Gabriel Goncalves Silva

Application of Capillary Electrophoresis to Monitor Meteorite Simulant Bioleaching by Acidithiobacillus ferrooxidans

1
00:00:00,240 --> 00:00:10,959
[Music]

2
00:00:18,620 --> 00:00:12,829
thank you very much for this opportunity

3
00:00:22,960 --> 00:00:21,200
I'm PhD student in Brazil I'm working

4
00:00:26,450 --> 00:00:22,970
with the interaction between

5
00:00:28,790 --> 00:00:26,460
microorganisms and me rights and in the

6
00:00:30,680 --> 00:00:28,800
beginning of my PhD I'm working with

7
00:00:33,319 --> 00:00:30,690
professor of fatherhood rages in the

8
00:00:35,270 --> 00:00:33,329
atmosphere a laboratory in the chemistry

9
00:00:37,610 --> 00:00:35,280
Institute at the University of Sao Paulo

10
00:00:43,069 --> 00:00:37,620
together with Alana and my colleagues

11
00:00:45,619 --> 00:00:43,079
that were here and to have a for people

12
00:00:47,810 --> 00:00:45,629
that are not familiar with the idea of

13
00:00:50,419 --> 00:00:47,820

this interaction between microorganisms

14
00:00:53,840 --> 00:00:50,429
and rocks and me writes we using

15
00:00:56,239 --> 00:00:53,850
laboratory some model microorganisms in

16
00:00:59,000 --> 00:00:56,249
this case the this cumulative traffic

17
00:01:02,660 --> 00:00:59,010
bacterium called acidity of bacillus for

18
00:01:07,970 --> 00:01:02,670
exceedance it's a really model for for

19
00:01:10,820 --> 00:01:07,980
us because as I was talking for it's a

20
00:01:16,210 --> 00:01:10,830
humanly to traffic microorganisms is a

21
00:01:19,690 --> 00:01:16,220
it's bacteria is able to use inorganic

22
00:01:23,810 --> 00:01:19,700
molecules that we found in rocks too as

23
00:01:27,370 --> 00:01:23,820
energy source for a living so to do so

24
00:01:31,790 --> 00:01:27,380
this bacterium used to living name

25
00:01:35,240 --> 00:01:31,800
various novel and it's an acid a philic

26
00:01:38,570 --> 00:01:35,250
bacterium like to live in places with a

27
00:01:42,440 --> 00:01:38,580
very low pH D so it can use iron and

28
00:01:44,810 --> 00:01:42,450
sulfur species as source of energy and

29
00:01:47,360 --> 00:01:44,820
this process of oxidation to get these

30
00:01:49,190 --> 00:01:47,370
energy and later to use the carbon

31
00:01:52,850 --> 00:01:49,200
dioxide from the atmosphere to produce

32
00:01:55,280 --> 00:01:52,860
its biomass and when we're thinking

33
00:01:58,040 --> 00:01:55,290
about the the use of these

34
00:02:00,530 --> 00:01:58,050
microorganisms in context of space

35
00:02:03,050 --> 00:02:00,540
exploration we need to look for our

36
00:02:08,380 --> 00:02:03,060
museums and seeing our collections of

37
00:02:10,570 --> 00:02:08,390
meteorites to see that the huge very

38
00:02:13,059 --> 00:02:10,580

different materials we have that comes

39
00:02:15,430 --> 00:02:13,069
from space so we can learn from these me

40
00:02:17,860 --> 00:02:15,440
writes how the composition of these

41
00:02:20,410 --> 00:02:17,870
rocks of these asteroids this planets

42
00:02:23,260 --> 00:02:20,420
seeing what we have here in this

43
00:02:25,300 --> 00:02:23,270
material represents hundreds of

44
00:02:28,960 --> 00:02:25,310
different kinds of asteroids and other

45
00:02:32,080 --> 00:02:28,970
bodies from the solar system like moon

46
00:02:34,540 --> 00:02:32,090
like Mars that we have pieces of rock

47
00:02:37,390 --> 00:02:34,550
from this place here on earth so you can

48
