
NASA
Michael Meyer
Lead Scientist, Mars Exploration Program, NASA HQ
MARS SCIENCE LABORATORY

1
00:00:06,230 --> 00:00:04,070
good afternoon my name is duane brown

2
00:00:08,950 --> 00:00:06,240
with the office of communications

3
00:00:11,030 --> 00:00:08,960
and welcome to nasa headquarters

4
00:00:13,190 --> 00:00:11,040
today you will hear about the curiosity

5
00:00:15,829 --> 00:00:13,200
rover's analysis of the first

6
00:00:17,269 --> 00:00:15,839
sample of rock powder ever collected

7
00:00:19,189 --> 00:00:17,279
on mars

8
00:00:20,310 --> 00:00:19,199
we'll have brief presentations from our

9
00:00:21,670 --> 00:00:20,320
panel

10
00:00:23,429 --> 00:00:21,680
then we'll open it up with questions

11
00:00:26,150 --> 00:00:23,439
starting here on the phone lines our

12
00:00:27,269 --> 00:00:26,160
centers and also have our social media

13
00:00:30,310 --> 00:00:27,279

community

14
00:00:31,750 --> 00:00:30,320
have an opportunity to ask questions

15
00:00:33,270 --> 00:00:31,760
of course you can get all of this

16
00:00:35,030 --> 00:00:33,280
information and the latest updates on

17
00:00:39,110 --> 00:00:35,040
curiosity and all of nasa's mall's

18
00:00:42,790 --> 00:00:40,709
mars

19
00:00:44,709 --> 00:00:42,800
and join the conversation

20
00:00:46,630 --> 00:00:44,719
in the social media community and there

21
00:00:48,310 --> 00:00:46,640
are a lot of people all around the world

22
00:00:49,830 --> 00:00:48,320
talking about mars

23
00:00:51,350 --> 00:00:49,840
send your question in to

24
00:00:55,189 --> 00:00:51,360
ask nasa

25
00:00:57,270 --> 00:00:55,199
and on twitter at mars curiosity

26
00:00:59,029 --> 00:00:57,280
before we begin

27
00:01:02,150 --> 00:00:59,039
coming to the podium

28
00:01:04,390 --> 00:01:02,160
to put things in context for everyone

29
00:01:06,710 --> 00:01:04,400
is the associate administrator

30
00:01:18,149 --> 00:01:06,720
for nasa's science mission directorate

31
00:01:21,670 --> 00:01:19,590
well i'd like to welcome everyone to

32
00:01:23,429 --> 00:01:21,680
this press conference this is uh just

33
00:01:25,590 --> 00:01:23,439
incredibly exciting incredible exciting

34
00:01:27,510 --> 00:01:25,600
for me and i think once you hear the

35
00:01:29,510 --> 00:01:27,520
results and i've not heard the detailed

36
00:01:31,910 --> 00:01:29,520
results yet i think there'll be a

37
00:01:34,710 --> 00:01:31,920
tremendous amount of excitement when we

38
00:01:36,550 --> 00:01:34,720

think about the mars science laboratory

39
00:01:39,910 --> 00:01:36,560
event that we had last august the

40
00:01:41,670 --> 00:01:39,920
landing of curiosity on the planet mars

41
00:01:43,270 --> 00:01:41,680
often what comes to mind is the seven

42
00:01:45,109 --> 00:01:43,280
minutes of terror

43
00:01:46,710 --> 00:01:45,119
well since then we've had seven months

44
00:01:48,069 --> 00:01:46,720
of anticipation

45
00:01:51,030 --> 00:01:48,079
for the results that you're going to

46
00:01:51,990 --> 00:01:51,040
hear about today

47
00:01:54,149 --> 00:01:52,000
for me

48
00:01:55,910 --> 00:01:54,159
one of the most remarkable things about

49
00:01:58,789 --> 00:01:55,920
the curiosity

50
00:02:00,709 --> 00:01:58,799
rover is that everything is working

51
00:02:02,870 --> 00:02:00,719
and i think that's just an incredible

52
00:02:05,270 --> 00:02:02,880
engineering feed and i want to remind

53
00:02:06,709 --> 00:02:05,280
everyone who's listening that the amount

54
00:02:09,350 --> 00:02:06,719
of work that went into the results

55
00:02:12,229 --> 00:02:09,360
you'll hear is is really been just

56
00:02:15,190 --> 00:02:12,239
incredibly intensive has pushed human

57
00:02:16,949 --> 00:02:15,200
technology has pushed what we're able to

58
00:02:19,430 --> 00:02:16,959
do not only on earth with

59
00:02:21,830 --> 00:02:19,440
instrumentation but on a planet that's

60
00:02:24,869 --> 00:02:21,840
tens of millions of miles away

61
00:02:26,949 --> 00:02:24,879
in a very difficult environment

62
00:02:28,550 --> 00:02:26,959
i also want to remind everyone that what

63
00:02:30,949 --> 00:02:28,560

you're going to hear about are not the

64
00:02:33,110 --> 00:02:30,959
discoveries of curiosity but the

65
00:02:35,750 --> 00:02:33,120
discoveries of scientists here on earth

66
00:02:37,190 --> 00:02:35,760
and represented here today are those

67
00:02:39,190 --> 00:02:37,200
scientists

68
00:02:40,710 --> 00:02:39,200
and it's not just the four folks who are

69
00:02:43,030 --> 00:02:40,720
up on the stage but it represents

70
00:02:44,630 --> 00:02:43,040
hundreds of scientists working days and

71
00:02:46,309 --> 00:02:44,640
nights and i think they've probably been

72
00:02:48,790 --> 00:02:46,319
doing uh

73
00:02:50,790 --> 00:02:48,800
ops you know on nights and weekends not

74
00:02:52,550 --> 00:02:50,800
because they have to but because they

75
00:02:53,670 --> 00:02:52,560
love it because this is what excites

76
00:02:55,750 --> 00:02:53,680
them

77
00:02:58,309 --> 00:02:55,760
the fact that we're on mars and that we

78
00:02:59,589 --> 00:02:58,319
have this analytical laboratory on mars

79
00:03:02,070 --> 00:02:59,599
that's being controlled by the

80
00:03:04,309 --> 00:03:02,080
scientists and engineers and technicians

81
00:03:06,149 --> 00:03:04,319
from here on planet earth so with that i

82
00:03:08,949 --> 00:03:06,159
will hand it over

83
00:03:09,910 --> 00:03:08,959
uh back to dwayne and

84
00:03:11,270 --> 00:03:09,920
you know i think this is going to be

85
00:03:19,589 --> 00:03:11,280
incredibly exciting i know my

86
00:03:23,350 --> 00:03:21,430
thank you john and that's a great segue

87
00:03:25,589 --> 00:03:23,360
because now i get to introduce

88
00:03:27,589 --> 00:03:25,599

these incredible scientists a small part

89
00:03:29,030 --> 00:03:27,599
of a tremendous team

90
00:03:31,670 --> 00:03:29,040
first up

91
00:03:33,589 --> 00:03:31,680
you're here from michael meyer

92
00:03:35,589 --> 00:03:33,599
lead scientist

93
00:03:40,869 --> 00:03:35,599
mars exploration program nasa

94
00:03:44,830 --> 00:03:42,949
john godzinger

95
00:03:47,190 --> 00:03:44,840
curiosity project

96
00:03:54,470 --> 00:03:47,200
scientists california institute of

97
00:03:59,270 --> 00:03:57,030
david blake

98
00:04:00,550 --> 00:03:59,280
principal investigator for curiosity's

99
00:04:02,869 --> 00:04:00,560
chemistry

100
00:04:05,350 --> 00:04:02,879
mineralogy investigation

101
00:04:10,710 --> 00:04:05,360
at nasa's ames research center

102
00:04:14,789 --> 00:04:12,869
and paul mahaffey

103
00:04:17,670 --> 00:04:14,799
principal investigator for curiosity's

104
00:04:19,830 --> 00:04:17,680
sample analysis at mars investigation at

105
00:04:21,670 --> 00:04:19,840
nasa's goddard space flight center in

106
00:04:24,550 --> 00:04:21,680
greenbelt maryland so with that i'll

107
00:04:27,030 --> 00:04:24,560
turn it over to you michael thanks duane

108
00:04:29,510 --> 00:04:27,040
the nasa mars exploration program has

109
00:04:32,390 --> 00:04:29,520
progressively approached the red planet

110
00:04:35,510 --> 00:04:32,400
from a global perspective to focus

111
00:04:38,390 --> 00:04:35,520
exploration of regions past and present

112
00:04:40,550 --> 00:04:38,400
that exhibit the potential for life

113
00:04:42,950 --> 00:04:40,560

every successive mission has boosted our

114
00:04:45,189 --> 00:04:42,960
expectations that mars could have been a

115
00:04:46,950 --> 00:04:45,199
habitable planet a place that could have

116
00:04:49,590 --> 00:04:46,960
supported life

117
00:04:51,510 --> 00:04:49,600
this program of orbiters and landers

118
00:04:53,990 --> 00:04:51,520
have brought us to the point of seeking

119
00:04:56,230 --> 00:04:54,000
a habitable environment on mars

120
00:04:57,830 --> 00:04:56,240
this is what brought the rover curiosity

121
00:05:00,390 --> 00:04:57,840
to gale crater

122
00:05:01,430 --> 00:05:00,400
mineralogical and geomorphological

123
00:05:03,830 --> 00:05:01,440
evidence

124
00:05:07,749 --> 00:05:03,840
from orbit showing that the area had

125
00:05:10,710 --> 00:05:07,759
significant amount of water in its past

126
00:05:12,790 --> 00:05:10,720
as john mentioned on august 6 curiosity

127
00:05:15,189 --> 00:05:12,800
landed spectacularly

128
00:05:16,710 --> 00:05:15,199
where we wanted in gale crater within

129
00:05:19,350 --> 00:05:16,720
two months the team found an ancient

130
00:05:21,350 --> 00:05:19,360
riverbed evidence of flowing water

131
00:05:23,430 --> 00:05:21,360
and we followed that downhill to

132
00:05:25,830 --> 00:05:23,440
yellowknife bay

133
00:05:28,870 --> 00:05:25,840
at the same time

134
00:05:30,469 --> 00:05:28,880
we exercised the rover's capabilities

135
00:05:31,830 --> 00:05:30,479
tested the instruments for the first

136
00:05:34,230 --> 00:05:31,840
time

137
00:05:36,870 --> 00:05:34,240
and doing science along the way

138
00:05:39,430 --> 00:05:36,880

we have now completed all the first time

139
00:05:41,749 --> 00:05:39,440
activities including the first sample

140
00:05:44,230 --> 00:05:41,759
drilled on another planet

141
00:05:46,550 --> 00:05:44,240
this mission has been a fantastic team

142
00:05:49,029 --> 00:05:46,560
effort of engineers and scientists

143
00:05:50,950 --> 00:05:49,039
to deliver a highly capable exploration

144
00:05:53,430 --> 00:05:50,960
rover to mars

145
00:05:55,510 --> 00:05:53,440
the rover is now fully commissioned

146
00:05:56,550 --> 00:05:55,520
for science all the instruments are

147
00:05:57,909 --> 00:05:56,560
working

148
00:06:03,430 --> 00:05:57,919
and the keys to the rover have been

149
00:06:08,950 --> 00:06:06,550
so mars has written the autobiography

150
00:06:11,590 --> 00:06:08,960
its autobiography and the rocks of gale

151
00:06:14,309 --> 00:06:11,600
crater and we just started deciphering

152
00:06:16,070 --> 00:06:14,319
that story so chapter one

153
00:06:18,150 --> 00:06:16,080
yellowknife bay

154
00:06:19,749 --> 00:06:18,160
this was an ancient environment with the

155
00:06:21,909 --> 00:06:19,759
right elements

156
00:06:22,950 --> 00:06:21,919
minerals indicating a near neutral

157
00:06:26,950 --> 00:06:22,960
environment

158
00:06:28,790 --> 00:06:26,960
and slightly salty liquid water

159
00:06:30,550 --> 00:06:28,800
all the prerequisites

160
00:06:32,550 --> 00:06:30,560
to support life

161
00:06:34,150 --> 00:06:32,560
a habitable environment

162
00:06:36,230 --> 00:06:34,160
and so for the rest of the story i'll

163
00:06:37,189 --> 00:06:36,240

turn this over to john great thanks

164
00:06:39,909 --> 00:06:37,199
michael

165
00:06:41,830 --> 00:06:39,919
um it's a it's a great uh science story

166
00:06:44,390 --> 00:06:41,840
as as michael was saying and i need to

167
00:06:47,270 --> 00:06:44,400
start first with acknowledging uh our

168
00:06:49,350 --> 00:06:47,280
colleagues that came before us and also

169
00:06:51,510 --> 00:06:49,360
the entire planetary community that that

170
00:06:54,309 --> 00:06:51,520
supported this mission as you know

171
00:06:55,430 --> 00:06:54,319
developing msl was a a tremendous

172
00:06:57,350 --> 00:06:55,440
challenge

173
00:06:59,110 --> 00:06:57,360
and uh and and we had plenty of

174
00:07:00,390 --> 00:06:59,120
adventures there but we got the support

175
00:07:02,870 --> 00:07:00,400
from our community and we really

176
00:07:05,270 --> 00:07:02,880
appreciate that i'd also like to thank

177
00:07:07,270 --> 00:07:05,280
the mars community and through the the

178
00:07:09,350 --> 00:07:07,280
leadership of matt gombeck and john

179
00:07:10,790 --> 00:07:09,360
grant which led to the the final

180
00:07:13,189 --> 00:07:10,800
selection of landing sites that

181
00:07:15,670 --> 00:07:13,199
ultimately led us to gale

182
00:07:17,029 --> 00:07:15,680
where we have uh uh have had a terrific

183
00:07:19,749 --> 00:07:17,039
time so far

184
00:07:22,390 --> 00:07:19,759
that's been great and also in particular

185
00:07:24,629 --> 00:07:22,400
uh the mer mission spirit opportunity

186
00:07:27,189 --> 00:07:24,639
mars express and and also mars

187
00:07:28,870 --> 00:07:27,199
reconnaissance orbiter uh if we have

188
00:07:30,550 --> 00:07:28,880

looked farther is because we have stood

189
00:07:32,710 --> 00:07:30,560
on the shoulders of giants and those

190
00:07:34,870 --> 00:07:32,720
missions allowed us to fine-tune our

191
00:07:35,990 --> 00:07:34,880
exploration campaign that led us to this

192
00:07:36,950 --> 00:07:36,000
place

193
00:07:38,790 --> 00:07:36,960
finally

194
00:07:41,029 --> 00:07:38,800
those of us that get to set up here

195
00:07:43,189 --> 00:07:41,039
today are joined by our colleagues

196
00:07:44,390 --> 00:07:43,199
back at jpl and elsewhere the other pis

197
00:07:47,589 --> 00:07:44,400
of the mission

198
00:07:50,869 --> 00:07:47,599
including uh ken edgett uh ralph gellert

199
00:07:53,110 --> 00:07:50,879
don hassler mike malen igor mitrafanoff

200
00:07:55,510 --> 00:07:53,120
and and roger wiens and javier gomez

201
00:07:57,589 --> 00:07:55,520
ovira every one of the instruments has

202
00:07:59,830 --> 00:07:57,599
led into the discovery that we have made

203
00:08:01,830 --> 00:07:59,840
here some of those instruments presented

204
00:08:04,629 --> 00:08:01,840
back in january when we first talked

205
00:08:06,230 --> 00:08:04,639
about the geology and that chemcam

206
00:08:08,710 --> 00:08:06,240
discovered the first evidence for

207
00:08:09,510 --> 00:08:08,720
sulfates in this area here you'll hear

208
00:08:12,469 --> 00:08:09,520
more

209
00:08:13,990 --> 00:08:12,479
results coming out next week at lpsc and

210
00:08:15,749 --> 00:08:14,000
then at egu

211
00:08:18,629 --> 00:08:15,759
over in europe in april you'll get to

212
00:08:20,710 --> 00:08:18,639
hear more still so this has been a very

213
00:08:22,950 --> 00:08:20,720

comprehensive exercise and we didn't

214
00:08:25,350 --> 00:08:22,960
just stumble into this area that this is

215
00:08:27,189 --> 00:08:25,360
something that took a lot of planning

216
00:08:29,430 --> 00:08:27,199
okay so let me go to the first display

217
00:08:32,070 --> 00:08:29,440
item and bring it back to where we were

218
00:08:34,550 --> 00:08:32,080
the night of of landing when we as a

219
00:08:37,350 --> 00:08:34,560
community first looked at this slide

220
00:08:39,190 --> 00:08:37,360
we had selected a landing sl site and

221
