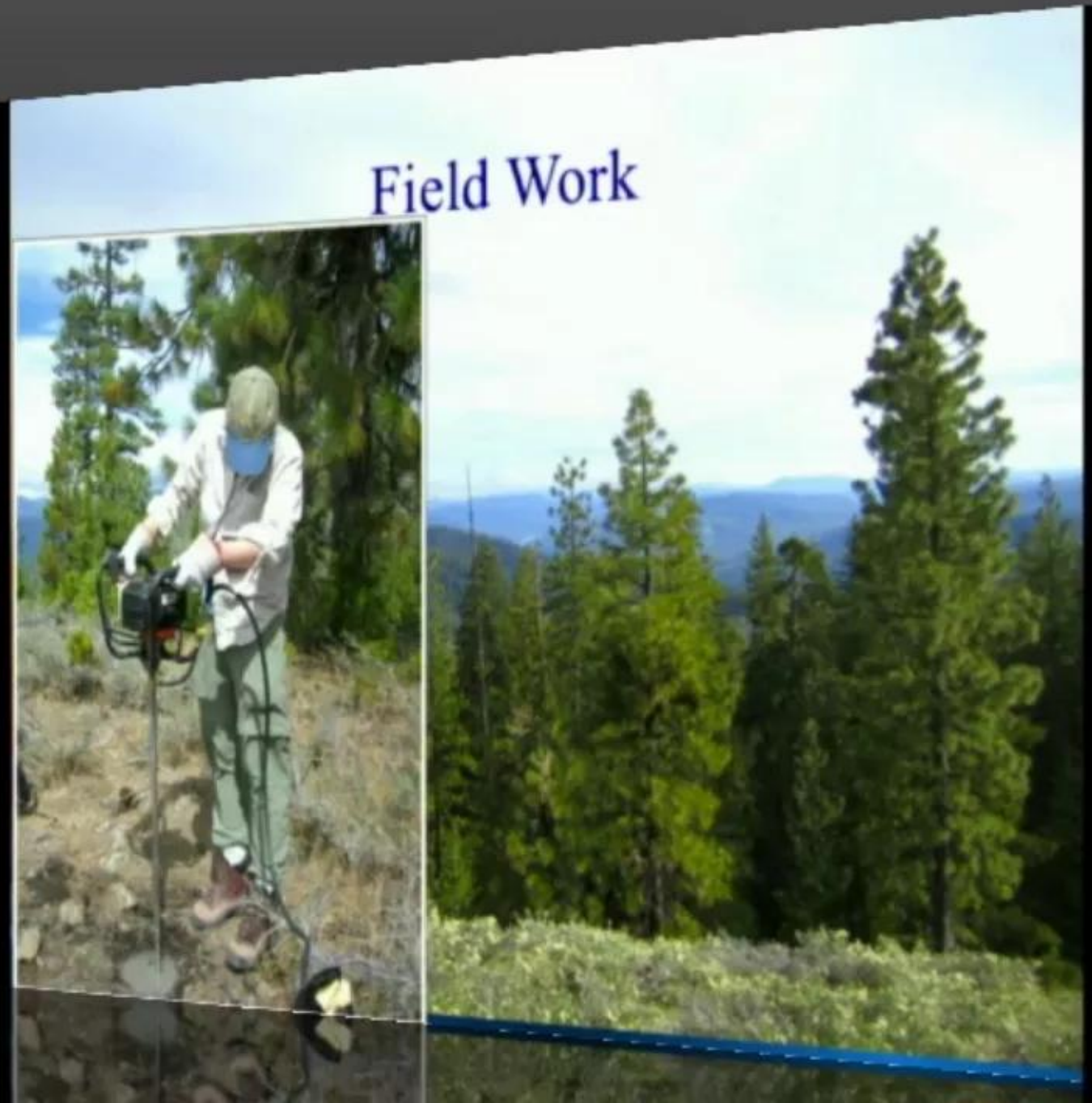
Field Work

1
00:00:13,730 --> 00:00:09,770
so my name is SJ I'm from the University

2
00:00:15,620 --> 00:00:13,740
of Nevada Las Vegas I just got there in

3
00:00:18,890 --> 00:00:15,630
January so this is all pretty brand-new

4
00:00:19,760 --> 00:00:18,900
to me as well as to you guys and today

5
00:00:21,859 --> 00:00:19,770
I'm going to be talking about

6
00:00:24,200 --> 00:00:21,869
constraining and elucidating the aqueous

7
00:00:25,580 --> 00:00:24,210
history of Gale Crater Mars by examining

8
00:00:26,900 --> 00:00:25,590
the a more fish oil component and

9
00:00:30,890 --> 00:00:26,910
hopefully I will never hit you with a

10
00:00:32,269 --> 00:00:30,900
sentence that long again so as a brief

11
00:00:34,490 --> 00:00:32,279
overview first I'm going to introduce

12
00:00:36,350 --> 00:00:34,500
you to our Amorphis materials because

13
00:00:38,150 --> 00:00:36,360

seven months ago I didn't know what they

14
00:00:40,280 --> 00:00:38,160
are so I don't expect you guys to know

15
00:00:41,479 --> 00:00:40,290
what they are I'll talk a little bit

16
00:00:43,729 --> 00:00:41,489
about the motivation for this particular

17
00:00:45,350 --> 00:00:43,739
study I'll go into our approach which is

18
00:00:47,930 --> 00:00:45,360
two-pronged we have a laboratory in a

19
00:00:49,160 --> 00:00:47,940
field component so far and then I'll

20
00:00:50,750 --> 00:00:49,170
talk a little bit about each of those

21
00:00:52,549 --> 00:00:50,760
components the synthesis and dissolution

22
00:00:54,979 --> 00:00:52,559
in the laboratory and then the field

23
00:00:57,049 --> 00:00:54,989
work and I'll present some very

24
00:01:00,170 --> 00:00:57,059
preliminary results that we have from

25
00:01:01,520 --> 00:01:00,180
some sample analysis so first off the

26
00:01:03,080 --> 00:01:01,530
amorphous materials we're talking about

27
00:01:05,240 --> 00:01:03,090
first of all what do I mean when I say

28
00:01:07,850 --> 00:01:05,250
amorphis it has to do with x-ray

29
00:01:09,620 --> 00:01:07,860
diffraction when you diffract x-rays

30
00:01:12,380 --> 00:01:09,630
through a crystal they give you these

31
00:01:14,570 --> 00:01:12,390
nice sharp peaks by which you can tell

32
00:01:17,679 --> 00:01:14,580
the structure of them these materials

33
00:01:20,149 --> 00:01:17,689
they have very short-range atomic order

34
00:01:22,969 --> 00:01:20,159
so they don't make nice sharp peaks they

35
00:01:24,499 --> 00:01:22,979
make broad peaks you can't really get

36
00:01:26,480 --> 00:01:24,509
much about the structure from them so we

37
00:01:28,340 --> 00:01:26,490
call them amorphous or nanocrystalline

38
00:01:30,410 --> 00:01:28,350

the ones in particular that I'm

39
00:01:32,480 --> 00:01:30,420
interested in our alafaya and hiss

40
00:01:34,210 --> 00:01:32,490
injure right alifann is an

41
00:01:38,330 --> 00:01:34,220
aluminosilicate his and right is a

42
00:01:40,789 --> 00:01:38,340