00:02:40,449 --> 00:02:37,400
use it to learn how to use them how to

49
00:02:42,930 --> 00:02:40,459
explore the possibilities we have in

50
00:02:46,540 --> 00:02:42,940
this material so when we think about

51
00:02:49,270 --> 00:02:46,550
that microorganism that can use material

52
00:02:52,390 --> 00:02:49,280
in this on organic molecules formula for

53
00:02:55,509 --> 00:02:52,400
these rocks we think the possibility of

54
00:02:59,259 --> 00:02:55,519
use of this contact for our exploration

55
00:03:01,509 --> 00:02:59,269
of natural resources and in a form for

56
00:03:04,479 --> 00:03:01,519
example of Billy Ching and the

57
00:03:08,500 --> 00:03:04,489
liberation of metals that are important

58
00:03:11,380 --> 00:03:08,510
in the colonization and to help the

59
00:03:14,740 --> 00:03:11,390
human beings to travel to other planets

60
00:03:19,870 --> 00:03:14,750
and survival there and use this kind of

61
00:03:22,240 --> 00:03:19,880
a way to access this material to help

62
00:03:24,729 --> 00:03:22,250
the colonization and even to prepare the

63
00:03:28,780 --> 00:03:24,739

soil for plantations and use in

64
00:03:33,490 --> 00:03:28,790
different ways to help us to complete

65
00:03:36,400 --> 00:03:33,500
the space but what we know now about me

66
00:03:38,800 --> 00:03:36,410
right the me rights in our collections I

67
00:03:41,140 --> 00:03:38,810
said there is a lot of different

68
00:03:44,020 --> 00:03:41,150
compositions but we can put it in two

69
00:03:47,110 --> 00:03:44,030
main groups they count right meteorites

70
00:03:49,330 --> 00:03:47,120
and the non Conrad meteorites what does

71
00:03:53,020 --> 00:03:49,340
mean for people we are not familiar of

72
00:03:55,600 --> 00:03:53,030
meteorites the chondrite material comes

73
00:03:57,580 --> 00:03:55,610
from the origin of the solar system the

74
00:03:59,110 --> 00:03:57,590
formation process of the solar system

75
00:04:01,210 --> 00:03:59,120
and the non-contract

76
00:04:03,970 --> 00:04:01,220
tells us about the history of the

77
00:04:07,060 --> 00:04:03,980
evolution of the solar system so we have

78
00:04:10,449 --> 00:04:07,070
the first material there and here we

79
00:04:14,650 --> 00:04:10,459
have some differentiation and separation

80
00:04:17,440 --> 00:04:14,660
of material so thinking about the main

81
00:04:19,539 --> 00:04:17,450
composition and the main phases of this

82
00:04:21,900 --> 00:04:19,549
material we have this tawny

83
00:04:24,050 --> 00:04:21,910
or rocky phase

84
00:04:27,960 --> 00:04:24,060
that we have in composition mainly

85
00:04:31,890 --> 00:04:27,970
silicate minerals from magnesium iron

86
00:04:35,370 --> 00:04:31,900
etc and we have the metallic phase that

87
00:04:38,180 --> 00:04:35,380
is mainly iron and nickel and we can

88
00:04:40,440 --> 00:04:38,190

find these two phases in different

89
00:04:45,690 --> 00:04:40,450
concentrations on each kind of meat

90
00:04:48,660 --> 00:04:45,700
right we have this group we have more

91
00:04:50,370 --> 00:04:48,670
composition of the rocky phase we have a

92
00:04:53,250 --> 00:04:50,380
group that I'll talk a little bit more

93
00:04:56,730 --> 00:04:53,260
that just the metallic phase just iron

94
00:05:01,230 --> 00:04:56,740
nickel and other metals and a mixture of

95
00:05:03,150 --> 00:05:01,240
both the stony-iron me right so going to

96
00:05:05,700 --> 00:05:03,160
start to think about the use of

