1
00:00:04,390 --> 00:00:02,710
on the spacecraft uh mine is one of two

2
00:00:05,829 --> 00:00:04,400
that are inside the analytical

3
00:00:07,829 --> 00:00:05,839
laboratory so

4
00:00:09,589 --> 00:00:07,839
uh when the things going around on mars

5
00:00:11,749 --> 00:00:09,599
and looking at stuff

6
00:00:13,749 --> 00:00:11,759
there are mast instruments that take

7
00:00:15,749 --> 00:00:13,759
pictures of things there are arm

8
00:00:17,510 --> 00:00:15,759
instruments that

9
00:00:20,230 --> 00:00:17,520
just put a put a thing down on the

10
00:00:22,150 --> 00:00:20,240
rocker or drill a rock and then my

11
00:00:25,590 --> 00:00:22,160
instrument chemin is actually inside the

12
00:00:27,830 --> 00:00:25,600
body of the rover and the the sampling

13
00:00:29,429 --> 00:00:27,840

arm and drill would would deliver a

14
00:00:31,429 --> 00:00:29,439
small powdered sample to me and then i

15
00:00:33,830 --> 00:00:31,439
would analyze it and so

16
00:00:36,150 --> 00:00:33,840
what kevin does is it's the uh it's the

17
00:00:38,310 --> 00:00:36,160
first instrument ever to land on mars

18
00:00:39,990 --> 00:00:38,320
that will give you the mineralogy of

19
00:00:42,549 --> 00:00:40,000
mars soils and rocks

20
00:00:43,990 --> 00:00:42,559
for the first time so that's the

21
00:00:46,310 --> 00:00:44,000
that's that's what we hope is going to

22
00:00:47,590 --> 00:00:46,320
happen on the 6th of august or

23
00:00:48,869 --> 00:00:47,600
soon thereafter

24
00:00:50,790 --> 00:00:48,879
now um

25
00:00:52,549 --> 00:00:50,800
i have some slides to show you exactly

26
00:00:54,869 --> 00:00:52,559
how the instrument works

27
00:00:57,189 --> 00:00:54,879
and then i have one of our one of our

28
00:00:58,310 --> 00:00:57,199
field instruments here in the orange box

29
00:01:00,229 --> 00:00:58,320
and i'm actually going to run some

30
00:01:02,069 --> 00:01:00,239
analyses

31
00:01:03,590 --> 00:01:02,079
and i sort of know what these are so

32
00:01:05,670 --> 00:01:03,600
it's i won't be stumped by the answer

33
00:01:07,429 --> 00:01:05,680
but i'm going to pretend i don't know

34
00:01:09,109 --> 00:01:07,439
and i'll show you how

35
00:01:10,149 --> 00:01:09,119
kevin would analyze these things on mars

36
00:01:11,590 --> 00:01:10,159
and i'll show you how the instrument

37
00:01:13,830 --> 00:01:11,600
works so

38
00:01:14,870 --> 00:01:13,840

first of all let's go to the first slide

39
00:01:18,550 --> 00:01:14,880
here

40
00:01:21,510 --> 00:01:18,560
and uh this is so uh it's a it gives you

41
00:01:22,950 --> 00:01:21,520
definitive mineralogy of of mars soil

42
00:01:24,469 --> 00:01:22,960
and rocks

43
00:01:25,670 --> 00:01:24,479
it uses a technique called x-ray

44
00:01:29,910 --> 00:01:25,680
diffraction

45
00:01:33,670 --> 00:01:29,920
new technique uh this actually next year

46
00:01:35,670 --> 00:01:33,680
when when curiosity lands on mars is the

47
00:01:38,149 --> 00:01:35,680
100th anniversary of the invention of

48
00:01:40,390 --> 00:01:38,159
x-ray diffraction so it's a big deal for

49
00:01:41,510 --> 00:01:40,400
mineralogists and diffractionists

50
00:01:43,749 --> 00:01:41,520
um

51
00:01:46,630 --> 00:01:43,759
it'll identify all the minerals present

52
00:01:48,230 --> 00:01:46,640
in soils and rocks now why why is that

53
00:01:49,510 --> 00:01:48,240
important uh

54
00:01:51,590 --> 00:01:49,520
you know

55
00:01:53,510 --> 00:01:51,600
minerals are are phases and they're

56
00:01:56,230 --> 00:01:53,520
stable only under certain conditions

57
00:01:59,109 --> 00:01:56,240
some temp turn pressure and and chemical

58
00:02:00,870 --> 00:01:59,119
uh things things around them and the

59
00:02:03,030 --> 00:02:00,880
result is if we know what the minerals

60
00:02:04,469 --> 00:02:03,040
are in a rock or in the soil

61
00:02:06,389 --> 00:02:04,479
we can tell you what the environment was

62
00:02:08,710 --> 00:02:06,399
when they were formed and and that's

63
00:02:10,869 --> 00:02:08,720

exactly what we want to know uh when we

64
00:02:12,550 --> 00:02:10,879
go to gale crater we want to know when

65
00:02:14,309 --> 00:02:12,560
we land there

66
00:02:16,229 --> 00:02:14,319
what was the condition there

67
00:02:18,710 --> 00:02:16,239
three and a half four billion years ago

68
00:02:20,309 --> 00:02:18,720
was there a lake there was it a river

69
00:02:22,390 --> 00:02:20,319
was there no water at all we don't think

70
00:02:24,550 --> 00:02:22,400
there was no water at all but but we

71
00:02:25,350 --> 00:02:24,560
will know from the mineralogy

72
00:02:36,869 --> 00:02:25,360
so

73
00:02:39,350 --> 00:02:36,879
x-ray fluorescence which tells you what

74
00:02:41,190 --> 00:02:39,360
elements are present in the minerals

75
00:02:43,030 --> 00:02:41,200
and there's only a single detector for

76
00:02:44,630 --> 00:02:43,040
this it's a ccd just like the kind of

77
00:02:47,670 --> 00:02:44,640
thing that's in your camera

78
00:02:49,030 --> 00:02:47,680
there's no moving parts and

79
00:02:50,550 --> 00:02:49,040
the only the only moving part of the

80
00:02:51,990 --> 00:02:50,560
instrument is actually a wheel that

81
00:02:54,630 --> 00:02:52,000
rotates the sample into position

82
00:02:56,949 --> 00:02:54,640
everything else uh doesn't have to move

83
00:02:59,509 --> 00:02:56,959
uh next slide

84
00:03:01,910 --> 00:02:59,519
okay so here's here's the here's the

85
00:03:03,910 --> 00:03:01,920
instrument there's basically an x-ray

86
00:03:05,990 --> 00:03:03,920
tube here just like you might have when

87
00:03:07,589 --> 00:03:06,000
you get your teeth x-rayed

88
00:03:09,670 --> 00:03:07,599

there's an x-ray beam there's a little

89
00:03:12,070 --> 00:03:09,680
pinhole collimator and it makes a little

90
00:03:13,589 --> 00:03:12,080
tiny pencil beam that's about 70 microns

91
00:03:14,710 --> 00:03:13,599
in diameter it's smaller than a human

92
00:03:16,229 --> 00:03:14,720
hair

93
00:03:19,910 --> 00:03:16,239
and the sample sits here in a

94
00:03:22,229 --> 00:03:19,920
transparent cell and the grains inside

95
00:03:24,710 --> 00:03:22,239
this transparent cell are are rotated

96
00:03:26,229 --> 00:03:24,720
around and moved by sound so we actually

97
00:03:27,830 --> 00:03:26,239
have a little vibration system that

98
00:03:30,309 --> 00:03:27,840
you'll hear it when i play when i when i

99
00:03:32,470 --> 00:03:30,319
run the sample you'll hear it whistling

100
00:03:34,470 --> 00:03:32,480
and these grains move around in the beam

101
00:03:35,910 --> 00:03:34,480
and diffraction occurs with the

102
00:03:37,030 --> 00:03:35,920
crystalline materials and they form

103
00:03:41,830 --> 00:03:37,040
these rings

104
00:03:43,910 --> 00:03:41,840
bring these images down to earth we form

105
00:03:45,509 --> 00:03:43,920
these uh one-dimensional things called

106
00:03:47,190 --> 00:03:45,519
diffractograms by looking at the

107
00:03:48,470 --> 00:03:47,200
intensities going outward from the

108
00:03:51,830 --> 00:03:48,480
central beam

109
00:03:54,149 --> 00:03:51,840
and these diffractograms will tell you

110
00:03:55,750 --> 00:03:54,159
the minerals present and how much of

111
00:03:57,509 --> 00:03:55,760
each mineral is present it's absolutely

112
00:04:00,550 --> 00:03:57,519
definitive and

113
00:04:01,910 --> 00:04:00,560

and i don't want to say it's foolproof

114
00:04:05,750 --> 00:04:01,920
it's close to it

115
00:04:07,750 --> 00:04:05,760
okay uh let's see next slide

116
00:04:09,910 --> 00:04:07,760
uh so here's an example

117
00:04:12,390 --> 00:04:09,920
this is uh this is one this is actually

118
00:04:16,789 --> 00:04:12,400
from the flight instrument this is one

119
00:04:20,469 --> 00:04:16,799
uh 110 second exposure of a ccd frame

120
00:04:22,069 --> 00:04:20,479
the ccd is 600 by 600 pixels so it's a

121
00:04:23,990 --> 00:04:22,079
really small sensor compared to what

122
00:04:26,790 --> 00:04:24,000
you're used to in your kind of cameras

123
00:04:28,710 --> 00:04:26,800
but it detects x-rays directly

124
00:04:30,950 --> 00:04:28,720
and it not only detects the x-rays but

125
00:04:32,870 --> 00:04:30,960
it measures their energies each each one

126
00:04:35,030 --> 00:04:32,880
of these little pixels in here measures

127
00:04:37,749 --> 00:04:35,040
the energy of a photon that strikes it

128
00:04:39,030 --> 00:04:37,759
individual photons so out of this 10

129
00:04:40,950 --> 00:04:39,040
second frame

130
00:04:42,230 --> 00:04:40,960
over here you can see we're starting to

131
00:04:44,310 --> 00:04:42,240
see these rings well this is a

132
00:04:45,909 --> 00:04:44,320
particularly strong diffraction

133
00:04:48,390 --> 00:04:45,919
this is quartz and barrel that's one of

134
00:04:49,909 --> 00:04:48,400
our standards very strong diffraction

135
00:04:53,189 --> 00:04:49,919
you can actually see these rings

136
00:04:55,830 --> 00:04:53,199
developing in 10 seconds of analysis and

137
00:04:56,870 --> 00:04:55,840
this is the 2d or 1d scan here and these

138
00:04:58,150 --> 00:04:56,880

peaks

139
00:04:59,670 --> 00:04:58,160
although there's a lot of noise here

140
00:05:01,909 --> 00:04:59,680
these peaks i could analyze this and

141
00:05:03,830 --> 00:05:01,919
tell you this is barrel and quartz

142
00:05:05,990 --> 00:05:03,840
and then if you look down here if you

143
00:05:08,070 --> 00:05:06,000
take the energies of all these photons

144
00:05:10,310 --> 00:05:08,080
that struck this detector and display

145
00:05:12,310 --> 00:05:10,320
them here you can see this is cobalt

146
00:05:14,950 --> 00:05:12,320
that's the actual x-ray beam that comes

147
00:05:17,110 --> 00:05:14,960
out of the the tube and then we've got

148
00:05:19,270 --> 00:05:17,120
uh chrome there's a little argon from

149
00:05:21,749 --> 00:05:19,280
the atmosphere uh

150
00:05:22,950 --> 00:05:21,759
silicon aluminum and so forth and this

151
00:05:24,950 --> 00:05:22,960
this chrome

152
00:05:26,550 --> 00:05:24,960
now this uh this barrel

153
00:05:29,029 --> 00:05:26,560
they wanted to make sure it was exactly

154
00:05:30,550 --> 00:05:29,039
perfect so we had to use emeralds

155
00:05:31,749 --> 00:05:30,560
it's one of the reasons why the machine

156
00:05:34,230 --> 00:05:31,759
that's not really the reason why the

157
00:05:36,230 --> 00:05:34,240
machine was expensive but we were told

158
00:05:37,350 --> 00:05:36,240
we had to use gem quality emeralds to

159
00:05:39,749 --> 00:05:37,360
make the

160
00:05:41,990 --> 00:05:39,759
the crush material for this and and the

161
00:05:43,990 --> 00:05:42,000
coloring agent in emerald is chrome so

162
00:05:44,950 --> 00:05:44,000
that's three three tenths of one percent

163
00:05:47,270 --> 00:05:44,960

chrome

164
00:05:48,790 --> 00:05:47,280
that was in that material okay next

165
00:05:50,870 --> 00:05:48,800
slide

166
00:05:52,629 --> 00:05:50,880
so we take uh maybe a hundred of those

167
00:05:53,830 --> 00:05:52,639
individual frames and sum them up and

168
00:05:56,150 --> 00:05:53,840
you can see we're starting to get a

169
00:05:58,950 --> 00:05:56,160
pattern here and then we take about five

170
00:06:00,710 --> 00:05:58,960
or ten of those hundred frame sets and

171
00:06:03,749 --> 00:06:00,720
make one major frame and that becomes an

172
00:06:05,270 --> 00:06:03,759
analysis and that has very low noise and

173
00:06:06,870 --> 00:06:05,280
and it's very easy to tell from that

174
00:06:09,189 --> 00:06:06,880
what's present

175
00:06:11,749 --> 00:06:09,199
next slide

176
00:06:13,830 --> 00:06:11,759
and we developed a number of prototypes

177
00:06:15,670 --> 00:06:13,840
for this machine this is actually what

178
00:06:17,270 --> 00:06:15,680
we called chemin four that was our first

179
00:06:18,950 --> 00:06:17,280
what we called portable

180
00:06:20,309 --> 00:06:18,960
but it just about killed us dragging it

181
00:06:21,350 --> 00:06:20,319
up the mountain so it wasn't that

182
00:06:23,510 --> 00:06:21,360
portable

183
00:06:26,469 --> 00:06:23,520
and this is up in spitsberg and norway

184
00:06:28,070 --> 00:06:26,479
80 degrees north

185
00:06:30,230 --> 00:06:28,080
and it was the first analysis in the

186
00:06:32,629 --> 00:06:30,240
field by x-ray diffraction

187
00:06:34,950 --> 00:06:32,639
um next slide

188
00:06:36,870 --> 00:06:34,960