ferric silicate generally in nature they

43
00:01:44,359 --> 00:01:40,799
form porous hollow nano balls they're

44
00:01:46,249 --> 00:01:44,369
about five nanometers across so they're

45
00:01:48,380 --> 00:01:46,259
very small they have lots of little tiny

46
00:01:50,450 --> 00:01:48,390
micro pores in them they're great at

47
00:01:52,999 --> 00:01:50,460
absorbing stuff which will become

48
00:01:56,830 --> 00:01:53,009
important at some point possibly not in

49
00:01:59,870 --> 00:01:56,840
this talk on Mars we have detected an

50
00:02:04,370 --> 00:01:59,880
amorphous component of the soil through

51
00:02:06,410 --> 00:02:04,380
xrd we have no idea what it is there's a

52
00:02:08,449 --> 00:02:06,420
lot of hypotheses it could be a lefay

53
00:02:12,260 --> 00:02:08,459
and Kissinger right ferrihydrite which

54
00:02:13,880 --> 00:02:12,270
is a ferric oxide basaltic glass opaline

55
00:02:15,980 --> 00:02:13,890
silica some people have mention

56
00:02:18,140 --> 00:02:15,990
that it could be something that doesn't

57
00:02:20,990 --> 00:02:18,150
exist on earth some kind of different

58
00:02:23,090 --> 00:02:21,000
phase that we don't see here but in

59
00:02:25,400 --> 00:02:23,100
general we just don't know what it is we

60
00:02:28,520 --> 00:02:25,410
know it's there it's hard to constrain

61
00:02:30,620 --> 00:02:28,530
the mineralogy so terrestrial formation

62
00:02:33,430 --> 00:02:30,630
environments for these materials are wet

63
00:02:36,199 --> 00:02:33,440

and temperate you'll tend to get them on

64
00:02:40,070 --> 00:02:36,209
volcanic slopes in places like Japan

65
00:02:41,630 --> 00:02:40,080
Hawaii New Zealand which really are

66
00:02:45,640 --> 00:02:41,640
terrible field sites you would never

67
00:02:50,120 --> 00:02:45,650
want to go there but that's encouraging

68
00:02:51,949 --> 00:02:50,130
in terms of Martian history so what

69
00:02:53,570 --> 00:02:51,959
we're trying to do is use the properties

70
00:02:55,910 --> 00:02:53,580
of the Martian materials to constrain

71
00:02:57,860 --> 00:02:55,920
Martian surface conditions if these

72
00:02:59,360 --> 00:02:57,870
things only form in warm wet

73
00:03:02,240 --> 00:02:59,370
environments and we're seeing them on

74
00:03:04,670 --> 00:03:02,250
Mars then presumably we can say that

75
00:03:06,259 --> 00:03:04,680
Mars had warm wet environments sometime

76
00:03:08,360 --> 00:03:06,269
it's past so that's something that we

77
00:03:12,620 --> 00:03:08,370
really like to be able to nail down and

78
00:03:14,630 --> 00:03:12,630
say definitively so that leads us right

79
00:03:16,340 --> 00:03:14,640
into the motivation we don't have a

80
00:03:19,550 --> 00:03:16,350
definitive identification of the margin

81
00:03:21,319 --> 00:03:19,560
amorphis component so what is it we

82
00:03:23,840 --> 00:03:21,329
haven't found any outcrops of the

83
00:03:25,610 --> 00:03:23,850
Martian material we can't go you know

84
00:03:28,970 --> 00:03:25,620