97
00:05:08,430 --> 00:05:05,710
meteorites we start to think in

98
00:05:12,120 --> 00:05:08,440
something there was very recently

99
00:05:15,690 --> 00:05:12,130
present in the the science the first

100
00:05:17,880 --> 00:05:15,700
idea the first challenge proof of

101
00:05:21,240 --> 00:05:17,890
concept was to understand if this

102
00:05:23,970 --> 00:05:21,250
bacteria could survive using this Iram

103
00:05:27,000 --> 00:05:23,980
not from Earth but from me rights to

104
00:05:31,140 --> 00:05:27,010
grow and to gather this designer jet

105
00:05:35,880 --> 00:05:31,150
survived so this first work from 2005

106
00:05:41,400 --> 00:05:35,890
just did this they put meteorite in a

107
00:05:43,770 --> 00:05:41,410
very acid media to fragments and one was

108
00:05:46,890 --> 00:05:43,780
a biotic experiment and the other the

109
00:05:50,610 --> 00:05:46,900
biotic experience using exactly the same

110
00:05:54,720 --> 00:05:50,620
bacteria we were present here and what

111
00:05:58,050 --> 00:05:54,730
we saw was that the micro the Iram in

112
00:05:59,940 --> 00:05:58,060
the me right was attacked by the acid so

113
00:06:02,790 --> 00:05:59,950

we have the solubilization part of this

114
00:06:05,220 --> 00:06:02,800
acid and for my room too but when we

115
00:06:08,250 --> 00:06:05,230
have the bacteria it was capable of

116
00:06:10,440 --> 00:06:08,260
using this iron and that's oxidizing

117
00:06:13,200 --> 00:06:10,450
desire and got the energy and survived

118
00:06:15,420 --> 00:06:13,210
in growth so yes

119
00:06:19,830 --> 00:06:15,430
bacteria can use our room for me rights

120
00:06:22,740 --> 00:06:19,840
to survive using iron but you have a

121
00:06:25,460 --> 00:06:22,750
little bit of sulfides here too but but

122
00:06:29,430 --> 00:06:25,470
the iron was the main source of energy

123
00:06:32,610 --> 00:06:29,440
but okay we can't grow bacteria there

124
00:06:35,330 --> 00:06:32,620
but in the other methods could it make

125
00:06:41,090 --> 00:06:35,340
it worse due to bacteria

126
00:06:43,580 --> 00:06:41,100
with these other methods to be a

127
00:06:47,560 --> 00:06:43,590
challenge for something like much bigger

128
00:06:51,050 --> 00:06:47,570
like a bio leaching process in the space

129
00:06:54,950 --> 00:06:51,060
there's one another paper one another

130
00:06:57,980 --> 00:06:54,960
work from 2009 that tried almost the

131
00:07:01,100 --> 00:06:57,990
same idea a little bit more complex but

132
00:07:03,860 --> 00:07:01,110
nothing more to understand was developed

133
00:07:07,159 --> 00:07:03,870
200 really understand how the meteorite

134
00:07:09,650 --> 00:07:07,169
composition could really become a

135
00:07:14,570 --> 00:07:09,660
challenge for this bacteria to be used

136
00:07:19,070 --> 00:07:14,580
in a much larger process so the first

137
00:07:24,230 --> 00:07:19,080
idea is to think how could this process

138
00:07:27,820 --> 00:07:24,240

be far as something much larger in space

139
00:07:31,340 --> 00:07:27,830
in a huge asteroid that could be an iron

140
00:07:36,320 --> 00:07:31,350
composition but we also need to think

141
00:07:39,050 --> 00:07:36,330
about how we can make this process

142
00:07:41,420 --> 00:07:39,060
really happen and how we can access the

143
00:07:46,820 --> 00:07:41,430
information to know that the process is

144
00:07:49,550 --> 00:07:46,830
developing well in the space so a method

145