00:08:40,709 --> 00:08:39,200
the landing ellipse in particular was

222
00:08:43,190 --> 00:08:40,719
close to mount sharp which was

223
00:08:44,790 --> 00:08:43,200
considered to be our primary objective

224
00:08:47,110 --> 00:08:44,800
and so you can think about drilling an

225
00:08:48,790 --> 00:08:47,120
oil well here uh you don't just go in

226
00:08:50,630 --> 00:08:48,800
with one objective you need primary

227
00:08:52,710 --> 00:08:50,640
objectives and you want secondary

228
00:08:55,350 --> 00:08:52,720
objectives and we had a secondary

229
00:08:57,190 --> 00:08:55,360
objective which was the distal part of

230
00:08:59,430 --> 00:08:57,200
this alluvial fan that you see here in

231
00:09:01,750 --> 00:08:59,440
the landing ellipse and we needed this

232
00:09:03,590 --> 00:09:01,760
in the back pocket in order to have the

233
00:09:05,750 --> 00:09:03,600
landing site

234
00:09:08,550 --> 00:09:05,760
confirmed by the review board and then

235
00:09:10,150 --> 00:09:08,560
eventually accepted by by headquarters

236
00:09:11,750 --> 00:09:10,160
and in case something happened to the

237
00:09:13,269 --> 00:09:11,760
rover we needed to make sure we had

238
00:09:15,030 --> 00:09:13,279

science to do and that a landing ellipse

239
00:09:17,030 --> 00:09:15,040
but that was sort of a you can think of

240
00:09:18,710 --> 00:09:17,040
it as a backup or a secondary objective

241
00:09:20,550 --> 00:09:18,720
and it turns out now in fact to have

242
00:09:24,790 --> 00:09:20,560
become our primary objective at this

243
00:09:27,350 --> 00:09:24,800
point uh we landed uh at the uh there

244
00:09:29,670 --> 00:09:27,360
where it says curiosity landing site and

245
00:09:31,269 --> 00:09:29,680
we drove just a few hundred meters in

246
00:09:33,110 --> 00:09:31,279
the opposite direction we did this

247
00:09:34,230 --> 00:09:33,120
deliberately and this was based on the

248
00:09:35,990 --> 00:09:34,240
mapping

249
00:09:38,389 --> 00:09:36,000
that the science team did an advance of

250
00:09:40,470 --> 00:09:38,399
landing and based on the previous

251
00:09:42,630 --> 00:09:40,480
mapping that came from odyssey and mro

252
00:09:44,389 --> 00:09:42,640
and all those great missions before us

253
00:09:46,230 --> 00:09:44,399
and in this particular case it led to

254
00:09:48,949 --> 00:09:46,240
the deliberate discovery

255
00:09:51,190 --> 00:09:48,959
so it wasn't serendipity or luck that

256
00:09:53,350 --> 00:09:51,200
got us here it was a result of planning

257
00:09:55,269 --> 00:09:53,360
now what paul and dave will tell you

258
00:09:57,190 --> 00:09:55,279
about is the part that we do consider

259
00:09:59,430 --> 00:09:57,200
serendipitous we had no idea that we

260
00:10:01,030 --> 00:09:59,440
were going to go into the aqueous

261
00:10:03,829 --> 00:10:01,040
environment that we were predicting to

262
00:10:06,069 --> 00:10:03,839
exist here and also find sulfates and

263
00:10:09,269 --> 00:10:06,079

also find clays and and those guys will

264
00:10:10,550 --> 00:10:09,279
tell you about it uh so that what that's

265
00:10:12,470 --> 00:10:10,560
that's one of the reasons that we're

266
00:10:14,790 --> 00:10:12,480
going to be spending some time here

267
00:10:16,630 --> 00:10:14,800
so let me turn it over to dave and he

268
00:10:18,710 --> 00:10:16,640
can tell you about kevin

269
00:10:20,470 --> 00:10:18,720
well thanks john and uh you know we got

270
00:10:24,310 --> 00:10:20,480
really excited when we first saw these

271
00:10:26,150 --> 00:10:24,320
uh these uh bedrock at john klein inside

272
00:10:28,949 --> 00:10:26,160
these concretions and and the reason is

273
00:10:30,829 --> 00:10:28,959
concretions are evidence of uh

274
00:10:33,190 --> 00:10:30,839
uh a water soaked sediment a soft

275
00:10:35,750 --> 00:10:33,200
sediment but what kind of an environment

276
00:10:37,590 --> 00:10:35,760
was it uh was it ever habitable for life

277
00:10:39,590 --> 00:10:37,600
and if it was

278
00:10:41,190 --> 00:10:39,600
would it preserve the organics for

279
00:10:43,430 --> 00:10:41,200
literally billions of years until we

280
00:10:45,269 --> 00:10:43,440
came here to to take a look to see if we

281
00:10:47,110 --> 00:10:45,279
could see what was there

282
00:10:48,710 --> 00:10:47,120
if you turn to the first graphic you can

283
00:10:51,110 --> 00:10:48,720
see what made us think we really found

284
00:10:54,069 --> 00:10:51,120
something special

285
00:10:56,310 --> 00:10:54,079
okay well this is what we call pay dirt

286
00:10:58,069 --> 00:10:56,320
this powder in the scoop here is from

287
00:11:00,470 --> 00:10:58,079
john klein the drill powder and it's

288
00:11:01,750 --> 00:11:00,480

gray green meaning that it wasn't highly

289
00:11:03,190 --> 00:11:01,760
oxidized

290
00:11:04,470 --> 00:11:03,200
and you can see in the back of the scoop

291
00:11:06,949 --> 00:11:04,480
there there's a little bit of reddish

292
00:11:08,949 --> 00:11:06,959
material this is from the rock nest and

293
00:11:11,269 --> 00:11:08,959
this is highly oxidized so anyway what

294
00:11:13,670 --> 00:11:11,279
it shows you is that this material was

295
00:11:15,990 --> 00:11:13,680
never highly oxidized and therefore if

296
00:11:18,310 --> 00:11:16,000
there was organic material present there

297
00:11:20,790 --> 00:11:18,320
it could have been preserved

298
00:11:22,550 --> 00:11:20,800
uh the second graphic shows comparison

299
00:11:25,030 --> 00:11:22,560
of the two x-ray diffraction patterns

300
00:11:27,509 --> 00:11:25,040
that chemin has collected so far on the

301
00:11:29,910 --> 00:11:27,519
left is rocknest soil and on the right

302
00:11:30,870 --> 00:11:29,920
is the pattern we got recently from john

303
00:11:32,630 --> 00:11:30,880
klein

304
00:11:34,389 --> 00:11:32,640
you can see they look very similar and

305
00:11:36,870 --> 00:11:34,399
from our analyses we can tell you they

306
00:11:38,150 --> 00:11:36,880
both have igneous minerals feldspar

307
00:11:40,310 --> 00:11:38,160
pyroxene

308
00:11:41,829 --> 00:11:40,320
olivine and magnetite

309
00:11:45,269 --> 00:11:41,839
what's different if you look at the john

310
00:11:48,230 --> 00:11:45,279
klein fraction pattern uh down close to

311
00:11:50,790 --> 00:11:48,240
the central uh point there the intensity

312
00:11:53,190 --> 00:11:50,800
is due to clay minerals and you see

313
00:11:54,069 --> 00:11:53,200

there's they're labeled phyllosilicates

314
00:11:55,509 --> 00:11:54,079
and

315
00:11:57,990 --> 00:11:55,519
we can tell you from our analysis

316
00:12:00,870 --> 00:11:58,000
there's between 20 and 30 percent of a

317
00:12:03,750 --> 00:12:00,880
phyllosilicate called smectite

318
00:12:06,069 --> 00:12:03,760
and that smektite forms in the presence

319
00:12:08,310 --> 00:12:06,079
of water we know that in addition

320
00:12:10,710 --> 00:12:08,320
we have evidence of salts like halite

321
00:12:12,389 --> 00:12:10,720
and calcium sulfates rather than iron or

322
00:12:15,509 --> 00:12:12,399
magnesium sulfates that were found at

323
00:12:19,269 --> 00:12:15,519
meridiani and this suggests that the the

324
00:12:21,509 --> 00:12:19,279
water was uh relatively neutral ph uh

325
00:12:23,190 --> 00:12:21,519
and uh in other words it was a potential

326
00:12:25,190 --> 00:12:23,200
habitable environment

327
00:12:27,509 --> 00:12:25,200
so all of this is what mineralogy can

328
00:12:28,389 --> 00:12:27,519
tell you from an ancient surface that's

329
00:12:30,550 --> 00:12:28,399
uh

330
00:12:32,870 --> 00:12:30,560
billions of years old so the next

331
00:12:35,269 --> 00:12:32,880
graphic uh shows you what we think a

332
00:12:38,150 --> 00:12:35,279
good terrestrial analog is for this

333
00:12:40,310 --> 00:12:38,160
material we found in yellowknife bay the

334
00:12:42,310 --> 00:12:40,320
left image shows a clay bearing sediment

335
00:12:43,590 --> 00:12:42,320
deposited in a lake bed in southern

336
00:12:45,350 --> 00:12:43,600
australia

337
00:12:47,509 --> 00:12:45,360
and on the right you see a core of the

338
00:12:49,590 --> 00:12:47,519

sediment and the different layers in the

339
00:12:51,829 --> 00:12:49,600
core represent

340
00:12:55,190 --> 00:12:51,839
different changes in mineral composition

341
00:12:58,069 --> 00:12:55,200
as the lake sediment was deposited

342
00:13:01,269 --> 00:12:58,079
and with that i'll let paul talk about

343
00:13:02,470 --> 00:13:01,279
what the sam instrument found

344
00:13:04,870 --> 00:13:02,480
thanks dave

345
00:13:06,550 --> 00:13:04,880
just delighted to show you some

346
00:13:08,790 --> 00:13:06,560
results from sam

347
00:13:11,350 --> 00:13:08,800
uh and i'm going to explain a little bit

348
00:13:12,470 --> 00:13:11,360
about how we did this fairly complex

349
00:13:14,310 --> 00:13:12,480
experiment

350
00:13:16,150 --> 00:13:14,320
but i thought it would be fun to bring

351
00:13:17,990 --> 00:13:16,160
along what's a

352
00:13:20,629 --> 00:13:18,000
full-size scale

353
00:13:22,310 --> 00:13:20,639
model of

354
00:13:23,590 --> 00:13:22,320
sam the sample analysis of mars

355
00:13:25,269 --> 00:13:23,600
experiment

356
00:13:27,750 --> 00:13:25,279
sam and kevin are both buried deep

357
00:13:30,069 --> 00:13:27,760
inside of a curiosity so in these kind

358
00:13:31,829 --> 00:13:30,079
of beautiful

359
00:13:34,389 --> 00:13:31,839
self-portraits that

360
00:13:36,069 --> 00:13:34,399
ken edgett's camera takes of curiosity

361
00:13:38,069 --> 00:13:36,079
you don't see much of salmon come in we

362
00:13:39,590 --> 00:13:38,079
have a test bed up at goddard

363
00:13:41,350 --> 00:13:39,600

you don't see much of it either because

364
00:13:43,030 --> 00:13:41,360
it's an environmental chamber it's it's

365
00:13:45,189 --> 00:13:43,040
buried deep inside

366
00:13:46,629 --> 00:13:45,199
an environment that represents mars so

367
00:13:47,750 --> 00:13:46,639
here we've kind of taken away the

368
00:13:50,790 --> 00:13:47,760
aluminum

369
00:13:52,069 --> 00:13:50,800
paneling and put on plexiglass and and

370
00:13:54,310 --> 00:13:52,079
made a model

371
00:13:55,910 --> 00:13:54,320
and where the experiment starts that i'm

372
00:13:58,629 --> 00:13:55,920
going to describe

373
00:14:00,790 --> 00:13:58,639
we have just a little bit of sample

374
00:14:04,310 --> 00:14:00,800
located inside

375
00:14:05,750 --> 00:14:04,320
a sam cup and i went last night into amy

376
00:14:07,750 --> 00:14:05,760
mcadams lab

377
00:14:10,710 --> 00:14:07,760
up at goddard and and dug around and

378
00:14:12,389 --> 00:14:10,720
found some nontrinite which is a clay

379
00:14:14,069 --> 00:14:12,399
mineral of the type that we're going to

380
00:14:16,069 --> 00:14:14,079
be talking about today

381
00:14:19,269 --> 00:14:16,079
and i there's a scale in there and i

382
00:14:21,590 --> 00:14:19,279
weighed out uh 45 thousandths of a gram

383
00:14:24,550 --> 00:14:21,600
of that stuff because that's about the

384
00:14:26,710 --> 00:14:24,560
amount that was was in our sam cup uh

385
00:14:28,310 --> 00:14:26,720
when we analyzed it so that's where the

386
00:14:29,990 --> 00:14:28,320
story of this analysis that i'm going to

387
00:14:32,069 --> 00:14:30,000
tell you starts

388
00:14:33,990 --> 00:14:32,079

we have the sample in the cup and sam we

389
00:14:36,069 --> 00:14:34,000
have loaded it the previous sole the

390
00:14:37,269 --> 00:14:36,079
previous day and we're ready to do our

391
00:14:39,590 --> 00:14:37,279
analysis

392
00:14:42,310 --> 00:14:39,600
so it's night on mars the rover's gone

393
00:14:44,949 --> 00:14:42,320
to sleep uh sam's kind of a night owl we

394
00:14:46,790 --> 00:14:44,959
like to operate at night and

395
00:14:49,189 --> 00:14:46,800
nobody else there to bother us but it's

396
00:14:50,949 --> 00:14:49,199
also a good thermal environment for some

397
00:14:54,230 --> 00:14:50,959
of the instruments to operate

398
00:14:55,910 --> 00:14:54,240
and so we had put the sample

399
00:14:56,790 --> 00:14:55,920
in the cup

400
00:14:58,949 --> 00:14:56,800
through

401
00:15:01,030 --> 00:14:58,959
this little inlet tube this vibrates as

402
00:15:03,430 --> 00:15:01,040
the sample is going into the cup and

403
00:15:04,389 --> 00:15:03,440
then the sample manipula manipulation

404
00:15:05,750 --> 00:15:04,399
system

405
00:15:08,870 --> 00:15:05,760
developed by our collaborators at

406
00:15:11,430 --> 00:15:08,880
honeybee robotics is

407
00:15:13,829 --> 00:15:11,440
is can be seen down here

408
00:15:16,629 --> 00:15:13,839
and it turns out that the way the sample

409
00:15:19,670 --> 00:15:16,639
gets to the oven is this little carousel

410
00:15:23,030 --> 00:15:19,680
rotates the samples dropped into the cup

411
00:15:25,350 --> 00:15:23,040
the oven the the quartz cup moves over

412
00:15:27,509 --> 00:15:25,360
and then it raises into into the oven a

413
00:15:29,269 --> 00:15:27,519

very small oven where we take the sample

414
00:15:30,470 --> 00:15:29,279
up to the maximum temperature that i'll

415
00:15:32,310 --> 00:15:30,480
show you

416
00:15:34,150 --> 00:15:32,320
and what we do then is we start heating

417
00:15:36,470 --> 00:15:34,160
up the oven we get a flow of helium

418
00:15:38,389 --> 00:15:36,480
going over the sample we heat up the

419
00:15:40,790 --> 00:15:38,399
oven and then with the mass spectrometer

420
00:15:42,389 --> 00:15:40,800
which is right in this area we sniff a

421
00:15:44,230 --> 00:15:42,399
little bit of that gas

422
00:15:46,389 --> 00:15:44,240
and we measure the the chemical

423
00:15:48,949 --> 00:15:46,399
constituents that come off

424
00:15:50,710 --> 00:15:48,959
and as we do that we capture a little

425
00:15:52,389 --> 00:15:50,720
bit of gas in our tunable laser

426
00:15:53,670 --> 00:15:52,399
spectrometer that was developed by chris

427
00:15:55,110 --> 00:15:53,680
webster's team

428
00:15:57,910 --> 00:15:55,120
out at jpl

429
00:16:00,710 --> 00:15:57,920
and we capture a little bit more of the

430
00:16:03,030 --> 00:16:00,720
gas in a hydrocarbon trap because one of

431
00:16:04,710 --> 00:16:03,040
our objectives of this experiment really

432
00:16:07,509 --> 00:16:04,720
is to search for organic compounds on

433
00:16:09,430 --> 00:16:07,519
mars and we later will send this gas to

434
00:16:10,790 --> 00:16:09,440
the gas chromatograph

435
00:16:13,189 --> 00:16:10,800
i think i have a button here that will

436
