Magnesium Perchlorate

1
00:00:11,120 --> 00:00:08,360
yeah okay so I'm actually here at

2
00:00:14,180 --> 00:00:11,130
cu-boulder like two buildings over um

3
00:00:16,039 --> 00:00:14,190
and my name is Katie prim and how I talk

4
00:00:17,510 --> 00:00:16,049
is really large so we're calling a nice

5
00:00:19,220 --> 00:00:17,520
firm ation of perchlorate and chloride

6
00:00:22,040 --> 00:00:19,230
brians under marshal living conditions

7
00:00:23,240 --> 00:00:22,050
so the images you see here are from the

8
00:00:24,590 --> 00:00:23,250
marsh in the movie so if you haven't

9
00:00:25,849 --> 00:00:24,600
seen it i would like close your ears and

10
00:00:28,550 --> 00:00:25,859
eyes and stuff because it's a really

11
00:00:30,290 --> 00:00:28,560
good movie and book so i watch it but if

12
00:00:32,179 --> 00:00:30,300
you have seen it you remember mark

13
00:00:34,100 --> 00:00:32,189

Watney he's trying to make potatoes for

14
00:00:37,400 --> 00:00:34,110
himself because he's alone on Mars and

15
00:00:40,040 --> 00:00:37,410
he needs to live but in order to make

16
00:00:42,860 --> 00:00:40,050
the potatoes grow he needs water and so

17
00:00:44,959 --> 00:00:42,870
he ends up combusting h 2 and 0 2 to

18
00:00:46,819 --> 00:00:44,969
make water but he ends up getting it

19
00:00:49,400 --> 00:00:46,829
build up a bow too and then blowing up

20
00:00:53,299 --> 00:00:49,410
right here so this theme of my talk is

21
00:00:54,380 --> 00:00:53,309
water on Mars so as you might know since

22
00:00:56,689 --> 00:00:54,390
we've been talking about Mars for a

23
00:00:58,760 --> 00:00:56,699
while there's a quite a few differences

24
00:01:00,590 --> 00:00:58,770
so the pressure on Mars is about 100

25
00:01:03,319 --> 00:01:00,600
times less it's 830 millibar here in

26
00:01:05,929 --> 00:01:03,329
Boulder so normal sea level is a

27
00:01:08,960 --> 00:01:05,939
thousand millibar average temperature is

28
00:01:11,660 --> 00:01:08,970
70 Kelvin less or so and the water vapor

29
00:01:13,250 --> 00:01:11,670
is about 10 times less so considering

30
00:01:16,130 --> 00:01:13,260
these conditions what water faces do we

31
00:01:19,039 --> 00:01:16,140
know exist on earth today or marsland

32
00:01:22,070 --> 00:01:19,049
today so you know from the Viking Lander

33
00:01:26,570 --> 00:01:22,080
I took an image saw all these rocks and

34
00:01:29,359 --> 00:01:26,580
iron-rich minerals and then it woke up

35
00:01:31,940 --> 00:01:29,369
again and saw that frost had deposited

36
00:01:33,679 --> 00:01:31,950
on the surface and so we know there had

37
00:01:35,480 --> 00:01:33,689
been water in the atmosphere and then it

38
00:01:37,940 --> 00:01:35,490

deposited onto the surface so this is

39
00:01:39,890 --> 00:01:37,950
like the Northern Plains or so of Mars

40
00:01:43,100 --> 00:01:39,900
and then the Hubble actually took images

41
00:01:44,870 --> 00:01:43,110
of the north polar cap and saw this

42
00:01:47,240 --> 00:01:44,880
white stuff and it actually almost

43
00:01:49,310 --> 00:01:47,250
disappeared and what's left is actually

44
00:01:51,679 --> 00:01:49,320
due to water ice so we know we have

45
00:01:53,719 --> 00:01:51,689
frost and then of course ourselves you

46
00:01:55,490 --> 00:01:53,729
might know recurring slope lineae if you

47
00:01:57,859 --> 00:01:55,500
don't know what that is it's just these

48
00:01:59,450 --> 00:01:57,869
dark streaks that look like flowing

49