00:07:53,890 --> 00:07:49,560
that could help us to this process is

146
00:08:02,350 --> 00:07:53,900
called the capillary electrophoresis is

147
00:08:15,170 --> 00:08:09,430
material to just two small copper say

148
00:08:18,409 --> 00:08:15,180
this we need this is the liquid where we

149
00:08:21,379 --> 00:08:18,419
have our sample and we put a capillary

150
00:08:26,060 --> 00:08:21,389
in this and put a very large difference

151
00:08:29,839 --> 00:08:26,070
of a charge so we can make the ions

152
00:08:32,480 --> 00:08:29,849
there in this ionic species that were in

153
00:08:35,930 --> 00:08:32,490
this liquid to go through this capillary

154
00:08:38,690 --> 00:08:35,940
and the difference between the the

155
00:08:42,860 --> 00:08:38,700
charges and the the molecules we have

156
00:08:45,110 --> 00:08:42,870
here we make it take different time to

157
00:08:49,610 --> 00:08:45,120
cross all the capillary so we can make

158
00:08:52,520 --> 00:08:49,620
it separate and we can quantify each of

159
00:08:56,569 --> 00:08:52,530
them when they pass in front of detector

160
00:08:59,900 --> 00:08:56,579
so we can quantify ionic species that we

161
00:09:03,680 --> 00:08:59,910
will try to analyze we can use low

162
00:09:06,440 --> 00:09:03,690
sample reagent volumes this all this

163
00:09:10,010 --> 00:09:06,450

equipment can be miniaturized so you can

164
00:09:14,150 --> 00:09:10,020
put in our in a innocent spaceship and

165
00:09:18,500 --> 00:09:14,160
send it very cheaper than water or other

166
00:09:21,110 --> 00:09:18,510
methods to quantify this and we can put

167
00:09:23,390 --> 00:09:21,120
it together with a great variety of

168
00:09:26,690 --> 00:09:23,400
detection systems that can make your

169
00:09:28,430 --> 00:09:26,700
data more precise so think about the

170
00:09:32,110 --> 00:09:28,440
other thinking to understand how we can

171
00:09:35,960 --> 00:09:32,120
make this process work in space this

172
00:09:40,250 --> 00:09:35,970
this work try to have to to analyze to

173
00:09:42,920 --> 00:09:40,260
have we have two goals in this work the

174
00:09:46,100 --> 00:09:42,930
first one is to evaluate the possibility

175
00:09:49,100 --> 00:09:46,110
of the growth of this acid bath Phil's

176
00:09:52,069 --> 00:09:49,110
truck seasons during up very large

177
00:09:55,640 --> 00:09:52,079
process of bio leaching using a mirror

178
00:09:58,250 --> 00:09:55,650
right similar to thinking in the in all

179
00:10:00,710 --> 00:09:58,260
the methods that we could you have in

180
00:10:04,490 --> 00:10:00,720
this me right hand could influence the

181
00:10:08,840 --> 00:10:04,500
this growth and try to do this thinking

182
00:10:12,290 --> 00:10:08,850
in the space using a method that could

183
00:10:15,470 --> 00:10:12,300
be using in space using the vote

184
00:10:17,690 --> 00:10:15,480
revolving a novel method inside the

185
00:10:20,300 --> 00:10:17,700
capillary electrophoresis we could

186
00:10:22,730 --> 00:10:20,310
analyze the for ionic species they're

187
00:10:25,130 --> 00:10:22,740
important for us aren't you a nerve

188
00:10:26,780 --> 00:10:25,140

three that will tell us about the growth

189
00:10:29,630 --> 00:10:26,790
of the bacteria

190
00:10:35,269 --> 00:10:29,640
Nico and cop out there the other main

191
00:10:37,790 --> 00:10:35,279
main metals we have in this mirror X so

192
00:10:40,250 --> 00:10:37,800
to do this we use it as it passes for