so from that we started developing other

189
00:06:38,390 --> 00:06:36,880
instruments and actually some of these

190
00:06:39,749 --> 00:06:38,400
are the thing i'm showing you here is

191
00:06:41,350 --> 00:06:39,759
actually a commercial instrument that

192
00:06:43,990 --> 00:06:41,360
was developed by a company that one of

193
00:06:46,629 --> 00:06:44,000
my uh postdocs actually started

194
00:06:47,990 --> 00:06:46,639
and so this uh this is what we called it

195
00:06:49,270 --> 00:06:48,000
was originally called mini chemin

196
00:06:51,430 --> 00:06:49,280
because it was supposed to be smaller

197
00:06:53,430 --> 00:06:51,440
than the chemin they called it terra and

198
00:06:55,670 --> 00:06:53,440
then this was one that we had that went

199
00:06:57,430 --> 00:06:55,680
in uh robotic vehicles we called

200
00:06:59,430 --> 00:06:57,440
robotera

201
00:07:00,550 --> 00:06:59,440
and this was a reflection instrument

202
00:07:02,550 --> 00:07:00,560
that was

203
00:07:04,629 --> 00:07:02,560
made by the for the getty museum for

204
00:07:05,510 --> 00:07:04,639
looking at artworks

205
00:07:07,589 --> 00:07:05,520
and

206
00:07:09,189 --> 00:07:07,599
next slide

207
00:07:12,629 --> 00:07:09,199
and then this just shows some of the

208
00:07:14,870 --> 00:07:12,639
this is up on mauna kea for uh for a uh

209
00:07:17,670 --> 00:07:14,880
in-situ resource utilization

210
00:07:20,390 --> 00:07:17,680
uh experiment for the for lunar stuff

211
00:07:22,550 --> 00:07:20,400
this is in the dry valleys of antarctica

212
00:07:24,629 --> 00:07:22,560
this is up in northern canada and this

213
00:07:26,950 --> 00:07:24,639

is again in spitsbergen

214
00:07:27,749 --> 00:07:26,960
uh next slide

215
00:07:29,830 --> 00:07:27,759
uh

216
00:07:31,430 --> 00:07:29,840
well this is in the utah desert

217
00:07:33,270 --> 00:07:31,440
but they wanted people wanted to try

218
00:07:35,510 --> 00:07:33,280
this to see if an astronaut in with

219
00:07:36,950 --> 00:07:35,520
gloves could use it and they sort of

220
00:07:39,270 --> 00:07:36,960
could

221
00:07:42,710 --> 00:07:39,280
this is uh seven kilometers down in a

222
00:07:44,790 --> 00:07:42,720
potash potash mine in new mexico

223
00:07:46,390 --> 00:07:44,800
and they needed to know which way to dig

224
00:07:48,309 --> 00:07:46,400
and they otherwise they'd have to assay

225
00:07:49,830 --> 00:07:48,319
the ore out of the mine and in a

226
00:07:51,909 --> 00:07:49,840
different county

227
00:07:55,029 --> 00:07:51,919
and

228
00:07:56,390 --> 00:07:55,039
lunar rocks you'd be surprised there's

229
00:07:58,550 --> 00:07:56,400
still a lot of research being done on

230
00:08:00,869 --> 00:07:58,560
lunarocks this is jeff taylor at the

231
00:08:03,189 --> 00:08:00,879
university of hawaii and we're analyzing

232
00:08:05,189 --> 00:08:03,199
100 lunar soils with this and they're

233
00:08:06,469 --> 00:08:05,199
going to be the baseline data for

234
00:08:09,430 --> 00:08:06,479
orbital

235
00:08:12,629 --> 00:08:09,440
missions to the moon

236
00:08:14,070 --> 00:08:12,639
okay let's stop for that right now and

237
00:08:15,189 --> 00:08:14,080
i kind of wanted to give you a flavor of

238
00:08:17,270 --> 00:08:15,199

it now i'm going to really show you the

239
00:08:19,350 --> 00:08:17,280
machine and and this is this is what i

240
00:08:21,270 --> 00:08:19,360
this really is what i wanted to show you

241
00:08:22,070 --> 00:08:21,280
this was just kind of like an intro

242
00:08:24,070 --> 00:08:22,080
so

243
00:08:25,189 --> 00:08:24,080
this is uh

244
00:08:27,029 --> 00:08:25,199
this is

245
00:08:28,710 --> 00:08:27,039
functionally identical to the thing

246
00:08:30,550 --> 00:08:28,720
we're sending to mars

247
00:08:32,550 --> 00:08:30,560
uh the difference is that there are

248
00:08:35,269 --> 00:08:32,560
commercial components in here

249
00:08:36,550 --> 00:08:35,279
uh when i put a sample in i put the

250
00:08:39,589 --> 00:08:36,560
sample in

251
00:08:41,110 --> 00:08:39,599
it's not a wheel with an automatic

252
00:08:42,870 --> 00:08:41,120
gizmo

253
00:08:44,790 --> 00:08:42,880
and when i prepare a sample i don't have

254
00:08:47,829 --> 00:08:44,800
the real fancy arm with the thing so

255
00:08:49,990 --> 00:08:47,839
i've got a hammer this is called a

256
00:08:52,070 --> 00:08:50,000
percussion mortar

257
00:08:53,829 --> 00:08:52,080
i i sent this all over the world with my

258
00:08:55,350 --> 00:08:53,839
little kit and i had to describe all the

259
00:08:56,949 --> 00:08:55,360
components

260
00:08:58,389 --> 00:08:56,959
through customs and

261
00:09:00,550 --> 00:08:58,399
the first time i called it a percussion

262
00:09:02,310 --> 00:09:00,560
mortar i had serious issues

263
00:09:06,790 --> 00:09:02,320

so i so i just called it a sample

264
00:09:10,150 --> 00:09:08,630
so anyway this is uh

265
00:09:12,230 --> 00:09:10,160
uh we've been all over the place with

266
00:09:14,150 --> 00:09:12,240
this it's battery powered it's it's uh

267
00:09:17,030 --> 00:09:14,160
wireless so i'm actually communicating

268
00:09:20,389 --> 00:09:17,040
it wireless with this this this thing

269
00:09:21,670 --> 00:09:20,399
this computer and let me uh

270
00:09:23,190 --> 00:09:21,680
so let me show you how i prepare a

271
00:09:24,630 --> 00:09:23,200
sample and then i'm going to show you

272
00:09:28,070 --> 00:09:24,640
the nuts and bolts of what an

273
00:09:29,430 --> 00:09:28,080
observation looks like so first of all

274
00:09:30,870 --> 00:09:29,440
uh i went all over in front of the

275
00:09:33,030 --> 00:09:30,880
hilton trying to find rocks and there's

276
00:09:36,150 --> 00:09:33,040
just no rocks in this there's no rocks

277
00:09:38,790 --> 00:09:36,160
in florida i'm pretty well convinced

278
00:09:40,949 --> 00:09:38,800
so i've got some beach sand here

279
00:09:42,790 --> 00:09:40,959
i've got a couple of seashells

280
00:09:45,269 --> 00:09:42,800
and i've got an aspirin tablet so i'm

281
00:09:46,389 --> 00:09:45,279
going to start with the beach sand

282
00:09:48,150 --> 00:09:46,399
and

283
00:09:49,509 --> 00:09:48,160
i'm not sure how fine grain this is so

284
00:09:50,389 --> 00:09:49,519
i'm going to grind it up just a little

285
00:09:52,790 --> 00:09:50,399
bit

286
00:09:55,030 --> 00:09:52,800
so i'm just going to put some beet sand

287
00:09:57,750 --> 00:09:55,040
in here

288
00:09:57,760 --> 00:10:02,230

my apologies to the custodial staff

289
00:10:04,790 --> 00:10:03,670
and

290
00:10:07,750 --> 00:10:04,800
i just want to make sure there's enough

291
00:10:11,910 --> 00:10:07,760
fine-grained material to analyze

292
00:10:16,069 --> 00:10:14,710
now this is a this is 150 micron sieve

293
00:10:17,670 --> 00:10:16,079
this is the same

294
00:10:20,069 --> 00:10:17,680
diameter sieve

295
00:10:21,750 --> 00:10:20,079
sieve diameter that is used on msl so

296
00:10:23,670 --> 00:10:21,760
i'll show you what this looks like

297
00:10:25,670 --> 00:10:23,680
after i'm done you can see what

298
00:10:27,030 --> 00:10:25,680
how small the the

299
00:10:29,030 --> 00:10:27,040
the holes are

300
00:10:30,710 --> 00:10:29,040
and just for for scale a human hair is

301
00:10:33,509 --> 00:10:30,720
about 100 microns so the holes are about

302
00:10:35,509 --> 00:10:33,519
the size of a human hair in diameter

303
00:10:39,110 --> 00:10:35,519
100 microns yeah

304
00:10:42,310 --> 00:10:40,710
and there's there's two kinds of ways to

305
00:10:43,750 --> 00:10:42,320
hit things there's whacking and there's

306
00:10:44,870 --> 00:10:43,760
thwacking

307
00:10:46,870 --> 00:10:44,880
and so

308
00:10:49,670 --> 00:10:46,880
whacking is when you just really whack

309
00:10:51,750 --> 00:10:49,680
something thwacking is you give it a

310
00:10:54,150 --> 00:10:51,760
a sharp wrap and that's the kind of

311
00:10:57,269 --> 00:10:54,160
thing that works for uh you know for

312
00:11:00,710 --> 00:10:58,710
and there's a there's actually kind of a

313
00:11:03,190 --> 00:11:00,720

joke that there was a

314
00:11:05,750 --> 00:11:03,200
what they call a critical design review

315
00:11:08,230 --> 00:11:05,760
for the sample preparation equipment for

316
00:11:09,990 --> 00:11:08,240
msl and it lasted three days and

317
00:11:11,829 --> 00:11:10,000
everybody was just dead tired it was six

318
00:11:13,110 --> 00:11:11,839
at night on the third day

319
00:11:15,030 --> 00:11:13,120
and uh

320
00:11:16,949 --> 00:11:15,040
uh the guy the guy who was answering

321
00:11:17,990 --> 00:11:16,959
questions um

322
00:11:20,550 --> 00:11:18,000
basically

323
00:11:22,230 --> 00:11:20,560
uh somebody asked him he said they were

324
00:11:23,430 --> 00:11:22,240
thwacking and he and somebody asked him

325
00:11:24,550 --> 00:11:23,440
the question you know what's the

326
00:11:25,590 --> 00:11:24,560
difference between whacking and

327
00:11:26,949 --> 00:11:25,600
thwacking

328
00:11:29,030 --> 00:11:26,959
and he basically said i'll tell you the

329
00:11:30,470 --> 00:11:29,040
answer to that or i'll i'm going to show

330
00:11:34,150 --> 00:11:30,480
you the answer to that if you ask me

331
00:11:41,269 --> 00:11:35,350
i think that was pretty close to the end

332
00:11:44,150 --> 00:11:42,550
okay so there's

333
00:11:45,670 --> 00:11:44,160
there's a little bit of material and you

334
00:11:47,350 --> 00:11:45,680
almost can't even see that in there but

335
00:11:49,030 --> 00:11:47,360
that's really enough to do an analysis

336
00:11:51,430 --> 00:11:49,040
on this machine

337
00:11:54,870 --> 00:11:53,110
that's right yeah even even though

338
00:11:57,430 --> 00:11:54,880

they're going to make grams of material

339
00:11:59,350 --> 00:11:57,440
on msl we need the amount that's about

340
00:12:01,430 --> 00:11:59,360
the size of a baby aspirin tablet that's

341
00:12:04,150 --> 00:12:01,440
how much we need

342
00:12:06,470 --> 00:12:04,160
yeah and i'll show you that i this is uh

343
00:12:12,470 --> 00:12:06,480
so let's see let me uh

344
00:12:17,829 --> 00:12:15,190
it's the the the actual machine going to

345
00:12:19,190 --> 00:12:17,839
mars is is about a 10 inch cube

346
00:12:21,750 --> 00:12:19,200
and this one

347
00:12:23,430 --> 00:12:21,760
uh is is better than it's worse it's

348
00:12:25,190 --> 00:12:23,440
it's better because we don't have to

349
00:12:26,389 --> 00:12:25,200
have that big sample wheel with all the

350
00:12:28,470 --> 00:12:26,399
things on it

351
00:12:30,310 --> 00:12:28,480
it's worse because we we carry our own

352
00:12:35,750 --> 00:12:30,320
power so

353
00:12:40,870 --> 00:12:38,310
you know on mars but for us we power

354
00:12:42,629 --> 00:12:40,880
with the with laptop batteries so so

355
00:12:44,230 --> 00:12:42,639
these these are pretty heavy in their

356
00:12:45,750 --> 00:12:44,240
own right

357
00:12:50,870 --> 00:12:45,760
but this this thing is pretty well

358
00:12:55,990 --> 00:12:53,829
so what you're hearing is is is uh

359
00:12:57,430 --> 00:12:56,000
there's a base this works uh very

360
00:12:59,509 --> 00:12:57,440
similar to

361
00:13:01,190 --> 00:12:59,519
the sample holders on mars

362
00:13:02,790 --> 00:13:01,200
it looks a bit like a tuning fork

363
00:13:05,670 --> 00:13:02,800

there's two sides and there's a there's

364
00:13:07,509 --> 00:13:05,680
a piezo vibrator in the middle that that

365
00:13:09,030 --> 00:13:07,519
vibrates at the resonant frequency of

366
00:13:11,110 --> 00:13:09,040
this tuning fork

367
00:13:14,389 --> 00:13:11,120
and that causes a material in there to

368
00:13:17,190 --> 00:13:14,399
move around and like a liquid

369
00:13:18,710 --> 00:13:17,200
okay so so uh it's pretty clever device

370
00:13:20,710 --> 00:13:18,720
my colleague philippe sarrison is the

371
00:13:22,230 --> 00:13:20,720
one who figured this out and this

372
00:13:23,990 --> 00:13:22,240
actually got

373
00:13:25,350 --> 00:13:24,000
nasa a commercial invention of the year

374
00:13:26,949 --> 00:13:25,360
this year

375
00:13:28,710 --> 00:13:26,959
and i was thinking it really ought to be

376
00:13:30,150 --> 00:13:28,720
something like

377
00:13:32,870 --> 00:13:30,160
a tricorder or something i don't know

378
00:13:35,350 --> 00:13:32,880
why a thing that just moves dirt around

379
00:13:36,230 --> 00:13:35,360