through chrism data or higher eyes data

85
00:03:31,280 --> 00:03:28,980
or Themis data and say here's an outcrop

86
00:03:35,210 --> 00:03:31,290
of Amorphis material we find it

87
00:03:37,550 --> 00:03:35,220
everywhere we found it in the rocknest

88
00:03:40,039 --> 00:03:37,560

soil and Gale Crater we found it in the

89
00:03:41,569 --> 00:03:40,049
Sheep bed mudstone when curiosity

90
00:03:43,850 --> 00:03:41,579
drilled into the mud stone we found it

91
00:03:46,610 --> 00:03:43,860
there a lot of people have hypothesized

92
00:03:48,770 --> 00:03:46,620
that the global hydration layer found in

93
00:03:50,720 --> 00:03:48,780
the equatorial regions of Mars is hosted

94
00:03:54,289 --> 00:03:50,730
by the same orefice component so

95
00:03:57,530 --> 00:03:54,299
presumably it's very widespread but we

96
00:03:59,000 --> 00:03:57,540
don't know where it's coming from the

97
00:04:01,819 --> 00:03:59,010
reason we've chosen alifann and hiss

98
00:04:04,490 --> 00:04:01,829
injure right to use as analogs for this

99
00:04:07,220 --> 00:04:04,500
material is because their properties

100
00:04:10,009 --> 00:04:07,230
closely resemble that of what we've seen

101
00:04:12,370 --> 00:04:10,019
on Mars the composition is similar

102
00:04:15,710 --> 00:04:12,380
there's some xrd evidence that these are

103
00:04:17,659 --> 00:04:15,720
at least the right type of material and

104
00:04:19,699 --> 00:04:17,669
then water release and evolved gas

105
00:04:22,760 --> 00:04:19,709
analysis which is something that the Sam

106
00:04:26,210 --> 00:04:22,770
instrument on curiosity can do and has

107
00:04:27,750 --> 00:04:26,220
done so our synthetic and field analogs

108
00:04:29,940 --> 00:04:27,760
can give us some insight

109
00:04:31,620 --> 00:04:29,950
into both the terrestrial and Martian

110
00:04:32,880 --> 00:04:31,630
materials and the reason we want insight

111
00:04:36,000 --> 00:04:32,890
into the terrestrial materials is

112
00:04:37,980 --> 00:04:36,010
because they're not particularly well

113
00:04:40,950 --> 00:04:37,990

studied alifann has about a decade of

114
00:04:42,570 --> 00:04:40,960
soil science research going into it it's

115
00:04:45,450 --> 00:04:42,580
fairly well constrained and everything

116
00:04:47,010 --> 00:04:45,460
except kinetics Kissinger right almost

117
00:04:48,870 --> 00:04:47,020
nobody's looked at it it's not very

118
00:04:50,760 --> 00:04:48,880
common and it's not actually good for

119
00:04:54,480 --> 00:04:50,770
much unlike Aleph in which you can use

120
00:04:55,920 --> 00:04:54,490
in lots of industrial contexts so we're

121
00:04:58,320 --> 00:04:55,930
taking a two-pronged approach towards

122
00:04:59,910 --> 00:04:58,330
this problem in the laboratory we're

123
00:05:02,520 --> 00:04:59,920
synthesizing the material using data

124
00:05:04,830 --> 00:05:02,530
from chemin and apxs on board curiosity

125
00:05:07,170 --> 00:05:04,840
to constrain the elemental ratios of our

126
