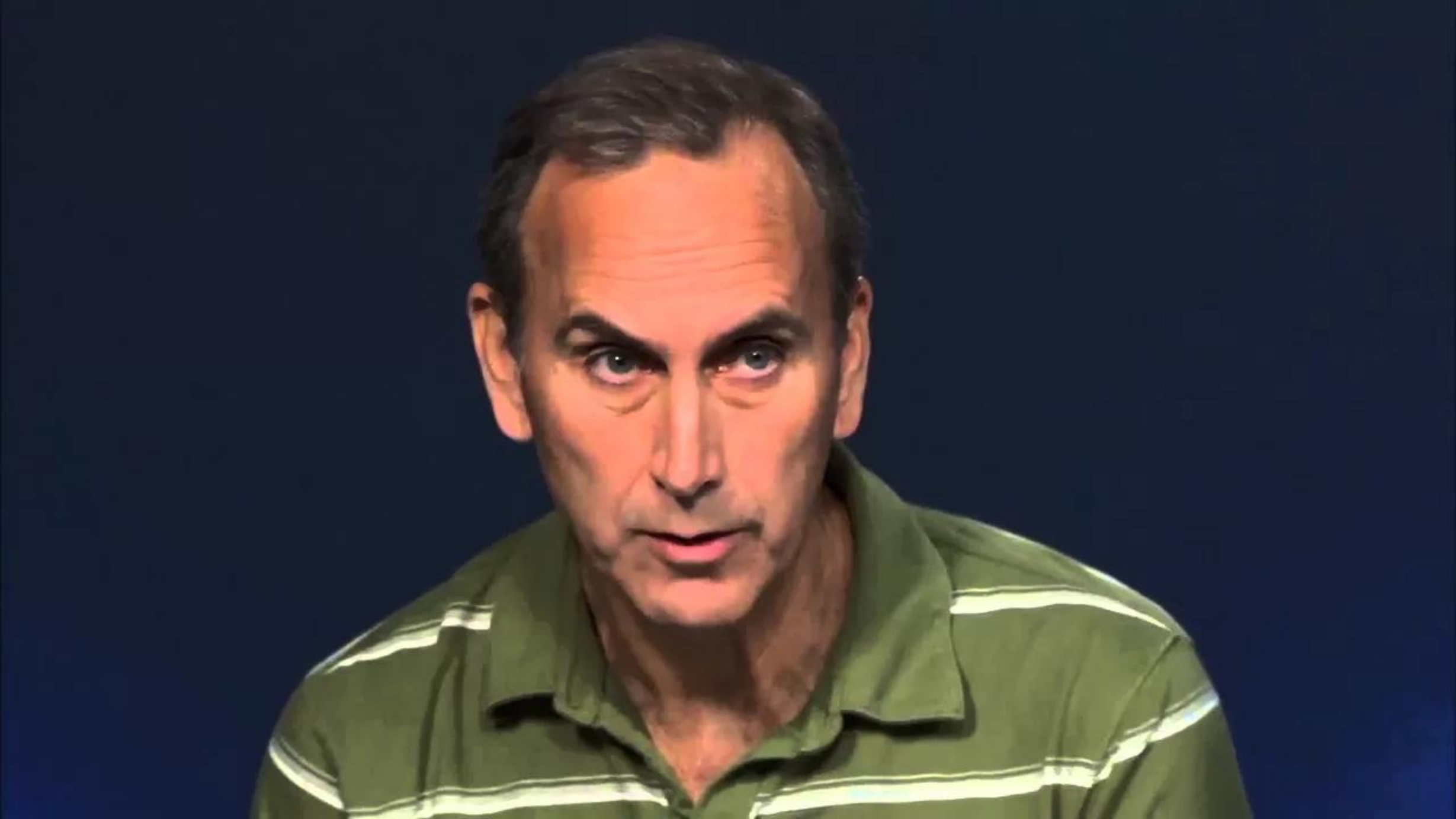

1
00:00:08,870 --> 00:00:06,789
welcome to nasa's jet propulsion

2
00:00:10,950 --> 00:00:08,880
laboratory in pasadena california i'm

3
00:00:13,030 --> 00:00:10,960
veronica mcgregor we're here to give you

4
00:00:16,230 --> 00:00:13,040
another update on the curiosity rover

5
00:00:18,470 --> 00:00:16,240
mission on mars today is sol number 51

6
00:00:21,510 --> 00:00:18,480
that marks 51 days more or less that the

7
00:00:23,269 --> 00:00:21,520
rover has been exploring the red planet

8
00:00:25,189 --> 00:00:23,279
uh if you were there right now where the

9
00:00:27,589 --> 00:00:25,199
rover is it's about six o'clock in the

10
00:00:29,269 --> 00:00:27,599
evening local time and it's late winter

11
00:00:31,750 --> 00:00:29,279
just a couple of days away from the

12
00:00:33,110 --> 00:00:31,760
start of spring let me introduce the

13
00:00:34,630 --> 00:00:33,120

science panel that is going to bring you

14
00:00:37,030 --> 00:00:34,640
up to date on some of the recent

15
00:00:37,910 --> 00:00:37,040
exciting discoveries on mars we'll begin

16
00:00:40,470 --> 00:00:37,920
with

17
00:00:42,389 --> 00:00:40,480
dr john grotzinger he's the project

18
00:00:46,310 --> 00:00:42,399
scientist for the mission he's with the

19
00:00:48,709 --> 00:00:46,320
california institute of technology

20
00:00:53,430 --> 00:00:48,719
dr mike malen with male and space

21
00:00:57,270 --> 00:00:54,869
rebecca williams she's with the

22
00:01:00,950 --> 00:00:57,280
planetary science institute in tucson

23
00:01:05,670 --> 00:01:03,189
and bill dietrich with the university of

24
00:01:07,750 --> 00:01:05,680
california at berkeley and we're going

25
00:01:09,830 --> 00:01:07,760
to begin with john gretzinger

26
00:01:11,590 --> 00:01:09,840
thanks veronica so i'll just bring up

27
00:01:14,230 --> 00:01:11,600
the date a little bit on where the rover

28
00:01:17,030 --> 00:01:14,240
is as veronica said it's the evening of

29
00:01:20,550 --> 00:01:17,040
saul 51 and the science team is now

30
00:01:22,870 --> 00:01:20,560
planning saw 52's activities

31
00:01:25,590 --> 00:01:22,880
it's been about three saws since we left

32
00:01:28,149 --> 00:01:25,600
the rock that we called jake matejevich

33
00:01:31,590 --> 00:01:28,159
and that rock is the first place where

34
00:01:34,230 --> 00:01:31,600
we actually put out the arm and took

35
00:01:36,630 --> 00:01:34,240
images with the molle camera and also

36
00:01:38,550 --> 00:01:36,640
the apxs instrument which gives us

37
00:01:40,870 --> 00:01:38,560
chemical composition

38
00:01:43,510 --> 00:01:40,880

and now we've driven quite a long way

39
00:01:46,469 --> 00:01:43,520
yesterday we had our longest drive of uh

40
00:01:48,789 --> 00:01:46,479
quite a bit over 50 meters maybe 53 54

41
00:01:52,469 --> 00:01:48,799
meters and we are most of the way now to

42
00:01:54,069 --> 00:01:52,479
glenelg and what will happen now is that

43
00:01:56,709 --> 00:01:54,079
the science team is busy trying to

44
00:01:59,670 --> 00:01:56,719
choose a target to collect material

45
00:02:01,429 --> 00:01:59,680
probably sand probably wind blown sand

46
00:02:04,230 --> 00:02:01,439
that we will put into the chemical

47
00:02:06,389 --> 00:02:04,240
laboratories for the first time

48
00:02:08,710 --> 00:02:06,399
on this mission into the salmon the

49
00:02:10,309 --> 00:02:08,720
chemin instruments and that's an

50
00:02:12,390 --> 00:02:10,319
activity that will take on the order of

51
00:02:14,550 --> 00:02:12,400
two to three weeks so we're we're

52
00:02:16,390 --> 00:02:14,560
choosing this target carefully so that

53
00:02:18,070 --> 00:02:16,400
we can do as much science as possible

54
00:02:20,949 --> 00:02:18,080
there

55
00:02:23,430 --> 00:02:20,959
okay so as we were driving along on the

56
00:02:25,510 --> 00:02:23,440
way to glenelg we encountered some

57
00:02:27,510 --> 00:02:25,520
really interesting outcrops that were

58
00:02:29,910 --> 00:02:27,520
surprising to the team

59
00:02:31,589 --> 00:02:29,920
and in the first graphic what you'll be

60
00:02:33,589 --> 00:02:31,599
able to see

61
00:02:36,550 --> 00:02:33,599
are these outcrops

62
00:02:39,190 --> 00:02:36,560
and this is one of them uh it's named

63
00:02:40,869 --> 00:02:39,200

hada and to us it just looked like

64
00:02:42,550 --> 00:02:40,879
somebody came along the surface of mars

65
00:02:43,910 --> 00:02:42,560
with a jackhammer and lifted up a

66
00:02:46,710 --> 00:02:43,920
sidewalk

67
00:02:48,630 --> 00:02:46,720
that you might see in downtown l.a

68
00:02:50,869 --> 00:02:48,640
and sort of a construction site so you

69
00:02:54,309 --> 00:02:50,879
can see this this rock unit

70
00:02:56,550 --> 00:02:54,319
and it's about uh 10 to 15 centimeters

71
00:02:58,229 --> 00:02:56,560
thick so it's sort of on that scale

72
00:02:59,910 --> 00:02:58,239
and it's tilted in the perspective

73
00:03:00,790 --> 00:02:59,920
you're looking at it's tilted off to the

74
00:03:02,710 --> 00:03:00,800
right

75
00:03:05,589 --> 00:03:02,720
and what it does is it exposes the

76
00:03:06,710 --> 00:03:05,599
materials that that make up this uh slab

77
00:03:09,030 --> 00:03:06,720
of rock

78
00:03:10,949 --> 00:03:09,040
and there's a couple of these and what

79
00:03:12,710 --> 00:03:10,959
we're going to be presenting today my

80
00:03:14,949 --> 00:03:12,720
colleagues here will show you

81
00:03:16,390 --> 00:03:14,959
what represents the consensus opinion of

82
00:03:18,790 --> 00:03:16,400
the science team

83
00:03:21,030 --> 00:03:18,800
that this is a rock that was formed in

84
00:03:23,030 --> 00:03:21,040
the presence of water and we can

85
00:03:26,309 --> 00:03:23,040
characterize that water as being a

86
00:03:28,630 --> 00:03:26,319
vigorous flow on the surface of mars

87
00:03:30,309 --> 00:03:28,640
and and we were really excited about

88
00:03:31,589 --> 00:03:30,319

this because this is one of the reasons

89
00:03:33,670 --> 00:03:31,599
that we were interested in coming to

90
00:03:35,670 --> 00:03:33,680
this landing site was because it

91
00:03:38,229 --> 00:03:35,680
presented from orbit

92
00:03:40,470 --> 00:03:38,239
quite a strong case that we would find

93
00:03:43,030 --> 00:03:40,480
evidence for water on the ground

94
00:03:44,550 --> 00:03:43,040
turns out that in fact we landed on this

95
00:03:46,070 --> 00:03:44,560
unit and

96
00:03:47,430 --> 00:03:46,080
and this makes a great starting point

97
00:03:49,350 --> 00:03:47,440
for us to do

98
00:03:52,949 --> 00:03:49,360
more sophisticated studies using the

99
00:03:55,509 --> 00:03:52,959
rover uh payload so what i'll do now is

100
00:03:58,149 --> 00:03:55,519
turn it over to mike thank you john

101
00:04:00,309 --> 00:03:58,159
uh i'm here sort of as the ghost of

102
00:04:02,630 --> 00:04:00,319
briefings passed i'm going to show you

103
00:04:05,509 --> 00:04:02,640
how we had anticipated with the design

104
00:04:06,869 --> 00:04:05,519
of the cameras this type of outcrop

105
00:04:08,550 --> 00:04:06,879
and how

106
00:04:09,509 --> 00:04:08,560
when i briefed

107
00:04:18,390 --> 00:04:09,519
the

108
00:04:20,789 --> 00:04:18,400
actually use as an example this would be

109
00:04:23,030 --> 00:04:20,799
the type of rock the cameras would excel

110
00:04:25,430 --> 00:04:23,040
on to remind you the mass cameras there

111
00:04:27,430 --> 00:04:25,440
are two of them one is a 34 millimeter

112
00:04:28,469 --> 00:04:27,440
focal length which is sort of a moderate

113
00:04:30,550 --> 00:04:28,479

wide angle

114
00:04:32,950 --> 00:04:30,560
and then a 100 millimeter which is

115
00:04:35,270 --> 00:04:32,960
telephoto lens gets about three times

116
00:04:36,469 --> 00:04:35,280
higher resolution if i have my first

117
00:04:38,870 --> 00:04:36,479
graphic

118
00:04:42,950 --> 00:04:38,880
you'll see this is a slide from the

119
00:04:46,550 --> 00:04:42,960
november 23rd presentation which is a

120
00:04:49,990 --> 00:04:46,560
conglomerate bedrock outcrop in central

121
00:04:52,070 --> 00:04:50,000
utah it's about 100 million years old

122
00:04:54,550 --> 00:04:52,080
and it's really a rock made out of a

123
00:04:58,230 --> 00:04:54,560
bunch of pieces of gravel it's a rock

124
00:05:00,710 --> 00:04:58,240
made out of rock and the the squares the

125
00:05:02,469 --> 00:05:00,720
white squares are enlarged at the bottom

126
00:05:04,230 --> 00:05:02,479
of this graphic if you look at the one

127
00:05:07,189 --> 00:05:04,240
on the right you can see there there are

128
00:05:09,749 --> 00:05:07,199
a few bands of light tone uh intermixed

129
00:05:12,070 --> 00:05:09,759
with sort of a speckly texture the

130
00:05:14,310 --> 00:05:12,080
speckly texture is the conglomerate has

131
00:05:16,950 --> 00:05:14,320
lots of little pebbles in it the lighter

132
00:05:20,070 --> 00:05:16,960
tone things are sandstone so there was

133
00:05:21,909 --> 00:05:20,080
sand moving down a stream along with

134
00:05:23,430 --> 00:05:21,919
cobbles and you'll see a little pebbles

135
00:05:25,909 --> 00:05:23,440
you'll see that a little bit later in

136
00:05:27,430 --> 00:05:25,919
this presentation by bill dietrich but

137
00:05:30,390 --> 00:05:27,440
this is the view that we get with the

138
00:05:31,430 --> 00:05:30,400

mass cam from 100 meters from a 50 meter

139
00:05:32,550 --> 00:05:31,440
distance

140
00:05:33,830 --> 00:05:32,560
and the next

141
00:05:36,629 --> 00:05:33,840
next slide

142
00:05:39,189 --> 00:05:36,639
shows if you got to 10 meters distance

143
00:05:41,350 --> 00:05:39,199
what you see in either the 34 millimeter

144
00:05:43,029 --> 00:05:41,360
camera at the top or the 100 millimeter

145
00:05:45,830 --> 00:05:43,039
uh camera at the bottom you can see that

146
00:05:48,150 --> 00:05:45,840
the particles the the pebbles are about

147
00:05:50,230 --> 00:05:48,160
a centimeter two centimeters across and