should merit that but you know whatever

380
00:13:37,350 --> 00:13:36,240
okay

381
00:13:38,550 --> 00:13:37,360
so

382
00:13:40,150 --> 00:13:38,560
what i'm going to do is i'm going to

383
00:13:44,550 --> 00:13:40,160
take and take a little bit of the

384
00:13:47,670 --> 00:13:46,069
and this is unlike

385
00:13:54,870 --> 00:13:47,680
msl

386
00:13:58,230 --> 00:13:56,150
so i'm just going to put it on a little

387
00:14:03,430 --> 00:13:58,240
spatula here and put it right in this

388
00:14:06,710 --> 00:14:05,110

and this is this is what would be coming

389
00:14:09,110 --> 00:14:06,720
down that little funnel and into the

390
00:14:10,790 --> 00:14:09,120
sample cells in the in the machine

391
00:14:13,030 --> 00:14:10,800
and this is what uh this is like an

392
00:14:14,550 --> 00:14:13,040
external shaker so that we can

393
00:14:16,389 --> 00:14:14,560
see what's going on to make sure the

394
00:14:21,110 --> 00:14:16,399
sample is good

395
00:14:24,150 --> 00:14:22,230
and

396
00:14:25,750 --> 00:14:24,160
i don't know if you can see the grains

397
00:14:27,189 --> 00:14:25,760
running around in there you can

398
00:14:28,230 --> 00:14:27,199
certainly come up later on and take a

399
00:14:30,710 --> 00:14:28,240
look but

400
00:14:32,389 --> 00:14:30,720
believe me they're they're kind of

401
00:14:34,629 --> 00:14:32,399
going in circles and the noise you hear

402
00:14:36,230 --> 00:14:34,639
is actually there's it's ramping

403
00:14:38,470 --> 00:14:36,240
this piezo

404
00:14:41,189 --> 00:14:38,480
through about 2 000 hertz which is the

405
00:14:43,110 --> 00:14:41,199
resonant frequency for this uh

406
00:14:46,389 --> 00:14:43,120
tuning fork and then when it gets a

407
00:14:48,310 --> 00:14:46,399
resonance it really shakes hard

408
00:14:56,470 --> 00:14:48,320
so okay i'm going to put this inside

409
00:15:00,949 --> 00:14:58,629
and i'll stop the uh

410
00:15:02,870 --> 00:15:00,959
stop this thing

411
00:15:04,629 --> 00:15:02,880
okay and now i'm going to command it

412
00:15:06,629 --> 00:15:04,639
from here i'm going to just tell it to

413
00:15:08,710 --> 00:15:06,639

and once i command it start going i'll

414
00:15:11,430 --> 00:15:08,720
turn this around so you can see see it

415
00:15:24,949 --> 00:15:11,440
start acquiring the data

416
00:15:27,509 --> 00:15:26,150
i'm gonna call it quartz i'm not

417
00:15:32,069 --> 00:15:27,519
supposed to know what it is but i'll

418
00:15:34,870 --> 00:15:33,750
i actually thought when i started out i

419
00:15:36,629 --> 00:15:34,880
actually thought

420
00:15:38,069 --> 00:15:36,639
that there were car there was carbonate

421
00:15:40,310 --> 00:15:38,079
you know i thought it was a carbonate

422
00:15:42,150 --> 00:15:40,320
sand and i think what the deal is is on

423
00:15:45,350 --> 00:15:42,160
the gulf coast it's carbonate and on the

424
00:15:51,910 --> 00:15:45,360
atlantic coast it's uh it's it's uh

425
00:15:56,710 --> 00:15:53,670
oh okay okay and that would be that

426
00:15:58,790 --> 00:15:56,720
would be calcite or carbonate

427
00:16:00,870 --> 00:15:58,800
uh well i'm gonna well that would be

428
00:16:02,310 --> 00:16:00,880
okay it would be it would actually be

429
00:16:03,670 --> 00:16:02,320
probably aragonite which is what the

430
00:16:04,550 --> 00:16:03,680
shell is which i'm not supposed to know

431
00:16:05,910 --> 00:16:04,560
either

432
00:16:08,150 --> 00:16:05,920
but i'll

433
00:16:11,829 --> 00:16:08,160
i'll tell you

434
00:16:13,749 --> 00:16:11,839
okay so start the analysis

435
00:16:22,389 --> 00:16:13,759
and

436
00:16:22,399 --> 00:16:25,509
okay

437
00:16:28,710 --> 00:16:27,430
so it finds resonance and then it starts

438
00:16:30,389 --> 00:16:28,720

shaking right around the resonance

439
00:16:32,230 --> 00:16:30,399
frequency

440
00:16:34,230 --> 00:16:32,240
and now it's uh

441
00:16:36,069 --> 00:16:34,240
now it's starting to uh

442
00:16:38,790 --> 00:16:36,079
starting to take analysis and let me see

443
00:16:42,629 --> 00:16:38,800
if i can find it here

444
00:16:42,639 --> 00:16:48,790
okay

445
00:16:52,550 --> 00:16:50,710
so it's not showing anything right now

446
00:17:00,389 --> 00:16:52,560
you should see the first

447
00:17:03,189 --> 00:17:01,670
this is about

448
00:17:05,029 --> 00:17:03,199
four times faster

449
00:17:07,350 --> 00:17:05,039
so we we kind of juiced this one up a

450
00:17:09,029 --> 00:17:07,360
little bit because we could

451
00:17:11,429 --> 00:17:09,039
we didn't have to answer the jpl for the

452
00:17:14,870 --> 00:17:12,710
okay there we go

453
00:17:16,390 --> 00:17:14,880
so that's 10 seconds of data

454
00:17:17,990 --> 00:17:16,400
and i can tell

455
00:17:20,309 --> 00:17:18,000
because i know this that that the

456
00:17:22,630 --> 00:17:20,319
court's uh strongest quartz peak is at

457
00:17:23,990 --> 00:17:22,640
30.5 right there so i could tell you

458
00:17:27,590 --> 00:17:24,000
right now that's quartz just from that

459
00:17:29,669 --> 00:17:27,600
one peak but but uh it collects data

460
00:17:31,590 --> 00:17:29,679
uh and shows it to you as it's doing it

461
00:17:34,230 --> 00:17:31,600
now we can't do this on mars because

462
00:17:36,310 --> 00:17:34,240
obviously we have to wait for the

463
00:17:38,150 --> 00:17:36,320

the acquisition and the link up to the

464
00:17:39,909 --> 00:17:38,160
to the to the satellite and all that so

465
00:17:41,430 --> 00:17:39,919
we won't know for a day we have to tell

466
00:17:43,350 --> 00:17:41,440
it to analyze for

467
00:17:46,310 --> 00:17:43,360
five hours and then we get five hours

468
00:17:47,830 --> 00:17:46,320
with the data but in the field

469
00:17:49,430 --> 00:17:47,840
if i if i can figure out what something

470
00:17:51,750 --> 00:17:49,440
is in 10 seconds

471
00:17:53,190 --> 00:17:51,760
i move on you know

472
00:17:55,510 --> 00:17:53,200
so um

473
00:17:57,029 --> 00:17:55,520
oops

474
00:17:58,789 --> 00:17:57,039
okay so i'll show you how to analyze

475
00:18:00,470 --> 00:17:58,799
this and i'm like maybe i'll just if i

476
00:18:03,750 --> 00:18:00,480
kneel down in front would that be

477
00:18:07,830 --> 00:18:03,760
good or maybe i can do it upside down

478
00:18:07,840 --> 00:18:10,230
uh

479
00:18:14,310 --> 00:18:12,630
should i turn it this way

480
00:18:15,909 --> 00:18:14,320
okay and i can here's what i can do i

481
00:18:17,270 --> 00:18:15,919
can i can go right here

482
00:18:20,070 --> 00:18:17,280
okay so

483
00:18:21,190 --> 00:18:20,080
so there's now that's only

484
00:18:23,350 --> 00:18:21,200
that's now

485
00:18:25,510 --> 00:18:23,360
five exposures of ten seconds each

486
00:18:26,950 --> 00:18:25,520
that's fifty fifty seconds of of

487
00:18:29,350 --> 00:18:26,960
exposure

488
00:18:31,029 --> 00:18:29,360

and what i'm going to do now

489
00:18:34,549 --> 00:18:31,039
is i'm going to

490
00:18:37,990 --> 00:18:36,310
let's see

491
00:18:40,070 --> 00:18:38,000
take this data and pull it down onto

492
00:18:41,669 --> 00:18:40,080
this computer so right now it's resonant

493
00:18:44,470 --> 00:18:41,679
on this machine

494
00:18:45,750 --> 00:18:44,480
and as soon as i i collected as soon as

495
00:18:47,830 --> 00:18:45,760
i um

496
00:18:50,390 --> 00:18:47,840
let's see processed

497
00:18:52,789 --> 00:18:50,400
as soon as i download it then it's

498
00:18:55,750 --> 00:18:52,799
resident on my computer and then i can

499
00:18:59,830 --> 00:18:55,760
use the programs on my computer to do

500
00:19:03,270 --> 00:19:01,590
so it just simply takes what you saw on

501
00:19:09,350 --> 00:19:03,280
the screen now it's going to open up in

502
00:19:13,750 --> 00:19:12,150
and it should open up this pattern here

503
00:19:14,950 --> 00:19:13,760
there's the pattern

504
00:19:16,390 --> 00:19:14,960
now

505
00:19:17,669 --> 00:19:16,400
normally i'd have to subtract the

506
00:19:18,950 --> 00:19:17,679
background this is a pretty low

507
00:19:22,950 --> 00:19:18,960
background so i don't really have to

508
00:19:24,789 --> 00:19:22,960
worry about it but let's go to identify

509
00:19:27,750 --> 00:19:24,799
search match setup

510
00:19:28,950 --> 00:19:27,760
and there's a i have a full now the

511
00:19:30,630 --> 00:19:28,960
difference between minerals and

512
00:19:31,990 --> 00:19:30,640
inorganic materials

513
00:19:33,430 --> 00:19:32,000

is there are

514
00:19:34,549 --> 00:19:33,440
hundreds of thousands of inorganic

515
00:19:36,230 --> 00:19:34,559
materials

516
00:19:38,950 --> 00:19:36,240
there's only about four or five thousand

517
00:19:40,230 --> 00:19:38,960
known minerals on the earth so uh so

518
00:19:42,470 --> 00:19:40,240
there's only four or five thousand to

519
00:19:44,710 --> 00:19:42,480
choose from um if there's something that

520
00:19:46,710 --> 00:19:44,720
we don't know that isn't a mineral that

521
00:19:48,230 --> 00:19:46,720
occurs on mars we'll still be able to

522
00:19:50,310 --> 00:19:48,240
find it out it'll be an inorganic

523
00:19:51,669 --> 00:19:50,320
compound that's unknown on the earth and

524
00:19:53,029 --> 00:19:51,679
we'll just name it we'll know what it

525
00:19:54,870 --> 00:19:53,039
we'll name it we'll be the guys who name

526
00:19:55,590 --> 00:19:54,880
what it is and it'll be a new mineral

527
00:19:57,270 --> 00:19:55,600
so

528
00:19:59,350 --> 00:19:57,280
this is uh called the international

529
00:20:01,110 --> 00:19:59,360
center for diffraction data powder

530
00:20:03,669 --> 00:20:01,120
powder diffraction files

531
00:20:05,190 --> 00:20:03,679
uh and there's like uh

532
00:20:07,190 --> 00:20:05,200
they have a list of all the minerals

533
00:20:10,150 --> 00:20:07,200
that are present and so all i have to do

534
00:20:11,750 --> 00:20:10,160
is go search match

535
00:20:16,230 --> 00:20:11,760
and

536
00:20:17,270 --> 00:20:16,240
figure out what fits

537
00:20:18,630 --> 00:20:17,280
and

538
00:20:22,549 --> 00:20:18,640

it finds

539
00:20:28,310 --> 00:20:25,270
so there's quartz

540
00:20:31,190 --> 00:20:28,320
and let's get rid of everything else

541
00:20:33,590 --> 00:20:31,200
and then i'll go back to

542
00:20:35,669 --> 00:20:33,600
do a quantitative well it's single it's

543
00:20:37,830 --> 00:20:35,679
a single phase course so there's no need

544
00:20:40,630 --> 00:20:37,840
reason to do quantitative analysis but

545
00:20:43,590 --> 00:20:40,640
let me just do a quick refinement

546
00:20:46,870 --> 00:20:43,600
to see if there's anything else there

547
00:20:46,880 --> 00:20:51,110
okay

548
00:20:55,110 --> 00:20:54,310
let's see full with f max

549
00:20:56,470 --> 00:20:55,120
so

550
00:20:59,029 --> 00:20:56,480
it only found quartz and it found a

551
00:20:59,830 --> 00:20:59,039
hundred percent quartz uh but let's go

552
00:21:02,870 --> 00:20:59,840
to

553
00:21:04,149 --> 00:21:02,880
if you just look at this it fit this

554
00:21:06,230 --> 00:21:04,159
pink line

555
00:21:07,990 --> 00:21:06,240
to the black line that was the observed

556
00:21:10,149 --> 00:21:08,000
data and this is

557
00:21:11,990 --> 00:21:10,159
this thing up here is the least squares

558
00:21:14,070 --> 00:21:12,000
refinement so these are the

559
00:21:16,149 --> 00:21:14,080
residuals left after doing the fit and

560
00:21:19,110 --> 00:21:16,159
that's that's a pretty good fit for 50

561
00:21:20,710 --> 00:21:19,120
seconds worth of data so that's

562
00:21:22,310 --> 00:21:20,720
definitely quartz

563
00:21:23,830 --> 00:21:22,320

no doubt about it

564
00:21:25,190 --> 00:21:23,840
now let me show you one more thing here

565
00:21:26,630 --> 00:21:25,200
while we're at it

566
00:21:27,990 --> 00:21:26,640
um

567
00:21:30,390 --> 00:21:28,000
i want to show you what the actual

568
00:21:32,310 --> 00:21:30,400
sensor looks like in here what what one

569
00:21:33,909 --> 00:21:32,320
let me show you what the sensor that

570
00:21:41,590 --> 00:21:33,919
collected all the data looks like and i

571
00:21:46,549 --> 00:21:45,270
so i'm going to download now a

572
00:21:50,630 --> 00:21:46,559
i'm going to download let's see i'll

573
00:21:52,149 --> 00:21:50,640
download one a single 10 second uh image

574
00:21:54,470 --> 00:21:52,159
002.tiff

575
00:21:56,149 --> 00:21:54,480
looks like it's called and i'll say save

576
00:22:00,310 --> 00:21:56,159