00:05:08,130 --> 00:05:07,180
synthetic material and then as soon as

127
00:05:11,340 --> 00:05:08,140
we've made it we're going to immediately

128
00:05:13,740 --> 00:05:11,350
dissolve it again performed using Mars

129
00:05:15,570 --> 00:05:13,750
relevant conditions and I'll talk later

130
00:05:18,750 --> 00:05:15,580
about what exactly those conditions are

131
00:05:20,160 --> 00:05:18,760
our fieldwork thus far has been in

132
00:05:22,260 --> 00:05:20,170
Griffith Park and the Klamath mountains

133
00:05:24,330 --> 00:05:22,270
yes that is Griffith Park in California

134
00:05:26,580 --> 00:05:24,340
not the place you would expect to be a

135
00:05:28,710 --> 00:05:26,590
Mars analog we're using those to

136
00:05:30,660 --> 00:05:28,720
contextualise alifann and history right

137
00:05:32,430 --> 00:05:30,670
see what the environments around them

138
00:05:34,680 --> 00:05:32,440

are like how they behave in a natural

139
00:05:36,330 --> 00:05:34,690
context and also investigating

140
00:05:41,250 --> 00:05:36,340
transitions in mineralogy due to

141
00:05:44,820 --> 00:05:41,260
weathering so synthesis we synthesized

142
00:05:46,830 --> 00:05:44,830
for hydrous amorphous alumina or ferric

143
00:05:48,930 --> 00:05:46,840
silicates using the bacon method of

144
00:05:50,610 --> 00:05:48,940
baker and strong i know there's a lot of

145
00:05:52,950 --> 00:05:50,620
Colin's on this page don't worry about

146
00:05:55,440 --> 00:05:52,960
them basically there's one that's just

147
00:06:00,690 --> 00:05:55,450
aluminum and silica in a one-to-one

148
00:06:05,310 --> 00:06:00,700
ratio ala Fane varies between about 12 1

149
00:06:07,680 --> 00:06:05,320
and 2 to 1 with aluminum being more than

150
00:06:11,940 --> 00:06:07,690
silica and that two to one we did one

151
00:06:14,010 --> 00:06:11,950
where we replaced one out of 99 of the

152
00:06:17,100 --> 00:06:14,020
aluminum's with an iron we did one that

153
00:06:18,450 --> 00:06:17,110
was half iron half aluminum and all

154
00:06:20,280 --> 00:06:18,460
three of those were mentioned in the

155
00:06:22,650 --> 00:06:20,290
baker and straw and paper the last one

156
00:06:24,540 --> 00:06:22,660
which is just iron and silica i decided

157
00:06:25,800 --> 00:06:24,550
i wanted to do as just kind of an end

158
00:06:27,180 --> 00:06:25,810
member to see what it looked like

159
00:06:30,420 --> 00:06:27,190
because i didn't know what it would look

160
00:06:32,250 --> 00:06:30,430
like and i was curious so there's a lot

161
00:06:33,390 --> 00:06:32,260
of words on there the things in quotes

162
00:06:34,410 --> 00:06:33,400
are what i'm going to be calling them

163
00:06:38,400 --> 00:06:34,420

because it's what i've been calling them

164
00:06:40,230 --> 00:06:38,410
for seven months so it's a sol-gel

165
00:06:41,279 --> 00:06:40,240
process i don't know if any of you know

166
00:06:42,929 --> 00:06:41,289
what that means I'm not

167
00:06:46,589 --> 00:06:42,939