148
00:05:52,150 --> 00:05:50,240
the bed of sand you can see is roughly

149
00:05:54,390 --> 00:05:52,160
the same there are layers in the bed of

150
00:05:57,029 --> 00:05:54,400
sand they're roughly the same thickness

151
00:05:59,670 --> 00:05:57,039
these are water lane sediments that were

152
00:06:02,390 --> 00:05:59,680
then turned into a rock and then that

153
00:06:04,550 --> 00:06:02,400
rock has been eroded away showing us

154
00:06:06,629 --> 00:06:04,560
this large outcrop

155
00:06:09,270 --> 00:06:06,639
the next slide

156
00:06:11,670 --> 00:06:09,280
shows a piece a feature on mars

157
00:06:15,110 --> 00:06:11,680
our first view of this

158
00:06:18,629 --> 00:06:15,120
similar type of rock came where the

159
00:06:21,590 --> 00:06:18,639
landing engines blew away the dirt and

160
00:06:24,469 --> 00:06:21,600
unveiled this layer beneath the surface

161
00:06:26,950 --> 00:06:24,479
debris and you can see in the upper left

162
00:06:28,469 --> 00:06:26,960
corner an enlargement of that of the

163
00:06:31,029 --> 00:06:28,479

white box that shows that there is a

164
00:06:32,950 --> 00:06:31,039
layer there that seems to have rocks

165
00:06:34,790 --> 00:06:32,960
embedded in it we have a higher

166
00:06:37,110 --> 00:06:34,800
resolution view of that in the next

167
00:06:39,830 --> 00:06:37,120
slide which was taken with the mast cam

168
00:06:42,469 --> 00:06:39,840
100 and you can see in the lower left

169
00:06:45,430 --> 00:06:42,479
now that the gravelly surface and the

170
00:06:47,909 --> 00:06:45,440
gravel at the edge of this layer this is

171
00:06:49,589 --> 00:06:47,919
a relatively thin outcrop of the

172
00:06:50,710 --> 00:06:49,599
materials you're going to see in a few

173
00:06:53,670 --> 00:06:50,720
minutes

174
00:06:55,990 --> 00:06:53,680
but basically we had anticipated and

175
00:06:58,469 --> 00:06:56,000
discussed both before the launch and

176
00:07:01,350 --> 00:06:58,479
right after landing that where we were

177
00:07:02,629 --> 00:07:01,360
going should have these water lane

178
00:07:05,270 --> 00:07:02,639
sediments that have been turned into

179
00:07:07,670 --> 00:07:05,280
rock and becky is going to talk a little

180
00:07:09,749 --> 00:07:07,680
bit more about the rocks themselves

181
00:07:11,270 --> 00:07:09,759
so from the bradbury landing site we

182
00:07:13,350 --> 00:07:11,280
knew we were seeing a different type of

183
00:07:14,710 --> 00:07:13,360
material one we really haven't seen on

184
00:07:16,790 --> 00:07:14,720
mars before

185
00:07:18,550 --> 00:07:16,800
and we were hoping that as we proceeded

186
00:07:20,790 --> 00:07:18,560
to glenelg we would see additional

187
00:07:22,390 --> 00:07:20,800
exposures of this type of material that

188
00:07:24,950 --> 00:07:22,400

we could investigate further

189
00:07:27,029 --> 00:07:24,960
specifically with the mass cam 100

190
00:07:29,670 --> 00:07:27,039
if i could have my first graphic please

191
00:07:32,070 --> 00:07:29,680
so this is the hotter exposure that john

192
00:07:34,309 --> 00:07:32,080
introduced you to a few moments ago and

193
00:07:37,029 --> 00:07:34,319
we were just really extremely fortunate

194
00:07:39,510 --> 00:07:37,039
to have such an ideal viewing geometry

195
00:07:41,510 --> 00:07:39,520
of this material this is a fractured

196
00:07:43,830 --> 00:07:41,520
rock outcrop that has been naturally

197
00:07:46,070 --> 00:07:43,840
tilted and it's just an ideal viewing

198
00:07:48,230 --> 00:07:46,080
geometry for the mast cam 100 to look at

199
00:07:50,550 --> 00:07:48,240
the fine scale textural properties of

200
00:07:52,390 --> 00:07:50,560
the rock when a geologist goes into the

201
00:07:54,950 --> 00:07:52,400
field what they want to do is see a

202
00:07:57,670 --> 00:07:54,960
fresh exposure of rock to look at things

203
00:07:59,430 --> 00:07:57,680
like the grain size the shape the color

204
00:08:01,510 --> 00:07:59,440
and the arrangement of those grains and

205
00:08:03,430 --> 00:08:01,520
that tells you a lot about the formation

206
00:08:06,070 --> 00:08:03,440
history of that rock

207
00:08:09,110 --> 00:08:06,080
so with the mass cam 100 where we

208
00:08:11,029 --> 00:08:09,120
acquired these images on sol 39

209
00:08:14,710 --> 00:08:11,039
and i'm going to zoom in on the lower

210
00:08:17,110 --> 00:08:14,720
left-hand portion of the screen

211
00:08:19,749 --> 00:08:17,120
what you see is this rock is made up of

212
00:08:21,830 --> 00:08:19,759
rounded gravels there's one circled for

213
00:08:24,390 --> 00:08:21,840

you at upper right and a matrix that's

214
00:08:26,390 --> 00:08:24,400
very sand rich and these attributes are

215
00:08:29,189 --> 00:08:26,400
consistent with a common sedimentary

216
00:08:31,270 --> 00:08:29,199
rock type called a conglomerate now the

217
00:08:33,589 --> 00:08:31,280
class that is circled is about three

218
00:08:35,670 --> 00:08:33,599
centimeters across it's roughly the size

219
00:08:37,350 --> 00:08:35,680
of the gravel that i'm holding in my

220
00:08:39,750 --> 00:08:37,360
hand and you'll see that the perimeter

221
00:08:42,310 --> 00:08:39,760
has a very rounded shape it's been worn

222
00:08:44,389 --> 00:08:42,320
by abrasion in a sediment transport

223
00:08:46,630 --> 00:08:44,399
process you'll also notice the gravel is

224
00:08:50,070 --> 00:08:46,640
sticking out from the rock and over time

225
00:08:51,590 --> 00:08:50,080
erosion is working on that rock face and

226
00:08:53,509 --> 00:08:51,600
liberating some of the gravels and

227
00:08:56,710 --> 00:08:53,519
they're falling down and accumulating on

228
00:08:59,269 --> 00:08:56,720
a pile at the base of the outcrop

229
00:09:01,110 --> 00:08:59,279
in the next slide

230
00:09:04,630 --> 00:09:01,120
a second exposure of this very same

231
00:09:07,190 --> 00:09:04,640
material we saw on sol 26 and imaged it

232
00:09:10,389 --> 00:09:07,200
with the mass cam 100 the narrow angle

233
00:09:12,790 --> 00:09:10,399
on sol 27 and this outcrop's name is

234
00:09:15,430 --> 00:09:12,800
link you see very similar textural

235
00:09:18,150 --> 00:09:15,440
properties that we saw at hada again

236
00:09:20,389 --> 00:09:18,160
very rounded gravels in a light tone

237
00:09:22,630 --> 00:09:20,399
sandy matrix and again we have that

238
00:09:25,670 --> 00:09:22,640

gravel pile that's adjacent to the rock

239
00:09:27,990 --> 00:09:25,680
outcrop so by looking at the size and

240
00:09:29,670 --> 00:09:28,000
shape distribution of the gravels that

241
00:09:31,590 --> 00:09:29,680
are not only in the rock outcrop but

242
00:09:33,750 --> 00:09:31,600
those that we infer were liberated from

243
00:09:37,190 --> 00:09:33,760
the rock outcrop there on the surface we

244
00:09:40,630 --> 00:09:37,200
can get a good idea of the range of of

245
00:09:42,310 --> 00:09:40,640
gravel size and shape properties

246
00:09:44,790 --> 00:09:42,320
that you see there in the next slide

247
00:09:46,630 --> 00:09:44,800
we'll zoom in and there's another one of

248
00:09:48,949 --> 00:09:46,640
these rounded gravels

249
00:09:52,310 --> 00:09:48,959
that's about one centimeter across so

250
00:09:54,470 --> 00:09:52,320
that's roughly the size of a plane m m

251
00:09:56,870 --> 00:09:54,480
and geologists are interested in rounded

252
00:09:58,710 --> 00:09:56,880
gravels because they tell you that they

253
00:10:00,949 --> 00:09:58,720
those particles have been subjected to a

254
00:10:04,150 --> 00:10:00,959
sediment transport process either by

255
00:10:06,470 --> 00:10:04,160
water or wind and so typically you start

256
00:10:08,630 --> 00:10:06,480
off with a very angular rock fragment

257
00:10:10,870 --> 00:10:08,640
and as it's transported it's bouncing

258
00:10:12,710 --> 00:10:10,880
along interacting with other grains and

259
00:10:14,630 --> 00:10:12,720
the surface and that wears away the

260
00:10:17,509 --> 00:10:14,640
edges until you have a very smooth

261
00:10:19,190 --> 00:10:17,519
surface such as you see here in this

262
00:10:20,069 --> 00:10:19,200
pebble

263
00:10:22,310 --> 00:10:20,079

and

264
00:10:24,230 --> 00:10:22,320
the key components of these gravels that

265
00:10:26,790 --> 00:10:24,240
we're seeing here are one the rounded

266
00:10:29,269 --> 00:10:26,800
shape but also the size these are too

267
00:10:31,110 --> 00:10:29,279
large to be transported by wind the

268
00:10:34,069 --> 00:10:31,120
consensus of the science team is that

269
00:10:35,829 --> 00:10:34,079
these are water transported gravels in a

270
00:10:37,829 --> 00:10:35,839
vigorous stream

271
00:10:38,790 --> 00:10:37,839
on the right of the graphic you can see

272
00:11:17,990 --> 00:10:38,800
a

273
00:11:19,670 --> 00:11:18,000
the rover site

274
00:11:20,949 --> 00:11:19,680
and to do that i'm going to use a term

275
00:11:22,949 --> 00:11:20,959
called fan

276
00:11:24,710 --> 00:11:22,959
and specifically alluvial fan and to

277
00:11:27,350 --> 00:11:24,720
explain that i'm going to take you on an

278
00:11:29,269 --> 00:11:27,360
aerial tour first through death valley

279
00:11:31,430 --> 00:11:29,279
and then back to gale and connect the

280
00:11:35,829 --> 00:11:31,440
dots between the fan and the deposits we

281
00:11:39,110 --> 00:11:37,110
i introduce you to an area you're

282
00:11:42,150 --> 00:11:39,120
familiar with there's los angeles and

283
00:11:44,230 --> 00:11:42,160
there is las vegas i-15 between and

284
00:11:45,910 --> 00:11:44,240
we're going to take a flight just to the

285
00:11:49,190 --> 00:11:45,920
right of sizzix

286
00:11:52,150 --> 00:11:49,200
and where there are six fans outlined in

287
00:11:53,990 --> 00:11:52,160
by in white that illustrate the form and

288
00:11:54,870 --> 00:11:54,000

process that i want to talk about

289
00:11:57,430 --> 00:11:54,880
um

290
00:11:59,269 --> 00:11:57,440
so we'll zoom in and you'll see the four

291