193
00:10:42,530 --> 00:10:40,260
exceedance a strength called LR that are

194
00:10:44,510 --> 00:10:42,540
isolated from Brazil in the classic

195
00:10:47,510 --> 00:10:44,520
medium for this microorganism

196
00:10:49,330 --> 00:10:47,520
with soluble iron the form of sulfate of

197
00:10:51,970 --> 00:10:49,340
aero tube

198
00:10:56,020 --> 00:10:51,980
and we develop what we call a STONER

199
00:10:58,660 --> 00:10:56,030
meteorite so it's a median that have a

200
00:11:01,720 --> 00:10:58,670
composition similar to the main group of

201
00:11:04,000 --> 00:11:01,730
iron meteorites called three a B which

202
00:11:07,180 --> 00:11:04,010
the composition have nine percent of

203
00:11:09,460 --> 00:11:07,190
iron almost nine percent of nickel and

204
00:11:13,390 --> 00:11:09,470
more or less half percent of cobalt

205
00:11:16,420 --> 00:11:13,400
that's the main composition of the this

206
00:11:20,830 --> 00:11:16,430
meteorite and we have all these species

207
00:11:24,690 --> 00:11:20,840
soluble as sulfates all the groups are

208
00:11:30,610 --> 00:11:24,700
in early Meyer flasks 30 degrees Celsius

209
00:11:32,980 --> 00:11:30,620
100 p.m. shaker and all in triplicate in

210
00:11:35,530 --> 00:11:32,990
the development of the capillary

211
00:11:39,610 --> 00:11:35,540
electrophoresis we use as a background

212
00:11:43,240 --> 00:11:39,620
electrolysis solution of 10 millimole

213
00:11:46,870 --> 00:11:43,250

per liter of hydroxy butyrate acid and

214
00:11:50,230 --> 00:11:46,880
histidine to work all this the the

215
00:11:53,830 --> 00:11:50,240
species together in a pH of 5 we use two

216
00:11:57,670 --> 00:11:53,840
different detectors one base it on the

217
00:12:00,220 --> 00:11:57,680
conductivity of the material passing the

218
00:12:04,560 --> 00:12:00,230
capillary energy detector all the

219
00:12:07,930 --> 00:12:04,570
samples were diluted so you can have the

220
00:12:09,730 --> 00:12:07,940
right concentration we use complementary

221
00:12:11,200 --> 00:12:09,740
methods a measurements or

222
00:12:13,690 --> 00:12:11,210
spectrophotometry the classic

223
00:12:16,750 --> 00:12:13,700
colorimetric method for R 2 R 3 to

224
00:12:19,660 --> 00:12:16,760
validate our data and use ICP as oh yes

225
00:12:22,210 --> 00:12:19,670
to analyze nickel and cobalt

226
00:12:23,110 --> 00:12:22,220
concentrations so here are the results

227
00:12:25,600 --> 00:12:23,120
first

228
00:12:28,570 --> 00:12:25,610
we're able to develop this new method of

229
00:12:30,970 --> 00:12:28,580
capillary o2 Francis so we were able to

230
00:12:35,410 --> 00:12:30,980
find exactly concentrations for iron

231
00:12:38,560 --> 00:12:35,420
cobalt nickel and iron 3 in one just run

232
00:12:41,290 --> 00:12:38,570
of the equipment and we have very low

233
00:12:43,600 --> 00:12:41,300
limit of quantification the dictation so

234
00:12:46,780 --> 00:12:43,610
we can make it work even for lower

235
00:12:49,450 --> 00:12:46,790
concentrations working in space and

236
00:12:52,270 --> 00:12:49,460
looking for the growth curves we have

237
00:12:55,810 --> 00:12:52,280
first the Clara metric method suspected

238
00:12:58,510 --> 00:12:55,820

photometry we saw traditional growth

239
00:13:01,570 --> 00:12:58,520
curve exponential growth to consuming

240
00:13:03,010 --> 00:13:01,580
all their iron and later precipitate of

241
00:13:05,920 --> 00:13:03,020