entirely sure what it means basically

168
00:06:52,409 --> 00:06:46,599
you put aluminum and iron in solution

169
00:06:53,519 --> 00:06:52,419
you add an alcohol of silica which I'm

170
00:06:55,799 --> 00:06:53,529
just going to call toews because

171
00:06:58,859 --> 00:06:55,809
tetraethyl orthosilicate is too much of

172
00:07:01,320 --> 00:06:58,869
a mouthful for me you slowly add sodium

173
00:07:02,670 --> 00:07:01,330
hydroxide hydrolyzed the TOS without

174
00:07:03,899 --> 00:07:02,680
forming silicon monomers which is

175
00:07:06,839 --> 00:07:03,909
important because you don't want just

176
00:07:08,760 --> 00:07:06,849
silica that's what you use that whoops

177
00:07:11,670 --> 00:07:08,770
so we use that peristaltic pump up there

178
00:07:14,070 --> 00:07:11,680
for takes a while but you don't have to

179
00:07:16,859 --> 00:07:14,080
do much and at the end you get this cool

180
00:07:18,929 --> 00:07:16,869
looking stuff you incubate it for seven

181
00:07:20,760 --> 00:07:18,939
days to form colloids and then you wash

182
00:07:23,939 --> 00:07:20,770
all the stuff that isn't your product

183
00:07:26,249 --> 00:07:23,949
out of it so the dissolution experience

184
00:07:27,510 --> 00:07:26,259
we haven't actually done yet we're using

185
00:07:29,489 --> 00:07:27,520
a bat we're going to use a batch reactor

186
00:07:33,119 --> 00:07:29,499
set up to look at the effect of pH

187
00:07:35,299 --> 00:07:33,129
activity of water temperature as many of

188
00:07:37,649 --> 00:07:35,309

those as we can in the next five years

189
00:07:39,689 --> 00:07:37,659
the Mars relevant conditions we're using

190
00:07:42,179 --> 00:07:39,699
our the pH of Dara site formation which

191
00:07:43,409 --> 00:07:42,189
is around 3.5 we've chosen that because

192
00:07:45,209 --> 00:07:43,419
there's Jerry site on the Martian

193
00:07:48,209 --> 00:07:45,219
surface so presumably the pH was around

194
00:07:50,749 --> 00:07:48,219
3.5 at some point the pH measured by the

195
00:07:55,889 --> 00:07:50,759
Phoenix lander which is the between

196
00:07:57,209 --> 00:07:55,899
seven point four and eight so that we

197
00:07:58,369 --> 00:07:57,219
know for a fact is on the Martian

198
00:08:00,929 --> 00:07:58,379
surface because we've measured it there

199
00:08:02,519 --> 00:08:00,939
and then if we have time we'll look at

200
00:08:05,189 --> 00:08:02,529
saturated Brian's and possible

201
00:08:07,920 --> 00:08:05,199
hydrothermal effects using variations of

202
00:08:09,809 --> 00:08:07,930
temperature so for the field work which

203
00:08:12,199 --> 00:08:09,819
is the exciting part we're looking at

204
00:08:16,439 --> 00:08:12,209
the topanga formation in Griffith Park

205
00:08:18,119 --> 00:08:16,449
which is a basaltic generally we chose

206
00:08:20,609 --> 00:08:18,129
it because of a satellite study by Alan

207
00:08:24,869 --> 00:08:20,619
treiman in 2014 we looked at whether

208
00:08:28,019 --> 00:08:24,879