it

577
00:22:03,190 --> 00:22:01,830
desktop

578
00:22:05,669 --> 00:22:03,200
and now i have the issue of trying to

579
00:22:07,590 --> 00:22:05,679
find it

580
00:22:09,750 --> 00:22:07,600
so let's see let's open up

581
00:22:10,870 --> 00:22:09,760
this is a program called image that will

582
00:22:12,310 --> 00:22:10,880
show you

583
00:22:13,909 --> 00:22:12,320
you could use image for your own

584
00:22:15,990 --> 00:22:13,919
pictures actually it's it's an image

585
00:22:19,110 --> 00:22:16,000
processing program

586
00:22:20,470 --> 00:22:19,120
file open

587
00:22:22,630 --> 00:22:20,480
and

588
00:22:24,390 --> 00:22:22,640

i'll go to

589
00:22:29,110 --> 00:22:24,400
details

590
00:22:33,750 --> 00:22:31,270
okay so this now let me just get this a

591
00:22:38,230 --> 00:22:33,760
little bit uh

592
00:22:41,909 --> 00:22:39,190
okay

593
00:22:43,510 --> 00:22:41,919
so this is a single uh let's see can you

594
00:22:44,950 --> 00:22:43,520
can you see that yeah there you can see

595
00:22:46,230 --> 00:22:44,960
it on the screen so i don't want to turn

596
00:22:48,710 --> 00:22:46,240
it around where everybody can see it but

597
00:22:49,669 --> 00:22:48,720
the screen doesn't work um this is a

598
00:22:53,430 --> 00:22:49,679
single

599
00:22:55,990 --> 00:22:53,440
uh 10 second scan and the the the center

600
00:22:57,990 --> 00:22:56,000
of of the undiffracted beam is here and

601
00:23:00,149 --> 00:22:58,000
these are these rings and this is the

602
00:23:02,950 --> 00:23:00,159
main ring of quartz right here at about

603
00:23:05,350 --> 00:23:02,960
30 and a half degrees and these are

604
00:23:06,950 --> 00:23:05,360
actual individual photons so this this

605
00:23:10,710 --> 00:23:06,960
this detector

606
00:23:13,350 --> 00:23:10,720
which is 10 24 long by 256 wide

607
00:23:15,750 --> 00:23:13,360
uh each one of those pixels will will

608
00:23:17,270 --> 00:23:15,760
identify a single photon and they'll

609
00:23:19,029 --> 00:23:17,280
tell you what the energy of the photon

610
00:23:20,789 --> 00:23:19,039
is so we're looking at individual x-ray

611
00:23:23,990 --> 00:23:20,799
photons that are striking this chip

612
00:23:26,070 --> 00:23:24,000
that's just marvelous i just it's always

613
00:23:27,430 --> 00:23:26,080

surprising to me when that when i that

614
00:23:29,190 --> 00:23:27,440
happens

615
00:23:31,350 --> 00:23:29,200
you know if i if i had figured this out

616
00:23:34,070 --> 00:23:31,360
in 1880

617
00:23:38,710 --> 00:23:34,080
i would have certainly got a nobel prize

618
00:23:42,230 --> 00:23:40,470
that's what progress is this is just an

619
00:23:44,230 --> 00:23:42,240
everyday thing now

620
00:23:46,230 --> 00:23:44,240
okay so let's see and and i could you

621
00:23:48,070 --> 00:23:46,240
know just let me

622
00:23:49,990 --> 00:23:48,080
blow this up a little bit and you can

623
00:23:51,909 --> 00:23:50,000
see there are actually these are

624
00:23:53,029 --> 00:23:51,919
individual photons that struck the chip

625
00:23:55,270 --> 00:23:53,039
and

626
00:23:56,950 --> 00:23:55,280
all of these things are cobalt k alpha i

627
00:24:00,230 --> 00:23:56,960
can see the energy of them somewhere

628
00:24:04,789 --> 00:24:02,630
there's the x y and the value

629
00:24:06,870 --> 00:24:04,799
and the value of these individual

630
00:24:08,390 --> 00:24:06,880
photons this is actually in what they

631
00:24:11,750 --> 00:24:08,400
call digital numbers so it doesn't read

632
00:24:13,750 --> 00:24:11,760
out in energy but those are all uh

633
00:24:15,190 --> 00:24:13,760
cobalt k alpha the the energy of the

634
00:24:17,110 --> 00:24:15,200
tube

635
00:24:18,950 --> 00:24:17,120
okay let's uh so let's move on let's do

636
00:24:21,990 --> 00:24:18,960
something more interesting

637
00:24:24,789 --> 00:24:22,000
um any you know any questions so far uh

638
00:24:29,269 --> 00:24:26,950

you said it was gonna analyze for five

639
00:24:30,630 --> 00:24:29,279
hours this would be one sample because

640
00:24:32,710 --> 00:24:30,640
you one second talk about how many

641
00:24:34,070 --> 00:24:32,720
samples you have you don't have as many

642
00:24:35,909 --> 00:24:34,080
as sam

643
00:24:37,510 --> 00:24:35,919
and i'm wondering you know talk a little

644
00:24:39,430 --> 00:24:37,520
bit about the strategy of taking the

645
00:24:41,110 --> 00:24:39,440
samples how often you'll take okay how

646
00:24:42,470 --> 00:24:41,120
many in the two actually

647
00:24:43,750 --> 00:24:42,480
what are you going to reserve for future

648
00:24:45,830 --> 00:24:43,760
years good question

649
00:24:49,269 --> 00:24:45,840
actually the the sample wheel in in the

650
00:24:50,230 --> 00:24:49,279
cabin instrument on msl has 27 empty

651
00:24:54,789 --> 00:24:50,240
cells

652
00:24:57,350 --> 00:24:54,799
and reused

653
00:25:00,710 --> 00:24:57,360
so we have we have 27

654
00:25:02,630 --> 00:25:00,720
pristine analyses in an empty clean cell

655
00:25:04,549 --> 00:25:02,640
and then we can dump that sample and

656
00:25:06,230 --> 00:25:04,559
reuse it sometimes you might have a

657
00:25:09,430 --> 00:25:06,240
sample that just gets stuck in there and

658
00:25:11,350 --> 00:25:09,440
that that that thing is lost but uh

659
00:25:14,549 --> 00:25:11,360
yeah we vibrate it and turn it upside

660
00:25:22,149 --> 00:25:16,950
oh sure yeah there's there's a the wheel

661
00:25:26,230 --> 00:25:24,149
it's vertical it's vertical and it's

662
00:25:28,310 --> 00:25:26,240
it's analyzed at the top

663
00:25:31,110 --> 00:25:28,320

and the the funnel comes down the the

664
00:25:33,350 --> 00:25:31,120
analyzing cell is at the top and the the

665
00:25:35,750 --> 00:25:33,360
beam is up here and so it vibrates does

666
00:25:38,230 --> 00:25:35,760
the analysis the ccd is here and then

667
00:25:40,310 --> 00:25:38,240
when we're done with this it rotates 180

668
00:25:42,950 --> 00:25:40,320
degrees so it's upside down and there's

669
00:25:45,350 --> 00:25:42,960
a sump down there and you vibrate it and

670
00:25:46,630 --> 00:25:45,360
the material comes out

671
00:25:48,870 --> 00:25:46,640
and then we're ready to do another

672
00:25:50,789 --> 00:25:48,880
analysis

673
00:25:53,510 --> 00:25:50,799
if you have successfully dumped the

674
00:25:55,510 --> 00:25:53,520
sample or not we we can tell

675
00:25:57,110 --> 00:25:55,520
after fashion we can we can rotate the

676
00:25:59,350 --> 00:25:57,120
cell back up

677
00:26:01,669 --> 00:25:59,360
we can do we can do some analyses and

678
00:26:04,390 --> 00:26:01,679
see that we only see clear windows just

679
00:26:05,190 --> 00:26:04,400
just the polymer windows and no material

680
00:26:07,269 --> 00:26:05,200
now

681
00:26:09,909 --> 00:26:07,279
the caveat is if there's stuff stuck in

682
00:26:12,710 --> 00:26:09,919
the corners and stuff well we don't see

683
00:26:15,029 --> 00:26:12,720
that now uh there's a way and so there's

684
00:26:17,269 --> 00:26:15,039
a potential for contamination in a cell

685
00:26:20,230 --> 00:26:17,279
that we reuse now there's there's a

686
00:26:22,549 --> 00:26:20,240
strategy for fixing that and basically

687
00:26:24,789 --> 00:26:22,559
it's it's it's a sample dilution what we

688
00:26:26,310 --> 00:26:24,799

do is we take a used cell if we want to

689
00:26:27,830 --> 00:26:26,320
renew it

690
00:26:30,390 --> 00:26:27,840
run it up to the top

691
00:26:32,470 --> 00:26:30,400
and we have uh we have the

692
00:26:33,350 --> 00:26:32,480
the ability or the option to take up to

693
00:26:35,990 --> 00:26:33,360
three

694
00:26:37,430 --> 00:26:36,000
aliquots of material from the saspa

695
00:26:39,190 --> 00:26:37,440
system

696
00:26:40,230 --> 00:26:39,200
one at a time vibrate them turn it over

697
00:26:42,070 --> 00:26:40,240
and dump it

698
00:26:44,630 --> 00:26:42,080
fill it up vibrate it turn over and dump

699
00:26:46,630 --> 00:26:44,640
it and hopefully by doing that we dilute

700
00:26:49,110 --> 00:26:46,640
the contamination with the sample we're

701
00:26:51,510 --> 00:26:49,120
going to analyze and then dump it

702
00:26:52,390 --> 00:26:51,520
and we also have a what we call a sample

703
00:26:54,549 --> 00:26:52,400
shunt

704
00:26:56,870 --> 00:26:54,559
it's just basically a big hopper that

705
00:26:59,590 --> 00:26:56,880
holds material and if we think the the

706
00:27:01,830 --> 00:26:59,600
funnel is is contaminated we can pour

707
00:27:03,190 --> 00:27:01,840
stuff through the funnel and dump it and

708
00:27:05,590 --> 00:27:03,200
pour stuff through the funnel and dump

709
00:27:07,430 --> 00:27:05,600
it so we have ways to

710
00:27:09,350 --> 00:27:07,440
to kind of clear the the machine of

711
00:27:11,029 --> 00:27:09,360
contamination now

712
00:27:12,549 --> 00:27:11,039
none of this stuff is perfect i mean

713
00:27:15,269 --> 00:27:12,559

it's really i'll tell you that the high

714
00:27:16,950 --> 00:27:15,279
ground is trying to deal with dirt

715
00:27:19,110 --> 00:27:16,960
you know how do you do it so that really

716
00:27:21,269 --> 00:27:19,120
is you can make really fancy machinery

717
00:27:22,950 --> 00:27:21,279
but just trying to transfer fine-grained

718
00:27:25,269 --> 00:27:22,960
material from one place to the other is

719
00:27:28,390 --> 00:27:25,279
really tough it's really tough

720
00:27:30,390 --> 00:27:28,400
on phoenix exactly yeah and we have a

721
00:27:32,390 --> 00:27:30,400
little bit well i mean when we saw the

722
00:27:33,510 --> 00:27:32,400
results from phoenix everybody had a

723
00:27:35,590 --> 00:27:33,520
powwow

724
00:27:36,950 --> 00:27:35,600
and the idea was

725
00:27:38,870 --> 00:27:36,960
you know we

726
00:27:40,789 --> 00:27:38,880
we don't know what's going to work if we

727
00:27:43,110 --> 00:27:40,799
get in a situation like that

728
00:27:45,590 --> 00:27:43,120
but uh gentry lee who's one of the big

729
00:27:47,430 --> 00:27:45,600
gurus uh on our on our on the committee

730
00:27:49,110 --> 00:27:47,440
who's reviewing us or the whole into the

731
00:27:50,870 --> 00:27:49,120
whole mission

732
00:27:52,950 --> 00:27:50,880
basically said he wanted as many knobs

733
00:27:54,549 --> 00:27:52,960
and dials on this thing as he could so

734
00:27:56,870 --> 00:27:54,559
we would have things to

735
00:27:59,590 --> 00:27:56,880
to twist and and change to see what we

736
00:28:00,710 --> 00:27:59,600
could change to to make it work

737
00:28:02,870 --> 00:28:00,720
so

738
00:28:04,389 --> 00:28:02,880

but we don't know you know nobody knows

739
00:28:05,350 --> 00:28:04,399
what you when you go to some new place

740
00:28:06,789 --> 00:28:05,360
you don't know what you're going to find

741
00:28:09,590 --> 00:28:06,799
there

742
00:28:10,950 --> 00:28:09,600
so it's it's and we're we're we're very

743
00:28:13,269 --> 00:28:10,960
worried about

744
00:28:15,029 --> 00:28:13,279
clogging something

745
00:28:17,510 --> 00:28:15,039
yeah phoenix it was amazing

746
00:28:20,310 --> 00:28:17,520
issue yeah and they you know better than

747
00:28:22,230 --> 00:28:20,320
i did i followed it closely but yeah i'm

748
00:28:24,470 --> 00:28:22,240
sure you were intimately involved in it

749
00:28:26,389 --> 00:28:24,480
they took the huge samples which i

750
00:28:29,750 --> 00:28:26,399
thought some chemists i thought they

751
00:28:31,350 --> 00:28:29,760
were too huge and too big yeah and i i i

752
00:28:33,190 --> 00:28:31,360
hope you're going to avoid that or what

753
00:28:34,630 --> 00:28:33,200
are you going to do to avoid taking

754
00:28:36,549 --> 00:28:34,640
giant samples that aren't going to go

755
00:28:38,389 --> 00:28:36,559
through the through that filter

756
00:28:40,149 --> 00:28:38,399
overly large samples yeah i thought they

757
00:28:41,909 --> 00:28:40,159
took overly large samples actually well

758
00:28:43,669 --> 00:28:41,919
i i took the cowardly route and figured

759
00:28:45,830 --> 00:28:43,679
it was the sas boss business whatever

760
00:28:47,669 --> 00:28:45,840
they gave me i could handle

761
00:28:50,070 --> 00:28:47,679
but the reality of it is

762
00:28:51,909 --> 00:28:50,080
uh everybody's worried about that and

763
00:28:53,990 --> 00:28:51,919

the first samples we take

764
00:28:55,590 --> 00:28:54,000