00:16:14,870 --> 00:16:13,199
make one of one of the columns light up

437
00:16:17,430 --> 00:16:14,880
and then the gas goes through those

438
00:16:19,350 --> 00:16:17,440

columns and the individual constituents

439
00:16:20,949 --> 00:16:19,360
come out one by one and then back into

440
00:16:24,230 --> 00:16:20,959
the mass spectrometer through a back

441
00:16:25,829 --> 00:16:24,240
door and again we we analyze uh what

442
00:16:27,829 --> 00:16:25,839
mars is made of

443
00:16:31,670 --> 00:16:27,839
and so if you go to the first graphic uh

444
00:16:33,829 --> 00:16:31,680
we'll show you some of the data

445
00:16:35,269 --> 00:16:33,839
and this really is just picking out the

446
00:16:38,150 --> 00:16:35,279
five uh

447
00:16:40,629 --> 00:16:38,160
major gases that were evolved from the

448
00:16:43,030 --> 00:16:40,639
sample and let's start with what's

449
00:16:45,670 --> 00:16:43,040
labeled water on top but the

450
00:16:46,949 --> 00:16:45,680
mass that we're monitoring that is mass

451
00:16:49,030 --> 00:16:46,959
18

452
00:16:50,870 --> 00:16:49,040
that's the signature of water and you

453
00:16:52,710 --> 00:16:50,880
see the temperature scale on the bottom

454
00:16:54,550 --> 00:16:52,720
going all the way up to 1500 degrees

455
00:16:57,030 --> 00:16:54,560
fahrenheit in this case

456
00:16:59,430 --> 00:16:57,040
and that water is coming off at really

457
00:17:01,910 --> 00:16:59,440
high temperature and that's exactly

458
00:17:03,749 --> 00:17:01,920
characteristic of these smektite clays

459
00:17:06,630 --> 00:17:03,759
and it's very good confirmation of what

460
00:17:08,710 --> 00:17:06,640
the chemin saw uh we really do have

461
00:17:10,309 --> 00:17:08,720
clays here and about thirty percent of

462
00:17:12,069 --> 00:17:10,319
the water that's coming off is that is

463
00:17:14,069 --> 00:17:12,079

that high temperature water

464
00:17:16,470 --> 00:17:14,079
uh go down to the lower left you'll see

465
00:17:18,630 --> 00:17:16,480
a blue trace that's oxygen we've we've

466
00:17:21,110 --> 00:17:18,640
blown it up by about a factor of of 10

467
00:17:24,390 --> 00:17:21,120
in this case for illustration and we did

468
00:17:25,829 --> 00:17:24,400
see some oxygen at a rock nest dust pile

469
00:17:28,470 --> 00:17:25,839
and we attributed that to the

470
00:17:30,870 --> 00:17:28,480
decomposition of a perchlorate which is

471
00:17:32,710 --> 00:17:30,880
pretty interesting it looks like there's

472
00:17:33,830 --> 00:17:32,720
very likely some perchlorate here as

473
00:17:36,230 --> 00:17:33,840
well

474
00:17:39,350 --> 00:17:36,240
the the red peak is likewise carbon

475
00:17:40,549 --> 00:17:39,360
dioxide the carbon dioxide is produced

476
00:17:42,549 --> 00:17:40,559
either from

477
00:17:45,909 --> 00:17:42,559
oxygen reacting with carbon in the

478
00:17:47,750 --> 00:17:45,919
sample and making this carbon dioxide or

479
00:17:50,070 --> 00:17:47,760
really the other alternative is a

480
00:17:51,990 --> 00:17:50,080
decomposition of a carbonate and both of

481
00:17:54,470 --> 00:17:52,000
those possibilities are just fascinating

482
00:17:57,750 --> 00:17:54,480
so that's what we'll be uh pursuing as

483
00:18:00,070 --> 00:17:57,760
we as we progress with new samples and

484
00:18:00,870 --> 00:18:00,080
so on and then finally in the bottom

485
00:18:02,710 --> 00:18:00,880
right

486
00:18:07,190 --> 00:18:02,720
at higher temperatures

487
00:18:10,310 --> 00:18:07,200
you see masses labeled 64 and and 34

488
00:18:12,390 --> 00:18:10,320

and those represent an oxidized and a

489
00:18:15,669 --> 00:18:12,400
reduced form of sulfur they represent

490
00:18:19,430 --> 00:18:15,679
respectively sulfur dioxide and hydrogen

491
00:18:20,630 --> 00:18:19,440
sulfide and so that's just fascinating

492
00:18:23,909 --> 00:18:20,640
we have

493
00:18:26,789 --> 00:18:23,919
both oxidized and much more than in this

494
00:18:28,630 --> 00:18:26,799
atmospheric dust much more reduced

495
00:18:30,549 --> 00:18:28,640
sulfur there as well

496
00:18:33,029 --> 00:18:30,559
what the tunable laser spectrometer was

497
00:18:34,950 --> 00:18:33,039
doing in the meantime in this experiment

498
00:18:37,909 --> 00:18:34,960
was measuring the deuterium to hydrogen

499
00:18:40,470 --> 00:18:37,919
ratio in water and a very interesting

500
00:18:42,630 --> 00:18:40,480
observation we had measured a very high

501
00:18:45,430 --> 00:18:42,640
deuterium hydrogen ratio

502
00:18:48,710 --> 00:18:45,440
in water evolved from the dust and we

503
00:18:50,870 --> 00:18:48,720
understand that as being a signature of

504
00:18:53,350 --> 00:18:50,880
a good fraction of

505
00:18:54,710 --> 00:18:53,360
water having been lost from the mars

506
00:18:56,470 --> 00:18:54,720
atmosphere

507
00:18:58,470 --> 00:18:56,480
over geological time

508
00:19:01,430 --> 00:18:58,480
and in this sample we see just the

509
00:19:03,909 --> 00:19:01,440
lowest uh deuterium to hydrogen ratio

510
00:19:05,350 --> 00:19:03,919
that we've seen in evolved gas so far

511
00:19:07,190 --> 00:19:05,360
and uh so that's something we're

512
00:19:10,150 --> 00:19:07,200
definitely going to be pursuing as as we

513
00:19:12,789 --> 00:19:10,160

go forward uh with other samples uh so

514
00:19:15,830 --> 00:19:12,799
go to the the uh next us

515
00:19:19,830 --> 00:19:15,840
slide and here's what the

516
00:19:22,710 --> 00:19:19,840
search for organics uh is looking like

517
00:19:24,789 --> 00:19:22,720
the data looks like uh

518
00:19:26,710 --> 00:19:24,799
signatures of mass to charge just as i

519
00:19:28,310 --> 00:19:26,720
showed in the previous time but here

520
00:19:30,630 --> 00:19:28,320
these compounds are coming out of the

521
00:19:32,470 --> 00:19:30,640
end of the gas chromatograph column and

522
00:19:35,190 --> 00:19:32,480
here we see two compounds that we

523
00:19:38,310 --> 00:19:35,200
actually had also detected uh at rock

524
00:19:41,110 --> 00:19:38,320
nest a very simple uh chloromethane and

525
00:19:42,789 --> 00:19:41,120
dichloromethane compounds and it looks

526
00:19:44,549 --> 00:19:42,799
like they're above the background level

527
00:19:46,390 --> 00:19:44,559
it looks like they're there

528
00:19:49,190 --> 00:19:46,400
we have to be very careful at this point

529
00:19:51,669 --> 00:19:49,200
in in interpretation this was the very

530
00:19:53,990 --> 00:19:51,679
first sample that had gone through the

531
00:19:55,909 --> 00:19:54,000
curiosity drill and so there's always a

532
00:19:56,710 --> 00:19:55,919
possibility that some residual carbon

533
00:19:58,950 --> 00:19:56,720
that

534
00:20:00,470 --> 00:19:58,960
was on the drill bit made its way into

535
00:20:01,750 --> 00:20:00,480
the sample so we're really looking

536
00:20:03,909 --> 00:20:01,760
forward to

537
00:20:06,230 --> 00:20:03,919
repeating this experiment and seeing if

538
00:20:08,149 --> 00:20:06,240

the signatures of simple chloromethane

539
00:20:10,390 --> 00:20:08,159
compounds uh persist

540
00:20:11,990 --> 00:20:10,400
so the really good news is the the

541
00:20:14,230 --> 00:20:12,000
instrument is just working beautifully

542
00:20:16,549 --> 00:20:14,240
it's a credit to the to the very

543
00:20:18,549 --> 00:20:16,559
talented team that worked hard on not

544
00:20:20,630 --> 00:20:18,559
only making this stuff but making it

545
00:20:22,950 --> 00:20:20,640
robust and making it work in this very

546
00:20:24,630 --> 00:20:22,960
difficult environment on mars so with

547
00:20:27,190 --> 00:20:24,640
that i'll turn it back to john for some

548
00:20:29,029 --> 00:20:27,200
additional comments great thanks paul so

549
00:20:31,110 --> 00:20:29,039
what i'd like to do now is sort of set

550
00:20:33,830 --> 00:20:31,120
the stage a little bit for what we view

551
00:20:35,750 --> 00:20:33,840
in this mission as the transition from

552
00:20:37,110 --> 00:20:35,760
the original goal a decade ago of the

553
00:20:39,270 --> 00:20:37,120
search for water

554
00:20:41,430 --> 00:20:39,280
on mars to now the search for habitable

555
00:20:43,350 --> 00:20:41,440
environments on mars and if we go to the

556
00:20:45,669 --> 00:20:43,360
first display item there

557
00:20:47,590 --> 00:20:45,679
uh what we can see are two two rocks

558
00:20:49,750 --> 00:20:47,600
separated by a decade of research the

559
00:20:50,710 --> 00:20:49,760
one on the left is from the opportunity

560
00:20:54,950 --> 00:20:50,720
rover

561
00:20:57,909 --> 00:20:54,960
uh back in in 2004 a rock called watmey

562
00:21:00,310 --> 00:20:57,919
uh and what you see here is a rock these

563
00:21:01,909 --> 00:21:00,320

images have been processed by mike malin

564
00:21:04,070 --> 00:21:01,919
and jim bell with what's called white

565
00:21:06,310 --> 00:21:04,080
balance and that helps bring out our

566
00:21:07,669 --> 00:21:06,320
terrestrial intuition to to sort of get

567
00:21:09,750 --> 00:21:07,679
a sense of what these rocks would look

568
00:21:11,830 --> 00:21:09,760
like if they were on earth the one on

569
00:21:14,470 --> 00:21:11,840
the left is is basically from the

570
00:21:16,870 --> 00:21:14,480
sequence of rocks at meridiani planum a

571
00:21:18,630 --> 00:21:16,880
rock that is reasonably fine grained the

572
00:21:21,270 --> 00:21:18,640
the particles were either formed in

573
00:21:23,990 --> 00:21:21,280
water or transported in water it was

574
00:21:26,149 --> 00:21:24,000
then cemented uh in water converted from

575
00:21:27,669 --> 00:21:26,159
sediment into rock and then after that

576
00:21:29,590 --> 00:21:27,679
it was fractured and then some of the

577
00:21:31,909 --> 00:21:29,600
fractures were filled in with what looks

578
00:21:34,230 --> 00:21:31,919
like a relatively uh

579
00:21:35,590 --> 00:21:34,240
uh thin material in this particular rock

580
00:21:37,510 --> 00:21:35,600
but you see all the bumps sticking out

581
00:21:39,590 --> 00:21:37,520
those are the famous blueberries these

582
00:21:41,430 --> 00:21:39,600
things we know are concretions well it

583
00:21:44,549 --> 00:21:41,440
turns out these things are turning up on

584
00:21:47,190 --> 00:21:44,559
mars and here on the right is our rock

585
00:21:50,390 --> 00:21:47,200
uh in the yellowknife bay area called

586
00:21:51,990 --> 00:21:50,400
sheep bed uh unit we've named it and

587
00:21:54,390 --> 00:21:52,000
again you can see it approximately has

588
00:21:56,470 --> 00:21:54,400

the same color on the surface uh it's

589
00:21:59,270 --> 00:21:56,480
laced with these features that look like

590
00:22:00,950 --> 00:21:59,280
concretions to us and the big difference

591
00:22:03,190 --> 00:22:00,960
is is that you can see in that rock that

592
00:22:04,630 --> 00:22:03,200
it has a white vein fill uh running

593
00:22:06,789 --> 00:22:04,640
through it that's the thing that chemcam

594
00:22:09,350 --> 00:22:06,799
first hit and told us that there were

595
00:22:11,350 --> 00:22:09,360
probably sulfates here so texturally you

596
00:22:13,110 --> 00:22:11,360
see rocks that were transported in water

597
00:22:15,830 --> 00:22:13,120
formed in water cemented and watered

598
00:22:17,510 --> 00:22:15,840
altered in water and uh but that's what

599
00:22:19,270 --> 00:22:17,520
you get on the surface and so what we

600
00:22:21,350 --> 00:22:19,280
need to do is scratch below the surface

601
00:22:23,510 --> 00:22:21,360
and if you go to the next one

602
00:22:24,710 --> 00:22:23,520
this is what a decade of of engineering

603
00:22:26,870 --> 00:22:24,720
gives you

604
00:22:29,270 --> 00:22:26,880
on the left there's a rock that was one

605
00:22:32,230 --> 00:22:29,280
of the first rocks that we ever uh

606
00:22:35,029 --> 00:22:32,240
interacted with it at mertiani uh with

607
00:22:37,750 --> 00:22:35,039
the rat rock abrasion tool and on the

608
00:22:39,350 --> 00:22:37,760
right we have the uh the drill hole uh

609
00:22:41,510 --> 00:22:39,360
from from curiosity and the drill hole

610
00:22:43,830 --> 00:22:41,520
is about one-third of the size of of the

611
00:22:46,390 --> 00:22:43,840
rat hole there on the left but the big

612
00:22:48,070 --> 00:22:46,400
story is in the powder that's generated

613
00:22:49,830 --> 00:22:48,080

and so as we learned at meridiani we

614
00:22:52,630 --> 00:22:49,840
have a rock that is composed

615
00:22:54,630 --> 00:22:52,640
significantly of hematite in addition to

616
00:22:56,789 --> 00:22:54,640
these sulfates iron bearing sulfates

617
00:22:59,669 --> 00:22:56,799
that indicate very acidic waters on the

618
00:23:02,070 --> 00:22:59,679
right we get to see the newmars the grey

619
00:23:04,070 --> 00:23:02,080
mars uh that one that suggests uh

620
00:23:07,270 --> 00:23:04,080
habitability that has these clays and

621
00:23:10,310 --> 00:23:07,280
other under other minerals present

622
00:23:12,310 --> 00:23:10,320
so what then do we mean by habitability

623
00:23:15,110 --> 00:23:12,320
the key thing here is an environment

624
00:23:17,430 --> 00:23:15,120
that a a microbe could have lived in and

625
00:23:19,029 --> 00:23:17,440
maybe even prospered in so there's three

626
00:23:21,909 --> 00:23:19,039
things that we want to point out today

627
00:23:23,669 --> 00:23:21,919
that that dave and paul have shown you

628
00:23:25,990 --> 00:23:23,679
and the first issue comes down to

629
00:23:28,230 --> 00:23:26,000
acidity we don't see any of the evidence

630
00:23:30,390 --> 00:23:28,240
that we have here the rock on the left

631
00:23:32,390 --> 00:23:30,400
the one from meridiani it's totally

632
00:23:33,830 --> 00:23:32,400
different in the subsurface in this rock

633
00:23:36,549 --> 00:23:33,840
on the right we have the clay minerals

634
00:23:39,190 --> 00:23:36,559
which form a neutral ph we don't see the

635
00:23:41,830 --> 00:23:39,200
iron sulfates which indicate acid ph

636
00:23:43,669 --> 00:23:41,840
instead we see calcium sulfate this rock

637
00:23:45,590 --> 00:23:43,679
quite frankly looks like a typical thing

638
00:23:48,230 --> 00:23:45,600

that we would get on earth and it's a

639
00:23:50,710 --> 00:23:48,240
neutral ph environment and i think

640
00:23:52,950 --> 00:23:50,720
everybody has a sense of what acidity

641
00:23:55,990 --> 00:23:52,960
means but there are some microbes that

642
00:23:58,630 --> 00:23:56,000
exist at very very low phs but wait

643
00:24:00,870 --> 00:23:58,640
there's more and the second point is