00:12:01,430 --> 00:11:59,279
that are facing us the white lines

292
00:12:04,069 --> 00:12:01,440
delineating the lateral boundaries of

293
00:12:05,990 --> 00:12:04,079
sediment deposition that has occurred as

294
00:12:07,509 --> 00:12:06,000
a consequence of sediment and water

295
00:12:09,110 --> 00:12:07,519
rushing out of the canyons that are on

296
00:12:12,470 --> 00:12:09,120
the hills there

297
00:12:14,069 --> 00:12:12,480
and we will now go up to the headwaters

298
00:12:16,310 --> 00:12:14,079
and we see the stream can the stream

299
00:12:18,470 --> 00:12:16,320
confine the canyon and then it reaches

300
00:12:21,190 --> 00:12:18,480
the front of the mountain and as water

301
00:12:23,430 --> 00:12:21,200
and sediment rushes out it spills

302
00:12:25,590 --> 00:12:23,440
and as it spills it forms a sheet of

303
00:12:27,350 --> 00:12:25,600
water or it runs out as discrete

304
00:12:29,350 --> 00:12:27,360
channels and you can see them there

305
00:12:31,590 --> 00:12:29,360
shifting right shifting left as it

306
00:12:33,590 --> 00:12:31,600
deposits it elevates and shifts right

307
00:12:35,750 --> 00:12:33,600
left back and forth building the fan

308
00:12:37,509 --> 00:12:35,760
structure that's so characteristic and

309
00:12:39,829 --> 00:12:37,519
so identifiable

310
00:12:41,829 --> 00:12:39,839
we've rotated it across the

311
00:12:43,910 --> 00:12:41,839
this white tone fan and now we're

312
00:12:45,670 --> 00:12:43,920
settling down and looking back so now

313
00:12:48,069 --> 00:12:45,680

you see the fan shape just like a fan

314
00:12:50,069 --> 00:12:48,079
you'd use to cool yourself on a hot day

315
00:12:53,030 --> 00:12:50,079
you see the white outlines

316
00:12:54,949 --> 00:12:53,040
of the structure um and you see how it's

317
00:12:56,310 --> 00:12:54,959
a result of water and sediment pouring

318
00:12:58,389 --> 00:12:56,320
out of a canyon

319
00:13:00,389 --> 00:12:58,399
so if i could now go to the next uh

320
00:13:02,470 --> 00:13:00,399
video

321
00:13:05,030 --> 00:13:02,480
we're going to go to gale crater and

322
00:13:07,670 --> 00:13:05,040
we're flying from north to south and we

323
00:13:09,670 --> 00:13:07,680
see in red lines the lateral boundaries

324
00:13:11,509 --> 00:13:09,680
of a fan just like what we saw in death

325
00:13:13,110 --> 00:13:11,519
valley and we're looking down at a

326
00:13:19,990 --> 00:13:13,120
canyon

327
00:13:22,550 --> 00:13:20,000
2 000 feet wide and about 100 feet deep

328
00:13:24,550 --> 00:13:22,560
and that canyon was cut by stream flows

329
00:13:27,030 --> 00:13:24,560
and that stream and sediment then

330
00:13:27,829 --> 00:13:27,040
entered the crater rim wall and spilled

331
00:13:29,030 --> 00:13:27,839
out

332
00:13:31,110 --> 00:13:29,040
from

333
00:13:33,430 --> 00:13:31,120
left and right and the blue lines

334
00:13:36,310 --> 00:13:33,440
delineate distinct channels that we can

335
00:13:39,509 --> 00:13:36,320
recognize fossil bends if you like

336
00:13:41,110 --> 00:13:39,519
we look at these channels and we see

337
00:13:42,150 --> 00:13:41,120
that they

338
00:13:44,310 --> 00:13:42,160

cut

339
00:13:45,269 --> 00:13:44,320
across the fan system and to us they

340
00:13:47,189 --> 00:13:45,279
suggest

341
00:13:49,269 --> 00:13:47,199
that this fan did not form in a single

342
00:13:50,629 --> 00:13:49,279
instance but this records some duration

343
00:13:52,710 --> 00:13:50,639
of a process

344
00:13:55,990 --> 00:13:52,720
now we find we settle down and there's

345
00:13:58,550 --> 00:13:56,000
curiosity it's about a two to four mile

346
00:14:00,710 --> 00:13:58,560
hike from the nearest channel to

347
00:14:02,629 --> 00:14:00,720
curiosity all downhill

348
00:14:04,550 --> 00:14:02,639
so we think it's reasonable to suggest

349
00:14:07,269 --> 00:14:04,560
that the water and sediment came down

350
00:14:08,870 --> 00:14:07,279
that fan that we see now the sediment at

351
00:14:11,509 --> 00:14:08,880
curiosity and looking back you see a

352
00:14:12,949 --> 00:14:11,519
watershed you see a canyon you saw a fan

353
00:14:15,110 --> 00:14:12,959
you see channels

354
00:14:17,910 --> 00:14:15,120
now what was it like then if you were

355
00:14:20,230 --> 00:14:17,920
standing at exactly curiosity's site at

356
00:14:23,990 --> 00:14:20,240
the time of the sediment deposition and

357
00:14:27,829 --> 00:14:25,590
so here is

358
00:14:29,910 --> 00:14:27,839
water moving sand and gravel

359
00:14:32,230 --> 00:14:29,920
it's a vigorous sediment transport

360
00:14:34,949 --> 00:14:32,240
process bursts and sweeps of turbulence

361
00:14:37,509 --> 00:14:34,959
mobilizing together sand and gravel

362
00:14:39,829 --> 00:14:37,519
uh and of course the consequence of that

363
00:14:41,910 --> 00:14:39,839

motion is collision breakage and

364
00:14:45,430 --> 00:14:41,920
rounding of particles

365
00:14:46,949 --> 00:14:45,440
uh and in a flow that we can estimate

366
00:14:49,430 --> 00:14:46,959
for the rover site that might have been

367
00:14:52,150 --> 00:14:49,440
from ankle to hip deep and maybe moving

368
00:14:55,030 --> 00:14:52,160
a few feet a second and we arrived now

369
00:14:56,710 --> 00:14:55,040
at what the the bed of the rover site

370
00:14:58,870 --> 00:14:56,720
might have looked like after the last

371
00:15:00,870 --> 00:14:58,880
flow of course visited by a few

372
00:15:03,189 --> 00:15:00,880
earthlings

373
00:15:05,670 --> 00:15:03,199
that was the atacama desert and you see

374
00:15:08,150 --> 00:15:05,680
the heterogeneous bed you see the

375
00:15:11,189 --> 00:15:08,160
patches of sediment and what we can

376
00:15:13,990 --> 00:15:11,199
think about then is that we were in a

377
00:15:15,910 --> 00:15:14,000
watershed we saw um going from an

378
00:15:17,110 --> 00:15:15,920
uplands to a lowlands and we would start

379
00:15:19,750 --> 00:15:17,120
with a rock

380
00:15:21,750 --> 00:15:19,760
that would be big and broken like this

381
00:15:25,350 --> 00:15:21,760
and it would travel something like 20 to

382
00:15:26,710 --> 00:15:25,360
25 miles and end up something small and

383
00:15:29,030 --> 00:15:26,720
rounded like this

384
00:15:32,550 --> 00:15:29,040
this going from this to this is direct

385
00:15:34,150 --> 00:15:32,560
visual evidence of the wear by

386
00:15:35,990 --> 00:15:34,160
what we call bed load transport of the

387
00:15:38,069 --> 00:15:36,000
wear particle collision and the

388
00:15:40,870 --> 00:15:38,079

transport by water

389
00:15:43,030 --> 00:15:40,880
to the side of interest so we can see

390
00:15:44,550 --> 00:15:43,040
from these stones as becky has described

391
00:15:45,590 --> 00:15:44,560
are very revealing to us about the

392
00:15:47,590 --> 00:15:45,600
process

393
00:15:49,749 --> 00:15:47,600
and even the potential of connecting

394
00:15:53,590 --> 00:15:49,759
curiosity to the fan system we observed

395
00:15:58,310 --> 00:15:56,230
okay so uh thanks bill i'll just wrap up

396
00:16:00,069 --> 00:15:58,320
here and and summarize some of the key

397
00:16:02,389 --> 00:16:00,079
uh observations

398
00:16:04,310 --> 00:16:02,399
uh that allow us to to tell you about

399
00:16:06,550 --> 00:16:04,320
this story about water flowing on mars

400
00:16:09,030 --> 00:16:06,560
so first of all this represents a great

401
00:16:11,030 --> 00:16:09,040
collaboration between the curiosity

402
00:16:13,509 --> 00:16:11,040
rover and the orbiters that are

403
00:16:16,230 --> 00:16:13,519
routinely mapping mars now in the case

404
00:16:18,870 --> 00:16:16,240
of the looking at the alluvial fan

405
00:16:23,189 --> 00:16:18,880
uh we we see that that's provided by

406
00:16:25,350 --> 00:16:23,199
both the highrise imager the ctx imager

407
00:16:27,350 --> 00:16:25,360
previous generations of imagers look at

408
00:16:30,230 --> 00:16:27,360
these features that geologists have long

409
00:16:31,910 --> 00:16:30,240
thought of as alluvial fans but now that

410
00:16:33,590 --> 00:16:31,920
we're down on the ground with curiosity

411
00:16:35,590 --> 00:16:33,600
we can see the textural evidence that

412
00:16:38,389 --> 00:16:35,600
becky and mike talked about where you

413
00:16:40,470 --> 00:16:38,399

see the individual pebbles the rounding

414
00:16:42,870 --> 00:16:40,480
the geometric relationship that they

415
00:16:44,069 --> 00:16:42,880
have to each other that gives us a sense

416
00:16:47,030 --> 00:16:44,079
for that

417
00:16:49,030 --> 00:16:47,040
so if we just go back one please

418
00:16:51,590 --> 00:16:49,040
we should be able to see

419
00:16:55,910 --> 00:16:51,600
where these different uh features occur

420
00:16:58,470 --> 00:16:55,920
on our route to glen elg and so goldburn

421
00:17:00,150 --> 00:16:58,480
was the was the outcrop that mike talked

422
00:17:02,310 --> 00:17:00,160
about the one that we got for free way

423
00:17:03,749 --> 00:17:02,320
back when when the the thrusters blew

424
00:17:05,909 --> 00:17:03,759
the soil away

425
00:17:07,909 --> 00:17:05,919
and at that time the team came up with a

426
00:17:09,510 --> 00:17:07,919
number of hypotheses to potentially

427
00:17:10,549 --> 00:17:09,520
account for this

428
00:17:12,230 --> 00:17:10,559
and then

429
00:17:14,390 --> 00:17:12,240
we had a lot of discussion about it and

430
00:17:16,069 --> 00:17:14,400
then we worked our way to link

431
00:17:19,029 --> 00:17:16,079
where we were able to see the first of

432
00:17:21,189 --> 00:17:19,039
the outcrops that becky talked about and

433
00:17:22,870 --> 00:17:21,199
we began to wonder about the stream flow

434
00:17:24,949 --> 00:17:22,880
option as being the most likely

435
00:17:27,189 --> 00:17:24,959
candidate and it was really when we got

436
00:17:28,710 --> 00:17:27,199
to hodo where we saw this again most

437
00:17:30,870 --> 00:17:28,720
clearly

438
00:17:33,590 --> 00:17:30,880

that it was it was very easy to reach

439