uh we've got an observation tray they

765
00:28:57,430 --> 00:28:55,600
can pick them up throw it on on the

766
00:28:59,350 --> 00:28:57,440
ground

767
00:29:01,190 --> 00:28:59,360
you know the southpaw system could could

768
00:29:04,070 --> 00:29:01,200
process some material and then pour it

769
00:29:06,950 --> 00:29:04,080
on this on this uh observation tray we

770
00:29:09,909 --> 00:29:06,960
can use the uh the hand lens instrument

771
00:29:11,830 --> 00:29:09,919
molly to to look at it uh

772
00:29:13,190 --> 00:29:11,840
you know many things we you know we

773
00:29:14,789 --> 00:29:13,200
really don't want to make the mistake of

774
00:29:18,389 --> 00:29:14,799
clogging something because it because

775
00:29:22,630 --> 00:29:19,430
that

776
00:29:24,389 --> 00:29:22,640
oh this one yeah

777
00:29:26,549 --> 00:29:24,399
yeah they they do the same thing you

778
00:29:28,630 --> 00:29:26,559
know the whole thing yeah let's go like

779
00:29:31,669 --> 00:29:28,640
that

780
00:29:34,230 --> 00:29:31,679
and uh i don't know if well

781
00:29:36,070 --> 00:29:34,240
the sample is going to be sieved through

782
00:29:38,549 --> 00:29:36,080
there but then what's left you can dump

783
00:29:40,230 --> 00:29:38,559
out yes how does that work

784
00:29:42,230 --> 00:29:40,240
uh i actually don't know i mean they

785
00:29:44,950 --> 00:29:42,240
have it's a it's a clamshell system i i

786
00:29:47,430 --> 00:29:44,960
haven't seen this the the chimera system

787
00:29:49,990 --> 00:29:47,440
actually uh dumped samples but they have

788
00:29:52,149 --> 00:29:50,000

the ability to scoop material sieve it

789
00:29:54,950 --> 00:29:52,159
and they can sieve it to two uh

790
00:29:57,909 --> 00:29:54,960
dimensions to one millimeter uh which

791
00:29:59,669 --> 00:29:57,919
the sam instrument can take and to 150

792
00:30:02,549 --> 00:29:59,679
microns which the sam instrument can

793
00:30:03,830 --> 00:30:02,559
take and and and i can take

794
00:30:05,990 --> 00:30:03,840
and that brings up another question

795
00:30:06,950 --> 00:30:06,000
sorry to ask so many questions

796
00:30:08,470 --> 00:30:06,960
um

797
00:30:10,870 --> 00:30:08,480
is this are you going to take some of

798
00:30:11,909 --> 00:30:10,880
the same samples for sam and chemin and

799
00:30:14,310 --> 00:30:11,919
analyze

800
00:30:16,389 --> 00:30:14,320
yeah in fact that's uh the the one thing

801
00:30:17,750 --> 00:30:16,399
i mean you know i talked about how

802
00:30:21,909 --> 00:30:17,760
mineralogy is going to tell you the

803
00:30:23,990 --> 00:30:21,919
environment well it it also tells you i

804
00:30:26,310 --> 00:30:24,000
mean there's there's no context for an

805
00:30:28,549 --> 00:30:26,320
organic measurement without knowing what

806
00:30:29,750 --> 00:30:28,559
it was in and so the the chemin

807
00:30:33,190 --> 00:30:29,760
instrument is going to provide the

808
00:30:35,510 --> 00:30:33,200
context for the sound measurement

809
00:30:38,230 --> 00:30:35,520
oh okay so and it's it's it's really

810
00:30:41,510 --> 00:30:38,240
critical that we get the same sample

811
00:30:44,549 --> 00:30:41,520
so you're actually going to um

812
00:30:45,269 --> 00:30:44,559
get the data back from chemin first

813
00:30:47,669 --> 00:30:45,279

uh

814
00:30:49,590 --> 00:30:47,679
that's to be decided no it's no i mean

815
00:30:51,990 --> 00:30:49,600
we you know it's going to take some

816
00:30:53,750 --> 00:30:52,000
pondering to figure out what we got but

817
00:30:54,870 --> 00:30:53,760
the plain fact is that kevin's going to

818
00:30:58,149 --> 00:30:54,880
take

819
00:31:00,310 --> 00:30:58,159
probably one night uh of analysis to to

820
00:31:01,110 --> 00:31:00,320
get a result and that's going to be sent

821
00:31:03,190 --> 00:31:01,120
down

822
00:31:05,990 --> 00:31:03,200
uh the sam instrument depending on what

823
00:31:09,110 --> 00:31:06,000
kind of analysis they do that could take

824
00:31:11,909 --> 00:31:09,120
one or two or maybe even three days so

825
00:31:13,350 --> 00:31:11,919
so we can't possibly do the analyses at

826
00:31:16,710 --> 00:31:13,360
the same time

827
00:31:18,310 --> 00:31:16,720
we'll have the same material and after

828
00:31:20,310 --> 00:31:18,320
that period of both things being

829
00:31:21,990 --> 00:31:20,320
analyzed then we have to sort it out

830
00:31:24,310 --> 00:31:22,000
what it meant was first you'll look at

831
00:31:28,710 --> 00:31:24,320
the sample by chemin get the data and

832
00:31:30,230 --> 00:31:28,720
after that then put it into sam um

833
00:31:31,430 --> 00:31:30,240
not at the same time because it wouldn't

834
00:31:32,630 --> 00:31:31,440
make any sense then you don't get the

835
00:31:34,630 --> 00:31:32,640
context

836
00:31:37,029 --> 00:31:34,640
certainly certainly that

837
00:31:40,870 --> 00:31:37,039
that will be done but at the same time

838
00:31:45,590 --> 00:31:43,269

i i think uh

839
00:31:47,909 --> 00:31:45,600
the you know unless it's very clear that

840
00:31:50,310 --> 00:31:47,919
this is not an interesting sample

841
00:31:52,070 --> 00:31:50,320
the the process of drilling and sieving

842
00:31:53,669 --> 00:31:52,080
and all that and and

843
00:31:55,269 --> 00:31:53,679
you know stopping at a rock doing

844
00:31:57,269 --> 00:31:55,279
everything else and saying okay this is

845
00:31:58,870 --> 00:31:57,279
important to drill drilling it having

846
00:32:01,509 --> 00:31:58,880
the material and sieving it

847
00:32:03,509 --> 00:32:01,519
that's a multi-soul thing and i think

848
00:32:05,430 --> 00:32:03,519
once we get to that point we're going to

849
00:32:08,310 --> 00:32:05,440
analyze it i think there was a lot of

850
00:32:10,070 --> 00:32:08,320
thought going into this is important

851
00:32:11,669 --> 00:32:10,080
and and so at that point it's probably

852
00:32:13,110 --> 00:32:11,679
going to be an automatic unless we think

853
00:32:14,789 --> 00:32:13,120
there's going to be some kind of

854
00:32:16,310 --> 00:32:14,799
clogging or jamming or a reason why we

855
00:32:18,149 --> 00:32:16,320
shouldn't do it

856
00:32:20,789 --> 00:32:18,159
so kramer from space flight magazine

857
00:32:22,549 --> 00:32:20,799
didn't i identify myself okay sorry okay

858
00:32:24,789 --> 00:32:22,559
yeah so let someone else ask a question

859
00:32:26,549 --> 00:32:24,799
okay no that was no i mean that's that's

860
00:32:28,549 --> 00:32:26,559
we're worried about this all the time

861
00:32:29,590 --> 00:32:28,559
you know

862
00:32:31,269 --> 00:32:29,600
uh

863
00:32:33,509 --> 00:32:31,279

okay should i i tell you what why don't

864
00:32:35,350 --> 00:32:33,519
i move on well okay i'll do the

865
00:32:36,950 --> 00:32:35,360
equivalent of of uh

866
00:32:38,789 --> 00:32:36,960
this is the great thing about being on

867
00:32:40,870 --> 00:32:38,799
earth

868
00:32:45,269 --> 00:32:40,880
i'll do the equivalent of of dumping a

869
00:32:49,269 --> 00:32:47,590
so if i first of all if i turn this

870
00:32:50,789 --> 00:32:49,279
upside down

871
00:32:54,630 --> 00:32:50,799
uh

872
00:32:54,640 --> 00:32:59,029
sure yeah yeah

873
00:33:03,430 --> 00:33:01,029
so these are these are two plastic

874
00:33:07,909 --> 00:33:03,440
windows and the pla and the plastic

875
00:33:09,269 --> 00:33:07,919
windows are 150 or 170 microns apart

876
00:33:11,269 --> 00:33:09,279
and

877
00:33:12,870 --> 00:33:11,279
the sample in this cell the sample feeds

878
00:33:14,789 --> 00:33:12,880
through that little hole there from up

879
00:33:17,110 --> 00:33:14,799
here from from right here i i just

880
00:33:18,549 --> 00:33:17,120
dumped it in right there

881
00:33:20,230 --> 00:33:18,559
and let me show you let me show you what

882
00:33:21,269 --> 00:33:20,240
it looks like well as long as we're here

883
00:33:26,789 --> 00:33:21,279
i'll show you what it looks like when

884
00:33:29,350 --> 00:33:28,389
and you can see that it's that it's

885
00:33:30,710 --> 00:33:29,360
moving

886
00:33:33,110 --> 00:33:30,720
oh yeah

887
00:33:35,269 --> 00:33:33,120
and we have the ability to

888
00:33:38,789 --> 00:33:35,279

we have the ability to

889
00:33:40,710 --> 00:33:38,799
do this really strongly or it in in all

890
00:33:48,310 --> 00:33:40,720
kinds of different ways

891
00:33:53,350 --> 00:33:51,029
and how long will this be going on

892
00:33:56,549 --> 00:33:53,360
this will be going on on on

893
00:33:58,789 --> 00:33:56,559
on mars as as long as 10 hours

894
00:34:00,470 --> 00:33:58,799
but but yeah i i think

895
00:34:02,149 --> 00:34:00,480
that's very a very conservative thing

896
00:34:03,750 --> 00:34:02,159
i'm thinking it would be

897
00:34:04,630 --> 00:34:03,760
we'll be able to do things in three four

898
00:34:06,070 --> 00:34:04,640
hours

899
00:34:08,230 --> 00:34:06,080
and that's called chaos mode we're

900
00:34:10,629 --> 00:34:08,240
worried about uh you see that when you

901
00:34:12,389 --> 00:34:10,639
when you just do this pulsing thing

902
00:34:13,190 --> 00:34:12,399
things start to segregate out just like

903
00:34:15,190 --> 00:34:13,200
uh

904
00:34:17,430 --> 00:34:15,200
you know if you have a can of mixed nuts

905
00:34:19,349 --> 00:34:17,440
the the big ones wind up at the top you

906
00:34:20,389 --> 00:34:19,359
know they sort themselves out by by

907
00:34:22,710 --> 00:34:20,399
jiggling

908
00:34:24,629 --> 00:34:22,720
and the chaos mode just really shakes it

909
00:34:27,190 --> 00:34:24,639
strongly and tries to homogenize

910
00:34:29,270 --> 00:34:27,200
everything again

911
00:34:32,710 --> 00:34:29,280
so okay now let me show you this this

912
00:34:34,869 --> 00:34:32,720
deal if it's upside down well

913
00:34:36,550 --> 00:34:34,879

not much is coming out right

914
00:34:41,270 --> 00:34:36,560
but watch what happens when i when i

915
00:34:47,030 --> 00:34:43,030
so that's why vibration is important

916
00:34:49,510 --> 00:34:47,909
and

917
00:34:50,869 --> 00:34:49,520
you know what i'll do this test i'm

918
00:34:52,710 --> 00:34:50,879
going to make okay i'm going to i'm

919
00:34:54,790 --> 00:34:52,720
going to grind up a clam shell

920
00:34:56,629 --> 00:34:54,800
and i didn't do anything i didn't try

921
00:34:58,310 --> 00:34:56,639
and clean this out i just turned it

922
00:35:00,790 --> 00:34:58,320
upside down and shook it

923
00:35:02,230 --> 00:35:00,800
so yeah so what i'm going to do is i'll

924
00:35:03,670 --> 00:35:02,240
uh i'll put the next sample in and

925
00:35:09,990 --> 00:35:03,680
analyze and we'll see how much quartz is

926
00:35:12,950 --> 00:35:11,030
uh

927
00:35:15,829 --> 00:35:12,960
it can get stuck if it's

928
00:35:17,990 --> 00:35:15,839
if it's if and we have uh my my

929
00:35:18,870 --> 00:35:18,000
colleague dave vandeman

930
00:35:23,109 --> 00:35:18,880
is

931
00:35:27,670 --> 00:35:23,119
i don't know what it's called but it's

932
00:35:34,390 --> 00:35:28,790
and they're

933
00:35:37,190 --> 00:35:34,400
literally stuff that we know is horrible

934
00:35:38,950 --> 00:35:37,200
like like ice chips mixed with dirt

935
00:35:41,750 --> 00:35:38,960
yeah yeah and that's one of the ones

936
00:35:44,950 --> 00:35:43,430
yeah

937
00:35:46,870 --> 00:35:44,960
and and

938
00:35:48,470 --> 00:35:46,880

we we we literally don't want to look at

939
00:35:50,790 --> 00:35:48,480
that we we

940
00:35:53,190 --> 00:35:50,800
i would suggest we can't look at that

941
00:35:55,430 --> 00:35:53,200
because with that i've done i mean i

942
00:35:57,030 --> 00:35:55,440
this actually will work with liquids

943
00:35:58,550 --> 00:35:57,040
well that's why i'm asking i've done

944
00:36:01,589 --> 00:35:58,560
i've done liquids

945
00:36:03,270 --> 00:36:01,599
and in fact this works with grease

946
00:36:05,750 --> 00:36:03,280
but but

947
00:36:07,430 --> 00:36:05,760
you have to clean it out afterwards

948
00:36:08,710 --> 00:36:07,440
you know and i don't want and i can i

949
00:36:10,790 --> 00:36:08,720
can use other

950
00:36:12,470 --> 00:36:10,800
cells but i can't use other funnels i

951
00:36:13,589 --> 00:36:12,480
only have one so

952
00:36:15,109 --> 00:36:13,599
we we

953
00:36:16,950 --> 00:36:15,119
you know we would do everything in our

954
00:36:19,589 --> 00:36:16,960
power not to get a sample like that

955
00:36:21,510 --> 00:36:19,599