644
00:24:02,630 --> 00:24:00,880
water activity this is how much

645
00:24:05,029 --> 00:24:02,640
available water there was for a

646
00:24:06,870 --> 00:24:05,039
microorganism to live in its environment

647
00:24:09,669 --> 00:24:06,880
so with that i'm going to pull out a

648
00:24:11,510 --> 00:24:09,679
prop here it's a jar of honey

649
00:24:14,390 --> 00:24:11,520
everybody always wonders why it is the

650
00:24:16,070 --> 00:24:14,400
solution of of water and sugar can last

651
00:24:18,390 --> 00:24:16,080
on the shelf forever and ever without

652
00:24:20,149 --> 00:24:18,400
spoiling and the reason why is that even

653
00:24:21,750 --> 00:24:20,159
though there's a lot of water in this

654
00:24:23,590 --> 00:24:21,760
honey there's not enough that's

655
00:24:26,149 --> 00:24:23,600
available for a microorganism and if a

656
00:24:27,750 --> 00:24:26,159
microorganism winds up in here all the

657
00:24:29,750 --> 00:24:27,760
water will be sucked out of the cell

658
00:24:32,149 --> 00:24:29,760
it's this thing called osmosis the

659
00:24:33,909 --> 00:24:32,159
organism won't be able to live turns out

660
00:24:35,510 --> 00:24:33,919
the rock on the left there that's what

661
00:24:37,269 --> 00:24:35,520
we think happened at meridiani but

662
00:24:40,149 --> 00:24:37,279
instead of sugar we had a salt called

663
00:24:41,990 --> 00:24:40,159

magnesium sulfate and there was so much

664
00:24:43,669 --> 00:24:42,000
of it that it would have inhibited

665
00:24:46,070 --> 00:24:43,679
microorganisms to live there that was

666
00:24:47,750 --> 00:24:46,080
not a habitable environment and then

667
00:24:49,590 --> 00:24:47,760
there's one more thing that we're really

668
00:24:52,630 --> 00:24:49,600
excited about that we

669
00:24:53,510 --> 00:24:52,640
that we found at mertiani sorry at

670
00:24:56,310 --> 00:24:53,520
gale

671
00:24:58,070 --> 00:24:56,320
and uh it's a battery and basically

672
00:24:59,830 --> 00:24:58,080
these minerals that dave and paul were

673
00:25:01,190 --> 00:24:59,840
telling you about they're effectively

674
00:25:03,430 --> 00:25:01,200
like batteries

675
00:25:05,990 --> 00:25:03,440
some of them are negatively charged and

676
00:25:07,510 --> 00:25:06,000
they have various oxidation states and

677
00:25:09,269 --> 00:25:07,520
what we have learned in the last 20

678
00:25:12,390 --> 00:25:09,279
years of modern microbiology is that

679
00:25:15,350 --> 00:25:12,400
very primitive organisms they can derive

680
00:25:17,830 --> 00:25:15,360
energy just by feeding on rocks so when

681
00:25:20,789 --> 00:25:17,840
paul talks about sulfate versus sulfide

682
00:25:22,310 --> 00:25:20,799
and dave talks about clays and magnetite

683
00:25:24,230 --> 00:25:22,320
these are the kind of things that tell

684
00:25:26,149 --> 00:25:24,240
you that there could have been a flow of

685
00:25:28,870 --> 00:25:26,159
electrons in the environment just like

686
00:25:30,549 --> 00:25:28,880
on this battery you hook up the wires

687
00:25:32,710 --> 00:25:30,559
and it goes to the light bulb and the

688
00:25:34,390 --> 00:25:32,720

light bulb turns on that's kind of what

689
00:25:36,470 --> 00:25:34,400
a microorganism would have done in this

690
00:25:38,630 --> 00:25:36,480
environment if life had ever evolved on

691
00:25:40,870 --> 00:25:38,640
mars and if it was present here so

692
00:25:43,190 --> 00:25:40,880
that's what we mean by habitability take

693
00:25:45,190 --> 00:25:43,200
all three of those factors and to really

694
00:25:47,590 --> 00:25:45,200
understand that that's that's what

695
00:25:48,789 --> 00:25:47,600
that's what we built this payload for

696
00:25:51,510 --> 00:25:48,799
and that's what we feel that we've

697
00:25:53,510 --> 00:25:51,520
succeeded at and so with that i'll turn

698
00:25:54,630 --> 00:25:53,520
it back to dwayne thank you gentlemen

699
00:25:56,310 --> 00:25:54,640
okay we're going to open it up for

700
00:25:58,230 --> 00:25:56,320
questions that normally i would start

701
00:25:59,830 --> 00:25:58,240
here in washington but we're going to go

702
00:26:01,350 --> 00:25:59,840
out to the west coast first and then

703
00:26:07,110 --> 00:26:01,360
come back to the jet propulsion

704
00:26:12,070 --> 00:26:10,470
hi how's it going nbc in los angeles so

705
00:26:14,230 --> 00:26:12,080
can you talk to me a little bit about

706
00:26:16,630 --> 00:26:14,240
the area where the rock was found

707
00:26:21,830 --> 00:26:16,640
what would it have been like uh in

708
00:26:25,590 --> 00:26:23,430
okay so what we imagined it would have

709
00:26:28,149 --> 00:26:25,600
looked like was the picture that dave

710
00:26:30,870 --> 00:26:28,159
showed uh we feel is a pretty good

711
00:26:33,909 --> 00:26:30,880
representation uh it's it's conservative

712
00:26:36,470 --> 00:26:33,919
in the sense that it shows a a lake bed

713
00:26:38,870 --> 00:26:36,480

that's dry the lake bed was filled by

714
00:26:40,870 --> 00:26:38,880
sediment derived from streams

715
00:26:43,430 --> 00:26:40,880
uh but we don't know how long lived it

716
00:26:44,789 --> 00:26:43,440
was and and so that's always a challenge

717
00:26:46,470 --> 00:26:44,799
we've got on mars it's not like the

718
00:26:48,710 --> 00:26:46,480
rocks come with numbers on them to tell

719
00:26:51,269 --> 00:26:48,720
you how long the water was there or how

720
00:26:53,190 --> 00:26:51,279
much there was there ultimately but we

721
00:26:55,350 --> 00:26:53,200
believe that that we wound up in the

722
00:26:57,830 --> 00:26:55,360
sheep bed unit at a place that was that

723
00:26:59,430 --> 00:26:57,840
was wet uh for a relatively long period

724
00:27:06,549 --> 00:26:59,440
of time enough for all these these

725
00:27:09,830 --> 00:27:07,750
okay we're going to canal we're going to

726
00:27:11,990 --> 00:27:09,840
come back to uh nasa headquarters any

727
00:27:15,269 --> 00:27:12,000
questions from a media in in the front

728
00:27:19,190 --> 00:27:16,549
okay so

729
00:27:20,789 --> 00:27:19,200
what what i will do then is let's go to

730
00:27:22,310 --> 00:27:20,799
our social media

731
00:27:23,669 --> 00:27:22,320
uh community

732
00:27:30,230 --> 00:27:23,679
for a couple of questions that have come

733
00:27:32,549 --> 00:27:31,430
before and

734
00:27:34,230 --> 00:27:32,559
then we're going to go to allen boyle

735
00:27:35,990 --> 00:27:34,240
but let me let me take the social media

736
00:27:38,389 --> 00:27:36,000
question first um

737
00:27:41,990 --> 00:27:38,399
clear nasa knows how to build rovers

738
00:27:46,789 --> 00:27:42,000

what will the 2020 rover look like or be

739
00:27:52,230 --> 00:27:47,909
one of the things that we're playing

740
00:27:55,430 --> 00:27:52,240
with the 2020 rover uh we now have

741
00:27:57,510 --> 00:27:55,440
a great capability in the entry descent

742
00:27:59,750 --> 00:27:57,520
and landing system and the rover system

743
00:28:00,549 --> 00:27:59,760
that we built for curiosity

744
00:28:02,630 --> 00:28:00,559
we

745
00:28:05,350 --> 00:28:02,640
want to use as much of that as possible

746
00:28:09,190 --> 00:28:05,360
in the 2020 rover and so the approach

747
00:28:10,230 --> 00:28:09,200
that we're taking is to use that

748
00:28:13,350 --> 00:28:10,240
descent

749
00:28:14,470 --> 00:28:13,360
landing capability and the rover as a

750
00:28:17,750 --> 00:28:14,480
platform

751
00:28:19,510 --> 00:28:17,760
for the for the 2020 mission but we're

752
00:28:22,070 --> 00:28:19,520
going to populate it with new

753
00:28:24,230 --> 00:28:22,080
instruments and new capabilities may be

754
00:28:26,710 --> 00:28:24,240
in the arm and for instance maybe doing

755
00:28:28,549 --> 00:28:26,720
coreness drilling so that's sort of in

756
00:28:31,029 --> 00:28:28,559
the mix but we're going to start with

757
00:28:33,269 --> 00:28:31,039
the basic rover and a system to get it

758
00:28:36,630 --> 00:28:33,279
to the surface safely and because of

759
00:28:40,070 --> 00:28:38,549
let's say not have to do a lot of the

760
00:28:42,470 --> 00:28:40,080
engineering development that was

761
00:28:44,470 --> 00:28:42,480
required for curiosity save a fair

762
00:28:46,630 --> 00:28:44,480
amount of money and get also a very

763
00:28:49,430 --> 00:28:46,640

capable rover system to the surface of

764
00:28:51,110 --> 00:28:49,440
mars with the newest and best

765
00:28:52,870 --> 00:28:51,120
instruments that we have available at

766
00:28:54,470 --> 00:28:52,880
the time

767
00:28:56,950 --> 00:28:54,480
okay now let's go to the phone lines and

768
00:28:59,590 --> 00:28:56,960
i believe we have alan boyle up uh first

769
00:29:02,950 --> 00:28:59,600
in the queue alan

770
00:29:05,430 --> 00:29:02,960
hi thank you uh alan ball from nbc news

771
00:29:07,909 --> 00:29:05,440
i just had a general question about

772
00:29:08,950 --> 00:29:07,919
uh how do you feel

773
00:29:11,750 --> 00:29:08,960
that

774
00:29:13,669 --> 00:29:11,760
it sounds like you're all excited about

775
00:29:18,230 --> 00:29:13,679
this and and do you feel like it's

776
00:29:20,389 --> 00:29:18,240
mission accomplished what went into uh

777
00:29:22,230 --> 00:29:20,399
nailing down these sorts of results can

778
00:29:25,430 --> 00:29:22,240
you describe a little bit of the emotion

779
00:29:28,389 --> 00:29:25,440
behind the process thank you

780
00:29:30,710 --> 00:29:28,399
well i'll i'll start with um

781
00:29:33,750 --> 00:29:30,720
sort of the whole idea of where to land

782
00:29:36,549 --> 00:29:33,760
on mars with this tremendous asset

783
00:29:39,750 --> 00:29:36,559
uh when it came down to it we narrowed

784
00:29:42,149 --> 00:29:39,760
the uh our landing sites down to four

785
00:29:43,750 --> 00:29:42,159
and all of them looked really good and

786
00:29:45,430 --> 00:29:43,760
as you might imagine

787
00:29:46,470 --> 00:29:45,440
every single scientist had their

788
00:29:49,430 --> 00:29:46,480

favorite

789
00:29:51,110 --> 00:29:49,440
and so we had four major contenders and

790
00:29:53,669 --> 00:29:51,120
i kept on thinking now that we picked

791
00:29:54,389 --> 00:29:53,679
curio that we picked gale crater to go

792
00:29:57,830 --> 00:29:54,399
to

793
00:30:00,230 --> 00:29:57,840
that the odds are 20 that are 75 that we

794
00:30:02,789 --> 00:30:00,240
picked the wrong place to go

795
00:30:04,950 --> 00:30:02,799
well you can imagine relief landing

796
00:30:07,830 --> 00:30:04,960
there and then almost right off the bat

797
00:30:10,950 --> 00:30:07,840
we do find evidence of water we see a

798
00:30:12,789 --> 00:30:10,960
ancient riverbed we're now finding a

799
00:30:14,950 --> 00:30:12,799
environment in the near subsurface you

800
00:30:17,909 --> 00:30:14,960
know not too far beneath the oxidized

801
00:30:18,950 --> 00:30:17,919
layer of finding sort of a neutral

802
00:30:20,789 --> 00:30:18,960
rock

803
00:30:23,350 --> 00:30:20,799
all the things that we were really

804
00:30:25,750 --> 00:30:23,360
hoping for to find a place that could

805
00:30:27,590 --> 00:30:25,760
have been habitable in its past so as

806
00:30:30,070 --> 00:30:27,600
far as as far as i'm concerned this is

807
00:30:31,909 --> 00:30:30,080
fantastic all the rest is gravy in terms

808
00:30:33,669 --> 00:30:31,919
of how the rover's going to go about

809
00:30:34,870 --> 00:30:33,679
looking around this area because it

810
00:30:38,789 --> 00:30:34,880
definitely

811
00:30:40,549 --> 00:30:38,799
was uh all the indications of being a

812
00:30:43,830 --> 00:30:40,559
habitable environment at one point in

813
00:30:48,789 --> 00:30:47,110

i think i'll i'll add to that by uh

814
00:30:51,510 --> 00:30:48,799
adding an additional point that what

815
00:30:53,350 --> 00:30:51,520
this does now is that uh i think with

816
00:30:54,710 --> 00:30:53,360
all the planning that that michael was

817
00:30:56,630 --> 00:30:54,720
talking about going into picking the

818
00:30:59,190 --> 00:30:56,640
landing site and then effectively

819
00:31:01,350 --> 00:30:59,200
exploiting the landing site uh you know

820
00:31:03,190 --> 00:31:01,360
we had 400 team members and before we

821
00:31:05,269 --> 00:31:03,200
landed for about two months folks got

822
00:31:08,149 --> 00:31:05,279
stuck into mapping this and that helped

823
00:31:10,310 --> 00:31:08,159
us expeditiously find a place that when

824
00:31:13,110 --> 00:31:10,320
we landed no matter where we landed we

825
00:31:14,710 --> 00:31:13,120
would be able to move there and and uh

826
00:31:16,230 --> 00:31:14,720
and do the instrument checkouts and

827
00:31:17,909 --> 00:31:16,240
hopefully a good place

828
00:31:20,389 --> 00:31:17,919
i think what we can do now with the

829
00:31:22,230 --> 00:31:20,399
issue of of habitability in the bag with

830
00:31:25,509 --> 00:31:22,240
a really good habitability now we can

831
00:31:27,269 --> 00:31:25,519
undertake a more systematic search for

832
00:31:29,830 --> 00:31:27,279
a brighter carbon signal the kind of

833
00:31:31,909 --> 00:31:29,840
thing that that paul was talking about

834
00:31:34,389 --> 00:31:31,919
uh the search for organic carbon is a is

835
00:31:35,830 --> 00:31:34,399
a is an issue of this mission

836
00:31:37,430 --> 00:31:35,840
and and you want to do this as

837
00:31:39,750 --> 00:31:37,440
deliberately as possible you don't want

838
00:31:42,070 --> 00:31:39,760

to just wander around and and try stuff

839
00:31:43,830 --> 00:31:42,080
out and so we have a search engine now

840
00:31:46,070 --> 00:31:43,840
and there's three components to this as

841
00:31:47,830 --> 00:31:46,080
i've i've stressed in the past the one

842
00:31:50,230 --> 00:31:47,840
is is that the primary environment has

843
00:31:52,710 --> 00:31:50,240
to have a mechanism by by which you

844
00:31:55,029 --> 00:31:52,720
enrich whatever carbon signal is there

845
00:31:57,350 --> 00:31:55,039
whatever reason it's there you'd like to

846
00:31:59,430 --> 00:31:57,360
have a good strong signal but the

847
00:32:01,750 --> 00:31:59,440
problem is is that what you see going on

848
00:32:04,070 --> 00:32:01,760
in these images is that there's a

849
00:32:05,909 --> 00:32:04,080
process that geologists call die genetic

850
00:32:07,990 --> 00:32:05,919
digenesis and it's all this chemical

851
00:32:09,590 --> 00:32:08,000
transformation that happens sometimes

852
00:32:12,389 --> 00:32:09,600
when you make these minerals and and

853