00:17:35,510 --> 00:17:33,600
team consensus to to come with you to

440
00:17:37,669 --> 00:17:35,520
to come to you and present this the

441
00:17:40,070 --> 00:17:37,679
story about where we are now the rover

442
00:17:43,590 --> 00:17:40,080
is currently about three quarters of the

443
00:17:45,909 --> 00:17:43,600
way between hada and and glenelg and

444
00:17:47,590 --> 00:17:45,919
we're working our way down into that key

445
00:17:49,590 --> 00:17:47,600
area where these three terrain types

446
00:17:50,789 --> 00:17:49,600
come together so if we can go to the

447
00:17:52,470 --> 00:17:50,799
next one

448
00:17:54,310 --> 00:17:52,480
again just to remind you something that

449
00:17:55,990 --> 00:17:54,320
we showed you

450
00:17:57,590 --> 00:17:56,000
before we landed

451
00:17:59,430 --> 00:17:57,600
in the press conference before them we

452
00:18:02,710 --> 00:17:59,440
see the alluvial fan in peace palace

453
00:18:04,789 --> 00:18:02,720
which is now the official name

454
00:18:06,230 --> 00:18:04,799
that the iau has

455
00:18:08,150 --> 00:18:06,240
approved

456
00:18:10,390 --> 00:18:08,160
as the entry point for water into this

457
00:18:12,150 --> 00:18:10,400
feature what we were uncertain of at the

458
00:18:14,710 --> 00:18:12,160
time of landing was whether or not this

459
00:18:16,870 --> 00:18:14,720
alluvial fan extended all the way down

460
00:18:19,350 --> 00:18:16,880
into the landing ellipse and you see

461
00:18:21,669 --> 00:18:19,360
where we landed is is quite a bit away

462
00:18:23,830 --> 00:18:21,679
from where you would identify as as bill

463
00:18:25,510 --> 00:18:23,840

said it'd be a few miles hike

464
00:18:27,750 --> 00:18:25,520
to get to the to the base of the

465
00:18:29,909 --> 00:18:27,760
alluvial fan so it looks like at least

466
00:18:32,710 --> 00:18:29,919
intermittently that that fan extended

467
00:18:35,350 --> 00:18:32,720
down to where where the rover was that's

468
00:18:36,870 --> 00:18:35,360
that's our most popular hypothesis right

469
00:18:38,310 --> 00:18:36,880
now for the team

470
00:18:41,110 --> 00:18:38,320
the other part of the story that we

471
00:18:42,789 --> 00:18:41,120
talked about is in the last slide

472
00:18:45,110 --> 00:18:42,799
where you now see the map of this

473
00:18:46,710 --> 00:18:45,120
feature called thermal inertia so we're

474
00:18:49,029 --> 00:18:46,720
beginning to get a sense of what that

475
00:18:51,909 --> 00:18:49,039
might mean now because you see the x

476
00:18:53,909 --> 00:18:51,919
where curiosity landed and you see high

477
00:18:55,430 --> 00:18:53,919
values of thermal inertia but not the

478
00:18:57,430 --> 00:18:55,440
highest values

479
00:18:59,669 --> 00:18:57,440
so we wonder

480
00:19:01,270 --> 00:18:59,679
what might cause this this greater

481
00:19:03,510 --> 00:19:01,280
retention of heat and it could be

482
00:19:05,750 --> 00:19:03,520
because you're dealing with materials

483
00:19:07,909 --> 00:19:05,760
that are consolidated and what we

484
00:19:09,669 --> 00:19:07,919
haven't told you today is anything about

485
00:19:11,510 --> 00:19:09,679
the rest of the payload what we might

486
00:19:12,789 --> 00:19:11,520
measure in terms of the chemistry what

487
00:19:15,350 --> 00:19:12,799
we might measure in terms of the

488
00:19:16,789 --> 00:19:15,360

mineralogy what we do know as we go down

489
00:19:18,789 --> 00:19:16,799
towards glenelg we're going to go

490
00:19:21,430 --> 00:19:18,799
towards that red patch which is where

491
00:19:24,070 --> 00:19:21,440
the thermal inertia becomes the highest

492
00:19:26,070 --> 00:19:24,080
and so our plan as we go forward now is

493
00:19:28,549 --> 00:19:26,080
to study the chemical and mineralogical

494
00:19:31,190 --> 00:19:28,559
attributes of these rocks and see how

495
00:19:34,390 --> 00:19:31,200
water may relate to the cementation of

496
00:19:36,470 --> 00:19:34,400
these gravels to form a rock

497
00:19:39,190 --> 00:19:36,480
and that that's really where it brings

498
00:19:42,310 --> 00:19:39,200
us is to really the beginning of the

499
00:19:43,990 --> 00:19:42,320
science mission where we have now

500
00:19:45,270 --> 00:19:44,000
discovered evidence for water and what

501
00:19:47,669 --> 00:19:45,280
we'd like to do is to begin to

502
00:19:50,310 --> 00:19:47,679
characterize habitable environments and

503
00:19:52,230 --> 00:19:50,320
that requires using all of our payload

504
00:19:54,310 --> 00:19:52,240
including the instruments that measure

505
00:19:56,710 --> 00:19:54,320
the chemistry and the mineralogy

506
00:20:01,270 --> 00:19:56,720
so we'll keep you updated as we go along

507
00:20:04,149 --> 00:20:02,470
okay we're going to open it up to

508
00:20:05,830 --> 00:20:04,159
questions i'll start by asking if

509
00:20:07,270 --> 00:20:05,840
there's any here at jpl and then we'll

510
00:20:09,029 --> 00:20:07,280
go to some of the folks on the phone

511
00:20:10,549 --> 00:20:09,039
line so we'll begin right here and just

512
00:20:13,350 --> 00:20:10,559
wait for a microphone to come to you and

513
00:20:15,270 --> 00:20:13,360

give us your name and affiliation

514
00:20:18,070 --> 00:20:15,280
hi uh mark coughlin with washington post

515
00:20:21,430 --> 00:20:18,080
in national geographic uh i i wonder if

516
00:20:23,909 --> 00:20:21,440
you have any estimate for the length of

517
00:20:24,789 --> 00:20:23,919
time that the water might have been

518
00:20:26,549 --> 00:20:24,799
running

519
00:20:28,549 --> 00:20:26,559
or any estimate of when it might have

520
00:20:32,950 --> 00:20:28,559
been running i have a follow-up question

521
00:20:36,870 --> 00:20:34,390
we at this point

522
00:20:37,669 --> 00:20:36,880
you you chose your words well estimate

523
00:20:39,510 --> 00:20:37,679
um

524
00:20:41,270 --> 00:20:39,520
we we see

525
00:20:42,630 --> 00:20:41,280
clear evidence of multiple channels

526
00:20:43,510 --> 00:20:42,640
across the fan

527
00:20:46,390 --> 00:20:43,520
and

528
00:20:49,990 --> 00:20:46,400
difference between what is the western

529
00:20:51,909 --> 00:20:50,000
portion of the fan and the

530
00:20:55,350 --> 00:20:51,919
eastern portion of the fan and we

531
00:21:00,630 --> 00:20:57,510
a period of time of significance to

532
00:21:01,350 --> 00:21:00,640
build progressively the fan

533
00:21:04,630 --> 00:21:01,360
the

534
00:21:06,630 --> 00:21:04,640
that it was a single

535
00:21:08,789 --> 00:21:06,640
burst of water that ran down the canyon

536
00:21:10,149 --> 00:21:08,799
and built it all in a day it's it's

537
00:21:11,270 --> 00:21:10,159
there's too many things to point away

538
00:21:12,549 --> 00:21:11,280

from that

539
00:21:14,950 --> 00:21:12,559
um

540
00:21:17,430 --> 00:21:14,960
we would anticipate uh

541
00:21:19,750 --> 00:21:17,440
that it could be easily

542
00:21:21,590 --> 00:21:19,760
thousands to millions of years but this

543
00:21:23,350 --> 00:21:21,600
is what the importance of finding these

544
00:21:25,430 --> 00:21:23,360
grain sizes because we can start to

545
00:21:27,590 --> 00:21:25,440
calculate the transport the water

546
00:21:29,830 --> 00:21:27,600
transport needed to move the gravel that

547
00:21:31,350 --> 00:21:29,840
then constrains the discharge water we

548
00:21:33,830 --> 00:21:31,360
can put the water in the channels we can

549
00:21:35,110 --> 00:21:33,840
begin to calculate

550
00:21:37,110 --> 00:21:35,120
how much

551
00:21:38,789 --> 00:21:37,120
how long that would take so this is

552
00:21:39,669 --> 00:21:38,799
opening the door

553
00:21:43,270 --> 00:21:39,679
to

554
00:21:45,029 --> 00:21:43,280
it's it's

555
00:21:47,270 --> 00:21:45,039
i'm comfortable to argue that it's

556
00:21:49,750 --> 00:21:47,280
certainly in the beyond the thousand

557
00:21:51,750 --> 00:21:49,760
times your time scale but

558
00:21:53,830 --> 00:21:51,760
we're still gathering data to go further

559
00:21:58,310 --> 00:21:53,840
with that i think it i think we can now

560
00:22:01,350 --> 00:21:59,590
okay do we have a question here in the

561
00:22:03,270 --> 00:22:01,360
front and then we'll go to a phone line

562
00:22:04,870 --> 00:22:03,280
right after you claudia mullard le monde

563
00:22:07,110 --> 00:22:04,880

you've partially answered but still i

564
00:22:09,190 --> 00:22:07,120
would like you uh either of you to

565
00:22:10,630 --> 00:22:09,200
answer the controversy on the choice of

566
00:22:11,750 --> 00:22:10,640
the site some research there was

567
00:22:14,070 --> 00:22:11,760
recently

568
00:22:16,310 --> 00:22:14,080
revealed saying that the clays on mars

569
00:22:17,510 --> 00:22:16,320
could not be due to water but to

570
00:22:18,549 --> 00:22:17,520
magmatic

571
00:22:20,070 --> 00:22:18,559
um

572
00:22:22,070 --> 00:22:20,080
precipitation

573
00:22:23,430 --> 00:22:22,080
i'm sure you're aware of of that

574
00:22:25,669 --> 00:22:23,440
research

575
00:22:28,310 --> 00:22:25,679
yeah i think uh you know the thing about

576
00:22:29,990 --> 00:22:28,320
curiosity is that we have the ability to

577
00:22:31,830 --> 00:22:30,000
to detect clays

578
00:22:34,230 --> 00:22:31,840
if we encounter them and then what we're

579
00:22:36,310 --> 00:22:34,240
going to do is we'll study the context

580
00:22:38,549 --> 00:22:36,320
in which those clays occur

581
00:22:40,870 --> 00:22:38,559
and and pick amongst the various options

582
00:22:42,630 --> 00:22:40,880
that are on the table so right now

583
00:22:44,310 --> 00:22:42,640
we have no opinion

584
00:22:46,230 --> 00:22:44,320
we haven't found any clays yet but when

585
00:22:47,909 --> 00:22:46,240
we do we're going to fit them within

586
00:22:52,470 --> 00:22:47,919
this context that you're hearing about

587
00:22:56,470 --> 00:22:53,669
okay we're going to go to the phone line

588
00:22:58,710 --> 00:22:56,480

and take irene klotz from writers

589
00:23:00,870 --> 00:22:58,720