basalts inside vesicles or SAP a night

209
00:08:30,509 --> 00:08:28,029
clays inside basalt vesicles which are

210
00:08:32,670 --> 00:08:30,519
Mars like take my word for it and then

211
00:08:36,949 --> 00:08:32,680
also the Klamath mountains which again

212
00:08:41,069 --> 00:08:36,959
are basaltic like Mars young soils

213
00:08:42,540 --> 00:08:41,079

fairly moist fairly warm and it's high

214
00:08:44,819 --> 00:08:42,550
iron and low aluminum which is the

215
00:08:46,439 --> 00:08:44,829
important part it's like Mars this bit

216
00:08:49,949 --> 00:08:46,449
right here just means that we are likely

217
00:08:52,710 --> 00:08:49,959
to find alifann or his injury so the

218
00:08:54,750 --> 00:08:52,720
beautiful Klamath mountains where we dug

219
00:08:57,630 --> 00:08:54,760
holes in the dirt

220
00:09:01,170 --> 00:08:57,640
and scenic griffith park where we dug

221
00:09:03,540 --> 00:09:01,180
holes in the dirt and also got some SAP

222
00:09:07,830 --> 00:09:03,550
rock from road cuts and took a picture

223
00:09:09,810 --> 00:09:07,840
with the Hollywood sign so from all of

224
00:09:11,880 --> 00:09:09,820
this we got those samples we examine

225
00:09:14,060 --> 00:09:11,890
them with xrd evolved gas analysis

226
00:09:16,260 --> 00:09:14,070
transmission electron microscopy

227
00:09:17,700 --> 00:09:16,270
unfortunately we didn't actually find a

228
00:09:19,770 --> 00:09:17,710
lot of amorphous materials which is not

229
00:09:23,670 --> 00:09:19,780
what we were expecting there were some

230
00:09:24,930 --> 00:09:23,680
hints in the xrd and the TEM but as far

231
00:09:27,030 --> 00:09:24,940
as I can tell from the data there's

232
00:09:29,810 --> 00:09:27,040
likely less amorphous material in this

233
00:09:33,060 --> 00:09:29,820
soil than there is in the Martian soil

234
00:09:34,980 --> 00:09:33,070
but a lot more work is needed we haven't

235
00:09:36,660 --> 00:09:34,990
actually done much with this and it's

236
00:09:38,760 --> 00:09:36,670
all been in the last two weeks so

237
00:09:40,500 --> 00:09:38,770
clearly there's more to be done in

238
00:09:41,940 --> 00:09:40,510

relation to the laboratory work our

239
00:09:44,430 --> 00:09:41,950
synthetic material provided us with a

240
00:09:46,410 --> 00:09:44,440
basis for comparison so that we could

241
00:09:49,620 --> 00:09:46,420
say you know is this the amorphous

242
00:09:53,610 --> 00:09:49,630
material we're looking for and the

243
00:09:56,190 --> 00:09:53,620
answer is probably not so sample

244
00:09:57,660 --> 00:09:56,200
analysis we did ftir on the lab samples

245
00:10:01,230 --> 00:09:57,670
just to confirm that it was a love Fame

246
00:10:03,240 --> 00:10:01,240
also field-emission sem to confirm if it

247
00:10:05,160 --> 00:10:03,250
was a low fame his and right to make

248
00:10:07,590 --> 00:10:05,170
sure we made the right stuff before we

249
00:10:11,220 --> 00:10:07,600
went looking in more detail then we also

250
00:10:13,860 --> 00:10:11,230