iron three divers permit

242
00:13:08,830 --> 00:13:05,930
later with the the bacterial growth the

243
00:13:11,980 --> 00:13:08,840
same path you must found in the air the

244
00:13:15,190 --> 00:13:11,990
simulant of our standard me right so we

245
00:13:17,830 --> 00:13:15,200
saw that yes you can grow the episodes

246
00:13:19,930 --> 00:13:17,840
for accidents in me rights and that the

247
00:13:23,170 --> 00:13:19,940
nico the presence of the nico and the

248
00:13:26,350 --> 00:13:23,180
comment doesn't change much the specific

249
00:13:29,740 --> 00:13:26,360
growth rate but can change the formation

250
00:13:32,230 --> 00:13:29,750
of the minerals precipitate we see the

251
00:13:35,470 --> 00:13:32,240
same pattern for the capillary

252
00:13:38,710 --> 00:13:35,480
electrophoresis that we develop but this

253
00:13:43,570 --> 00:13:38,720
time a little bit more noisy results we

254
00:13:45,940 --> 00:13:43,580
can see for sure where the that that

255
00:13:48,490 --> 00:13:45,950
curve that the spanish show curve so

256
00:13:50,530 --> 00:13:48,500
well but we have the growth and then the

257
00:13:52,150 --> 00:13:50,540
formation of the precipitate in the

258
00:13:54,700 --> 00:13:52,160
traditional media we can see in the

259
00:13:57,940 --> 00:13:54,710
conductivity and UV detector with a good

260
00:14:00,040 --> 00:13:57,950
correlation coefficient in the green

261
00:14:03,430 --> 00:14:00,050
compared to the calorimetric composition

262
00:14:05,440 --> 00:14:03,440
the same we saw for the standard

263
00:14:07,720 --> 00:14:05,450

meteorite simulate and now we have a

264
00:14:10,540 --> 00:14:07,730
better correlation coefficient and we

265
00:14:13,330 --> 00:14:10,550
see that the nickel and cobalt doesn't

266
00:14:16,810 --> 00:14:13,340
change this growth so just to conclude

267
00:14:20,830 --> 00:14:16,820
we saw with this work first the novel

268
00:14:22,840 --> 00:14:20,840
merit to capillary and dr phrases allow

269
00:14:27,700 --> 00:14:22,850
us to detect in a single run

270
00:14:29,860 --> 00:14:27,710
oh the the ions that we we want to to

271
00:14:32,760 --> 00:14:29,870
quantify thinking the grow in the space

272
00:14:35,740 --> 00:14:32,770
in an iron mature in asteroid in space

273
00:14:37,480 --> 00:14:35,750
the bacteria was able to grow the

274
00:14:38,950 --> 00:14:37,490
simulant showing no significant

275
00:14:42,340 --> 00:14:38,960
difference due the presence of nickel

276
00:14:44,860 --> 00:14:42,350
and cobalt and this dope there is two

277
00:14:47,200 --> 00:14:44,870
results together make us think more

278
00:14:49,330 --> 00:14:47,210
about the possibilities of future study

279
00:14:53,590 --> 00:14:49,340
of the leaching of metal-rich asteroids

280
00:14:56,890 --> 00:14:53,600
and maybe out kind of asteroids so this

281
00:14:59,980 --> 00:14:56,900
was published in a paper the last year

282
00:15:02,530 --> 00:14:59,990
if you can see it you have been in

283
00:15:05,020 --> 00:15:02,540
doubts about it you can see it and just

284
00:15:07,600 --> 00:15:05,030
for future work we propose different

285
00:15:10,450 --> 00:15:07,610
kind of which writes a more broad study

286
00:15:13,690 --> 00:15:10,460
of all of them that is in fact to become

287
00:15:14,620 --> 00:15:13,700
my kg researcher and do me now thank you

288
00:15:19,350 --> 00:15:14,630

very much

289
00:15:28,420 --> 00:15:19,360
[Applause]