hi um thanks very much i have a couple

590
00:23:02,870 --> 00:23:00,880
questions first i just wanted to clarify

591
00:23:03,990 --> 00:23:02,880
that the uh this

592
00:23:06,789 --> 00:23:04,000
very interesting research you're

593
00:23:08,950 --> 00:23:06,799
reporting today this was all based on

594
00:23:11,350 --> 00:23:08,960
imagery there was no

595
00:23:12,789 --> 00:23:11,360
mineralogical or chemical analysis is

596
00:23:15,510 --> 00:23:12,799
that right

597
00:23:17,669 --> 00:23:15,520
uh yeah that's right irene i you know

598
00:23:20,630 --> 00:23:17,679
the the thing about it in some cases

599
00:23:22,870 --> 00:23:20,640
when you do geology uh you know a

600
00:23:25,909 --> 00:23:22,880
picture is worth a thousand words

601
00:23:27,990 --> 00:23:25,919
and in this case the the team felt uh in

602
00:23:30,230 --> 00:23:28,000
discussing really this is just one of

603
00:23:32,070 --> 00:23:30,240
these cases where it's it's kind of all

604
00:23:34,630 --> 00:23:32,080
about the images that brings you to this

605
00:23:36,310 --> 00:23:34,640
point but the images only get you so far

606
00:23:37,750 --> 00:23:36,320
you know you look at the at the rock

607
00:23:39,669 --> 00:23:37,760
that's still up on the screen there and

608
00:23:41,990 --> 00:23:39,679
you wonder why is it as hard as it is

609
00:23:43,750 --> 00:23:42,000
that for that we really have to get into

610
00:23:46,390 --> 00:23:43,760
the chemistry of mineralogy and that's

611
00:23:48,070 --> 00:23:46,400
the next step for us

612
00:23:49,990 --> 00:23:48,080
thanks and uh just to let you know john

613
00:23:52,390 --> 00:23:50,000

i was listening to you in death valley

614
00:23:54,630 --> 00:23:52,400
um i understand that on earth the

615
00:23:56,710 --> 00:23:54,640
tilting would come from plate tectonics

616
00:23:57,669 --> 00:23:56,720
but what would account for the

617
00:24:11,830 --> 00:23:57,679
the

618
00:24:14,950 --> 00:24:11,840
that

619
00:24:17,510 --> 00:24:14,960
somewhere near this uh this outcrop uh

620
00:24:19,350 --> 00:24:17,520
a small impact occurred and just simply

621
00:24:23,909 --> 00:24:19,360
lifted the beds up and rotated them but

622
00:24:30,149 --> 00:24:26,710
okay we'll go next to npr joe polka go

623
00:24:34,630 --> 00:24:31,350
hello

624
00:24:38,310 --> 00:24:36,310
well if you called on me i can't hear

625
00:24:40,149 --> 00:24:38,320
myself or you i'm afraid

626
00:24:41,990 --> 00:24:40,159
can you hear me now joe yeah okay go

627
00:24:45,350 --> 00:24:42,000
ahead okay i can you can hear me i take

628
00:24:48,310 --> 00:24:45,360
it yes um two questions then uh one is

629
00:24:50,070 --> 00:24:48,320
uh do you have any idea how long ago

630
00:24:52,070 --> 00:24:50,080
this event took place

631
00:24:55,110 --> 00:24:52,080
and the second is uh can you say

632
00:24:57,669 --> 00:24:55,120
anything about uh how the rock became

633
00:24:59,750 --> 00:24:57,679
embedded with uh

634
00:25:01,669 --> 00:24:59,760
water i mean i mean sorry how the rock

635
00:25:03,750 --> 00:25:01,679
you said that there were pieces of rock

636
00:25:06,710 --> 00:25:03,760
embedded in rock and i wondered how that

637
00:25:10,470 --> 00:25:08,870
mike why don't you take that okay uh

638
00:25:11,909 --> 00:25:10,480

let's see what was the first part of it

639
00:25:12,950 --> 00:25:11,919
how old is that

640
00:25:15,909 --> 00:25:12,960
uh

641
00:25:19,110 --> 00:25:15,919
we have no real way of estimating ages

642
00:25:22,070 --> 00:25:19,120
on mars quantitatively this is an old

643
00:25:24,310 --> 00:25:22,080
fee these are old rocks uh it is

644
00:25:26,390 --> 00:25:24,320
possible they were actually buried under

645
00:25:27,190 --> 00:25:26,400
the materials that the mound is now made

646
00:25:29,430 --> 00:25:27,200
out

647
00:25:31,830 --> 00:25:29,440
the mound that we see now that the mound

648
00:25:33,830 --> 00:25:31,840
has retreated to uncover these features

649
00:25:36,390 --> 00:25:33,840
that's a possibility which would make

650
00:25:38,789 --> 00:25:36,400
them extremely ancient or they may be

651
00:25:41,510 --> 00:25:38,799
somewhat younger but probably

652
00:25:43,430 --> 00:25:41,520
several billion years would be at a

653
00:25:45,830 --> 00:25:43,440
canonical estimate by most scientists

654
00:25:48,310 --> 00:25:45,840
about how old things are of in this

655
00:25:50,149 --> 00:25:48,320
region of mars

656
00:25:51,830 --> 00:25:50,159
how the rock how we got the rock

657
00:25:54,310 --> 00:25:51,840
basically what's happened as bill

658
00:25:57,029 --> 00:25:54,320
described you had water transporting

659
00:25:58,710 --> 00:25:57,039
these gravels down to the downslope to

660
00:25:59,590 --> 00:25:58,720
the bottom of the

661
00:26:01,269 --> 00:25:59,600
fan

662
00:26:03,190 --> 00:26:01,279
at that point they just

663
00:26:06,149 --> 00:26:03,200

stayed there other materials were

664
00:26:08,230 --> 00:26:06,159
deposited on top of them

665
00:26:10,870 --> 00:26:08,240
and eventually

666
00:26:13,269 --> 00:26:10,880
they were cemented together by salts or

667
00:26:15,830 --> 00:26:13,279
bicarbonates or some other material to

668
00:26:17,110 --> 00:26:15,840
act as a as a means of of holding the

669
00:26:18,710 --> 00:26:17,120
rock together

670
00:26:21,430 --> 00:26:18,720
and then since then they've been

671
00:26:24,230 --> 00:26:21,440
uncovered again and that uncovering has

672
00:26:26,710 --> 00:26:24,240
revealed the this resistant rock unit

673
00:26:28,710 --> 00:26:26,720
but basically it was gravel that was

674
00:26:30,710 --> 00:26:28,720
transported by water

675
00:26:33,350 --> 00:26:30,720
sat on the surface for a while was then

676
00:26:35,830 --> 00:26:33,360
buried and became lithified turned into

677
00:26:38,470 --> 00:26:35,840
a rock thereafter so it's a rock made

678
00:26:40,950 --> 00:26:38,480
out of other pieces of rock and that's

679
00:26:43,990 --> 00:26:40,960
what we see at the surface today

680
00:26:52,470 --> 00:26:45,750
okay next we're going to craig kovalt on

681
00:26:57,190 --> 00:26:54,870
craig kovalt

682
00:27:00,310 --> 00:26:57,200
hi this is craig cavall

683
00:27:04,470 --> 00:27:00,320
with space ref and

684
00:27:08,230 --> 00:27:06,630
can you hear me okay yes we can hear you

685
00:27:11,750 --> 00:27:08,240
go ahead

686
00:27:13,669 --> 00:27:11,760
uh a couple questions uh relative to the

687
00:27:15,430 --> 00:27:13,679
alluvial fan

688
00:27:18,549 --> 00:27:15,440

down in the bottom of the crater there

689
00:27:20,950 --> 00:27:18,559
what does it speak to relative to the

690
00:27:22,789 --> 00:27:20,960
what was going on above the crater rim

691
00:27:24,470 --> 00:27:22,799
relative to water and the nature of

692
00:27:26,389 --> 00:27:24,480
water

693
00:27:28,470 --> 00:27:26,399
of course

694
00:27:30,230 --> 00:27:28,480
via the imagery from mro and the

695
00:27:34,070 --> 00:27:30,240
previous orbiters we're going to have a

696
00:27:36,549 --> 00:27:35,669
okay so

697
00:27:41,909 --> 00:27:36,559
the

698
00:27:45,190 --> 00:27:41,919
is about 200 square miles or 500 square

699
00:27:47,750 --> 00:27:45,200
kilometers we see traces of smaller

700
00:27:50,230 --> 00:27:47,760
tributary gullies in that area so it

701
00:27:51,669 --> 00:27:50,240
suggests that there were concentrations

702
00:27:53,590 --> 00:27:51,679
of water

703
00:27:55,029 --> 00:27:53,600
that entered then the larger canyon than

704
00:27:57,669 --> 00:27:55,039
did the cutting

705
00:27:59,190 --> 00:27:57,679
the how that where the water come from

706
00:28:01,669 --> 00:27:59,200
and the mechanism delivery is something

707
00:28:04,470 --> 00:28:01,679
we're exploring currently

708
00:28:06,630 --> 00:28:04,480
that water then ran down the canyon

709
00:28:07,590 --> 00:28:06,640
though and and transported sediment

710
00:28:09,830 --> 00:28:07,600
across

711
00:28:12,070 --> 00:28:09,840
a slope of just about one percent it's a

712
00:28:13,990 --> 00:28:12,080
very gentle gradient fan

713
00:28:15,909 --> 00:28:14,000

um and and

714
00:28:19,669 --> 00:28:15,919
apparently continued down to where our

715
00:28:23,110 --> 00:28:21,830
family a second question

716
00:28:24,950 --> 00:28:23,120
is

717
00:28:25,750 --> 00:28:24,960
pardon the fun

718
00:28:27,750 --> 00:28:25,760
that

719
00:28:28,630 --> 00:28:27,760
given the

720
00:28:33,110 --> 00:28:28,640
mars

721
00:28:39,750 --> 00:28:34,470
really

722
00:28:43,190 --> 00:28:41,350
mars exploration throughout here i'm

723
00:28:45,190 --> 00:28:43,200
giving you history

724
00:28:48,070 --> 00:28:45,200
uh going back from there in line and

725
00:28:49,830 --> 00:28:48,080
hold normally you're saying

726
00:28:51,830 --> 00:28:49,840
i i think craig it's it sounds like

727
00:28:53,110 --> 00:28:51,840
you're scuba diving right now

728
00:28:55,190 --> 00:28:53,120
i'm not sure we got all that but if

729
00:28:58,630 --> 00:28:55,200
you're if you're asking you know what

730
00:29:00,070 --> 00:28:58,640
what is the profound uh significance of

731
00:29:01,909 --> 00:29:00,080
this discovery

732
00:29:03,990 --> 00:29:01,919
i i think the reason that we're we're

733
00:29:06,549 --> 00:29:04,000
coming out with this as early as we are

734
00:29:08,070 --> 00:29:06,559
is is because i i would guess at this

735
00:29:09,590 --> 00:29:08,080
point in the history of exploration in

736
00:29:12,149 --> 00:29:09,600
the mars program

737
00:29:14,230 --> 00:29:12,159
we're getting better at at being able to

738
00:29:16,070 --> 00:29:14,240

integrate the orbiter data with

739
00:29:18,230 --> 00:29:16,080
predictions about what things define on

740
00:29:20,230 --> 00:29:18,240
the surface and so

741
00:29:22,470 --> 00:29:20,240
i think for a geologist to look from

742
00:29:24,549 --> 00:29:22,480
orbit and see an alluvial fan

743
00:29:25,990 --> 00:29:24,559
and then see a conglomerate rock that