00:02:01,730 --> 00:01:59,460
water on Mars so this is higher

50
00:02:04,639 --> 00:02:01,740
elevation lower elevation see these dark

51
00:02:08,240 --> 00:02:04,649
streaks going in so this is evidence we

52
00:02:09,830 --> 00:02:08,250
have of liquid water on Mars as you

53
00:02:12,800 --> 00:02:09,840
might be thinking instead

54
00:02:14,509 --> 00:02:12,810
timber if you watch NASA TV they had

55
00:02:16,280 --> 00:02:14,519
this big announcement saying oh my gosh

56
00:02:18,559 --> 00:02:16,290
there's water on Mars and stuff and this

57
00:02:20,780 --> 00:02:18,569
paper was published and if you actually

58
00:02:22,640 --> 00:02:20,790
read the paper they say that they're

59
00:02:24,830 --> 00:02:22,650
hydrated salts and they don't actually

60
00:02:27,170 --> 00:02:24,840
say they found water they just say in

61
00:02:29,330 --> 00:02:27,180
order for hydrated salts to be on Mars

62
00:02:31,460 --> 00:02:29,340
you have to have a liquid phase but

63
00:02:34,400 --> 00:02:31,470

hydrated salts alone might not be

64
00:02:36,080 --> 00:02:34,410
indicative of liquid water because if

65
00:02:38,360 --> 00:02:36,090
you have a hydrated salts you can have

66
00:02:40,309 --> 00:02:38,370
an anhydrous salt increase the relative

67
00:02:42,680 --> 00:02:40,319
humidity and they get a hydrate salt or

68
00:02:45,589 --> 00:02:42,690
which this doesn't have a liquid phase

69
00:02:47,720 --> 00:02:45,599
and or you can have an aqueous salt

70
00:02:49,940 --> 00:02:47,730
solution lower the relative humidity and

71
00:02:51,650 --> 00:02:49,950
get a hydrated salt so there's a couple

72
00:02:53,180 --> 00:02:51,660
different ways to have the hydrated salt

73
00:02:55,250 --> 00:02:53,190
and you don't always need liquid water

74
00:02:57,470 --> 00:02:55,260
but I'm going to be focusing on this a

75
00:03:01,400 --> 00:02:57,480
kwiat sauce acquiesce salt solution and

76
00:03:02,390 --> 00:03:01,410
hydrated salts so in order to understand

77
00:03:04,190 --> 00:03:02,400
everything I'm going to be talking about

78
00:03:06,830 --> 00:03:04,200
you need to know the pathways of liquid

79
00:03:08,270 --> 00:03:06,840
water that could be possible on Mars so

80
00:03:09,860 --> 00:03:08,280
if you're starting with a salt crystal

81
00:03:12,170 --> 00:03:09,870
and you have water vapor in this case

82
00:03:14,690 --> 00:03:12,180
sodium chloride you increase the

83
00:03:16,729 --> 00:03:14,700
relative humidity you get a liquid and

84
00:03:18,770 --> 00:03:16,739
this is actually called deliquescent so

85
00:03:20,270 --> 00:03:18,780
I might be throwing that word around so

86
00:03:22,789 --> 00:03:20,280
if you think about temperature and

87
00:03:24,170 --> 00:03:22,799
relative humidity space lowered relative

88
00:03:26,830 --> 00:03:24,180

humidity here and higher relative

89
00:03:29,809 --> 00:03:26,840
immunity over here you have some solid

90
00:03:31,339 --> 00:03:29,819
crystal and salt you passed some

91
00:03:34,039 --> 00:03:31,349
threshold or relative humidity and

92
00:03:35,120 --> 00:03:34,049
temperature and you can get a liquid so

93
00:03:36,860 --> 00:03:35,130
I'm going to be showing a video that

94
00:03:39,500 --> 00:03:36,870
starts with this crystal and then it

95
00:03:43,099 --> 00:03:39,510
turns into a liquid droplet so you see

96
00:03:44,900 --> 00:03:43,109
here it starts to darken and now it's a

97
00:03:47,270 --> 00:03:44,910