00:32:14,389 --> 00:32:12,399
chemicals uh it they they actually use

854
00:32:16,789 --> 00:32:14,399
use the organics as part of this

855
00:32:18,470 --> 00:32:16,799
electron flow i was talking about so

856
00:32:19,990 --> 00:32:18,480
they can be degraded and then you leave

857
00:32:21,669 --> 00:32:20,000
the rock sitting around for a couple of

858
00:32:24,310 --> 00:32:21,679
billion years and it's getting bombarded

859
00:32:25,909 --> 00:32:24,320
with radiation this is not a simple

860
00:32:28,149 --> 00:32:25,919
problem and it's going to take us a

861
00:32:30,070 --> 00:32:28,159
while but i think the mission is up to

862
00:32:32,470 --> 00:32:30,080
it and and we're really excited to get

863
00:32:33,750 --> 00:32:32,480

started on that now

864
00:32:34,630 --> 00:32:33,760
maybe dave and paul want to say

865
00:32:36,070 --> 00:32:34,640
something

866
00:32:37,509 --> 00:32:36,080
well i don't know you know i think we

867
00:32:39,990 --> 00:32:37,519
really round the table with this

868
00:32:41,430 --> 00:32:40,000
analysis because uh just coming to this

869
00:32:43,669 --> 00:32:41,440
place and

870
00:32:46,230 --> 00:32:43,679
analyzing this bedrock uh finding an

871
00:32:47,830 --> 00:32:46,240
aqueous environment finding a what

872
00:32:50,549 --> 00:32:47,840
appeared to be a habitable environment

873
00:32:52,549 --> 00:32:50,559
and and with good preservation potential

874
00:32:56,389 --> 00:32:52,559
it kind of covered all the

875
00:32:58,389 --> 00:32:56,399
all the points of what i would call a a

876
00:33:00,630 --> 00:32:58,399
just an elegant sample to analyze with

877
00:33:02,470 --> 00:33:00,640
our capability so i'm really happy we

878
00:33:04,230 --> 00:33:02,480
landed at the spot

879
00:33:06,870 --> 00:33:04,240
yeah just uh

880
00:33:09,029 --> 00:33:06,880
yeah you know this is really a different

881
00:33:10,950 --> 00:33:09,039
new set of tools with chemcam on the

882
00:33:13,830 --> 00:33:10,960
mast and the survey tools we have the

883
00:33:15,509 --> 00:33:13,840
first definitive mineralogy for a range

884
00:33:16,230 --> 00:33:15,519
of minerals with chemin

885
00:33:17,590 --> 00:33:16,240
and

886
00:33:20,310 --> 00:33:17,600
you know the capabilities we've

887
00:33:22,389 --> 00:33:20,320
described with sam and you know the the

888
00:33:24,870 --> 00:33:22,399

team is just

889
00:33:27,509 --> 00:33:24,880
delighted to be waking up every morning

890
00:33:29,269 --> 00:33:27,519
and and you know looking at what's

891
00:33:31,830 --> 00:33:29,279
happening on this different planet is

892
00:33:33,830 --> 00:33:31,840
just tremendously exciting

893
00:33:36,870 --> 00:33:33,840
the next question is from dan vagano of

894
00:33:39,110 --> 00:33:36,880
usa today dan

895
00:33:40,470 --> 00:33:39,120
hi thanks dan vergano usa today i guess

896
00:33:42,630 --> 00:33:40,480
this is sir john grotzinger really

897
00:33:43,509 --> 00:33:42,640
anyone who can handle it

898
00:33:44,630 --> 00:33:43,519
uh

899
00:33:46,549 --> 00:33:44,640
in the past you seemed a little

900
00:33:48,789 --> 00:33:46,559
pessimistic about getting this kind of

901
00:33:50,470 --> 00:33:48,799
signal from this site on the first

902
00:33:53,590 --> 00:33:50,480
drilling you know what does it mean to

903
00:33:54,950 --> 00:33:53,600
have sort of pulled out these chemicals

904
00:33:58,710 --> 00:33:54,960
on this attempt about the whole

905
00:34:04,070 --> 00:34:01,269
well i i you know i think that uh if the

906
00:34:06,070 --> 00:34:04,080
pessimism you refer to is that that we

907
00:34:09,109 --> 00:34:06,080
go into this type of exploration with

908
00:34:11,349 --> 00:34:09,119
our guard up uh i think it's justified

909
00:34:13,909 --> 00:34:11,359
because you know when you land on mars

910
00:34:15,909 --> 00:34:13,919
you know strange things can happen

911
00:34:17,750 --> 00:34:15,919
and and i i think if there's a positive

912
00:34:19,430 --> 00:34:17,760
message here is that is that we're

913
00:34:21,190 --> 00:34:19,440

getting better at this and i don't think

914
00:34:24,149 --> 00:34:21,200
it's by accident i think it's the result

915
00:34:26,710 --> 00:34:24,159
of the agency having a program of

916
00:34:28,790 --> 00:34:26,720
missions that build on top of each other

917
00:34:30,389 --> 00:34:28,800
and that and that we can now be more

918
00:34:32,310 --> 00:34:30,399
predictive about what we're doing but

919
00:34:33,909 --> 00:34:32,320
you still never quite know what's going

920
00:34:35,829 --> 00:34:33,919
to happen until till we get there it

921
00:34:37,990 --> 00:34:35,839
just so happened that the environment

922
00:34:39,909 --> 00:34:38,000
that we've been exploring is is one that

923
00:34:40,790 --> 00:34:39,919
we have a lot of experience with here on

924
00:34:43,349 --> 00:34:40,800
earth

925
00:34:45,270 --> 00:34:43,359
and uh and and i and i believe that our

926
00:34:47,990 --> 00:34:45,280
science team was well prepared for that

927
00:34:49,990 --> 00:34:48,000
to really focus and and figure out where

928
00:34:51,109 --> 00:34:50,000
exactly to drive the rover but you

929
00:34:53,669 --> 00:34:51,119
always need to be careful when you're

930
00:34:57,829 --> 00:34:53,679
working on mars

931
00:35:02,470 --> 00:35:00,630
thanks delane um congratulations this is

932
00:35:05,190 --> 00:35:02,480
pretty exciting stuff you guys are

933
00:35:06,630 --> 00:35:05,200
reporting today i had two questions the

934
00:35:09,430 --> 00:35:06,640
first is

935
00:35:11,829 --> 00:35:09,440
what else needs to be done for

936
00:35:14,870 --> 00:35:11,839
analysis of the um

937
00:35:16,470 --> 00:35:14,880
of the organics to um you mentioned a

938
00:35:19,190 --> 00:35:16,480

little bit about that

939
00:35:20,950 --> 00:35:19,200
the the assessments were preliminary and

940
00:35:24,150 --> 00:35:20,960
then the second question probably is for

941
00:35:27,349 --> 00:35:24,160
john um i know this is not a life

942
00:35:30,470 --> 00:35:27,359
detection mission but given that you've

943
00:35:32,950 --> 00:35:30,480
scored a hole in one so early

944
00:35:36,069 --> 00:35:32,960
how much farther can you push this

945
00:35:37,750 --> 00:35:36,079
through the remaining 18 months of the

946
00:35:40,550 --> 00:35:37,760
of the

947
00:35:42,069 --> 00:35:40,560
primary mission

948
00:35:44,310 --> 00:35:42,079
well let me start with

949
00:35:47,430 --> 00:35:44,320
the organics

950
00:35:49,589 --> 00:35:47,440
we have we're planning when we had a

951
00:35:52,230 --> 00:35:49,599
pause to

952
00:35:54,069 --> 00:35:52,240
look at these software

953
00:35:56,550 --> 00:35:54,079
issues

954
00:35:59,270 --> 00:35:56,560
had planned to do two more samples

955
00:36:01,349 --> 00:35:59,280
one where we really instead of one dump

956
00:36:03,670 --> 00:36:01,359
about the size that i showed we put in

957
00:36:04,950 --> 00:36:03,680
three dumps and really try and uh

958
00:36:07,990 --> 00:36:04,960
increase the

959
00:36:09,910 --> 00:36:08,000
uh the signal from very trace compounds

960
00:36:12,390 --> 00:36:09,920
uh but what we're really looking forward

961
00:36:13,750 --> 00:36:12,400
to is getting the second drilled sample

962
00:36:16,150 --> 00:36:13,760
where we've really flushed out the

963
00:36:18,470 --> 00:36:16,160

drilling system uh accomplished two

964
00:36:20,550 --> 00:36:18,480
things number one there may be a little

965
00:36:21,910 --> 00:36:20,560
bit of residue from from rock nests

966
00:36:23,670 --> 00:36:21,920
still in there you saw it in fact the

967
00:36:26,230 --> 00:36:23,680
picture that dave showed there's a

968
00:36:28,550 --> 00:36:26,240
little bit of that coating on on the

969
00:36:30,550 --> 00:36:28,560
sample transfer chain and so we'd like

970
00:36:32,150 --> 00:36:30,560
to dilute that out further

971
00:36:35,510 --> 00:36:32,160
and uh

972
00:36:38,790 --> 00:36:35,520
then very long term uh we'll have to

973
00:36:40,710 --> 00:36:38,800
decide uh exactly when we decide to use

974
00:36:43,030 --> 00:36:40,720
uh what's our wet chemistry cups and we

975
00:36:45,030 --> 00:36:43,040
have nine of those and uh that'll be a

976
00:36:46,710 --> 00:36:45,040
very deliberate decision and we'll we'll

977
00:36:48,230 --> 00:36:46,720
not do that until we're ready but at

978
00:36:49,990 --> 00:36:48,240
some point we're really looking forward

979
00:36:52,710 --> 00:36:50,000
to doing an entirely different type of

980
00:36:55,030 --> 00:36:52,720
chemical analysis

981
00:36:56,950 --> 00:36:55,040
i guess irene the answer to the second

982
00:36:58,870 --> 00:36:56,960
half of the question is to

983
00:37:01,190 --> 00:36:58,880
underscore what you said which is that

984
00:37:02,870 --> 00:37:01,200
uh you know we're not a life detection

985
00:37:05,190 --> 00:37:02,880
mission if there was microbial

986
00:37:07,829 --> 00:37:05,200
metabolism going on we really wouldn't

987
00:37:09,589 --> 00:37:07,839
have the ability to to measure that and

988
00:37:11,829 --> 00:37:09,599

if there were ancient microfossils in

989
00:37:13,589 --> 00:37:11,839
the rock is as good as mali is i mean it

990
00:37:15,430 --> 00:37:13,599
can tell us definitively that we have a

991
00:37:18,790 --> 00:37:15,440
mudstone here but it would not be able

992
00:37:21,910 --> 00:37:18,800
to resolve individual fossil microbes

993
00:37:23,990 --> 00:37:21,920
what we can do is to survey additional

994
00:37:26,550 --> 00:37:24,000
targets that that we have picked out and

995
00:37:29,030 --> 00:37:26,560
we still want to go to mount sharp uh

996
00:37:31,349 --> 00:37:29,040
and and we we hope to get there and

997
00:37:33,349 --> 00:37:31,359
there are different combinations of of

998
00:37:35,190 --> 00:37:33,359
minerals that we see from orbit that

999
00:37:37,430 --> 00:37:35,200
give us different prospects

1000
00:37:39,589 --> 00:37:37,440
and and what i hope will become a a

1001
00:37:42,230 --> 00:37:39,599
burgeoning new field of competi of

1002
00:37:44,069 --> 00:37:42,240
comparative planetary habitability and

1003
00:37:45,430 --> 00:37:44,079
and what that means is that if you if

1004
00:37:47,109 --> 00:37:45,440
you look at how we've studied the

1005
00:37:48,950 --> 00:37:47,119
ancient earth and you look at the

1006
00:37:50,550 --> 00:37:48,960
minerals and compounds and substances

1007
00:37:52,230 --> 00:37:50,560
that are available

1008
00:37:54,630 --> 00:37:52,240
and you look at the ways that different

1009
00:37:57,109 --> 00:37:54,640
prokaryotic microorganisms can do their

1010
00:37:59,349 --> 00:37:57,119
metabolism they use different materials

1011
00:38:01,750 --> 00:37:59,359
it's almost like an organism has evolved

1012
00:38:04,870 --> 00:38:01,760
to exploit every one of these little

1013
00:38:06,950 --> 00:38:04,880

rock batteries that exists in the record

1014
00:38:08,790 --> 00:38:06,960
and so the question is how many of these

1015
00:38:11,190 --> 00:38:08,800
different kinds of batteries can can we

1016
00:38:13,430 --> 00:38:11,200
find at gale crater and and i think that

1017
00:38:19,829 --> 00:38:13,440
really becomes our mission along with

1018
00:38:19,839 --> 00:38:25,750
irene did you have a follow-up

1019
00:38:31,190 --> 00:38:27,670
give us a little update on the status of

1020
00:38:33,510 --> 00:38:31,200
the rover now with the recovery from the

1021
00:38:34,150 --> 00:38:33,520
computer reboot and they shut down for

1022
00:38:35,910 --> 00:38:34,160
the

1023
00:38:38,870 --> 00:38:35,920
solar

1024
00:38:43,109 --> 00:38:41,190
yeah i mean things are looking well the

1025
00:38:44,310 --> 00:38:43,119
rover is still on side b

1026
00:38:46,470 --> 00:38:44,320
and

1027
00:38:48,150 --> 00:38:46,480
it's operating just fine they're still

1028
00:38:50,950 --> 00:38:48,160
suspending most of the scientific

1029
00:38:53,510 --> 00:38:50,960
activities for a couple more saws as

1030
00:38:57,030 --> 00:38:53,520
they sort through what they think was

1031
00:38:59,190 --> 00:38:57,040
the root cause and the problem of side a

1032
00:39:01,829 --> 00:38:59,200
and uh because they want to make sure

1033
00:39:05,270 --> 00:39:01,839
that that is a confirmed operational

1034
00:39:06,230 --> 00:39:05,280
backup for any more operations

1035
00:39:08,069 --> 00:39:06,240
um

1036
00:39:10,950 --> 00:39:08,079
and as you mentioned solar conjunction

1037
00:39:13,109 --> 00:39:10,960
we're headed toward that uh

1038
00:39:14,950 --> 00:39:13,119

basically we can't talk to the rover and

1039
00:39:17,190 --> 00:39:14,960
rover talk to us

1040
00:39:18,550 --> 00:39:17,200
for most of the month of april

1041
00:39:21,829 --> 00:39:18,560
and so what's going to happen is we'll

1042
00:39:22,710 --> 00:39:21,839
we'll do some more science activities

1043
00:39:25,109 --> 00:39:22,720
now

1044
00:39:27,349 --> 00:39:25,119
through the end of this month uh

1045
00:39:29,270 --> 00:39:27,359
you know permitting with the engineers

1046
00:39:32,069 --> 00:39:29,280
confirming that things are safe for us

1047
00:39:33,190 --> 00:39:32,079
to do those operations but we will not

1048
00:39:35,670 --> 00:39:33,200
do

1049
00:39:37,750 --> 00:39:35,680
another drilling uh the second drill

1050
00:39:39,109 --> 00:39:37,760
hole until after solar conjunction so

1051
00:39:40,870 --> 00:39:39,119
that's we're not going to start that

1052
00:39:44,310 --> 00:39:40,880
activity until

1053
00:39:49,030 --> 00:39:46,230
our next caller from the wall street

1054
00:39:50,390 --> 00:39:49,040
journal robert lee hutz

1055
00:39:53,349 --> 00:39:50,400
robert lee

1056
00:39:56,390 --> 00:39:53,359
uh yes uh thank you uh can you hear me

1057
00:39:58,470 --> 00:39:56,400
all yes uh good good good so gentlemen

1058
00:40:01,190 --> 00:39:58,480
um in a simple straightforward

1059
00:40:04,390 --> 00:40:01,200
declarative sentence please or two

1060
00:40:14,630 --> 00:40:04,400
please tell my readers uh what you have

1061
00:40:19,349 --> 00:40:16,390
i think we had a we have found a

1062
00:40:21,670 --> 00:40:19,359
habitable environment uh that that is so

1063
00:40:23,829 --> 00:40:21,680

benign and supportive of life that

1064
00:40:25,349 --> 00:40:23,839
probably if this water was around and

1065
00:40:32,870 --> 00:40:25,359
you had been on the planet you would

1066
00:40:32,880 --> 00:40:36,230
i think that did it for him

1067
00:40:39,109 --> 00:40:37,430