290
00:15:31,870 --> 00:15:28,430
okay are there any questions thank you

291
00:15:33,760 --> 00:15:31,880
it was a very nice talk but maybe it's a

292
00:15:35,620 --> 00:15:33,770
stupid question cuz I'm not in the field

293
00:15:41,560 --> 00:15:35,630
but could you go back to your results

294
00:15:43,780 --> 00:15:41,570
like slide 17 Megan yeah um could you

295
00:15:46,500 --> 00:15:43,790
clarify a bit more what's the difference

296
00:15:50,460 --> 00:15:46,510
between iron and iron in precipitation

297
00:15:53,500 --> 00:15:50,470
when this microorganism gross it

298
00:15:57,430 --> 00:15:53,510
consumed the iron - and oxidized to a

299
00:16:00,270 --> 00:15:57,440
form of iron 3 in even in this low pH

300
00:16:04,660 --> 00:16:00,280
higher highest concentrations of air

301
00:16:07,650 --> 00:16:04,670
creates a possibility formation of

302
00:16:11,830 --> 00:16:07,660
minerals like ox Hydrox

303
00:16:14,860 --> 00:16:11,840
oxide rods of iron and oxide drugs so

304
00:16:17,710 --> 00:16:14,870
fatal viral that precipitate as minerals

305
00:16:20,470 --> 00:16:17,720
like Jerez I'd and choise my night so

306
00:16:23,200 --> 00:16:20,480
this is the idea about formation of a

307
00:16:25,600 --> 00:16:23,210
new soil in an asteroid is this

308
00:16:27,550 --> 00:16:25,610
formation of this precipitate that takes

309
00:16:30,130 --> 00:16:27,560
a little bit of the iron and sometimes

310
00:16:31,690 --> 00:16:30,140
can take a little bit of the nickel in

311
00:16:33,490 --> 00:16:31,700
the cobalt and the other metals in the

312
00:16:38,320 --> 00:16:33,500
solution and the formation of this

313
00:16:40,570 --> 00:16:38,330

precipitate we can also have we can also

314
00:16:43,140 --> 00:16:40,580
detect the concentrations if you have

315
00:16:46,350 --> 00:16:43,150
the possibility of openness the

316
00:16:52,690 --> 00:16:46,360
solubility this the precipitate in

317
00:16:56,110 --> 00:16:52,700
hydrochloric acid thank you I have a

318
00:16:58,360 --> 00:16:56,120
question so you have a CEC for new

319
00:17:01,750 --> 00:16:58,370
system that's excellent we need to talk

320
00:17:05,590 --> 00:17:03,760
like what is the sensitivity the limit

321
00:17:10,420 --> 00:17:05,600
of detection and the dynamic range of

322
00:17:12,880 --> 00:17:10,430
fear see for lis sensor I guess that did

323
00:17:16,090 --> 00:17:12,890
I can't remember the results right now

324
00:17:22,840 --> 00:17:16,100
but the deranged we could work who else

325
00:17:25,050 --> 00:17:22,850
until that's okay I can't remember but I

326
00:17:27,910 --> 00:17:25,060
think there was something like 25

327
00:17:30,700 --> 00:17:27,920
millimoles per liter we can

328
00:17:32,940 --> 00:17:30,710
work who in the the this curve and the

329
00:17:34,980 --> 00:17:32,950
lower concentrations in the scale of

330
00:17:42,160 --> 00:17:34,990
micromoles per liter

331
00:17:42,700 --> 00:17:42,170
all right the answers thank you great

332
00:17:47,110 --> 00:17:42,710
talk

333
00:17:50,260 --> 00:17:47,120
I really appreciate you opening the

334
00:17:55,420 --> 00:17:50,270
possibility of soil generation by this

335
00:17:57,190 --> 00:17:55,430
micro planetary bodies in that context I

336
00:18:01,950 --> 00:17:57,200
had a question then about some of your

337
00:18:06,970 --> 00:18:01,960
extrapolations based on but maybe how

338
00:18:09,810 --> 00:18:06,980

this microbe can create plant available

339
00:18:13,510 --> 00:18:09,820
nutrients for growing plants on other

340
00:18:19,330 --> 00:18:13,520
planets it is that assumption correct or

341
00:18:22,510 --> 00:18:19,340
am I out of in fact we're trying to see

342
00:18:24,700 --> 00:18:22,520