744
00:29:29,110 --> 00:29:26,000
looks like it was transported an

745
00:29:31,990 --> 00:29:29,120
alluvial fan is not rocket science

746
00:29:34,230 --> 00:29:32,000
um but it is exactly the reason that we

747
00:29:35,909 --> 00:29:34,240
chose this landing site is because from

748
00:29:37,029 --> 00:29:35,919
orbit there are some signals that are

749
00:29:38,830 --> 00:29:37,039
very clear

750
00:29:41,990 --> 00:29:38,840
and you build your your course of

751
00:29:43,990 --> 00:29:42,000
exploration built on those those those

752
00:29:45,909 --> 00:29:44,000
foundations that that you think you're

753
00:29:47,110 --> 00:29:45,919
most likely to be able to establish and

754
00:29:48,230 --> 00:29:47,120
that and i believe that's what we've

755
00:29:50,630 --> 00:29:48,240
done now

756
00:29:52,710 --> 00:29:50,640
and so as we go forward now we bring the

757
00:29:55,110 --> 00:29:52,720
rest of the payload in we look at more

758
00:29:57,190 --> 00:29:55,120
rocks we get more context

759
00:29:59,430 --> 00:29:57,200
and the question about habitability goes

760
00:30:01,909 --> 00:29:59,440
just beyond the simple observation of of

761
00:30:04,710 --> 00:30:01,919
water on mars to recreating the

762
00:30:06,389 --> 00:30:04,720
environments in greater detail with an

763
00:30:09,190 --> 00:30:06,399

understanding of the chemistry that was

764
00:30:10,789 --> 00:30:09,200
going on at that time to ask if this is

765
00:30:13,029 --> 00:30:10,799
the kind of place that that

766
00:30:15,669 --> 00:30:13,039
microorganisms could have lived

767
00:30:17,830 --> 00:30:15,679
so certainly flowing water is a place

768
00:30:19,909 --> 00:30:17,840
where that could happen and this

769
00:30:22,950 --> 00:30:19,919
particular kind of rock may or may not

770
00:30:24,870 --> 00:30:22,960
be a good place for us to preserve

771
00:30:27,110 --> 00:30:24,880
those components that we associate with

772
00:30:29,110 --> 00:30:27,120
a habitable environment so that's still

773
00:30:30,710 --> 00:30:29,120
to be determined and

774
00:30:35,350 --> 00:30:30,720
that's the research the team is working

775
00:30:48,230 --> 00:30:37,750
okay the next color is randy showstack

776
00:30:48,240 --> 00:30:53,510
randy showstack with eos magazine

777
00:30:56,389 --> 00:30:54,710
okay we're going to go to the next

778
00:30:59,190 --> 00:30:56,399
caller and that would be leo enright

779
00:31:00,870 --> 00:30:59,200
with irish television go ahead leo

780
00:31:02,549 --> 00:31:00,880
thanks very much uh a couple of

781
00:31:05,350 --> 00:31:02,559
questions if i may

782
00:31:08,310 --> 00:31:05,360
my first question uh this is obviously a

783
00:31:10,149 --> 00:31:08,320
stunning announcement uh and

784
00:31:12,070 --> 00:31:10,159
i mean quite an extraordinary result of

785
00:31:14,149 --> 00:31:12,080
an early stage

786
00:31:15,990 --> 00:31:14,159
and i'm not a geologist i'm a journalist

787
00:31:18,389 --> 00:31:16,000
so i'm asking you why why did it take

788
00:31:21,430 --> 00:31:18,399

you so long to make this announcement i

789
00:31:23,590 --> 00:31:21,440
mean it seems that any uh you know first

790
00:31:26,630 --> 00:31:23,600
year geology student would have looked

791
00:31:29,029 --> 00:31:26,640
at that exposure and said immediately uh

792
00:31:30,630 --> 00:31:29,039
you know that's water transport uh high

793
00:31:32,310 --> 00:31:30,640
speed all of that

794
00:31:34,070 --> 00:31:32,320
you know was there somebody saying hang

795
00:31:36,630 --> 00:31:34,080
on a minute this could be something else

796
00:31:41,190 --> 00:31:36,640
and if they wear what was that

797
00:31:44,230 --> 00:31:41,200
yeah well uh so leo thanks for that uh

798
00:31:45,830 --> 00:31:44,240
you know i actually it it turns out that

799
00:31:48,549 --> 00:31:45,840
that really there's some details here

800
00:31:50,310 --> 00:31:48,559
that matter uh that that that may or may

801
00:31:52,870 --> 00:31:50,320
not be worth getting into

802
00:31:55,110 --> 00:31:52,880
but you know there are options and so

803
00:31:57,190 --> 00:31:55,120
you know the the sort of the putting

804
00:31:58,789 --> 00:31:57,200
this in the context of a jackhammered

805
00:32:00,789 --> 00:31:58,799
urban sidewalk

806
00:32:03,190 --> 00:32:00,799
actually if you take concrete as a

807
00:32:05,350 --> 00:32:03,200
substance it is not something that

808
00:32:07,029 --> 00:32:05,360
remains liquid because water is flowing

809
00:32:09,750 --> 00:32:07,039
freely across the surface and being

810
00:32:11,830 --> 00:32:09,760
vigorous it it's really in a geological

811
00:32:13,669 --> 00:32:11,840
context something called a debris flow

812
00:32:16,230 --> 00:32:13,679
and and i would say you know then you've

813
00:32:19,029 --> 00:32:16,240

got a more viscous material and we are

814
00:32:20,630 --> 00:32:19,039
interested in the details of of what how

815
00:32:21,669 --> 00:32:20,640
the water expressed itself on the

816
00:32:23,830 --> 00:32:21,679
surface

817
00:32:26,470 --> 00:32:23,840
and and so we do keep in mind these

818
00:32:28,789 --> 00:32:26,480
alternative hypotheses as as we look at

819
00:32:31,029 --> 00:32:28,799
this and i think you have to look at

820
00:32:33,669 --> 00:32:31,039
this rock in a lot of detail and see it

821
00:32:36,310 --> 00:32:33,679
in a couple of places before you feel

822
00:32:38,549 --> 00:32:36,320
confident as as a science team moving

823
00:32:40,710 --> 00:32:38,559
forward with a majority opinion that

824
00:32:42,549 --> 00:32:40,720
really this is more likely the result of

825
00:32:44,470 --> 00:32:42,559
water flowing vigorously across the

826
00:32:47,110 --> 00:32:44,480
surface rather than just sort of

827
00:32:48,710 --> 00:32:47,120
sluggishly pushing along in a and a pile

828
00:32:50,389 --> 00:32:48,720
of watery debris

829
00:32:52,310 --> 00:32:50,399
uh so the extent that that makes a

830
00:32:54,070 --> 00:32:52,320
difference to you that that's a nuance

831
00:32:56,230 --> 00:32:54,080
that we were we were interested to

832
00:33:02,549 --> 00:32:56,240
pursue

833
00:33:08,070 --> 00:33:05,029
my other question related to um

834
00:33:09,669 --> 00:33:08,080
really the process of humans versus

835
00:33:11,909 --> 00:33:09,679
robots

836
00:33:14,870 --> 00:33:11,919
next tomorrow is researchers night

837
00:33:18,470 --> 00:33:14,880
throughout europe and in ireland uh

838
00:33:20,710 --> 00:33:18,480

as it happens uh in in two

839
00:33:23,909 --> 00:33:20,720
way they'll be discussing the benefits

840
00:33:25,190 --> 00:33:23,919
the the possible benefits of astronauts

841
00:33:26,549 --> 00:33:25,200
versus

842
00:33:29,350 --> 00:33:26,559
robots

843
00:33:30,950 --> 00:33:29,360
in planetary exploration so i wonder did

844
00:33:33,990 --> 00:33:30,960
you have any thoughts

845
00:33:37,350 --> 00:33:34,000
for for that audience as to you know

846
00:33:39,350 --> 00:33:37,360
having made this extraordinary uh early

847
00:33:41,269 --> 00:33:39,360
uh discovery uh does this tell you

848
00:33:44,070 --> 00:33:41,279
something about the merit the relative

849
00:33:45,350 --> 00:33:44,080
merits of humans versus robots

850
00:33:47,190 --> 00:33:45,360
well uh

851
00:33:49,269 --> 00:33:47,200
again thank you for the heads up on that

852
00:33:52,470 --> 00:33:49,279
question by email allowed me to think it

853
00:33:55,029 --> 00:33:52,480
through a little bit uh i uh

854
00:33:57,269 --> 00:33:55,039
you know i think this is the kind of

855
00:33:59,590 --> 00:33:57,279
problem where this kind of rock given

856
00:34:02,230 --> 00:33:59,600
the evidence we have from orbit which is

857
00:34:03,110 --> 00:34:02,240
analyzed by humans in advance of landing

858
00:34:05,430 --> 00:34:03,120
there

859
00:34:08,310 --> 00:34:05,440
when when we arrive at something like

860
00:34:10,149 --> 00:34:08,320
this with a robot we can actually test

861
00:34:12,069 --> 00:34:10,159
the hypotheses including the

862
00:34:14,310 --> 00:34:12,079
alternatives pretty quickly and

863
00:34:16,149 --> 00:34:14,320

efficiently and arrive at a consensus

864
00:34:17,990 --> 00:34:16,159
opinion a lot of people have asked you

865
00:34:19,909 --> 00:34:18,000
know what about this gigantic team and

866
00:34:21,510 --> 00:34:19,919
how does it come together and i would

867
00:34:24,069 --> 00:34:21,520
say it's just simply an issue of signal

868
00:34:26,310 --> 00:34:24,079
to noise if if the geological signal of

869
00:34:27,909 --> 00:34:26,320
the process is large enough it's very

870
00:34:29,510 --> 00:34:27,919
easy to build consensus and that's what

871
00:34:32,230 --> 00:34:29,520
happened to our team

872
00:34:33,909 --> 00:34:32,240
so for a robot it's easy to to achieve

873
00:34:36,230 --> 00:34:33,919
the data that you want to get but let's

874
00:34:39,510 --> 00:34:36,240
say that this was a rock that we didn't

875
00:34:41,909 --> 00:34:39,520
expect at all something that that

876
00:34:44,389 --> 00:34:41,919
provided no earthly analogs something

877
00:34:46,470 --> 00:34:44,399
that wasn't easily to analyze i think

878
00:34:48,629 --> 00:34:46,480
then if you're working with a robot

879
00:34:50,629 --> 00:34:48,639
and a very large team it becomes very

880
00:34:52,389 --> 00:34:50,639
difficult to reach consensus and

881
00:34:55,589 --> 00:34:52,399
therefore there's no substitute really

882
00:34:57,670 --> 00:34:55,599
for a human when it comes to exploring

883
00:34:59,510 --> 00:34:57,680
really complex situations because the

884
00:35:01,190 --> 00:34:59,520
triage that you can do

885
00:35:03,510 --> 00:35:01,200
mentally as you as you pass your

886
00:35:05,270 --> 00:35:03,520
judgment over the options and and

887
00:35:07,349 --> 00:35:05,280
command yourself to walk to different

888
00:35:09,589 --> 00:35:07,359

places and make different measurements

889