liquid so this is actually what I do I

98
00:03:50,180 --> 00:03:47,280
actually study how this fins phase

99
00:03:53,470 --> 00:03:50,190
transition happens this deliquescent but

100
00:03:56,599 --> 00:03:53,480
if you're lower than freezing point or

101
00:03:57,770 --> 00:03:56,609
higher than that you can get ice so if

102
00:04:00,400 --> 00:03:57,780
you're starting with this liquid region

103
00:04:03,319 --> 00:04:00,410
has some other relative humidity

104
00:04:04,580 --> 00:04:03,329
temperature threshold you can get ice

105
00:04:07,460 --> 00:04:04,590
form so again i'm going to show another

106
00:04:09,379 --> 00:04:07,470
video starting with the liquid phase of

107
00:04:11,539 --> 00:04:09,389
this turning into an ice particle so

108
00:04:14,659 --> 00:04:11,549
it's liquid it grows it grows and as our

109
00:04:16,039 --> 00:04:14,669
sporting ice here so this is ice so

110
00:04:18,170 --> 00:04:16,049
these are all the phase transitions that

111
00:04:20,750 --> 00:04:18,180
you can think about for what could be

112
00:04:23,340 --> 00:04:20,760
possible on Mars because we know there's

113
00:04:25,830 --> 00:04:23,350

not just liquid water because of the

114
00:04:28,260 --> 00:04:25,840
pressure and the temperature so I

115
00:04:30,180 --> 00:04:28,270
actually study at what points these

116
00:04:31,860 --> 00:04:30,190
things happen so where's the liquid

117
00:04:35,160 --> 00:04:31,870
region where's ice region where is just

118
00:04:37,140 --> 00:04:35,170
a solid salt so you also might be

119
00:04:38,550 --> 00:04:37,150
thinking well we're just going this way

120
00:04:40,110 --> 00:04:38,560
increasing relative me is there any

121
00:04:41,790 --> 00:04:40,120
difference from decreasing relative

122
00:04:44,520 --> 00:04:41,800
humidity so if you decrease decrease

123
00:04:48,780 --> 00:04:44,530
relative humidity from a liquid you get

124
00:04:51,240 --> 00:04:48,790
a salt crystal back oh we you actually

125
00:04:53,460 --> 00:04:51,250
get F fluorescence and it's interesting

126
00:04:55,290 --> 00:04:53,470
because fo essence doesn't happen at the

127
00:04:58,620 --> 00:04:55,300
exact point of deliquescent it actually

128
00:05:01,230 --> 00:04:58,630
has hysteresis so hysteresis is if you

129
00:05:03,450 --> 00:05:01,240
have a crystal and salt you increase the

130
00:05:05,340 --> 00:05:03,460
relative humidity at some dr h or del

131
00:05:07,350 --> 00:05:05,350
questions relative humidity you get a

132
00:05:08,880 --> 00:05:07,360
liquid droplet but if you're over here

133
00:05:11,580 --> 00:05:08,890
past the deliquesce this relative

134
00:05:13,440 --> 00:05:11,590
humidity you decrease the relative

135
00:05:15,780 --> 00:05:13,450
humidity you won't get a crystal back

136
00:05:18,150 --> 00:05:15,790
here you actually have to decrease the

137
00:05:20,820 --> 00:05:18,160
relative maybe even more until this fr

138
00:05:22,860 --> 00:05:20,830

since relative committee which is more

139
00:05:25,050 --> 00:05:22,870
commonly below the deliquescent relative

140
00:05:27,030 --> 00:05:25,060
me so the history of the salt particles

141
00:05:29,280 --> 00:05:27,040
important because if you're in this

142
00:05:30,570 --> 00:05:29,290
region of relative humidity depending on

143
00:05:31,650 --> 00:05:30,580
if you started with the crystal or

144
00:05:33,720 --> 00:05:31,660
started with the liquid you don't

145
00:05:37,560 --> 00:05:33,730