inside our system

956
00:36:23,829 --> 00:36:21,520
so when you put something on your table

957
00:36:25,510 --> 00:36:23,839
your your observation table can you take

958
00:36:27,270 --> 00:36:25,520
that sample and use it again

959
00:36:29,030 --> 00:36:27,280
uh no okay because i was thinking it

960
00:36:29,990 --> 00:36:29,040
would just sublimate and then you

961
00:36:32,150 --> 00:36:30,000
wouldn't have to worry about the water

962
00:36:33,829 --> 00:36:32,160
anymore uh true one of the things we

963
00:36:35,430 --> 00:36:33,839

thought about i mean we thought you know

964
00:36:37,349 --> 00:36:35,440
we've really thought about this a lot

965
00:36:40,470 --> 00:36:37,359
one of the things we've thought about is

966
00:36:42,870 --> 00:36:40,480
so you you you drill and just throw

967
00:36:45,270 --> 00:36:42,880
everything on the on the ground and look

968
00:36:46,230 --> 00:36:45,280
or on the observation tray see what

969
00:36:48,310 --> 00:36:46,240
happens

970
00:36:49,990 --> 00:36:48,320
and if it's the kind of thing you want

971
00:36:52,470 --> 00:36:50,000
and you can sublimate the ice or if

972
00:36:54,150 --> 00:36:52,480
that's what it is then you can go back

973
00:36:56,390 --> 00:36:54,160
with the scoop and take some of the

974
00:36:57,829 --> 00:36:56,400
stuff that you either that was residual

975
00:37:00,069 --> 00:36:57,839
around the hole or that you dumped on

976
00:37:01,589 --> 00:37:00,079
the ground and scoop that up

977
00:37:03,670 --> 00:37:01,599
but uh

978
00:37:07,349 --> 00:37:03,680
you know we really really don't want to

979
00:37:08,870 --> 00:37:07,359
have a a one-off

980
00:37:09,910 --> 00:37:08,880
well you could call it a less than

981
00:37:11,510 --> 00:37:09,920
nominal

982
00:37:14,150 --> 00:37:11,520
collection

983
00:37:16,870 --> 00:37:14,160
we don't want that

984
00:37:18,150 --> 00:37:16,880
yeah okay let me uh so we're gonna do

985
00:37:19,990 --> 00:37:18,160
two things here i'm gonna i'm gonna

986
00:37:21,670 --> 00:37:20,000
analyze a clamshell

987
00:37:22,870 --> 00:37:21,680
and i i'm gonna pretend i don't know

988
00:37:24,710 --> 00:37:22,880

what it is

989
00:37:26,550 --> 00:37:24,720
and you saw i didn't really clean out

990
00:37:27,829 --> 00:37:26,560
the cell it's right here and there's

991
00:37:29,829 --> 00:37:27,839
still a little bit of quartz left in

992
00:37:31,589 --> 00:37:29,839
there now we we would actually dump and

993
00:37:33,430 --> 00:37:31,599
fill and dump and fill a couple of times

994
00:37:35,990 --> 00:37:33,440
to to clean out the contamination but

995
00:37:38,310 --> 00:37:36,000
let's just see how much in this in this

996
00:37:39,510 --> 00:37:38,320
analysis how much contamination left

997
00:37:40,630 --> 00:37:39,520
from quartz

998
00:37:42,630 --> 00:37:40,640
so

999
00:37:45,990 --> 00:37:42,640
now i'm gonna i guess i'll do it

1000
00:37:47,750 --> 00:37:46,000
this is why uh geologists are

1001
00:37:49,109 --> 00:37:47,760
are so well balanced

1002
00:37:50,550 --> 00:37:49,119
because we really can take out our

1003
00:37:51,910 --> 00:37:50,560
aggressions

1004
00:37:58,470 --> 00:37:51,920
on in

1005
00:37:58,480 --> 00:38:03,990
okay that ought to do it

1006
00:38:04,000 --> 00:38:11,030
okay now let's get rid of this

1007
00:38:18,230 --> 00:38:12,470
i'm assuming a lot of this is going to

1008
00:38:23,829 --> 00:38:21,670
okay um maybe not

1009
00:38:25,349 --> 00:38:23,839
okay so here's my here's my sieve and

1010
00:38:27,990 --> 00:38:25,359
you know maybe i can if you want to see

1011
00:38:29,670 --> 00:38:28,000
what the size is that's a good time

1012
00:38:31,910 --> 00:38:29,680
um

1013
00:38:33,670 --> 00:38:31,920

it's it's pretty fine grain but that's

1014
00:38:36,310 --> 00:38:33,680
actually very coarse for the kinds of

1015
00:38:41,430 --> 00:38:36,320
analyses that we do

1016
00:38:43,990 --> 00:38:42,550
so you find it better to have a lot of

1017
00:38:46,550 --> 00:38:44,000
small particles and a few large

1018
00:38:48,550 --> 00:38:46,560
particles obviously yeah

1019
00:38:50,470 --> 00:38:48,560
oh this is just stainless steel or brass

1020
00:38:51,589 --> 00:38:50,480
or something yeah

1021
00:38:53,510 --> 00:38:51,599
yeah

1022
00:38:55,190 --> 00:38:53,520
and i have some really expensive ones

1023
00:38:57,430 --> 00:38:55,200
that are nick pure nickel some of them

1024
00:38:59,349 --> 00:38:57,440
can contaminate actually but i guess

1025
00:39:01,750 --> 00:38:59,359
you've done those experiments to figure

1026
00:39:03,670 --> 00:39:01,760
out yeah could come through yeah

1027
00:39:05,510 --> 00:39:03,680
now uh

1028
00:39:07,829 --> 00:39:05,520
so let's see okay so now i'm going to

1029
00:39:14,950 --> 00:39:07,839
take this material that i smashed

1030
00:39:14,960 --> 00:39:22,470
and i'll twack it

1031
00:39:25,349 --> 00:39:23,910
okay and there's a lot of material in

1032
00:39:26,470 --> 00:39:25,359
there from from just doing that one

1033
00:39:28,230 --> 00:39:26,480
thing

1034
00:39:31,349 --> 00:39:28,240
so there's there's probably half a gram

1035
00:39:33,589 --> 00:39:31,359
which is way way more than i need

1036
00:39:39,430 --> 00:39:33,599
you need a few milligrams yeah

1037
00:39:45,430 --> 00:39:42,710
so that i did exactly the percussion

1038
00:39:47,430 --> 00:39:45,440

drill is it just pounds on things and

1039
00:39:49,589 --> 00:39:47,440
and then and then it it entrains the

1040
00:39:51,670 --> 00:39:49,599
material of the drill stem so basically

1041
00:39:52,790 --> 00:39:51,680
doing this is very similar to what's

1042
00:39:54,710 --> 00:39:52,800
going to happen

1043
00:39:56,630 --> 00:39:54,720
on msl

1044
00:39:59,109 --> 00:39:56,640
okay so now i'm going to take my

1045
00:40:07,270 --> 00:39:59,119
contaminated ones to use cell

1046
00:40:15,829 --> 00:40:09,510
and put a little bit of this

1047
00:40:27,670 --> 00:40:21,750
okay

1048
00:40:29,030 --> 00:40:27,680
and i'll put it in here

1049
00:40:30,790 --> 00:40:29,040
and i guess i still have the other

1050
00:40:32,790 --> 00:40:30,800
analysis going so i'm just going to stop

1051
00:40:38,630 --> 00:40:32,800
it

1052
00:40:38,640 --> 00:40:41,829
start another one

1053
00:40:49,510 --> 00:40:44,630
i'm going to call this one

1054
00:40:56,870 --> 00:40:50,310
okay

1055
00:40:58,069 --> 00:40:56,880
and tell it to go

1056
00:41:00,150 --> 00:40:58,079
and

1057
00:41:06,309 --> 00:41:00,160
now let me get it over to where we can

1058
00:41:11,109 --> 00:41:08,710
okay seashell acquiring

1059
00:41:12,470 --> 00:41:11,119
and uh

1060
00:41:13,829 --> 00:41:12,480
see what happens

1061
00:41:15,990 --> 00:41:13,839
now you're going to see something

1062
00:41:18,390 --> 00:41:16,000
interesting here um

1063
00:41:21,750 --> 00:41:18,400

the the uh the pattern that shows on

1064
00:41:23,990 --> 00:41:21,760
here is the raw pattern what we call the

1065
00:41:26,390 --> 00:41:24,000
film pattern just a raw pattern it's not

1066
00:41:27,829 --> 00:41:26,400
it's not segregated by energies

1067
00:41:29,589 --> 00:41:27,839
and

1068
00:41:31,510 --> 00:41:29,599
this happens to have a lot of calcium in

1069
00:41:33,109 --> 00:41:31,520
it right it's a calcium carbonate and

1070
00:41:35,589 --> 00:41:33,119
calcium carbonate

1071
00:41:38,069 --> 00:41:35,599
is strongly fluoresced by cobalt cobalt

1072
00:41:39,910 --> 00:41:38,079
which means it's it it will form a a

1073
00:41:41,990 --> 00:41:39,920
higher background than you saw on the

1074
00:41:43,829 --> 00:41:42,000
quartz thing you'll should see a like a

1075
00:41:45,750 --> 00:41:43,839
a mound

1076
00:41:47,270 --> 00:41:45,760
oh there we go okay so

1077
00:41:49,270 --> 00:41:47,280
obviously it's not quite as strong a

1078
00:41:58,150 --> 00:41:49,280
defractor as quartz but let's let's wait

1079
00:42:03,270 --> 00:42:00,470
okay and let's go over to

1080
00:42:04,630 --> 00:42:03,280
x-ray fluorescence and

1081
00:42:11,510 --> 00:42:04,640
i should be able to show you a lot of

1082
00:42:17,589 --> 00:42:15,589
okay so this is log scale so

1083
00:42:19,349 --> 00:42:17,599
this this peak of calcium is actually a

1084
00:42:21,750 --> 00:42:19,359
thousand counts and the background is

1085
00:42:23,430 --> 00:42:21,760
down here around three so that's a lot

1086
00:42:25,589 --> 00:42:23,440
so what you're seeing here is you're

1087
00:42:27,750 --> 00:42:25,599
seeing this is the cobalt peak this is

1088
00:42:29,430 --> 00:42:27,760

the peak from the x-ray tube there's a

1089
00:42:31,750 --> 00:42:29,440
little bit of iron here that i think is

1090
00:42:34,550 --> 00:42:31,760
contamination from the camera it's a

1091
00:42:37,910 --> 00:42:34,560
commercial camera and this is cobalt

1092
00:42:39,589 --> 00:42:37,920
or rather calcium k alpha calcium k beta

1093
00:42:41,430 --> 00:42:39,599
now this this particular instrument

1094
00:42:43,349 --> 00:42:41,440
isn't very good at x-ray fluorescence

1095
00:42:45,990 --> 00:42:43,359
because we have a big thick brilliant

1096
00:42:47,109 --> 00:42:46,000
window on the camera because with this

1097
00:42:49,270 --> 00:42:47,119
is

1098
00:42:52,470 --> 00:42:49,280
used all over the world and if we break

1099
00:42:53,829 --> 00:42:52,480
vacuum or lose the the window uh then we

1100
00:42:56,790 --> 00:42:53,839
then we lost it

1101
00:42:59,270 --> 00:42:56,800
yeah so so that's uh there we go there's

1102
00:43:01,670 --> 00:42:59,280
there's calcium we don't see much below

1103
00:43:03,270 --> 00:43:01,680
calcium with this particular instrument

1104
00:43:05,109 --> 00:43:03,280
aside from that you see a little bit of

1105
00:43:07,190 --> 00:43:05,119
iron and this is the cobalt peak from

1106
00:43:11,990 --> 00:43:07,200
the x-ray tube

1107
00:43:15,510 --> 00:43:13,430
okay so you can see there's a much

1108
00:43:18,550 --> 00:43:15,520
higher background here this high

1109
00:43:20,870 --> 00:43:18,560
background is is actually that calcium

1110
00:43:23,030 --> 00:43:20,880
being detected and you'll see it if i

1111
00:43:24,950 --> 00:43:23,040
showed you the the actual image of the

1112
00:43:27,430 --> 00:43:24,960
chip you would see there's a lot of

1113
00:43:30,550 --> 00:43:27,440

counts that aren't on diffraction rings

1114
00:43:32,230 --> 00:43:30,560
and those are calcium x-rays

1115
00:43:35,349 --> 00:43:32,240
so

1116
00:43:38,069 --> 00:43:35,359
uh no quartz quartz is fairly low energy

1117
00:43:41,190 --> 00:43:38,079
with this with the uh msl instrument we

1118
00:43:43,030 --> 00:43:41,200
we could with this one we can't

1119
00:43:44,630 --> 00:43:43,040
okay i'll just let this go a couple more

1120
00:43:45,829 --> 00:43:44,640
times because there's a lot of noise

1121
00:43:47,510 --> 00:43:45,839
here

1122
00:43:49,190 --> 00:43:47,520
and

1123
00:43:50,630 --> 00:43:49,200
okay quartz is coming in right there so

1124
00:44:00,870 --> 00:43:50,640
we'll see a little quartz this is

1125
00:44:03,589 --> 00:44:02,230
oh

1126
00:44:07,030 --> 00:44:03,599
that's right

1127
00:44:08,309 --> 00:44:07,040
little bit dump it fill it again shake

1128
00:44:10,630 --> 00:44:08,319
it dump it and then the third time you

1129
00:44:12,309 --> 00:44:10,640
do the analysis and that's very

1130
00:44:14,150 --> 00:44:12,319
effective plenty of sample to do that

1131
00:44:15,510 --> 00:44:14,160
with yeah it's very effective

1132
00:44:18,390 --> 00:44:15,520
okay i'm going to stop right here and

1133
00:44:20,470 --> 00:44:18,400
i'll download this pattern

1134
00:44:22,230 --> 00:44:20,480
and uh we'll analyze it and something

1135
00:44:25,589 --> 00:44:22,240
you're going to see you're going to see

1136
00:44:28,230 --> 00:44:25,599
that the background of the of the

1137
00:44:30,150 --> 00:44:28,240
pattern that i that i download

1138
00:44:31,589 --> 00:44:30,160

doesn't have as high a background and

1139
00:44:34,069 --> 00:44:31,599
the reason is

1140
00:44:36,390 --> 00:44:34,079
this is called uh what we call film mode

1141
00:44:38,230 --> 00:44:36,400
it's just showing you every every photon

1142
00:44:39,910 --> 00:44:38,240
that strikes the ccd

1143
00:44:41,910 --> 00:44:39,920
when i download a pattern i'm going to

1144
00:44:45,270 --> 00:44:41,920