00:35:11,270 --> 00:35:09,599
uh is really the compelling reason to to

890
00:35:13,270 --> 00:35:11,280
want to do human exploration because

891
00:35:15,670 --> 00:35:13,280
it's just so much more efficient and you

892
00:35:17,270 --> 00:35:15,680
probably will arrive at conclusions that

893
00:35:19,349 --> 00:35:17,280
are more likely to be correct than if

894
00:35:20,790 --> 00:35:19,359
you had just a robot along but we don't

895
00:35:22,470 --> 00:35:20,800
consider this to be a particularly

896
00:35:27,430 --> 00:35:22,480
complex scenario that we're looking at

897
00:35:30,950 --> 00:35:29,030
okay we're going to the next reporter on

898
00:35:41,910 --> 00:35:30,960
the phone and that would be eric hand

899
00:35:46,390 --> 00:35:44,470
okay we're going to go then to the next

900
00:35:48,870 --> 00:35:46,400
person and that would be emily loctawala

901
00:35:50,310 --> 00:35:48,880
from the planetary society

902
00:35:52,310 --> 00:35:50,320
that was probably eric

903
00:35:54,310 --> 00:35:52,320
oh nope that was emily's okay we're

904
00:35:56,550 --> 00:35:54,320
going to keep going down we have a lot

905
00:36:00,630 --> 00:35:56,560
todd halverson florida today are you on

906
00:36:03,670 --> 00:36:02,710
sounds like the phone system went off it

907
00:36:04,710 --> 00:36:03,680
does

908
00:36:07,030 --> 00:36:04,720
all right let me see if there's any

909
00:36:08,630 --> 00:36:07,040
questions here while we go um

910
00:36:12,470 --> 00:36:08,640
try to find any callers i don't know if

911
00:36:13,750 --> 00:36:12,480
there's some folks over okay

912
00:36:16,550 --> 00:36:13,760
once we go back to that question of

913
00:36:17,990 --> 00:36:16,560

habitats and habitability um

914
00:36:20,390 --> 00:36:18,000
what do you think

915
00:36:22,950 --> 00:36:20,400
uh this you know the the finding that

916
00:36:25,670 --> 00:36:22,960
you have right now tells us about this

917
00:36:27,910 --> 00:36:25,680
site and uh perhaps the you know

918
00:36:28,870 --> 00:36:27,920
implications for the larger site uh

919
00:36:32,150 --> 00:36:28,880
around that where you're gonna be

920
00:36:34,150 --> 00:36:32,160
heading in terms of glenelg uh

921
00:36:38,150 --> 00:36:34,160
you said i believe that that this is a

922
00:36:40,630 --> 00:36:38,160
potentially habitable place um

923
00:36:42,870 --> 00:36:40,640
how significant is that in terms of the

924
00:36:43,589 --> 00:36:42,880
overall mission of curiosity which is to

925
00:36:45,430 --> 00:36:43,599
find

926
00:36:48,069 --> 00:36:45,440
habitable places yeah

927
00:36:50,630 --> 00:36:48,079
uh so that's that's a very that's a very

928
00:36:51,990 --> 00:36:50,640
important uh aspect of the mission it's

929
00:36:53,510 --> 00:36:52,000
maybe the core of the mission is to

930
00:36:54,870 --> 00:36:53,520
explore for habitable environments so

931
00:36:56,470 --> 00:36:54,880
again just to remind you what a

932
00:36:57,829 --> 00:36:56,480
habitable environment is it's one that

933
00:37:00,150 --> 00:36:57,839
has water

934
00:37:01,910 --> 00:37:00,160
uh sources of energy for the

935
00:37:04,310 --> 00:37:01,920
microorganisms to utilize for their

936
00:37:05,990 --> 00:37:04,320
metabolism and then a source of carbon

937
00:37:08,790 --> 00:37:06,000
to build structures

938
00:37:11,270 --> 00:37:08,800

so in that in that sort of flow uh

939
00:37:13,430 --> 00:37:11,280
that's what we're doing here and and now

940
00:37:15,589 --> 00:37:13,440
we've got a hall pass for the water

941
00:37:17,990 --> 00:37:15,599
observation and now we're going to move

942
00:37:20,150 --> 00:37:18,000
on to the the chemical building blocks

943
00:37:22,390 --> 00:37:20,160
of life and do the elemental chemistry

944
00:37:23,589 --> 00:37:22,400
and the mineralogy and see if everything

945
00:37:25,270 --> 00:37:23,599
adds up to

946
00:37:27,750 --> 00:37:25,280
the kind of scenario where there would

947
00:37:29,430 --> 00:37:27,760
be you could reconstruct the kind of

948
00:37:32,069 --> 00:37:29,440
energy balances that might have occurred

949
00:37:33,829 --> 00:37:32,079
in this particular ancient environment

950
00:37:36,069 --> 00:37:33,839
then the last one is the most difficult

951
00:37:38,790 --> 00:37:36,079
of all i i believe and something we've

952
00:37:39,750 --> 00:37:38,800
said uh clearly all along

953
00:37:41,430 --> 00:37:39,760
you know

954
00:37:44,230 --> 00:37:41,440
finding evidence for preserved organic

955
00:37:45,910 --> 00:37:44,240
carbon is not easy on earth on a planet

956
00:37:47,750 --> 00:37:45,920
that teems with life and has lots of

957
00:37:49,030 --> 00:37:47,760
water you go back to rocks that are

958
00:37:51,589 --> 00:37:49,040
billions of years old and what you

959
00:37:54,069 --> 00:37:51,599
discover is that the very process that

960
00:37:56,230 --> 00:37:54,079
that enables life to be present water if

961
00:37:59,030 --> 00:37:56,240
you have too much of a good thing it's a

962
00:38:00,710 --> 00:37:59,040
mild oxidant and it actually results in

963
00:38:02,710 --> 00:38:00,720

and redistribution of those large

964
00:38:05,349 --> 00:38:02,720
organic molecules into things like

965
00:38:07,829 --> 00:38:05,359
carbon dioxide that just drift away

966
00:38:10,630 --> 00:38:07,839
so there's a part of this game that we

967
00:38:12,790 --> 00:38:10,640
refer to as preservation

968
00:38:14,390 --> 00:38:12,800
and and we look at a rock like this and

969
00:38:16,870 --> 00:38:14,400
wonder okay well it might have been a

970
00:38:17,589 --> 00:38:16,880
habitable environment but part of that

971
00:38:20,550 --> 00:38:17,599
is

972
00:38:22,230 --> 00:38:20,560
preserve organic carbon and if you have

973
00:38:23,670 --> 00:38:22,240
your choice between one kind of rock and

974
00:38:25,030 --> 00:38:23,680
another kind of rock

975
00:38:26,550 --> 00:38:25,040
you know we would look at this and this

976
00:38:28,790 --> 00:38:26,560
would be something that i think we would

977
00:38:31,270 --> 00:38:28,800
probably want to drill at some point and

978
00:38:32,950 --> 00:38:31,280
use the sam instrument to inspect

979
00:38:34,710 --> 00:38:32,960
but there might be other things that

980
00:38:37,109 --> 00:38:34,720
have a higher potential to have

981
00:38:38,950 --> 00:38:37,119
preserved organic carbon than this

982
00:38:40,950 --> 00:38:38,960
so the point of the mapping that we're

983
00:38:42,950 --> 00:38:40,960
going to be doing as we go around is to

984
00:38:44,310 --> 00:38:42,960
look at these different kinds of rocks

985
00:38:46,470 --> 00:38:44,320
and assess their potential for

986
00:38:48,550 --> 00:38:46,480
preservation

987
00:38:50,470 --> 00:38:48,560
and then and then try to rank those in

988
00:38:53,349 --> 00:38:50,480

terms of our priority but this is just

989
00:38:57,990 --> 00:38:53,359
our first so it would be a prospect but

990
00:39:02,230 --> 00:38:59,270
okay we're going to go back to the phone

991
00:39:04,870 --> 00:39:02,240
lines and todd halverson from florida

992
00:39:07,750 --> 00:39:04,880
today you can go ahead uh thanks very

993
00:39:09,670 --> 00:39:07,760
much todd halbertson of florida today i

994
00:39:12,630 --> 00:39:09,680
guess for john could

995
00:39:15,750 --> 00:39:12,640
you give us a general estimate

996
00:39:18,550 --> 00:39:15,760
of when you expect to get to glenelg at

997
00:39:21,190 --> 00:39:18,560
this point and i was wondering if you

998
00:39:24,710 --> 00:39:21,200
could kind of give us a sort of a real

999
00:39:28,230 --> 00:39:24,720
general idea on the go forward plan from

1000
00:39:30,150 --> 00:39:28,240
salz 52 and beyond

1001
00:39:32,150 --> 00:39:30,160
right so we've got uh probably a couple

1002
00:39:36,230 --> 00:39:32,160
saws ahead of us where we're looking at

1003
00:39:39,510 --> 00:39:36,240
targets that uh the rover will want to

1004
00:39:41,109 --> 00:39:39,520
to scoop uh our our first step in and

1005
00:39:42,550 --> 00:39:41,119
putting materials into the sam and

1006
00:39:45,030 --> 00:39:42,560
chemin instruments

1007
00:39:46,710 --> 00:39:45,040
is to acquire a loose material we have a

1008
00:39:48,710 --> 00:39:46,720
requirement to do that

1009
00:39:50,870 --> 00:39:48,720
and we have a couple of nice targets

1010
00:39:53,270 --> 00:39:50,880
that are within somewhere between two

1011
00:39:54,950 --> 00:39:53,280
and three and four saws in front of us

1012
00:39:57,030 --> 00:39:54,960
and then when we get to that target

1013
00:39:59,030 --> 00:39:57,040

we'll park for what will seem like a

1014
00:40:01,430 --> 00:39:59,040
very long time it's going to take on the

1015
00:40:03,990 --> 00:40:01,440
order of at least two weeks maybe three

1016
00:40:04,870 --> 00:40:04,000
weeks because there's such a complex set

1017
00:40:06,870 --> 00:40:04,880
of

1018
00:40:08,230 --> 00:40:06,880
processes that we have to go through

1019
00:40:10,630 --> 00:40:08,240
using the rover that have never been

1020
00:40:12,150 --> 00:40:10,640
done before on mars and obviously

1021
00:40:13,750 --> 00:40:12,160
because it's what we call a first time

1022
00:40:15,349 --> 00:40:13,760
activity we're going to be conservative

1023
00:40:16,790 --> 00:40:15,359
we're going to go slowly we're going to

1024
00:40:18,630 --> 00:40:16,800
make sure that everything is working in

1025
00:40:20,870 --> 00:40:18,640
the sequence that it should

1026
00:40:22,950 --> 00:40:20,880
and then after that we we will proceed

1027
00:40:24,550 --> 00:40:22,960
to the final glen egg glenelg

1028
00:40:26,550 --> 00:40:24,560
destination

1029
00:40:29,510 --> 00:40:26,560
where we'll look around and then begin

1030
00:40:34,150 --> 00:40:29,520
to evaluate what our our first candidate

1031
00:40:39,030 --> 00:40:35,750
okay we're going to go now to ken kramer

1032
00:40:40,230 --> 00:40:39,040
from space flight magazine go ahead

1033
00:40:42,710 --> 00:40:40,240
it should