actually know what phase transition or

146
00:05:39,360 --> 00:05:37,570
phase you have so which salts do I want

147
00:05:41,490 --> 00:05:39,370
to study and why because we have only

148
00:05:42,960 --> 00:05:41,500
salts on Mars and what's interesting for

149
00:05:46,740 --> 00:05:42,970
water this is marvin the martian if you

150
00:05:48,570 --> 00:05:46,750
don't know so I'm steady perchlorate and

151
00:05:50,880 --> 00:05:48,580
chlorides because the Phoenix lander

152
00:05:52,830 --> 00:05:50,890
found both of these and more

153
00:05:55,200 --> 00:05:52,840
specifically perchlorate in point five

154
00:05:56,400 --> 00:05:55,210
percent by mass and I want to study

155
00:05:58,680 --> 00:05:56,410
these because they're globally

156
00:06:01,860 --> 00:05:58,690
distributed and both of these are highly

157
00:06:07,230 --> 00:06:01,870
deliquescent so they take up water vapor

158
00:06:09,690 --> 00:06:07,240
at a low relative humidity oh okay so

159
00:06:11,490 --> 00:06:09,700
how I actually do this I make solutions

160
00:06:13,800 --> 00:06:11,500
of the of magnesium perchlorate and

161
00:06:16,110 --> 00:06:13,810
chloride in water I nebulized them onto

162
00:06:17,700 --> 00:06:16,120
this Court's disk shown here and then I

163
00:06:19,560 --> 00:06:17,710

stick them into my room and microscope

164
00:06:21,840 --> 00:06:19,570
so our AMA microscope is kind of special

165
00:06:23,040 --> 00:06:21,850
because well the wrong microscope so

166
00:06:25,380 --> 00:06:23,050
it's kind of cool it has a Raman

167
00:06:27,080 --> 00:06:25,390
spectrometer as a ccd camera so you can

168
00:06:29,940 --> 00:06:27,090
actually look at what you're seeing and

169
00:06:32,640 --> 00:06:29,950
we have it outfitted with a sample cell

170
00:06:34,430 --> 00:06:32,650
so in the sample cell we have a liquid

171
00:06:36,700 --> 00:06:34,440
nitrogen temperature controller and

172
00:06:39,850 --> 00:06:36,710
humidity controller so we can actually

173
00:06:42,400 --> 00:06:39,860
make the conditions like Mars and in

174
00:06:45,040 --> 00:06:42,410
addition since we have our particles on

175
00:06:49,030 --> 00:06:45,050
this disk we can see what the park holes

176
00:06:50,950 --> 00:06:49,040
look like on a micron size basis so

177
00:06:52,990 --> 00:06:50,960
let's get into this my agent perchlorate

178
00:06:56,640 --> 00:06:53,000
this is actually my museum quarry not

179
00:06:59,440 --> 00:06:56,650
something else so what we know now

180
00:07:01,630 --> 00:06:59,450
magnuson perchlorate some studies spike

181
00:07:03,790 --> 00:07:01,640
off at all found the dell questions

182
00:07:07,630 --> 00:07:03,800
relative humidity around forty to fifty

183
00:07:09,480 --> 00:07:07,640
percent rh at this along this model line

184
00:07:12,970 --> 00:07:09,490
and then they found the efflorescence

185
00:07:14,560 --> 00:07:12,980
oops efflorescence relative midi again

186
00:07:17,050 --> 00:07:14,570
has hysteresis though it's lower than

187
00:07:19,570 --> 00:07:17,060
the deliquescent charlton movie around

188
00:07:21,760 --> 00:07:19,580

twenty percent rh so i wanted to study

189
00:07:23,410 --> 00:07:21,770
exactly since we know the dell questions

190
00:07:25,210 --> 00:07:23,420
that we know that F for essence we have

191
00:07:27,790 --> 00:07:25,220
this model here saying that i should

192
00:07:30,250 --> 00:07:27,800
form here but does it actually form here

193
00:07:32,140 --> 00:07:30,260
