53,839
i would

252
00:10:57,350 --> 00:10:56,880
like to thank my collaborators and also

253
00:11:00,790 --> 00:10:57,360
thanks

254
00:11:02,310 --> 00:11:00,800
the microsphere project the antarctic

255
00:11:04,630 --> 00:11:02,320
brazilian program

256
00:11:06,310 --> 00:11:04,640
the university of sao paulo the

257
00:11:08,230 --> 00:11:06,320
oceanographic institute and the

258
00:11:10,949 --> 00:11:08,240
microsoft electron labs

259
00:11:12,389 --> 00:11:10,959
for all the support give to realize this