1034
00:40:44,790 --> 00:40:42,720
and then after that we will proceed to

1035
00:40:46,150 --> 00:40:44,800
the final wedding

1036
00:40:48,230 --> 00:40:46,160
ken kramer

1037
00:40:49,430 --> 00:40:48,240
you have to turn down your television

1038
00:40:53,910 --> 00:40:49,440

let me ask you a question that came in

1039
00:40:57,910 --> 00:40:55,670
she said

1040
00:40:59,829 --> 00:40:57,920
do conglomerate rocks present particular

1041
00:41:04,630 --> 00:40:59,839
difficulties for drilling and sampling

1042
00:41:08,069 --> 00:41:06,390
that's uh that's another good question

1043
00:41:10,870 --> 00:41:08,079
this particular rock that we're looking

1044
00:41:13,270 --> 00:41:10,880
at one of the yes they do this we would

1045
00:41:15,430 --> 00:41:13,280
consider this to be a challenging rock

1046
00:41:17,109 --> 00:41:15,440
because the particles that make it up

1047
00:41:18,390 --> 00:41:17,119
you see that they weather out as

1048
00:41:21,270 --> 00:41:18,400
discrete

1049
00:41:23,829 --> 00:41:21,280
uh bits of gravel as as bill and becky

1050
00:41:25,430 --> 00:41:23,839
were were showing and the fact that they

1051
00:41:28,630 --> 00:41:25,440
weather out and they retain their

1052
00:41:30,790 --> 00:41:28,640
original shape so well suggest that it's

1053
00:41:32,790 --> 00:41:30,800
it's cemented but probably not

1054
00:41:35,109 --> 00:41:32,800
completely cemented and so what we would

1055
00:41:37,190 --> 00:41:35,119
worry about by drilling this rock is

1056
00:41:39,589 --> 00:41:37,200
that maybe it would fragment and break

1057
00:41:41,349 --> 00:41:39,599
along the boundaries between each one of

1058
00:41:43,430 --> 00:41:41,359
these bits of gravel

1059
00:41:46,390 --> 00:41:43,440
and and we might not actually get much

1060
00:41:48,630 --> 00:41:46,400
material up into the drill bit so where

1061
00:41:51,510 --> 00:41:48,640
now the project now is looking at these

1062
00:41:53,750 --> 00:41:51,520
kinds of rocks and collecting analogs

1063
00:41:55,750 --> 00:41:53,760

from earth to begin doing some testing

1064
00:41:57,510 --> 00:41:55,760
with to make sure we're ready to to

1065
00:41:59,349 --> 00:41:57,520
wrestle with something like this

1066
00:42:00,870 --> 00:41:59,359
okay and there's one more from emily

1067
00:42:03,030 --> 00:42:00,880
before i go to the phone line this is

1068
00:42:05,430 --> 00:42:03,040
when twitter comes in handy when the

1069
00:42:07,430 --> 00:42:05,440
phone doesn't work um

1070
00:42:09,109 --> 00:42:07,440
let's see uh are you chagrined at all

1071
00:42:11,510 --> 00:42:09,119
that you didn't stop at hatta to

1072
00:42:13,990 --> 00:42:11,520
investigate with molly or did masscam100

1073
00:42:16,790 --> 00:42:14,000
give you all you needed

1074
00:42:19,510 --> 00:42:16,800
oh well that's uh that's another that's

1075
00:42:21,750 --> 00:42:19,520
an easier one uh in that case we we

1076
00:42:24,550 --> 00:42:21,760
weren't really able to use the arm we

1077
00:42:26,550 --> 00:42:24,560
had to go through uh cap two

1078
00:42:28,069 --> 00:42:26,560
uh in order to be able to use the arm

1079
00:42:29,030 --> 00:42:28,079
and that was so many weeks out into the

1080
00:42:31,990 --> 00:42:29,040
future

1081
00:42:33,910 --> 00:42:32,000
uh we made the decision to to drive away

1082
00:42:35,430 --> 00:42:33,920
but now having seen these

1083
00:42:37,829 --> 00:42:35,440
similar rocks in three different

1084
00:42:40,230 --> 00:42:37,839
locations we we have confidence

1085
00:42:42,390 --> 00:42:40,240
uh that at some point we'll find another

1086
00:42:44,390 --> 00:42:42,400
one that looks similar to this

1087
00:42:46,950 --> 00:42:44,400
and and if not then remember that the

1088
00:42:49,030 --> 00:42:46,960

name glenelg is a palindrome chosen by

1089
00:42:50,390 --> 00:42:49,040
the team to represent that we're

1090
00:42:52,630 --> 00:42:50,400
actually going to be passing by here

1091
00:42:55,589 --> 00:42:52,640
again on the way out uh so we can

1092
00:42:57,030 --> 00:42:55,599
recover that if we need to

1093
00:42:59,990 --> 00:42:57,040
okay we're going to go back to the phone

1094
00:43:03,750 --> 00:43:00,000
line and carl franzen from talking point

1095
00:43:07,270 --> 00:43:05,349
hello can you can you guys hear me all

1096
00:43:09,109 --> 00:43:07,280
right i can barely hear you okay yes we

1097
00:43:11,510 --> 00:43:09,119
can hear you go ahead

1098
00:43:13,670 --> 00:43:11,520
okay uh yeah i just wanted to uh

1099
00:43:15,109 --> 00:43:13,680
following up on thank you again for uh

1100
00:43:17,030 --> 00:43:15,119
hosting this and uh explaining

1101
00:43:18,630 --> 00:43:17,040
everything uh that you found so far it's

1102
00:43:19,750 --> 00:43:18,640
a really exciting

1103
00:43:22,150 --> 00:43:19,760
uh

1104
00:43:23,589 --> 00:43:22,160
announcement hello can you hear me

1105
00:43:25,030 --> 00:43:23,599
go ahead yes

1106
00:43:27,030 --> 00:43:25,040
you might need to turn down your uh yeah

1107
00:43:28,790 --> 00:43:27,040
so uh i'm following up on an earlier

1108
00:43:31,510 --> 00:43:28,800
question i just wanted to ask i mean is

1109
00:43:34,630 --> 00:43:31,520
there any way that we'll be able to tell

1110
00:43:37,030 --> 00:43:34,640
uh either now or later on from uh

1111
00:43:38,550 --> 00:43:37,040
analysis of the uh the rock and soil

1112
00:43:40,550 --> 00:43:38,560
samples uh

1113
00:43:42,630 --> 00:43:40,560

whether or not there was anything uh

1114
00:43:44,710 --> 00:43:42,640
living in this water whether that was on

1115
00:43:45,990 --> 00:43:44,720
the stream bed itself or flowing through

1116
00:43:49,910 --> 00:43:46,000
the stream and

1117
00:43:52,470 --> 00:43:49,920
uh you know or or is that uh not uh

1118
00:43:54,790 --> 00:43:52,480
even in the cards here or or is that a

1119
00:43:56,550 --> 00:43:54,800
possibility i guess

1120
00:43:58,870 --> 00:43:56,560
uh it's certainly a possibility that we

1121
00:44:01,349 --> 00:43:58,880
can try to look uh and to be brief as

1122
00:44:04,150 --> 00:44:01,359
possible this just requires us to sample

1123
00:44:04,950 --> 00:44:04,160
the rock uh collect uh

1124
00:44:07,990 --> 00:44:04,960
some

1125
00:44:09,589 --> 00:44:08,000
portion of it and be able to look for uh

1126
00:44:11,349 --> 00:44:09,599
organic carbon which is one of the

1127
00:44:13,270 --> 00:44:11,359
objectives of the mission and if we find

1128
00:44:15,750 --> 00:44:13,280
it that in its own right does not

1129
00:44:17,430 --> 00:44:15,760
require that that there was ever uh

1130
00:44:19,750 --> 00:44:17,440
living microorganisms here there are

1131
00:44:21,510 --> 00:44:19,760
lots of other ways that organic carbon

1132
00:44:24,790 --> 00:44:21,520
can be introduced to the

1133
00:44:27,270 --> 00:44:24,800
to the surface of uh the of mars by

1134
00:44:28,790 --> 00:44:27,280
inorganic processes and one of the great

1135
00:44:31,270 --> 00:44:28,800
things about

1136
00:44:32,710 --> 00:44:31,280
a river system like this is that it it

1137
00:44:35,109 --> 00:44:32,720
could potentially collect those

1138
00:44:37,670 --> 00:44:35,119

materials from much farther away than

1139
00:44:39,190 --> 00:44:37,680
the rover is and bring them right to us

1140
00:44:40,630 --> 00:44:39,200
and uh

1141
00:44:42,710 --> 00:44:40,640
so you know this is definitely something

1142
00:44:45,030 --> 00:44:42,720
that if we can uh we would like to drill

1143
00:44:47,190 --> 00:44:45,040
at some point and do that exploration

1144
00:44:48,550 --> 00:44:47,200
but you said the carbon could be from uh

1145
00:44:50,230 --> 00:44:48,560
you know like you said a variety of

1146
00:44:52,710 --> 00:44:50,240
sources so is there any is there any way

1147
00:44:54,950 --> 00:44:52,720
to decisively know based on studying it

1148
00:44:58,150 --> 00:44:54,960
using any of the instruments uh whether

1149
00:45:01,670 --> 00:44:58,160
or not it came from a living a a living

1150
00:45:05,910 --> 00:45:03,430
or arguments like that are based on the

1151
00:45:08,230 --> 00:45:05,920
preponderance of evidence and when we

1152
00:45:10,710 --> 00:45:08,240
we take that uh that argument to the

1153
00:45:12,230 --> 00:45:10,720
earth uh and go back to rocks that are

1154
00:45:14,950 --> 00:45:12,240
billions of years old we require

1155
00:45:17,030 --> 00:45:14,960
multiple lines of evidence and curiosity

1156
00:45:19,190 --> 00:45:17,040
has the ability to detect organic

1157
00:45:20,630 --> 00:45:19,200
carbons and and actually tear them apart

1158
00:45:22,630 --> 00:45:20,640
in some detail

1159
00:45:24,470 --> 00:45:22,640
uh but it's going to have to wait to

1160
00:45:27,270 --> 00:45:24,480
another mission to to be able to

1161
00:45:30,150 --> 00:45:27,280
definitively uh demonstrate that

1162
00:45:31,270 --> 00:45:30,160
okay thanks helpful

1163
00:45:32,950 --> 00:45:31,280

all right we're going to take our last

1164
00:45:35,030 --> 00:45:32,960
question from the phone line now and

1165
00:45:41,270 --> 00:45:35,040
that would be uh ken cramer from space

1166
00:45:44,790 --> 00:45:43,589
okay no ken has dropped off the line all

1167
00:45:46,470 --> 00:45:44,800
right we're going to wrap it up then

1168
00:45:47,750 --> 00:45:46,480
here ken just go ahead and contact us

1169
00:45:49,829 --> 00:45:47,760
another way and we'll get your question

1170
00:45:51,510 --> 00:45:49,839
to the panel

1171
00:45:53,750 --> 00:45:51,520
and i just want to encourage everyone to

1172
00:45:56,069 --> 00:45:53,760
continue to follow this mission we post

1173
00:45:57,750 --> 00:45:56,079
updates daily and we have plenty of

1174
00:46:00,069 --> 00:45:57,760
videos that go along with the mission

1175
00:46:02,710 --> 00:46:00,079
each week posted on thursdays you can

1176
00:46:05,430 --> 00:46:02,720
find everything at nasa.gov

1177
00:46:07,670 --> 00:46:05,440
msl so just continue to follow us and