so i do a trajectory so i start with the

194
00:07:35,260 --> 00:07:32,150
solid i go through the liquid base and i

195
00:07:38,140 --> 00:07:35,270
see exactly what point water ice forms

196
00:07:40,030 --> 00:07:38,150
on the salt in order to do that I have

197
00:07:42,730 --> 00:07:40,040
to know how this Raman microscope

198
00:07:44,460 --> 00:07:42,740
technique works so over here is the

199
00:07:46,540 --> 00:07:44,470
image of magnesium perchlorate

200
00:07:51,600 --> 00:07:46,550
crystallises individual particle and

201
00:07:54,310 --> 00:07:51,610
this is a size bar and this is the Raman

202
00:07:55,630 --> 00:07:54,320
spectrum that I see so this is the 08

203
00:07:58,120 --> 00:07:55,640
region and this is the perchlorate

204
00:07:59,830 --> 00:07:58,130
region so here at zero percent all right

205
00:08:03,070 --> 00:07:59,840
you have the hexahydrate you have a

206
00:08:05,170 --> 00:08:03,080
little peek hydrate sharp peak from the

207
00:08:07,150 --> 00:08:05,180
hydrate and then the perchlorate just

208
00:08:09,160 --> 00:08:07,160
over here so you increase their all took

209
00:08:10,240 --> 00:08:09,170
me to around fifty percent rh and you

210
00:08:12,580 --> 00:08:10,250
get dull questions like we've seen

211
00:08:14,770 --> 00:08:12,590
before so you see this particle is now

212
00:08:17,050 --> 00:08:14,780
homogeneous and looks liquid and this

213
00:08:19,930 --> 00:08:17,060

hydrate peak actually is broadened

214
00:08:22,120 --> 00:08:19,940
because of unbound water and you might

215
00:08:24,460 --> 00:08:22,130
see as we keep going a pro chlorite peak

216
00:08:27,940 --> 00:08:24,470
doesn't change increase the relative

217
00:08:30,010 --> 00:08:27,950
even relative you relative humidity even

218
00:08:31,840 --> 00:08:30,020
more to ninety-five percent and get ice

219
00:08:36,610 --> 00:08:31,850
form so you see especially in the OHA

220
00:08:40,540 --> 00:08:36,620
gin and you see it optically so then now

221
00:08:44,250 --> 00:08:40,550
we decrease it and at 59-59 percent rh

222
00:08:47,470 --> 00:08:44,260
we get the liquid again and then farther

223
00:08:48,760 --> 00:08:47,480
25% rh we get still a liquid and it's

224
00:08:50,310 --> 00:08:48,770
below the dell questions relative

225
00:08:53,040 --> 00:08:50,320
immunity and filing it

226
00:08:55,710 --> 00:08:53,050
a percent rh we get the hexahydrate back

227
00:08:58,440 --> 00:08:55,720
again so crystal so i repeat these days

228
00:08:59,610 --> 00:08:58,450
over and over again and see at different

229
00:09:02,640 --> 00:08:59,620
temperatures where does this ice

230
00:09:04,320 --> 00:09:02,650
actually form and I actually get this so

231
00:09:07,470 --> 00:09:04,330
you can see del questions here

232
00:09:09,570 --> 00:09:07,480
efflorescence here and ice actually

233
00:09:11,790 --> 00:09:09,580
doesn't form on this theoretical model

234
00:09:14,370 --> 00:09:11,800
line it actually forms a little bit past

235
00:09:17,790 --> 00:09:14,380
here so supersaturation actually occurs

236
00:09:20,940 --> 00:09:17,800
and so if you think about the different

237
00:09:22,980 --> 00:09:20,950
regions of liquid phases that could be

238
00:09:25,440 --> 00:09:22,990

liquid phase that could be present for

239
00:09:27,390 --> 00:09:25,450
magnesium perchlorate with using just

240
00:09:30,480 --> 00:09:27,400
models you have this part of the liquid

241
00:09:32,220 --> 00:09:30,490