download something that's filtered for

1145
00:44:47,670 --> 00:44:45,280
cobalt k alpha so so it shows you

1146
00:44:49,270 --> 00:44:47,680
something that that is only has the

1147
00:44:51,510 --> 00:44:49,280
energies of cobalt k-alpha which will

1148
00:44:53,510 --> 00:44:51,520
get rid of that calcium fluorescence

1149
00:44:57,829 --> 00:44:53,520
so let me go to

1150
00:45:04,390 --> 00:45:00,309
and i want to go to processed

1151
00:45:07,190 --> 00:45:04,400
and i want this k alpha mdi

1152
00:45:07,200 --> 00:45:13,990
and open

1153
00:45:19,589 --> 00:45:16,309
okay so you can see this is one of the

1154
00:45:21,589 --> 00:45:19,599
advantages of of being able to filter to

1155
00:45:23,670 --> 00:45:21,599
energy filter an x-ray pattern you get

1156
00:45:25,190 --> 00:45:23,680
rid of all that fluorescence

1157
00:45:27,589 --> 00:45:25,200
so this this still

1158
00:45:29,430 --> 00:45:27,599
let's see i don't know how many uh

1159
00:45:31,430 --> 00:45:29,440
how many 10 second collections we did

1160
00:45:33,430 --> 00:45:31,440
but that's this this would be way early

1161
00:45:36,069 --> 00:45:33,440
for me to try and say anything but i'm

1162
00:45:38,390 --> 00:45:36,079
going to do it anyway

1163
00:45:42,230 --> 00:45:38,400

okay uh

1164
00:45:46,150 --> 00:45:44,829
and with this much uh

1165
00:45:48,710 --> 00:45:46,160
bad uh

1166
00:45:49,750 --> 00:45:48,720
this much chop down here the computer

1167
00:45:52,230 --> 00:45:49,760
always

1168
00:45:56,710 --> 00:45:52,240
finds weird stuff so this is this is why

1169
00:45:58,670 --> 00:45:56,720
it's fortunate to still have a job

1170
00:46:01,109 --> 00:45:58,680
okay so there's uh

1171
00:46:05,030 --> 00:46:01,119
aragonite and that seems to fit pretty

1172
00:46:06,550 --> 00:46:05,040
well and it didn't find quartz but

1173
00:46:09,430 --> 00:46:06,560
let's see here

1174
00:46:13,270 --> 00:46:09,440
let me type in quartz and we'll see

1175
00:46:13,280 --> 00:46:16,630
um

1176
00:46:28,550 --> 00:46:18,390
okay

1177
00:46:32,870 --> 00:46:30,950
so i'll put quartz over here i'll get

1178
00:46:34,309 --> 00:46:32,880
rid of everything else and now i'm going

1179
00:46:36,790 --> 00:46:34,319
to analyze for

1180
00:46:38,030 --> 00:46:36,800
those two materials

1181
00:46:45,030 --> 00:46:38,040
and let's

1182
00:46:47,510 --> 00:46:45,910
okay

1183
00:46:57,190 --> 00:46:47,520
two phases

1184
00:47:01,990 --> 00:46:59,270
okay so here's

1185
00:47:02,950 --> 00:47:02,000
here's what it found uh let me let me

1186
00:47:04,309 --> 00:47:02,960
change

1187
00:47:05,750 --> 00:47:04,319
well it's kind of hard to work upside

1188
00:47:08,069 --> 00:47:05,760

down let's see

1189
00:47:11,990 --> 00:47:08,079
i think this is it no

1190
00:47:14,790 --> 00:47:13,430
okay

1191
00:47:16,710 --> 00:47:14,800
and

1192
00:47:18,069 --> 00:47:16,720
this is it maybe

1193
00:47:21,990 --> 00:47:18,079
this is it

1194
00:47:24,470 --> 00:47:22,829
this is

1195
00:47:28,550 --> 00:47:24,480
it

1196
00:47:28,560 --> 00:47:31,190
there we go

1197
00:47:34,230 --> 00:47:33,109
okay so here's the residual that's not a

1198
00:47:35,829 --> 00:47:34,240
bad fit

1199
00:47:41,270 --> 00:47:35,839
and let's see

1200
00:47:41,280 --> 00:47:45,030
well i completely messed this up let me

1201
00:47:45,040 --> 00:47:49,270
see if i can find this other

1202
00:47:49,280 --> 00:47:53,510
jade

1203
00:47:53,520 --> 00:48:01,109
let's try it again

1204
00:48:04,309 --> 00:48:02,870
well now i can't find my now i can't

1205
00:48:08,230 --> 00:48:04,319
find anything looks like i dragged it

1206
00:48:11,430 --> 00:48:08,240
off sk off the off the thing here

1207
00:48:13,270 --> 00:48:11,440
oh okay sorry okay okay let me do uh

1208
00:48:14,790 --> 00:48:13,280
oh you're right let me do one more thing

1209
00:48:16,069 --> 00:48:14,800
i want to i want to show you something

1210
00:48:18,230 --> 00:48:16,079
really cool

1211
00:48:20,950 --> 00:48:18,240
uh

1212
00:48:23,670 --> 00:48:20,960
okay well i've shown you a bunch of

1213
00:48:27,670 --> 00:48:26,150

and once again i'm not going to spend

1214
00:48:29,270 --> 00:48:27,680
too much time there will be some

1215
00:48:30,470 --> 00:48:29,280
contamination with the analysis because

1216
00:48:31,750 --> 00:48:30,480
i want to i don't want to waste time

1217
00:48:34,710 --> 00:48:31,760
doing anything

1218
00:48:36,230 --> 00:48:34,720
uh well it also i wanted to show you

1219
00:48:39,430 --> 00:48:36,240
about spin-offs and commercial

1220
00:48:41,589 --> 00:48:39,440
applications and and ways this is useful

1221
00:48:43,990 --> 00:48:41,599
uh it turns out that almost all

1222
00:48:45,910 --> 00:48:44,000
pharmaceuticals are crystalline and this

1223
00:48:47,190 --> 00:48:45,920
is a bare aspirin

1224
00:48:49,910 --> 00:48:47,200
and you can do

1225
00:48:51,750 --> 00:48:49,920
analysis of drugs with this

1226
00:48:53,430 --> 00:48:51,760
so i'm gonna

1227
00:49:06,069 --> 00:48:53,440
analyze this bare aspirin which i don't

1228
00:49:13,430 --> 00:49:07,589
okay so let's see i need to dump this

1229
00:49:13,440 --> 00:49:25,430
this shouldn't take too long

1230
00:49:25,440 --> 00:49:31,430
yes

1231
00:49:35,990 --> 00:49:33,670
uh they will drill uh

1232
00:49:38,150 --> 00:49:36,000
as much as well but tens of grams but

1233
00:49:42,230 --> 00:49:38,160
maybe 10 grams of material so it's way

1234
00:49:46,630 --> 00:49:44,309
okay there's a little bit of powdered uh

1235
00:49:49,109 --> 00:49:46,640
we don't know what it is

1236
00:49:50,549 --> 00:49:49,119
and uh

1237
00:49:57,270 --> 00:49:50,559
and it's definitely gonna be mixed well

1238
00:50:03,109 --> 00:49:58,870

well it's just going to be contaminated

1239
00:50:03,119 --> 00:50:06,230
and

1240
00:50:11,750 --> 00:50:09,109
i'm sorry

1241
00:50:19,349 --> 00:50:11,760
oh yeah yeah

1242
00:50:23,190 --> 00:50:20,870
wants to see if he's got good drugs with

1243
00:50:27,510 --> 00:50:26,230
yeah yeah

1244
00:50:28,870 --> 00:50:27,520
okay let's

1245
00:50:31,990 --> 00:50:28,880
now i'm gonna

1246
00:50:32,000 --> 00:50:38,870
and

1247
00:50:38,880 --> 00:50:42,710
okay

1248
00:50:42,720 --> 00:50:51,190
i'll stop this one

1249
00:50:56,390 --> 00:50:54,549
and well i might as well talk about the

1250
00:50:58,390 --> 00:50:56,400
i knew that i knew that i could do this

1251
00:50:59,829 --> 00:50:58,400
with my instrument and so i actually

1252
00:51:01,829 --> 00:50:59,839
contacted

1253
00:51:04,870 --> 00:51:01,839
i got really interested in

1254
00:51:07,030 --> 00:51:04,880
malaria drug screening for for

1255
00:51:10,390 --> 00:51:07,040
third world countries and it turns out

1256
00:51:12,390 --> 00:51:10,400
that between 50 and 90 of the drugs in

1257
00:51:14,470 --> 00:51:12,400
southeast asia and africa are are

1258
00:51:15,430 --> 00:51:14,480
counterfeit and especially malaria drugs

1259
00:51:17,190 --> 00:51:15,440
and so

1260
00:51:19,829 --> 00:51:17,200
i've been analyzing i've been working

1261
00:51:21,990 --> 00:51:19,839
with the republic of vietnam to

1262
00:51:23,829 --> 00:51:22,000
get a database and and try and get this

1263
00:51:25,829 --> 00:51:23,839

into their system for

1264
00:51:27,829 --> 00:51:25,839
identifying counterfeit drugs and they

1265
00:51:29,109 --> 00:51:27,839
they seem to be pretty interested in

1266
00:51:30,470 --> 00:51:29,119
doing it

1267
00:51:34,950 --> 00:51:30,480
they've already sent me like two or

1268
00:51:38,790 --> 00:51:36,390
and what i really want to do is i want

1269
00:51:40,950 --> 00:51:38,800
to make this it is obviously very simple

1270
00:51:43,349 --> 00:51:40,960
to operate and we want to make it real

1271
00:51:45,109 --> 00:51:43,359
turn key just like you would for a you

1272
00:51:48,950 --> 00:51:45,119
know like a bomb sniffer out at an

1273
00:52:01,190 --> 00:51:55,990
okay let's see

1274
00:52:06,150 --> 00:52:04,710
so this might take uh

1275
00:52:07,349 --> 00:52:06,160
why don't i end let's let's let's just

1276
00:52:08,950 --> 00:52:07,359
accrue for a little bit and i'll just

1277
00:52:11,349 --> 00:52:08,960
answer questions for you

1278
00:52:13,990 --> 00:52:11,359
if we're available is that on the rover

1279
00:52:16,710 --> 00:52:14,000
or is this data that's downloaded

1280
00:52:19,430 --> 00:52:16,720
it's uh what what happens is we we had a

1281
00:52:21,109 --> 00:52:19,440
lot of questions about about that and it

1282
00:52:24,870 --> 00:52:21,119
turned out the the best way to do it the

1283
00:52:26,390 --> 00:52:24,880
safest way is we take the raw data the

1284
00:52:28,630 --> 00:52:26,400
this the chemin instrument collects all

1285
00:52:31,190 --> 00:52:28,640
the raw data all those individual frames

1286
00:52:34,069 --> 00:52:31,200
and the rover compute element then does

1287
00:52:35,990 --> 00:52:34,079
an algorithm to make this this summed up

1288
00:52:40,309 --> 00:52:36,000

2d image

1289
00:52:41,990 --> 00:52:40,319
ground and then we make the 1d scan and

1290
00:52:43,030 --> 00:52:42,000
do the analysis there

1291
00:52:45,670 --> 00:52:43,040
so

1292
00:52:47,990 --> 00:52:45,680
it's it could be very turnkey

1293
00:52:50,470 --> 00:52:48,000
but we we simply don't know what is

1294
00:52:52,150 --> 00:52:50,480
what's going to happen up there and you

1295
00:52:53,510 --> 00:52:52,160
we want to have as much human in the

1296
00:52:55,190 --> 00:52:53,520
loop as we can

1297
00:52:56,950 --> 00:52:55,200
uh without

1298
00:52:58,710 --> 00:52:56,960
causing problems

1299
00:53:01,589 --> 00:52:58,720
when you say 2d image you're talking

1300
00:53:03,910 --> 00:53:01,599
about the one with the cir circles yes

1301
00:53:07,190 --> 00:53:03,920
the the circles that that that those

1302
00:53:09,829 --> 00:53:07,200
diffraction circles will be sent down uh

1303
00:53:12,470 --> 00:53:09,839
about 10 of those per analysis so about

1304
00:53:14,470 --> 00:53:12,480
some sums of one hour each 10 of those

1305
00:53:16,950 --> 00:53:14,480
will come down and then we'll we'll do

1306
00:53:18,710 --> 00:53:16,960
the 1d conversion and do the analysis on

1307
00:53:20,309 --> 00:53:18,720
the ground

1308
00:53:21,430 --> 00:53:20,319
that just saves a lot of wear and tear

1309
00:53:23,270 --> 00:53:21,440
we you know we don't want to make the

1310
00:53:25,190 --> 00:53:23,280
spacecraft do more than

1311
00:53:26,630 --> 00:53:25,200
we need to

1312
00:53:28,390 --> 00:53:26,640
okay

1313
00:53:30,069 --> 00:53:28,400

so let's uh

1314
00:53:32,390 --> 00:53:30,079
so that's uh there's the pattern that

1315
00:53:34,470 --> 00:53:32,400
looks like a pretty good pattern

1316
00:53:37,190 --> 00:53:34,480
let's see if we can figure out

1317
00:53:40,710 --> 00:53:37,200
now i hope this works

1318
00:53:44,870 --> 00:53:40,720
okay so now i'm going to go to

1319
00:53:48,549 --> 00:53:46,470
processed

1320
00:53:49,990 --> 00:53:48,559
i'm going to do a film because i don't

1321
00:53:51,349 --> 00:53:50,000
really have fluorescence here that'll

1322
00:53:54,549 --> 00:53:51,359
give me more data

1323
00:53:54,559 --> 00:54:00,470
open

1324
00:54:03,430 --> 00:54:02,150
okay there's the pattern

1325
00:54:05,430 --> 00:54:03,440
and i want to put i'm going to put a

1326
00:54:07,670 --> 00:54:05,440
background on here to get rid of this

1327
00:54:12,150 --> 00:54:07,680
this background

1328
00:54:17,030 --> 00:54:14,309
okay that looks pretty good

1329
00:54:20,470 --> 00:54:17,040
identify search match and this time i'm

1330
00:54:23,109 --> 00:54:20,480
going with this organic data set this is

1331
00:54:25,030 --> 00:54:23,119
450 000 crystalline organic compounds

1332
00:54:28,069 --> 00:54:25,040
it's going to it's going to search 450

1333
00:54:29,030 --> 00:54:28,079
000 possible compounds

1334
00:54:30,549 --> 00:54:29,040
and

1335
00:54:33,589 --> 00:54:30,559
one of the one of the problems with the

1336
00:54:35,190 --> 00:54:33,599
database that i use is it's got

1337
00:54:37,430 --> 00:54:35,200
everything but the kitchen sink in there

1338
00:54:39,589 --> 00:54:37,440

and the thing is that pharmaceuticals

1339
00:54:43,349 --> 00:54:39,599
are like minerals there's only a few

1340
00:54:45,109 --> 00:54:43,359
thousands of them instead of 450 000 so

1341