let me

1068
00:40:41,430 --> 00:40:39,119
uh before we go on the phone lines again

1069
00:40:43,190 --> 00:40:41,440
let me uh take another question from

1070
00:40:45,829 --> 00:40:43,200
twitter um

1071
00:40:47,750 --> 00:40:45,839
the opportunity rover

1072
00:40:49,990 --> 00:40:47,760
three months and it's going on for many

1073
00:40:53,750 --> 00:40:50,000
many years how long do you think

1074
00:40:54,550 --> 00:40:53,760
curiosity could last

1075
00:40:58,470 --> 00:40:54,560
uh

1076
00:41:00,790 --> 00:40:58,480
the the half-life of of its power is on

1077
00:41:03,190 --> 00:41:00,800
the order of 84 years

1078
00:41:05,990 --> 00:41:03,200
so i expect the rover to be there to

1079
00:41:10,710 --> 00:41:06,000
shake the first astronaut's hand

1080
00:41:15,430 --> 00:41:13,750
next up new york times kenneth chang

1081
00:41:17,430 --> 00:41:15,440
ken

1082
00:41:19,270 --> 00:41:17,440
thanks for taking my question i was

1083
00:41:21,910 --> 00:41:19,280
wondering given that this rocks had good

1084
00:41:23,270 --> 00:41:21,920
preservation was there a hope or

1085
00:41:25,589 --> 00:41:23,280
expectation that they actually would

1086
00:41:26,870 --> 00:41:25,599
have a stronger organic signal and what

1087
00:41:30,790 --> 00:41:26,880
does it mean that you don't have a

1088
00:41:35,270 --> 00:41:32,309

yeah i mean

1089
00:41:37,829 --> 00:41:35,280
i think we try since mars is such a

1090
00:41:39,910 --> 00:41:37,839
different planet to go in as as much as

1091
00:41:43,270 --> 00:41:39,920
we can at least i certainly do

1092
00:41:45,190 --> 00:41:43,280
uh with an open mind uh it's one reason

1093
00:41:47,910 --> 00:41:45,200
we have kind of the broad chemical

1094
00:41:49,829 --> 00:41:47,920
survey capability we have on on sam

1095
00:41:51,829 --> 00:41:49,839
we're we're looking for signatures

1096
00:41:54,150 --> 00:41:51,839
wherever they might be

1097
00:41:55,750 --> 00:41:54,160
and you know i suppose

1098
00:41:57,030 --> 00:41:55,760
you know

1099
00:41:59,109 --> 00:41:57,040
on earth it's

1100
00:42:01,430 --> 00:41:59,119
you know finding organics in in very

1101
00:42:04,150 --> 00:42:01,440
very ancient rocks is a

1102
00:42:05,109 --> 00:42:04,160
difficult proposition and

1103
00:42:08,150 --> 00:42:05,119
so

1104
00:42:09,750 --> 00:42:08,160
yeah no great expectations we're just

1105
00:42:12,309 --> 00:42:09,760
looking for the environments that are

1106
00:42:14,150 --> 00:42:12,319
right in the first place and looking at

1107
00:42:17,750 --> 00:42:14,160
it as best we can with the tools that we

1108
00:42:19,510 --> 00:42:17,760
have and and see what see what we see

1109
00:42:21,349 --> 00:42:19,520
ken if if i can i'll just add a little

1110
00:42:23,750 --> 00:42:21,359
bit to that uh

1111
00:42:24,630 --> 00:42:23,760
paul's reference to the early earth

1112
00:42:27,030 --> 00:42:24,640
is

1113
00:42:29,589 --> 00:42:27,040

there

1114
00:42:31,349 --> 00:42:29,599
you have to have a search paradigm and

1115
00:42:33,109 --> 00:42:31,359
and that paradigm gets built on your

1116
00:42:35,030 --> 00:42:33,119
understanding of the processes that

1117
00:42:36,470 --> 00:42:35,040
result in the preservation of organics

1118
00:42:38,870 --> 00:42:36,480
in the rock record

1119
00:42:40,950 --> 00:42:38,880
and and one of the big things on earth

1120
00:42:43,750 --> 00:42:40,960
is that because of plate tectonics we we

1121
00:42:45,430 --> 00:42:43,760
have a lot of heat uh that exists that

1122
00:42:47,190 --> 00:42:45,440
of course exist today

1123
00:42:49,670 --> 00:42:47,200
so a lot of organic compounds are

1124
00:42:52,069 --> 00:42:49,680
degraded in the presence of that heat on

1125
00:42:54,230 --> 00:42:52,079
mars we actually think the planet cools

1126
00:42:55,750 --> 00:42:54,240
with time and so it may not be that

1127
00:42:57,670 --> 00:42:55,760
heat's the problem it might be that

1128
00:43:00,150 --> 00:42:57,680
radiation is the problem something that

1129
00:43:01,910 --> 00:43:00,160
we're not so affected by on earth so we

1130
00:43:03,829 --> 00:43:01,920
have these three factors as i said

1131
00:43:05,589 --> 00:43:03,839
before to reiterate them i think we're

1132
00:43:07,270 --> 00:43:05,599
all going to have to learn these the

1133
00:43:09,589 --> 00:43:07,280
first is the primary concentration

1134
00:43:11,109 --> 00:43:09,599
mechanism the second is that all that

1135
00:43:12,870 --> 00:43:11,119
cool chemistry that creates the

1136
00:43:14,230 --> 00:43:12,880
habitable environment including the

1137
00:43:15,910 --> 00:43:14,240
presence of water itself is not

1138
00:43:17,990 --> 00:43:15,920

necessarily a good thing for the

1139
00:43:19,910 --> 00:43:18,000
preservation of organics and then the

1140
00:43:22,550 --> 00:43:19,920
third thing is the radiation environment

1141
00:43:24,870 --> 00:43:22,560
and so our trick is to find a place

1142
00:43:26,870 --> 00:43:24,880
where all three of those things

1143
00:43:28,710 --> 00:43:26,880
went right and and that could take the

1144
00:43:32,069 --> 00:43:28,720
entire length of this mission but we're

1145
00:43:36,790 --> 00:43:34,870
okay i just want to remind folks that um

1146
00:43:39,030 --> 00:43:36,800
particularly the folks who are

1147
00:43:40,470 --> 00:43:39,040
viewing this program the community the

1148
00:43:43,589 --> 00:43:40,480
social media community

1149
00:43:47,990 --> 00:43:43,599
join the conversation at mars curiosity

1150
00:43:50,309 --> 00:43:48,000
and send in a question hashtag ask nasa

1151
00:43:52,829 --> 00:43:50,319
our next question will be from nature

1152
00:43:55,750 --> 00:43:52,839
alex whitsey

1153
00:43:57,670 --> 00:43:55,760
alex thanks i have a question for john

1154
00:43:59,670 --> 00:43:57,680
gratzinger what does this mean for

1155
00:44:01,430 --> 00:43:59,680
getting to mount sharp you talked about

1156
00:44:03,750 --> 00:44:01,440
primary objective becoming now to

1157
00:44:06,470 --> 00:44:03,760
explore the area when might you begin a

1158
00:44:08,870 --> 00:44:06,480
traverse to mount sharp

1159
00:44:10,390 --> 00:44:08,880
well like like michael was saying uh we

1160
00:44:12,550 --> 00:44:10,400
we do uh whether we like it or not we

1161
00:44:14,630 --> 00:44:12,560
have solar conjunction coming up here

1162
00:44:17,349 --> 00:44:14,640
and but as soon we've discussed this as

1163
00:44:19,829 --> 00:44:17,359

a team and as soon as we uh get past

1164
00:44:21,670 --> 00:44:19,839
conjunction uh we're gonna we're gonna

1165
00:44:23,030 --> 00:44:21,680
jump right into drilling a second sample

1166
00:44:24,309 --> 00:44:23,040
because as you know it's very important

1167
00:44:26,550 --> 00:44:24,319
to confirm

1168
00:44:29,030 --> 00:44:26,560
uh what you've gotten before with rock

1169
00:44:30,950 --> 00:44:29,040
nest uh you know we analyze a couple of

1170
00:44:32,550 --> 00:44:30,960
scoops and our goal here is to do a

1171
00:44:34,309 --> 00:44:32,560
couple of drill holes

1172
00:44:37,510 --> 00:44:34,319
and depending on what we find because

1173
00:44:39,349 --> 00:44:37,520
we're discovery driven uh that you know

1174
00:44:41,670 --> 00:44:39,359
if it continues to look promising we'll

1175
00:44:44,950 --> 00:44:41,680
do some more work if not uh we'll get on

1176
00:44:46,790 --> 00:44:44,960
the road and and we'll probably clean up

1177
00:44:49,589 --> 00:44:46,800
business with a few things that we pass

1178
00:44:52,550 --> 00:44:49,599
by uh to help characterize the overall

1179
00:44:55,750 --> 00:44:52,560
broad environment but uh our decision as

1180
00:44:57,990 --> 00:44:55,760
a team is to finish up here at uh john

1181
00:45:00,309 --> 00:44:58,000
klein and then hit the road to mount

1182
00:45:02,470 --> 00:45:00,319
sharp

1183
00:45:04,870 --> 00:45:02,480
okay i'm i'm probably in trouble for

1184
00:45:07,990 --> 00:45:04,880
this but i'm gonna do it anyway

1185
00:45:11,589 --> 00:45:08,000
um i'm gonna turn the mic over to the uh

1186
00:45:13,430 --> 00:45:11,599
the head of the the planetary division

1187
00:45:14,790 --> 00:45:13,440
dr jim green

1188
00:45:17,349 --> 00:45:14,800

thank you duane

1189
00:45:19,750 --> 00:45:17,359
the one question i have then based on

1190
00:45:22,390 --> 00:45:19,760
the observations and

1191
00:45:26,710 --> 00:45:22,400
what you found out today is would you

1192
00:45:29,750 --> 00:45:26,720
say that mars was habitable before

1193
00:45:35,829 --> 00:45:29,760
or about the same time as earth was in

1194
00:45:35,839 --> 00:45:39,910
that's a good question jim

1195
00:45:43,910 --> 00:45:41,990
i'm i'm not sure we'll ever really be

1196
00:45:46,230 --> 00:45:43,920
able to address that with our payload

1197
00:45:49,990 --> 00:45:46,240
but uh you know we've we've got a couple

1198
00:45:52,790 --> 00:45:50,000
of different options here for the age of

1199
00:45:55,510 --> 00:45:52,800
of you know just relative to mars how

1200
00:45:57,510 --> 00:45:55,520
old these things are and quite now quite

1201
00:46:00,390 --> 00:45:57,520
frankly they go between being as young

1202
00:46:02,150 --> 00:46:00,400
as that as that alluvial fan lobe that

1203
00:46:04,630 --> 00:46:02,160
comes down which i think would be

1204
00:46:06,870 --> 00:46:04,640
relatively young in the history of mars

1205
00:46:08,710 --> 00:46:06,880
and it could be quite old uh maybe these

1206
00:46:10,309 --> 00:46:08,720
rocks are somehow related to the base

1207
00:46:11,589 --> 00:46:10,319
amount sharp we can't rule out that

1208
00:46:13,589 --> 00:46:11,599
we're not looking at the base amount

1209
00:46:15,510 --> 00:46:13,599
sharp right now in a way

1210
00:46:17,190 --> 00:46:15,520
so we got a lot of options open before

1211
00:46:18,950 --> 00:46:17,200
us but i i think in any one of those

1212
00:46:21,030 --> 00:46:18,960
versions we're talking about older than

1213
00:46:23,030 --> 00:46:21,040

three billion years ago and we're

1214
00:46:24,550 --> 00:46:23,040
probably looking at a situation where

1215
00:46:26,470 --> 00:46:24,560
plus or minus a couple hundred million

1216
00:46:28,470 --> 00:46:26,480
years it's about the time that we start

1217
00:46:30,390 --> 00:46:28,480
seeing the first record of of life

1218
00:46:32,230 --> 00:46:30,400
preserved on earth

1219
00:46:34,470 --> 00:46:32,240
it's a great comparative planetary

1220
00:46:36,950 --> 00:46:34,480
question

1221
00:46:38,950 --> 00:46:36,960
make a good reporter jim

1222
00:46:41,190 --> 00:46:38,960
um okay let's go back to the phone lines

1223
00:46:50,870 --> 00:46:41,200
uh mark kaufman um from the washington

1224
00:46:50,880 --> 00:46:59,829
do we have mark on the phone

1225
00:46:59,839 --> 00:47:05,430
okay let's move to craig kovalt craig

1226
00:47:13,670 --> 00:47:09,670
hi this is uh greg kovals with space ref

1227
00:47:19,109 --> 00:47:16,950
the question on the clays if one of the

1228
00:47:23,270 --> 00:47:19,119
more significant findings is that you

1229
00:47:25,910 --> 00:47:23,280
had abundant water flow through the clay

1230
00:47:27,109 --> 00:47:25,920
how does that relate to me right endings

1231
00:47:28,950 --> 00:47:27,119
where

1232
00:47:32,309 --> 00:47:28,960
they have also

1233
00:47:34,870 --> 00:47:32,319
identified significant water

1234
00:47:40,309 --> 00:47:34,880
days found in martian meteor

1235
00:47:43,990 --> 00:47:42,309
water and then how does that relate to

1236
00:47:46,069 --> 00:47:44,000
martian meteorites

1237
00:47:47,349 --> 00:47:46,079
well i i think uh

1238
00:47:49,510 --> 00:47:47,359

you know the clays and martian

1239
00:47:52,549 --> 00:47:49,520
meteorites were just almost trace

1240
00:47:53,990 --> 00:47:52,559
quantities and and uh probably and the

1241
00:47:57,270 --> 00:47:54,000
martian meteorites that we've seen are

1242
00:47:58,549 --> 00:47:57,280
mostly uh purely ignorance igneous rocks

1243
00:48:00,630 --> 00:47:58,559
uh

1244
00:48:02,630 --> 00:48:00,640
the the clay's in this rock which is a

1245
00:48:06,150 --> 00:48:02,640
mudstone which was something deposited

1246
00:48:07,750 --> 00:48:06,160
in a shallow uh aqueous environment uh

1247
00:48:09,670 --> 00:48:07,760
are really a major percentage of the

1248
00:48:11,270 --> 00:48:09,680
rock and so they really represent a

1249
00:48:12,790 --> 00:48:11,280
significant process

1250
00:48:14,470 --> 00:48:12,800
and plus

1251
00:48:17,109 --> 00:48:14,480
i guess you could call meteorites the

1252
00:48:18,710 --> 00:48:17,119
ultimate what we call float rock uh it

1253
00:48:20,630 --> 00:48:18,720
came from someplace else and we don't

1254
00:48:22,790 --> 00:48:20,640
know where it came from we know where

1255
00:48:25,990 --> 00:48:22,800
this stuff came from it came from this

1256
00:48:27,270 --> 00:48:26,000
bedrock uh in yellowknife bay and so we

1257
00:48:29,349 --> 00:48:27,280
know that this

1258
00:48:32,950 --> 00:48:29,359
environment existed in yellowknife bay

1259
00:48:32,960 --> 00:48:36,630
do you have a follow-up correct

1260
00:48:42,950 --> 00:48:39,190
question is uh

1261
00:48:45,750 --> 00:48:42,960
happy uh there has been some chatter

1262
00:48:49,430 --> 00:48:45,760
which you may have a uh

1263
00:48:52,470 --> 00:48:49,440

leak in one of here chemistry

1264
00:48:56,470 --> 00:48:53,670
yeah

1265
00:48:59,190 --> 00:48:56,480
in the rock nest sample we

1266
00:49:01,349 --> 00:48:59,200
uh certainly detected

1267
00:49:04,630 --> 00:49:01,359
some vapor that was very easily

1268
00:49:07,589 --> 00:49:04,640
identifiable uh a trace amount of vapor

1269
00:49:11,510 --> 00:49:07,599
nanomoles uh the the signature of of

1270
00:49:13,510 --> 00:49:11,520
what's inside uh our wet chemistry cells

1271
00:49:15,750 --> 00:49:13,520
and so one way or another whether it was

1272
00:49:18,549 --> 00:49:15,760
through a a very small leak through one

1273
00:49:21,829 --> 00:49:18,559
of the pinch-offs or or processing a

1274
00:49:25,109 --> 00:49:21,839
little bit of that vapor is there

1275
00:49:27,750 --> 00:49:25,119
what we are doing is trying to

1276
00:49:30,549 --> 00:49:27,760
uh get smarter about how we do

1277
00:49:32,390 --> 00:49:30,559
experiments to avoid some ambiguity with

1278
00:49:34,790 --> 00:49:32,400
regard to where carbon

1279
00:49:36,870 --> 00:49:34,800
coming from our sample comes from and so

1280
00:49:38,309 --> 00:49:36,880