phase here but if you think about my

242
00:09:34,290 --> 00:09:32,230
studies you actually have an extension

243
00:09:36,990 --> 00:09:34,300
of this liquid phase over here so we

244
00:09:38,790 --> 00:09:37,000
going to liquid for even longer and if

245
00:09:41,400 --> 00:09:38,800
you decrease the relative humidity from

246
00:09:43,080 --> 00:09:41,410
the ice you can have even more

247
00:09:45,720 --> 00:09:43,090
metastable liquid because of

248
00:09:47,640 --> 00:09:45,730
efflorescence so to relate this to Mars

249
00:09:49,110 --> 00:09:47,650
because this is all temperature or not

250
00:09:51,390 --> 00:09:49,120
all temperatures a wide range of

251
00:09:53,610 --> 00:09:51,400
temperatures and relative humidities we

252
00:09:57,930 --> 00:09:53,620
can plot a diurnal cycle on this and

253
00:10:00,300 --> 00:09:57,940
then see exactly how long liquid water

254
00:10:02,220 --> 00:10:00,310
could be present due to the deliquescent

255
00:10:05,390 --> 00:10:02,230
and ice formation of magazine

256
00:10:09,600 --> 00:10:05,400
perchlorate so if I plot this same

257
00:10:11,700 --> 00:10:09,610
profile on a time versus relative

258
00:10:14,010 --> 00:10:11,710
humidity scale so this is noon to noon

259
00:10:17,130 --> 00:10:14,020
we can see exactly how long liquid is

260
00:10:18,930 --> 00:10:17,140
present so noon to around midnight or so

261
00:10:20,820 --> 00:10:18,940
we get we have a crystal and then del

262
00:10:22,860 --> 00:10:20,830
question starts to happen here and then

263
00:10:26,370 --> 00:10:22,870

this red line is that theoretical ice

264
00:10:29,520 --> 00:10:26,380
line where they say should form but with

265
00:10:31,440 --> 00:10:29,530
my studies the liquid region is actually

266
00:10:34,020 --> 00:10:31,450
extended for almost two hours longer

267
00:10:37,080 --> 00:10:34,030
than previously thought so we can have

268
00:10:39,150 --> 00:10:37,090
liquid for longer and and then finally

269
00:10:41,610 --> 00:10:39,160
you have ice again and then due to

270
00:10:43,800 --> 00:10:41,620
melting and efflorescence we have more

271
00:10:46,380 --> 00:10:43,810
metastable liquid so for this particular

272
00:10:48,240 --> 00:10:46,390
Mars diurnal cycle liquid president

273
00:10:50,910 --> 00:10:48,250
liquid water as president for almost two

274
00:10:52,920 --> 00:10:50,920
hours longer so again this is magnesium

275
00:10:54,870 --> 00:10:52,930
perchlorate there are other salts on

276
00:10:58,050 --> 00:10:54,880
Mars so what about magnesium chloride

277
00:10:59,760 --> 00:10:58,060
because it's also found on Mars Mars so

278
00:11:01,990 --> 00:10:59,770
I did the same types of studies for my

279
00:11:04,660 --> 00:11:02,000
assume chloride and I

280
00:11:07,120 --> 00:11:04,670
that for this particular Dino circle

281
00:11:09,130 --> 00:11:07,130
diurnal cycle again liquid water is

282
00:11:12,130 --> 00:11:09,140
present for over half the day so again

283
00:11:14,500 --> 00:11:12,140
noon to noon and its present for a

284
00:11:17,860 --> 00:11:14,510
really long time and this so this is

285
00:11:20,890 --> 00:11:17,870
again the theoretical ice line and then

286
00:11:23,920 --> 00:11:20,900
I've extended it for almost an hour

287
00:11:25,870 --> 00:11:23,930
through my studies so to relate this

288
00:11:28,900 --> 00:11:25,880

back to I sister biology and other

289
00:11:31,630 --> 00:11:28,910
things like analogs on earth so we have