did tem xrd EGA and upcoming we're going

251
00:10:15,990 --> 00:10:13,870
to be doing some dissolutions on it so

252
00:10:18,830 --> 00:10:16,000
in the ftir this is from monterey

253
00:10:22,410 --> 00:10:18,840
pelletier they synthesized alla fain

254
00:10:24,450 --> 00:10:22,420
they found some good bands of this is

255
00:10:28,110 --> 00:10:24,460
water stretching waterbending and this

256
00:10:30,870 --> 00:10:28,120
is silicon oxygen aluminum stretching

257
00:10:32,670 --> 00:10:30,880
and our spectrum match pretty well with

258
00:10:35,670 --> 00:10:32,680
that actually the scales are a little

259
00:10:38,040 --> 00:10:35,680
different but they're all pretty much in

260
00:10:39,930 --> 00:10:38,050
the right place so from this we decided

261
00:10:41,550 --> 00:10:39,940
yeah we probably have alafaya and his

262
00:10:43,140 --> 00:10:41,560
injure right i'm not sure what this

263
00:10:44,580 --> 00:10:43,150

feature is but it gets bigger the more

264
00:10:46,730 --> 00:10:44,590
iron you have so that's something that i

265
00:10:49,790 --> 00:10:46,740
would like to look into in the future

266
00:10:54,030 --> 00:10:49,800
again field emission electron microscopy

267
00:10:56,370 --> 00:10:54,040
this is from Baker and strong you can

268
00:10:59,250 --> 00:10:56,380
see that kind of this fluffy stuff is

269
00:11:01,920 --> 00:10:59,260
probably nano balls our stuff is all so

270
00:11:03,660 --> 00:11:01,930
fluffy and likely has nano balls so from

271
00:11:06,630 --> 00:11:03,670
these two we decided yes we probably

272
00:11:08,430 --> 00:11:06,640
made the right stuff so then at JSC

273
00:11:10,710 --> 00:11:08,440
where I was for the last two weeks

274
00:11:13,620 --> 00:11:10,720
we examined stuff with transmission

275
00:11:15,480 --> 00:11:13,630
electron microscopy again this is our

276
00:11:18,060 --> 00:11:15,490
stuff this is a different study done

277
00:11:20,850 --> 00:11:18,070
previously they match pretty well this

278
00:11:24,540 --> 00:11:20,860
is a field sample we looked through this

279
00:11:26,670 --> 00:11:24,550
field sample for three hours this was

280
00:11:30,240 --> 00:11:26,680
the only grain we found that was

281
00:11:33,780 --> 00:11:30,250
non-crystalline so that at least is

282
00:11:37,200 --> 00:11:33,790
saying something it is not look like the

283
00:11:39,870 --> 00:11:37,210
rest of the stuff so maybe not looking

284
00:11:42,600 --> 00:11:39,880
so good for the field samples there's

285
00:11:45,630 --> 00:11:42,610
one at a more similar scale so in the

286
00:11:47,670 --> 00:11:45,640
xrd this is the chemin data this is our

287
00:11:50,700 --> 00:11:47,680
data this is reference for his injure

288
00:11:54,060 --> 00:11:50,710

right again our stuff looks pretty

289
00:11:56,760 --> 00:11:54,070
different this is you know a different

290
00:11:58,650 --> 00:11:56,770
instrument but a we're not seeing the

291
00:12:03,150 --> 00:11:58,660