what we did with these rock nest samples

1281
00:49:40,950 --> 00:49:38,319
was we

1282
00:49:43,270 --> 00:49:40,960
preheated the sample and

1283
00:49:46,150 --> 00:49:43,280
let helium flow over it

1284
00:49:47,990 --> 00:49:46,160
uh something like 20 minutes and it's a

1285
00:49:49,910 --> 00:49:48,000
very clear signature of all that vapor

1286
00:49:52,230 --> 00:49:49,920
being flushed out of the system so

1287
00:49:54,470 --> 00:49:52,240
that's really a a very robust way we

1288
00:49:57,510 --> 00:49:54,480

believe of of getting around this issue

1289
00:50:00,309 --> 00:49:57,520
that uh we saw at rocknest

1290
00:50:01,589 --> 00:50:00,319
uh yeah yeah

1291
00:50:06,870 --> 00:50:01,599
next caller

1292
00:50:11,270 --> 00:50:10,069
hi can you hear me yes

1293
00:50:12,950 --> 00:50:11,280
great i was wondering if you could

1294
00:50:15,030 --> 00:50:12,960
compare this to

1295
00:50:16,630 --> 00:50:15,040
enceladus or europa or other comparative

1296
00:50:19,109 --> 00:50:16,640
potentially habitable environments is

1297
00:50:20,790 --> 00:50:19,119
this the most certain

1298
00:50:23,109 --> 00:50:20,800
habitable environment outside of earth

1299
00:50:25,750 --> 00:50:23,119
that we've seen yet or

1300
00:50:28,230 --> 00:50:25,760
the first that we are definitely sure is

1301
00:50:30,309 --> 00:50:28,240
habitable can you

1302
00:50:31,990 --> 00:50:30,319
put that in other contexts

1303
00:50:34,230 --> 00:50:32,000
yeah i'd go for it

1304
00:50:35,589 --> 00:50:34,240
i think the answer is yes uh i mean i

1305
00:50:37,510 --> 00:50:35,599
think something you know there was a

1306
00:50:39,270 --> 00:50:37,520
question earlier about what

1307
00:50:41,670 --> 00:50:39,280
what's the take-home message about this

1308
00:50:43,589 --> 00:50:41,680
and we i i think this is probably the

1309
00:50:45,829 --> 00:50:43,599
only definitively

1310
00:50:48,230 --> 00:50:45,839
habitable environment that we've

1311
00:50:49,910 --> 00:50:48,240
described and recorded uh

1312
00:50:52,150 --> 00:50:49,920
i don't know you know there are places

1313
00:50:56,230 --> 00:50:52,160

we would suggest could be habitable but

1314
00:51:01,270 --> 00:50:59,030
and again here we're poking at um

1315
00:51:03,270 --> 00:51:01,280
what happened a very very long time ago

1316
00:51:06,150 --> 00:51:03,280
you know it's not a current puddle on

1317
00:51:08,069 --> 00:51:06,160
mars mars is now cold and wet

1318
00:51:09,510 --> 00:51:08,079
and a lot of the atmosphere has escaped

1319
00:51:11,589 --> 00:51:09,520
and some of the radiation may have

1320
00:51:13,910 --> 00:51:11,599
processed samples that we're looking at

1321
00:51:17,030 --> 00:51:13,920
uh it's in some respects it's a fairly

1322
00:51:19,270 --> 00:51:17,040
harsh environment and so the focus

1323
00:51:21,349 --> 00:51:19,280
of the mission is is a lot on what

1324
00:51:22,870 --> 00:51:21,359
things looked like in the past that's

1325
00:51:24,790 --> 00:51:22,880
kind of the idea both of this mission

1326
00:51:26,309 --> 00:51:24,800
where you can get down and look at drill

1327
00:51:28,470 --> 00:51:26,319
into the rocks and do the types of

1328
00:51:30,230 --> 00:51:28,480
experiments we've described but also

1329
00:51:31,589 --> 00:51:30,240
kind of the intent of an upcoming

1330
00:51:33,750 --> 00:51:31,599
mission which is going to launch this

1331
00:51:35,910 --> 00:51:33,760
year maven which is trying to study how

1332
00:51:37,910 --> 00:51:35,920
the current atmosphere is escaping and

1333
00:51:40,390 --> 00:51:37,920
then through modeling try and get back

1334
00:51:41,910 --> 00:51:40,400
to what early mars look like so all

1335
00:51:44,549 --> 00:51:41,920
these things are part of a program and

1336
00:51:46,150 --> 00:51:44,559
they all tie together but it sure is fun

1337
00:51:49,190 --> 00:51:46,160
to dig in the dirt and try and

1338
00:51:52,150 --> 00:51:49,200

understand the ancient environment

1339
00:51:54,069 --> 00:51:52,160
i guess one way to look at this is with

1340
00:51:56,150 --> 00:51:54,079
with curiosity we've been able to take

1341
00:51:57,990 --> 00:51:56,160
this to the next level of understanding

1342
00:52:00,309 --> 00:51:58,000
whether or not mars is habitable it's

1343
00:52:02,549 --> 00:52:00,319
not just a broad brush oh yeah there's

1344
00:52:04,309 --> 00:52:02,559
water and yeah there's rocks we actually

1345
00:52:05,910 --> 00:52:04,319
know there's particular environments

1346
00:52:07,109 --> 00:52:05,920
that water was there for a significant

1347
00:52:09,109 --> 00:52:07,119
amount of time

1348
00:52:11,190 --> 00:52:09,119
that it was neutral

1349
00:52:12,230 --> 00:52:11,200
it wasn't too salty there's plenty of

1350
00:52:16,870 --> 00:52:12,240
water

1351
00:52:18,470 --> 00:52:16,880
from microorganisms to use if they were

1352
00:52:20,549 --> 00:52:18,480
there

1353
00:52:23,349 --> 00:52:20,559
and the idea that we have oxidized and

1354
00:52:26,069 --> 00:52:23,359
neutral species in this place so as we

1355
00:52:28,309 --> 00:52:26,079
look into the details it looks better

1356
00:52:29,589 --> 00:52:28,319
and and for that reason i would actually

1357
00:52:30,390 --> 00:52:29,599
agree with

1358
00:52:32,630 --> 00:52:30,400
with

1359
00:52:34,710 --> 00:52:32,640
dave and paul

1360
00:52:35,910 --> 00:52:34,720
okay we're coming up uh top of the hour

1361
00:52:37,510 --> 00:52:35,920
we're going to be wrapping up shortly i

1362
00:52:38,950 --> 00:52:37,520
want to come back here to headquarters

1363
00:52:40,230 --> 00:52:38,960

and see if there any questions in ours

1364
00:52:44,150 --> 00:52:40,240
i'll take a couple more calls on the

1365
00:52:46,710 --> 00:52:45,030
um

1366
00:52:49,349 --> 00:52:46,720
can you wait for the mic please and uh

1367
00:52:51,589 --> 00:52:49,359
give your name affiliation sorry

1368
00:52:53,670 --> 00:52:51,599
it's kitty feldy with kpcc southern

1369
00:52:55,750 --> 00:52:53,680
california public radio

1370
00:52:57,750 --> 00:52:55,760
i know discovery is the exciting part

1371
00:53:00,549 --> 00:52:57,760
you don't know what you're going to find

1372
00:53:02,870 --> 00:53:00,559
but what could you with the the

1373
00:53:04,309 --> 00:53:02,880
equipment that we have and the range

1374
00:53:05,990 --> 00:53:04,319
that you're going to have i mean what

1375
00:53:08,390 --> 00:53:06,000
are the kinds of things we could detect

1376
00:53:11,030 --> 00:53:08,400
that could even make it more

1377
00:53:14,309 --> 00:53:11,040
specific i mean what what possib what

1378
00:53:16,790 --> 00:53:14,319
could we possibly find that is much more

1379
00:53:19,270 --> 00:53:16,800
provable than what you found and and

1380
00:53:21,430 --> 00:53:19,280
told us about today as far as habitable

1381
00:53:24,150 --> 00:53:21,440
conditions or

1382
00:53:25,910 --> 00:53:24,160
finding some more clues about life on

1383
00:53:27,829 --> 00:53:25,920
mars

1384
00:53:29,750 --> 00:53:27,839
let me let me use that as a chance to to

1385
00:53:32,870 --> 00:53:29,760
go into the issue about the deliberate

1386
00:53:33,670 --> 00:53:32,880
search for organic compounds again as i

1387
00:53:35,270 --> 00:53:33,680
said

1388
00:53:36,710 --> 00:53:35,280

earlier we need this we need this

1389
00:53:38,630 --> 00:53:36,720
paradigm and it has to be a mars

1390
00:53:40,630 --> 00:53:38,640
paradigm we can start first with our

1391
00:53:42,549 --> 00:53:40,640
understanding of earth but as i already

1392
00:53:44,470 --> 00:53:42,559
said there's the three parts the thing

1393
00:53:46,630 --> 00:53:44,480
that that to me i think many of us on

1394
00:53:47,990 --> 00:53:46,640
the team that seems the most familiar

1395
00:53:50,710 --> 00:53:48,000
for this environment which is an

1396
00:53:53,109 --> 00:53:50,720
alluvial fan and possibly a lake that

1397
00:53:54,710 --> 00:53:53,119
was there that's very familiar and we

1398
00:53:57,270 --> 00:53:54,720
can think about mechanisms that would

1399
00:53:59,670 --> 00:53:57,280
have generated carbon even carbon that

1400
00:54:01,990 --> 00:53:59,680
comes from outer space

1401
00:54:04,069 --> 00:54:02,000
that would have accumulated there

1402
00:54:05,990 --> 00:54:04,079
after that it starts to get different

1403
00:54:07,990 --> 00:54:06,000
the one at the very end on earth we have

1404
00:54:09,430 --> 00:54:08,000
plate tectonics that tends to heat rocks

1405
00:54:12,470 --> 00:54:09,440
up and destroy

1406
00:54:14,870 --> 00:54:12,480
organic material on mars we don't have

1407
00:54:16,870 --> 00:54:14,880
that but we do have radiation the one in

1408
00:54:18,870 --> 00:54:16,880
the middle is going to be i think the

1409
00:54:21,589 --> 00:54:18,880
really fun one for the team this this

1410
00:54:24,470 --> 00:54:21,599
process called digenesis because on

1411
00:54:27,430 --> 00:54:24,480
earth we're used to a sort of a stable

1412
00:54:29,910 --> 00:54:27,440
of of compounds that that we know about

1413
00:54:31,910 --> 00:54:29,920

that can that can cause oxidation of

1414
00:54:33,670 --> 00:54:31,920
organic compounds on mars we've got a

1415
00:54:36,510 --> 00:54:33,680
new cast of characters some of which now

1416
00:54:39,030 --> 00:54:36,520
are becoming familiar uh things like

1417
00:54:41,109 --> 00:54:39,040
perchlorates uh there could be other

1418
00:54:43,670 --> 00:54:41,119
things there as well that that that paul

1419
00:54:45,030 --> 00:54:43,680
and and and and dave will eventually

1420
00:54:47,270 --> 00:54:45,040
tease out with their instruments that

1421
00:54:48,789 --> 00:54:47,280
might be present there trace quantities

1422
00:54:51,270 --> 00:54:48,799
and the question is when you put those

1423
00:54:53,589 --> 00:54:51,280
things in water and you add organics how

1424
00:54:55,910 --> 00:54:53,599
do they react in a way that might break

1425
00:54:58,150 --> 00:54:55,920
them down how fast does it occur how

1426
00:55:00,150 --> 00:54:58,160
aggressive is the reaction and and i

1427
00:55:02,069 --> 00:55:00,160
think that's what i mean by comparative

1428
00:55:04,549 --> 00:55:02,079
planetary habitability we can begin to

1429
00:55:05,510 --> 00:55:04,559
start to play that game now

1430
00:55:06,950 --> 00:55:05,520
okay we're going to take one more

1431
00:55:09,829 --> 00:55:06,960
question from the phone line and then

1432
00:55:11,349 --> 00:55:09,839
i'm going to um invite dr grensfeld to

1433
00:55:13,589 --> 00:55:11,359
come up for some potting words and then

1434
00:55:15,670 --> 00:55:13,599
i will uh conclude the briefing and i

1435
00:55:18,870 --> 00:55:15,680
believe we have sky and telescope

1436
00:55:20,950 --> 00:55:18,880
camille are you on the phone line

1437
00:55:24,069 --> 00:55:20,960
yes hi i'd

1438
00:55:26,710 --> 00:55:24,079

be a bit of a long shot but

1439
00:55:29,349 --> 00:55:26,720
in december there was discussions

1440
00:55:32,150 --> 00:55:29,359
i actually be

1441
00:55:34,630 --> 00:55:32,160
dust mound and and not creative

1442
00:55:36,549 --> 00:55:34,640
as far as

1443
00:55:37,750 --> 00:55:36,559
goes this

1444
00:55:38,870 --> 00:55:37,760
sign of

1445
00:55:41,829 --> 00:55:38,880
relate

1446
00:55:43,430 --> 00:55:41,839
is it does it have any effect on

1447
00:55:45,589 --> 00:55:43,440
communities

1448
00:55:48,390 --> 00:55:45,599
uh camille could you please talk uh

1449
00:55:49,829 --> 00:55:48,400
repeat the question you're kind of

1450
00:55:52,549 --> 00:55:49,839
going in and out on here let's try that

1451
00:55:55,829 --> 00:55:52,559
again can you repeat the question

1452
00:55:58,150 --> 00:55:55,839
sure let me try my hand

1453
00:55:58,950 --> 00:55:58,160
is that better yes

1454
00:56:02,549 --> 00:55:58,960
okay

1455
00:56:04,710 --> 00:56:02,559
um at the agu in december there was

1456
00:56:06,789 --> 00:56:04,720
discussion that

1457
00:56:11,030 --> 00:56:06,799
mount sharp might be this sort of mound

1458
00:56:12,870 --> 00:56:11,040
of dust and it might not be from

1459
00:56:17,349 --> 00:56:12,880
water eroding

1460
00:56:20,309 --> 00:56:17,359
as far as the scale goes this former

1461
00:56:21,910 --> 00:56:20,319
lake bed is it a large enough scale that

1462
00:56:26,230 --> 00:56:21,920
we can say

1463
00:56:30,630 --> 00:56:26,240

how marc job was built or is this pretty

1464
00:56:35,349 --> 00:56:32,549
uh i'll i'll let the others chime in

1465
00:56:37,190 --> 00:56:35,359
here but uh we have

1466
00:56:38,630 --> 00:56:37,200
we're actually not quite sure how mount

1467
00:56:39,910 --> 00:56:38,640
sharp was built

1468
00:56:42,390 --> 00:56:39,920
and so

1469
00:56:44,390 --> 00:56:42,400
the real evidence of how that happened

1470
00:56:47,030 --> 00:56:44,400
is in amount sharp

1471
00:56:49,589 --> 00:56:47,040
and so what we're seeing now is what's

1472
00:56:51,990 --> 00:56:49,599
at the base and what may have

1473
00:56:54,549 --> 00:56:52,000
not necessarily pre-existed but happened

1474
00:56:56,710 --> 00:56:54,559
uh at the same time or even later uh

1475
00:57:00,950 --> 00:56:56,720
looking here we are at the yellowknife

1476
00:57:03,349 --> 00:57:00,960
bay but how mount sharp was formed

1477
00:57:05,829 --> 00:57:03,359
we had to go to mount sharp to see those

1478
00:57:07,990 --> 00:57:05,839
layers to sort that out

1479
00:57:10,150 --> 00:57:08,000
yeah i agree with michael completely

1480
00:57:11,910 --> 00:57:10,160
and just give you a heads up

1481
00:57:13,829 --> 00:57:11,920
that when we start driving a mount sharp

1482
00:57:15,670 --> 00:57:13,839
and you see us dragging our feet as as

1483
00:57:17,430 --> 00:57:15,680
we go along there and stopping to look

1484
00:57:19,750 --> 00:57:17,440
at a few things that's because we'll be

1485
00:57:21,829 --> 00:57:19,760
trying to figure out how the rocks we're

1486
00:57:23,430 --> 00:57:21,839
at now at yellowknife bay relate to

1487
00:57:25,510 --> 00:57:23,440
mount sharp that's how we get the

1488
00:57:27,750 --> 00:57:25,520

relative age of all this stuff

1489
00:57:29,030 --> 00:57:27,760
yeah good point

1490
00:57:31,510 --> 00:57:29,040
okay so

1491
00:57:32,950 --> 00:57:31,520
before dr gronstal comes up i am going

1492
00:57:34,309 --> 00:57:32,960
to take one question going back to the

1493
00:57:38,829 --> 00:57:34,319
west coast of the jet propulsion

1494
00:57:43,990 --> 00:57:41,910
jpl yeah this is uh nbcla john this

1495