290
00:11:34,330 --> 00:11:31,640
done one pond in Antarctica oh can you

291
00:11:38,080 --> 00:11:34,340
see this maybe not oh yeah okay so this

292
00:11:40,600 --> 00:11:38,090
actually is a looks like a river type

293
00:11:42,670 --> 00:11:40,610
channel and this is the relative

294
00:11:45,850 --> 00:11:42,680
humidity profile so at Point a it's

295
00:11:47,350 --> 00:11:45,860
around fifteen eighteen percent rh here

296
00:11:49,450 --> 00:11:47,360
and you can kind of see this little

297
00:11:51,610 --> 00:11:49,460
streak and then it shoots up to around

298
00:11:53,470 --> 00:11:51,620
one hundred percent rh @ b which is this

299
00:11:57,880 --> 00:11:53,480
image so you can see it has darkened

300
00:12:00,130 --> 00:11:57,890
just like an RSL on Mars so this is also

301
00:12:06,220 --> 00:12:00,140
some other proof of liquid water present

302
00:12:08,800 --> 00:12:06,230
on Mars and about um life on different

303
00:12:10,780 --> 00:12:08,810
planets you can have so this

304
00:12:13,060 --> 00:12:10,790
deliquescent that can happen on

305
00:12:16,660 --> 00:12:13,070
different salts can actually help

306
00:12:19,030 --> 00:12:16,670
cyanobacteria or other organisms obtain

307
00:12:21,700 --> 00:12:19,040
water and actually live so this is a

308
00:12:24,630 --> 00:12:21,710
back right rock and this like grey line

309
00:12:27,880 --> 00:12:24,640
that you see here is cyanobacteria

310
00:12:31,420 --> 00:12:27,890
bacteria and it's covered it has a layer

311
00:12:33,130 --> 00:12:31,430
of nacl and so the NSEL is actually

312
00:12:34,870 --> 00:12:33,140
deliquesce takes in water and then the

313
00:12:39,100 --> 00:12:34,880

cyanobacteria uses that water to

314
00:12:42,250 --> 00:12:39,110
actually grow and live so just into

315
00:12:44,350 --> 00:12:42,260
conclusions so deliquescent said these

316
00:12:46,890 --> 00:12:44,360
salts on Mars could be an explanation of

317
00:12:49,630 --> 00:12:46,900
how water is present on Mars today and

318
00:12:51,160 --> 00:12:49,640
evidence of organisms living in salty

319
00:12:55,000 --> 00:12:51,170
brine conditions on earth could be an

320
00:12:58,030 --> 00:12:55,010
analog of life on Mars just thank my

321
00:13:06,280 --> 00:12:58,040
group and NASA and a stuffer funding and

322
00:13:15,079 --> 00:13:08,960
there's Britney Spears you remember this

323
00:13:17,809 --> 00:13:15,089
um thing I really interesting study I'm

324
00:13:22,639 --> 00:13:17,819
curious does did you take into account

325
00:13:25,220 --> 00:13:22,649
pressure yes so so the studies for our

326
00:13:27,170 --> 00:13:25,230
mock Raman microscope before I started

327
00:13:29,780 --> 00:13:27,180
doing this and a couple other people

328
00:13:31,009 --> 00:13:29,790
they did it on earth and so they did at

329
00:13:32,480 --> 00:13:31,019
Abraham pressure and they're like

330
00:13:34,430 --> 00:13:32,490
whatever and so we were like oh we can

331
00:13:36,379 --> 00:13:34,440
actually do mar stuff so we just kept it

332
00:13:38,480 --> 00:13:36,389
at ambient pressure so all this is at

333
00:13:40,879 --> 00:13:38,490
ambient pressure but we're actually

334
00:13:42,199 --> 00:13:40,889
about in like the next couple weeks

335
00:13:44,449 --> 00:13:42,209
we're going to lower the pressure and

336
00:13:45,710 --> 00:13:44,459
actually and we do nitrogen so we're

337
00:13:55,040 --> 00:13:45,720
going to add co2 and see how that