same kind of Amorphis hump that we are

292
00:12:05,160 --> 00:12:03,160
seeing in the in the chemin data this is

293
00:12:07,590 --> 00:12:05,170
a different scale so that's a little

294
00:12:10,470 --> 00:12:07,600
more similar it's kind of hard to tell

295
00:12:12,420 --> 00:12:10,480
but I'm not too sure this stuff right

296
00:12:15,540 --> 00:12:12,430
here is promising that means lots of

297
00:12:18,090 --> 00:12:15,550
small particles as far as I can tell so

298
00:12:20,250 --> 00:12:18,100
it definitely needs more work the

299
00:12:22,410 --> 00:12:20,260
evolved gas analysis the synthetic stuff

300
00:12:25,560 --> 00:12:22,420
that we did matches pretty well with

301
00:12:27,330 --> 00:12:25,570
Mars so that's promising the field

302
00:12:30,510 --> 00:12:27,340
samples not so great I'll have much

303
00:12:32,220 --> 00:12:30,520
higher temperature water releases so for

304
00:12:34,980 --> 00:12:32,230
future work we need more rigorous study

305
00:12:36,420 --> 00:12:34,990
of the field samples we're going to be

306
00:12:38,280 --> 00:12:36,430
doing pyrophosphate and oxalate

307
00:12:40,470 --> 00:12:38,290
dissolutions to really nail down how

308
00:12:43,590 --> 00:12:40,480
much amorphous material is actually in

309
00:12:47,850 --> 00:12:43,600
them to see if our other results are

310
00:12:50,010 --> 00:12:47,860
robust so that we know really you know

311
00:12:52,740 --> 00:12:50,020
if we just are looking in the wrong

312
00:12:56,060 --> 00:12:52,750
places and then the batch dissolution

313
00:12:57,860 --> 00:12:56,070

experiments to nail down you know or to

314
00:13:00,300 --> 00:12:57,870
investigate what these things look like

315
00:13:03,750 --> 00:13:00,310
under Mars relevant conditions and how

316
00:13:05,870 --> 00:13:03,760
they behave so in conclusion that's

317
00:13:07,950 --> 00:13:05,880
pretty much everything I talked about

318
00:13:10,440 --> 00:13:07,960
and I know I said I wouldn't throw that

319
00:13:24,259 --> 00:13:10,450
sentence at you again but i did so i

320
00:13:30,299 --> 00:13:27,449
two quick questions first one um what

321
00:13:33,449 --> 00:13:30,309
xrd instrument are you using we used app

322
00:13:35,910 --> 00:13:33,459
analytical xrd instrument at JSC we were

323
00:13:38,340 --> 00:13:35,920
gonna use chemin but chemin is down you

324
00:13:41,069 --> 00:13:38,350
mean like a chemin test bed yes I came

325
00:13:43,499 --> 00:13:41,079
in for which I have a phone at JSC yeah

326
00:13:45,239 --> 00:13:43,509
okay and then my second question is um

327
00:13:47,039 --> 00:13:45,249
you know since you didn't find a lot of

328
00:13:49,169 --> 00:13:47,049
alafaya orange right you know in the

329
00:13:50,340 --> 00:13:49,179
site do you have a backup field site

330
00:13:52,859 --> 00:13:50,350
that you guys are thinking about going

331
00:13:54,239 --> 00:13:52,869
to uh well you know I was thinking about

332
00:14:04,769 --> 00:13:54,249
that and I thought maybe New Zealand