00:54:46,069 --> 00:54:45,119
we really need to make a database that

1342
00:54:47,670 --> 00:54:46,079
actually

1343
00:54:49,430 --> 00:54:47,680
suits what we're doing

1344
00:54:51,430 --> 00:54:49,440
you know why look through the woods when

1345
00:54:53,510 --> 00:54:51,440
you know it's in the it's just in the

1346
00:54:55,829 --> 00:54:53,520
shrubs

1347
00:55:01,270 --> 00:54:55,839
okay

1348
00:55:04,230 --> 00:55:01,280
benzoic acid

1349
00:55:07,030 --> 00:55:04,240
that's uh that's aspirin

1350
00:55:09,670 --> 00:55:07,040
so there's an there's a there's an

1351
00:55:11,670 --> 00:55:09,680
analysis of an aspirin from my uh from

1352
00:55:13,430 --> 00:55:11,680
my aspirin bottle in the hotel which i

1353
00:55:14,710 --> 00:55:13,440
used this morning

1354
00:55:15,990 --> 00:55:14,720
uh

1355
00:55:18,309 --> 00:55:16,000
yeah

1356
00:55:21,270 --> 00:55:18,319
so okay

1357
00:55:23,030 --> 00:55:21,280
uh

1358
00:55:24,230 --> 00:55:23,040
maybe it's can we go to the slides just

1359
00:55:27,829 --> 00:55:24,240
for the last couple of slides and i

1360
00:55:31,510 --> 00:55:29,750
okay this was the next slide this is

1361
00:55:34,390 --> 00:55:31,520
what i read when i discovered this thing

1362
00:55:35,829 --> 00:55:34,400
about uh malaria pills and i this was in

1363
00:55:37,670 --> 00:55:35,839

the smithsonian magazine a couple of

1364
00:55:40,150 --> 00:55:37,680
years ago and

1365
00:55:41,990 --> 00:55:40,160
i i contacted the scientists that they

1366
00:55:43,510 --> 00:55:42,000
that they described in there and i and i

1367
00:55:46,150 --> 00:55:43,520
worked with them for the last couple of

1368
00:55:47,109 --> 00:55:46,160
years and uh so that's how i kind of got

1369
00:55:48,549 --> 00:55:47,119
into it

1370
00:55:52,390 --> 00:55:48,559
and

1371
00:55:54,789 --> 00:55:52,400
actually

1372
00:55:57,109 --> 00:55:54,799
wheat starch just normal wheat starch

1373
00:56:01,109 --> 00:55:57,119
and that's what they use as a binder for

1374
00:56:03,510 --> 00:56:01,119
the malaria pills next line

1375
00:56:05,589 --> 00:56:03,520
this is uh called uh metaplantex it's

1376
00:56:07,270 --> 00:56:05,599
one of the one of the uh and the thing

1377
00:56:09,190 --> 00:56:07,280
about malaria drugs is there's only one

1378
00:56:10,230 --> 00:56:09,200
miracle drug left and if it's if it's

1379
00:56:11,190 --> 00:56:10,240
abused

1380
00:56:12,789 --> 00:56:11,200
then

1381
00:56:14,069 --> 00:56:12,799
there will be resistance to it and we

1382
00:56:15,990 --> 00:56:14,079
won't have it that's why it's so

1383
00:56:17,910 --> 00:56:16,000
important so this shows you a

1384
00:56:19,349 --> 00:56:17,920
quantitative analysis of this

1385
00:56:21,270 --> 00:56:19,359
metaplantics

1386
00:56:23,190 --> 00:56:21,280
pill which was supposed to have 17

1387
00:56:26,390 --> 00:56:23,200
percent of artesanate which is the

1388
00:56:29,030 --> 00:56:26,400

actual active ingredient and i wound up

1389
00:56:35,270 --> 00:56:32,150
uh 15.5 so that's not too bad and it

1390
00:56:36,950 --> 00:56:35,280
basically suggests this is a good pill

1391
00:56:41,349 --> 00:56:36,960
um

1392
00:56:48,150 --> 00:56:42,829
maybe that's the last

1393
00:56:53,349 --> 00:56:48,160
okay okay good okay well so that's uh

1394
00:56:57,109 --> 00:56:54,950
and

1395
00:56:59,589 --> 00:56:57,119
oh yeah thanks

1396
00:57:01,349 --> 00:56:59,599
us where it's the rover if there's a

1397
00:57:03,589 --> 00:57:01,359
diagram maybe on that on that on the

1398
00:57:05,829 --> 00:57:03,599
booklet there where is the instrument

1399
00:57:07,910 --> 00:57:05,839
okay it's it's inside the box so where

1400
00:57:08,549 --> 00:57:07,920
where inside the box uh if you look at

1401
00:57:10,230 --> 00:57:08,559
it

1402
00:57:12,150 --> 00:57:10,240
or the back

1403
00:57:15,430 --> 00:57:12,160
and if you look if you look at the top

1404
00:57:17,910 --> 00:57:15,440
front deck there are there there are are

1405
00:57:20,150 --> 00:57:17,920
three covers for funnels

1406
00:57:22,069 --> 00:57:20,160
now there's there's uh on one side there

1407
00:57:24,950 --> 00:57:22,079
are two funnels that's sam and the two

1408
00:57:26,950 --> 00:57:24,960
funnels are the oh yes and and then the

1409
00:57:29,670 --> 00:57:26,960
one funnel and and actually in in the in

1410
00:57:31,750 --> 00:57:29,680
the msl uh

1411
00:57:33,910 --> 00:57:31,760
in the msl movie they show what that

1412
00:57:36,069 --> 00:57:33,920
they show you know they the thing goes

1413
00:57:38,069 --> 00:57:36,079

around and drills a rock and analyzes

1414
00:57:39,190 --> 00:57:38,079
something that's the chemin funnel and

1415
00:57:40,870 --> 00:57:39,200
that's the kind of instrument they're

1416
00:57:44,549 --> 00:57:40,880
showing

1417
00:57:46,390 --> 00:57:44,559
so he's going to take the sample

1418
00:57:47,990 --> 00:57:46,400
collected by the drill and dump it in

1419
00:57:50,390 --> 00:57:48,000
there yes

1420
00:57:53,030 --> 00:57:50,400
and it is how wide

1421
00:57:56,390 --> 00:57:53,040
the funnel the funnel is about

1422
00:57:58,630 --> 00:57:56,400
yay big and it has it and

1423
00:57:59,829 --> 00:57:58,640
it has about a three millimeter diameter

1424
00:58:01,670 --> 00:57:59,839
uh

1425
00:58:03,990 --> 00:58:01,680
um

1426
00:58:05,910 --> 00:58:04,000
portion that goes down to where the the

1427
00:58:07,349 --> 00:58:05,920
it drops into the cell okay three

1428
00:58:08,950 --> 00:58:07,359
millimeters

1429
00:58:11,430 --> 00:58:08,960
right yeah i'm thinking of that tiny

1430
00:58:14,710 --> 00:58:11,440
model and that's this that's um yeah

1431
00:58:17,109 --> 00:58:14,720
actually very misleading yeah yes so the

1432
00:58:18,950 --> 00:58:17,119
the the actual mechanical part the drill

1433
00:58:20,230 --> 00:58:18,960
bit you you're taking three of them to

1434
00:58:21,589 --> 00:58:20,240
mars

1435
00:58:23,910 --> 00:58:21,599
what's you expect i mean how many

1436
00:58:26,069 --> 00:58:23,920
samples can you drill do you expect to

1437
00:58:28,150 --> 00:58:26,079
be able to drill good question there's

1438
00:58:29,990 --> 00:58:28,160

yeah they have they're able to i think

1439
00:58:31,670 --> 00:58:30,000
the i i don't think they expect they're

1440
00:58:33,109 --> 00:58:31,680
going to wear down a drill maybe they

1441
00:58:34,870 --> 00:58:33,119
maybe they will but

1442
00:58:36,549 --> 00:58:34,880
a lot of it was just so that if a drill

1443
00:58:38,309 --> 00:58:36,559
gets stuck in a rock they're not they're

1444
00:58:43,030 --> 00:58:38,319
not anchored there for the rest of their

1445
00:58:44,870 --> 00:58:43,040
lives you know so uh but they're uh

1446
00:58:48,710 --> 00:58:44,880
they're they're certainly using them as

1447
00:58:51,510 --> 00:58:48,720
as consumables so uh

1448
00:58:53,990 --> 00:58:51,520
the the real question is on gail you

1449
00:58:56,150 --> 00:58:54,000
know we we're we've got a 20 20 uh

1450
00:58:58,230 --> 00:58:56,160
kilometer ellipse and

1451
00:59:00,470 --> 00:58:58,240
we're going to be doing a lot of driving

1452
00:59:02,789 --> 00:59:00,480
to get to the clay regions which are at

1453
00:59:04,150 --> 00:59:02,799
the edge and so they're i don't know

1454
00:59:05,670 --> 00:59:04,160
that there there will at least be

1455
00:59:07,030 --> 00:59:05,680
heightened discussions i wouldn't call

1456
00:59:09,109 --> 00:59:07,040
them arguments about what we're going to

1457
00:59:10,710 --> 00:59:09,119
do people are going to want to analyze

1458
00:59:12,549 --> 00:59:10,720
every rock they see people are going to

1459
00:59:14,630 --> 00:59:12,559
want to just head for the hills

1460
00:59:18,069 --> 00:59:14,640
and the real answer is

1461
00:59:21,349 --> 00:59:18,079
we're not going to be drill limited or

1462
00:59:23,829 --> 00:59:21,359
sample cell limited in sam or chemin

1463
00:59:25,589 --> 00:59:23,839

we won't be resource limited for any of

1464
00:59:27,109 --> 00:59:25,599
our stuff

1465
00:59:29,270 --> 00:59:27,119
it's really going to be

1466
00:59:31,109 --> 00:59:29,280
there's going to be a lot of driving

1467
00:59:32,789 --> 00:59:31,119
to get to some of the really good spots

1468
00:59:34,710 --> 00:59:32,799
and so uh

1469
00:59:37,829 --> 00:59:34,720
we don't expect to hit

1470
00:59:40,390 --> 00:59:37,839
75 samples or which was the original

1471
00:59:42,549 --> 00:59:40,400
uh requirement for this instrument

1472
00:59:44,829 --> 00:59:42,559
but we can we could analyze 75 samples

1473
00:59:47,349 --> 00:59:44,839
and i think sam is in a similar

1474
00:59:49,349 --> 00:59:47,359
situation so i don't think there's any

1475
00:59:51,190 --> 00:59:49,359
consumable related

1476
00:59:52,630 --> 00:59:51,200
reason why we're not going to be able to

1477
00:59:54,069 --> 00:59:52,640
analyze what we want to analyze it's

1478
00:59:55,349 --> 00:59:54,079
really just going to be

1479
00:59:58,710 --> 00:59:55,359
drive versus

1480
01:00:00,950 --> 00:59:58,720
you know

1481
01:00:02,470 --> 01:00:00,960
when you say 75 samples it sounds like

1482
01:00:05,589 --> 01:00:02,480
so few

1483
01:00:08,230 --> 01:00:05,599
i mean are you hoping to get

1484
01:00:10,789 --> 01:00:08,240
more than that no i it's that's actually

1485
01:00:13,430 --> 01:00:10,799
quite quite a few and and the the fact

1486
01:00:15,190 --> 01:00:13,440
is i mean i i was

1487
01:00:16,710 --> 01:00:15,200
i was kind of defending this concept of

1488
01:00:19,109 --> 01:00:16,720

what i was doing and all this other

1489
01:00:21,670 --> 01:00:19,119
stuff to somebody uh who is who is a

1490
01:00:22,710 --> 01:00:21,680
real mars guy and basically his comment

1491
01:00:25,510 --> 01:00:22,720
was that

1492
01:00:26,870 --> 01:00:25,520
the very first analysis of mars soil

1493
01:00:28,309 --> 01:00:26,880
that we get the first quantitative

1494
01:00:29,829 --> 01:00:28,319
analysis of mineralogy is going to

1495
01:00:33,510 --> 01:00:29,839
rewrite the book

1496
01:00:35,670 --> 01:00:33,520
so i i you know uh and

1497
01:00:37,589 --> 01:00:35,680
and really if we wound up analyzing 75

1498
01:00:39,670 --> 01:00:37,599
of the wrong things or 75 of the same

1499
01:00:43,670 --> 01:00:39,680
thing we wouldn't learn anything so i

1500
01:00:46,230 --> 01:00:43,680
think there's going to be a lot of

1501
01:00:47,990 --> 01:00:46,240
just a lot of huge thought going into do

1502
01:00:49,510 --> 01:00:48,000
we drill this you know do we drive there

1503
01:00:51,829 --> 01:00:49,520
do we look at this and

1504
01:00:54,549 --> 01:00:51,839
and with 350

1505
01:00:56,150 --> 01:00:54,559
scientists deciding this in a tactical

1506
01:01:01,030 --> 01:00:56,160
time scale of like eight hours it's

1507
01:01:08,390 --> 01:01:03,990
the ap excess and the most power yeah on

1508
01:01:11,430 --> 01:01:09,910
logical instruments that's what actually

1509
01:01:14,870 --> 01:01:11,440
was one of those

1510
01:01:18,309 --> 01:01:14,880
um okay well the the uh

1511
01:01:21,190 --> 01:01:19,190
the

1512
01:01:24,549 --> 01:01:21,200
apxs instrument is not a mineralogy

1513
01:01:25,510 --> 01:01:24,559

instrument it just tells you elements so

1514
01:01:28,390 --> 01:01:25,520
if you

1515
01:01:29,829 --> 01:01:28,400
wouldn't be able to tell it from a lump

1516
01:01:31,349 --> 01:01:29,839
of diamond

1517
01:01:33,670 --> 01:01:31,359
there's nothing wrong with it it's a

1518
01:01:35,910 --> 01:01:33,680
great instrument and and it's

1519
01:01:37,750 --> 01:01:35,920
it's provided really useful data but

1520
01:01:40,390 --> 01:01:37,760
it's not a mineralogical instrument

1521
01:01:41,829 --> 01:01:40,400
now the the moss power spectrometer does

1522
01:01:44,390 --> 01:01:41,839
do mineralogy

1523
01:01:47,829 --> 01:01:44,400
but it and it does mineralogy of iron

1524
01:01:52,470 --> 01:01:50,630
just exquisitely and in fact dick morris

1525
01:01:54,309 --> 01:01:52,480
who does all those analyses is on my

1526
01:01:57,109 --> 01:01:54,319
team

1527
01:01:58,950 --> 01:01:57,119
but anything that's not iron containing

1528
01:02:01,270 --> 01:01:58,960
it's just not there

1529
01:02:07,270 --> 01:02:01,280
so so this will give you the full suite

1530
01:02:14,069 --> 01:02:11,910
okay well uh i i guess that's it uh