this possibility we have a student in

343
00:18:27,700 --> 00:18:24,710
our lab they're trying to use this

344
00:18:33,070 --> 00:18:27,710
minerals that are precipitated to grow

345
00:18:36,190 --> 00:18:33,080
some some some food some I guess was

346
00:18:39,040 --> 00:18:36,200
wheat lived in this minerals but we are

347
00:18:43,270 --> 00:18:39,050
seeing a lot of problems because they're

348
00:18:46,240 --> 00:18:43,280
stable in LA and lower pH when he when

349
00:18:51,040 --> 00:18:46,250
you get to the neutral pH there's a lot

350
00:18:54,580 --> 00:18:51,050
of sulfur in the area so the iron

351
00:18:58,440 --> 00:18:54,590
becomes another farmers are iron out the

352
00:19:00,910 --> 00:18:58,450
toxins so it's very hard for the seed to

353
00:19:03,400 --> 00:19:00,920
grow but we are trying to see the

354
00:19:07,630 --> 00:19:03,410
possibility of use part of this minerals

355
00:19:10,650 --> 00:19:07,640
and part of other materials maybe other

356
00:19:14,080 --> 00:19:10,660
plan the plants that came from the

357
00:19:17,260 --> 00:19:14,090
previous generation to create some kind

358
00:19:20,500 --> 00:19:17,270
of soil we use for futures but we're

359
00:19:22,620 --> 00:19:20,510
starting to play with it we can see

360
00:19:24,410 --> 00:19:22,630
where can do with this precipitate

361
00:19:27,460 --> 00:19:24,420
that's great thank you

362
00:19:29,740 --> 00:19:27,470
[Music]

363
00:19:35,350 --> 00:19:29,750

great talk I love the idea of things

364
00:19:37,770 --> 00:19:35,360
growing on metals do you see any other

365
00:19:42,240 --> 00:19:37,780
oxidation of the iron

366
00:19:45,030 --> 00:19:42,250
but during your growth the in this pH

367
00:19:47,610 --> 00:19:45,040
the the electrode electrode difference

368
00:19:51,000 --> 00:19:47,620
for the oxidation the iron to try room

369
00:19:54,510 --> 00:19:51,010
three is much higher so that's exactly

370
00:19:57,090 --> 00:19:54,520
why the this microorganisms can grow

371
00:19:59,550 --> 00:19:57,100
better you know in a lower pH D so have

372
00:20:04,050 --> 00:19:59,560
more energy the difference so we can

373
00:20:08,400 --> 00:20:04,060
keep the little little bit of oxidation

374
00:20:10,980 --> 00:20:08,410
the abiotic oxidation and we try to to

375
00:20:14,750 --> 00:20:10,990
take as a baseline when you're trying to

376
00:20:20,520 --> 00:20:14,760
make your experiments with abiotic -

377
00:20:27,960 --> 00:20:20,530
okay do you see any siderophores for the

378
00:20:31,110 --> 00:20:27,970
active import of the iron species if I

379
00:20:34,490 --> 00:20:31,120
do see any small molecules secreted by

380
00:20:37,950 --> 00:20:34,500
the organism that help import the other

381
00:20:40,440 --> 00:20:37,960
my work didn't focus on this but we're

382
00:20:44,670 --> 00:20:40,450
trying to understand more about this as

383
00:20:47,700 --> 00:20:44,680
we have other sources of iron for

384
00:20:50,310 --> 00:20:47,710
example in study with satellite as a

385
00:20:53,370 --> 00:20:50,320
possibility of use in conditions like

386
00:20:55,620 --> 00:20:53,380
Mars so we're trying to understand

387
00:20:59,850 --> 00:20:55,630
understand the possibilities of use of

388
00:21:03,600 --> 00:20:59,860

EPs and maybe other surface to gather

389
00:21:05,910 --> 00:21:03,610
this the design for the bacteria it's a

390
00:21:08,640 --> 00:21:05,920
model bacteria there's a lot of study

391
00:21:12,060 --> 00:21:08,650
been doing about this but there's a lot

392
00:21:14,700 --> 00:21:12,070
of questions open how the formation of

393
00:21:17,820 --> 00:21:14,710
the precipitate how it works to get

394
00:21:20,460 --> 00:21:17,830
desire so there's a lot kindred with