00:57:46,789 --> 00:57:44,000
question is for you back in november you

1496
00:57:48,309 --> 00:57:46,799
said uh that uh there was gonna be the

1497
00:57:51,109 --> 00:57:48,319
news was gonna be one for the history

1498
00:57:56,390 --> 00:57:51,119
books did you know now what or then what

1499
00:58:01,109 --> 00:57:58,150
well i i can tell you i feel better

1500
00:58:05,910 --> 00:58:03,510
you know you you do uh when that kind of

1501
00:58:08,549 --> 00:58:05,920
a thing you do need to sort of annie up

1502
00:58:11,190 --> 00:58:08,559
uh you know i i i think you know

1503
00:58:14,230 --> 00:58:11,200
basically again the that that expression

1504
00:58:16,950 --> 00:58:14,240
at that time was just simply looking at

1505
00:58:18,549 --> 00:58:16,960
uh the second run coming out of sam and

1506
00:58:20,710 --> 00:58:18,559
realizing that the instrument did a

1507
00:58:23,510 --> 00:58:20,720
replicate of what it did the the first

1508
00:58:25,589 --> 00:58:23,520
time and that if you ever got it into

1509
00:58:28,309 --> 00:58:25,599
the right place this would all pay off

1510
00:58:30,309 --> 00:58:28,319
really well and and so it it's just

1511
00:58:31,990 --> 00:58:30,319
having confidence in the science team to

1512
00:58:33,829 --> 00:58:32,000
to get the mapping and provide the

1513
00:58:35,510 --> 00:58:33,839

direction of where to go

1514
00:58:37,430 --> 00:58:35,520
and uh it seems like that's what's

1515
00:58:40,470 --> 00:58:37,440
happened and and i i certainly feel

1516
00:58:44,230 --> 00:58:42,630
okay my uh my my director's saying we

1517
00:58:45,990 --> 00:58:44,240
still have a few more calls so if you

1518
00:58:47,589 --> 00:58:46,000
guys don't mind we may need to go over

1519
00:58:48,390 --> 00:58:47,599
just for a few minutes there's a lot of

1520
00:58:50,390 --> 00:58:48,400
uh

1521
00:58:52,710 --> 00:58:50,400
excitement interesting questions from

1522
00:58:53,990 --> 00:58:52,720
folks uh not only in the media calls

1523
00:58:55,430 --> 00:58:54,000
been on the social media front so we're

1524
00:58:59,030 --> 00:58:55,440
going to go to alicia

1525
00:59:01,349 --> 00:58:59,040
chang associated press alicia

1526
00:59:03,030 --> 00:59:01,359
hi thanks for taking my question um

1527
00:59:05,190 --> 00:59:03,040
for john gratinger um you know i'm

1528
00:59:07,670 --> 00:59:05,200
wondering how you can declare this about

1529
00:59:10,150 --> 00:59:07,680
a habitable environment without a strong

1530
00:59:12,230 --> 00:59:10,160
organic signal

1531
00:59:13,910 --> 00:59:12,240
uh thanks alicia that that

1532
00:59:15,910 --> 00:59:13,920
also gives me a chance to elaborate on

1533
00:59:18,870 --> 00:59:15,920
something that i i mentioned before but

1534
00:59:21,829 --> 00:59:18,880
i i think it's often an easily confused

1535
00:59:23,910 --> 00:59:21,839
you don't have to have organic carbon

1536
00:59:26,069 --> 00:59:23,920
present uh

1537
00:59:28,390 --> 00:59:26,079
in a in a geological environment that's

1538
00:59:31,109 --> 00:59:28,400

habitable in order to have microbial

1539
00:59:34,150 --> 00:59:31,119
metabolism to occur for example almost

1540
00:59:37,270 --> 00:59:34,160
all prokaryotic organisms they don't use

1541
00:59:39,109 --> 00:59:37,280
organics to to metabolize uh they

1542
00:59:40,870 --> 00:59:39,119
actually use inorganic compounds there

1543
00:59:44,390 --> 00:59:40,880
does need to be a source of carbon there

1544
00:59:46,069 --> 00:59:44,400
somewhere uh but if it's just co2 you

1545
00:59:47,750 --> 00:59:46,079
can have you know it's it's a

1546
00:59:49,990 --> 00:59:47,760
complicated word here but a chemo

1547
00:59:52,789 --> 00:59:50,000
lithoautotrophic organism that literally

1548
00:59:56,630 --> 00:59:52,799
lives on rocks it feeds on rocks

1549
00:59:58,470 --> 00:59:56,640
uh add that co2 there and and they will

1550
01:00:00,789 --> 00:59:58,480
metabolize and generate organic

1551
01:00:03,430 --> 01:00:00,799
compounds based on that that uh that

1552
01:00:05,670 --> 01:00:03,440
carbon so the fact that that paul is

1553
01:00:07,670 --> 01:00:05,680
able to show in the sam that that co2

1554
01:00:09,589 --> 01:00:07,680
spike that's what we're really excited

1555
01:00:12,470 --> 01:00:09,599
about there because then that gives us

1556
01:00:14,150 --> 01:00:12,480
our our sort of desiderata of the key

1557
01:00:17,510 --> 01:00:14,160
elements that are the building blocks

1558
01:00:18,549 --> 01:00:17,520
for life hydrogen oxygen phosphorus

1559
01:00:22,309 --> 01:00:18,559
sulfur

1560
01:00:25,190 --> 01:00:22,319
uh and and then of course uh nitrogen uh

1561
01:00:27,510 --> 01:00:25,200
and then also uh carbon and it can it

1562
01:00:29,670 --> 01:00:27,520
can be inorganic for to be utilized by a

1563
01:00:31,270 --> 01:00:29,680

microbe

1564
01:00:33,109 --> 01:00:31,280
and let me just make an announcement uh

1565
01:00:35,270 --> 01:00:33,119
we're going to take a few more questions

1566
01:00:37,750 --> 01:00:35,280
and uh these gentlemen will be available

1567
01:00:40,230 --> 01:00:37,760
following the briefing for the media who

1568
01:00:42,789 --> 01:00:40,240
want to uh have one-on-ones so just call

1569
01:00:44,470 --> 01:00:42,799
my office or the jpl jpl office and we

1570
01:00:46,630 --> 01:00:44,480
will get these folks to answer some of

1571
01:00:48,549 --> 01:00:46,640
your questions the media that i will

1572
01:00:51,589 --> 01:00:48,559
call on please limit

1573
01:00:53,190 --> 01:00:51,599
uh to one question so i can uh

1574
01:00:56,069 --> 01:00:53,200
hopefully get us out in the next five

1575
01:00:58,870 --> 01:00:56,079
minutes so uh next up is ken kramer

1576
01:01:01,030 --> 01:00:58,880
space flight magazine

1577
01:01:03,190 --> 01:01:01,040
hi thanks for taking my question and uh

1578
01:01:05,030 --> 01:01:03,200
really great results um i'd like to

1579
01:01:07,190 --> 01:01:05,040
follow up on something john john just

1580
01:01:08,870 --> 01:01:07,200
said i'm interested to know uh

1581
01:01:11,750 --> 01:01:08,880
maybe even from from

1582
01:01:15,190 --> 01:01:11,760
paul mahaffey about the sam run did you

1583
01:01:17,910 --> 01:01:15,200
see any nitrogen or phosphorus or

1584
01:01:19,270 --> 01:01:17,920
orobutanes and can you talk about what

1585
01:01:22,710 --> 01:01:19,280
was the weight percent level of the

1586
01:01:26,549 --> 01:01:24,549
so i think the the weight percent of the

1587
01:01:28,230 --> 01:01:26,559
phallosilicates is best answered by

1588
01:01:29,510 --> 01:01:28,240

chemin and and you gave a number for

1589
01:01:31,910 --> 01:01:29,520
that of

1590
01:01:34,950 --> 01:01:31,920
20 20 to 38 percent

1591
01:01:38,710 --> 01:01:34,960
and uh did we see nitrogen compounds we

1592
01:01:42,309 --> 01:01:38,720
we certainly are in our trace uh gases

1593
01:01:44,230 --> 01:01:42,319
looking for those uh it's it's uh seems

1594
01:01:46,950 --> 01:01:44,240
that we have some nitrogen oxides uh

1595
01:01:49,910 --> 01:01:46,960
coming up uh we're looking at compounds

1596
01:01:51,270 --> 01:01:49,920
like hcn and so on uh deconvoluting

1597
01:01:53,589 --> 01:01:51,280
those spectra

1598
01:01:55,990 --> 01:01:53,599
requires work and so we're we're working

1599
01:01:58,069 --> 01:01:56,000
away on that but uh it sure looks like

1600
01:01:59,990 --> 01:01:58,079
we have nitrogen compounds there in

1601
01:02:01,910 --> 01:02:00,000
terms of phosphorus we haven't seen any

1602
01:02:03,750 --> 01:02:01,920
but that really is an ap excess result

1603
01:02:04,870 --> 01:02:03,760
they they see phosphorus in their

1604
01:02:08,230 --> 01:02:04,880
compounds

1605
01:02:11,109 --> 01:02:08,240
very interestingly we see a fair bit of

1606
01:02:12,950 --> 01:02:11,119
hydrogen chloride coming up into our

1607
01:02:14,950 --> 01:02:12,960
into our lines and so

1608
01:02:17,029 --> 01:02:14,960
the chlorine is not just producing these

1609
01:02:20,230 --> 01:02:17,039
trace

1610
01:02:22,630 --> 01:02:20,240
chloromethane compounds but is also

1611
01:02:25,990 --> 01:02:22,640
producing hydrochloric acid

1612
01:02:29,029 --> 01:02:27,349
next up

1613
01:02:30,789 --> 01:02:29,039

peter spots christian science monitor

1614
01:02:32,230 --> 01:02:30,799
peter

1615
01:02:35,190 --> 01:02:32,240
well thank you very much for extending

1616
01:02:37,750 --> 01:02:35,200
this um the one question i have

1617
01:02:39,910 --> 01:02:37,760
for john i think it is uh earlier in in

1618
01:02:41,829 --> 01:02:39,920
this series of briefings since the

1619
01:02:44,470 --> 01:02:41,839
landing you mentioned that there were

1620
01:02:46,470 --> 01:02:44,480
some tests you would have to perform uh

1621
01:02:47,910 --> 01:02:46,480
once you did find organics to see if

1622
01:02:48,950 --> 01:02:47,920
they were home grown or came from

1623
01:02:51,750 --> 01:02:48,960
elsewhere i wonder if you could

1624
01:02:54,470 --> 01:02:51,760
recapitulate that a bit

1625
01:02:56,230 --> 01:02:54,480
uh yeah uh i'll i'll just answer quickly

1626
01:02:59,190 --> 01:02:56,240
and then see if paul wants to add

1627
01:03:01,029 --> 01:02:59,200
further to that but uh as paul outlined

1628
01:03:04,150 --> 01:03:01,039
uh you know we're not done yet here we

1629
01:03:06,069 --> 01:03:04,160
want to do some more runs uh to to

1630
01:03:07,510 --> 01:03:06,079
enhance the the signal that that he's

1631
01:03:09,910 --> 01:03:07,520
seeing in sam

1632
01:03:12,390 --> 01:03:09,920
uh but after that if we got a positive

1633
01:03:13,750 --> 01:03:12,400
detection that was reinforced and and we

1634
01:03:16,150 --> 01:03:13,760
know that the

1635
01:03:17,910 --> 01:03:16,160
if there's an organic compound that's

1636
01:03:20,230 --> 01:03:17,920
not coming from the instrument and it's

1637
01:03:21,829 --> 01:03:20,240
not coming from the rover then we can

1638
01:03:24,150 --> 01:03:21,839

feel confident that it does come from

1639
01:03:26,710 --> 01:03:24,160
mars then we got two options there the

1640
01:03:29,109 --> 01:03:26,720
one is is that you know there's this all

1641
01:03:31,829 --> 01:03:29,119
there's this sort of never-ending

1642
01:03:34,309 --> 01:03:31,839
rain of of cosmic debris that occurs on

1643
01:03:36,390 --> 01:03:34,319
the surface of the planet and so it

1644
01:03:38,870 --> 01:03:36,400
could be that we're detecting that and

1645
01:03:41,750 --> 01:03:38,880
then it could be that it is actually

1646
01:03:44,390 --> 01:03:41,760
being manufactured on mars and then you

1647
01:03:46,309 --> 01:03:44,400
have to bifurcate again to in order to

1648
01:03:49,349 --> 01:03:46,319
show that the organic that you're seeing

1649
01:03:51,349 --> 01:03:49,359
wasn't manufactured by some inorganic

1650
01:03:52,390 --> 01:03:51,359
process for example in a hydrothermal

1651
01:03:55,270 --> 01:03:52,400
environment

1652
01:03:57,109 --> 01:03:55,280
uh and and then if you can discount that

1653
01:03:59,670 --> 01:03:57,119
then maybe you've got something that

1654
01:04:01,829 --> 01:03:59,680
that could be a trace of a buy signature

1655
01:04:04,069 --> 01:04:01,839
but that's a that's a long row for us to

1656
01:04:06,069 --> 01:04:04,079
hoe there

1657
01:04:08,789 --> 01:04:06,079
our last question is going to be from

1658
01:04:13,670 --> 01:04:08,799
mark kaufman from the washington post

1659
01:04:16,390 --> 01:04:14,710
all right

1660
01:04:18,950 --> 01:04:16,400
okay thank you very much thank you very

1661
01:04:22,789 --> 01:04:18,960
much every single question um

1662
01:04:28,069 --> 01:04:24,789
has talked about

1663
01:04:29,589 --> 01:04:28,079

yellowknife bay as being aqueous and and

1664
01:04:32,470 --> 01:04:29,599
references to

1665
01:04:34,230 --> 01:04:32,480
possibly a a lake

1666
01:04:35,990 --> 01:04:34,240
could you could anyone be more specific

1667
01:04:38,230 --> 01:04:36,000
i mean would it be accurate to say that

1668
01:04:41,029 --> 01:04:38,240
at this point you believe that this

1669
01:04:46,309 --> 01:04:41,039
was a lake or something like a lake and

1670
01:04:51,190 --> 01:04:49,029
i i think mark uh you'll continue to see

1671
01:04:51,990 --> 01:04:51,200
us hum and haw about that one

1672
01:04:52,829 --> 01:04:52,000
uh

1673
01:04:55,589 --> 01:04:52,839
you know

1674
01:04:57,910 --> 01:04:55,599
the there's obviously this unit uh

1675
01:05:00,470 --> 01:04:57,920
called the sheep bed and and the

1676
01:05:01,670 --> 01:05:00,480
geologists can can map this around and

1677
01:05:04,230 --> 01:05:01,680
and see that it extends around

1678
01:05:06,309 --> 01:05:04,240
yellowknife bay and that it projects

1679
01:05:07,190 --> 01:05:06,319
under what we call the gillespie unit

1680
01:05:09,349 --> 01:05:07,200
and so

1681
01:05:11,029 --> 01:05:09,359
it extends underneath the outcrop to

1682
01:05:12,870 --> 01:05:11,039
some unknown distance

1683
01:05:14,789 --> 01:05:12,880
so you know just looking around the bay

1684
01:05:17,029 --> 01:05:14,799
that's that's sort of a minimum

1685
01:05:18,470 --> 01:05:17,039
and uh but the real question is you know

1686
01:05:21,510 --> 01:05:18,480
if this was a lake

1687
01:05:23,349 --> 01:05:21,520
how long how deep uh you know what what

1688
01:05:24,870 --> 01:05:23,359

was it like the hydrology and that's a

1689
01:05:26,150 --> 01:05:24,880
much much harder thing for us to

1690
01:05:28,870 --> 01:05:26,160
reconstruct

1691
01:05:31,510 --> 01:05:28,880
uh so i i think it's safest for at this

1692
01:05:33,430 --> 01:05:31,520
point to just say that uh we we see

1693
01:05:35,029 --> 01:05:33,440
something that's fine-grained it could

1694
01:05:37,750 --> 01:05:35,039
have been the material that was eroded

1695
01:05:38,630 --> 01:05:37,760
from the crater rim that accumulated

1696
01:05:42,549 --> 01:05:38,640
uh

1697
01:05:43,510 --> 01:05:42,559
pool

1698
01:05:45,109 --> 01:05:43,520
uh

1699
01:05:47,750 --> 01:05:45,119
but we don't have to go much further

1700
01:05:51,589 --> 01:05:47,760
than that and uh and and we'll just have

1701
01:05:53,589 --> 01:05:51,599
to see we can still collect more data

1702
01:05:55,670 --> 01:05:53,599
okay now i'd like to invite dr

1703
01:06:05,430 --> 01:05:55,680
grimsville up for some remarks and then

1704
01:06:08,870 --> 01:06:07,430
well gentlemen thanks very much for that

1705
01:06:09,670 --> 01:06:08,880
that description

1706
01:06:11,829 --> 01:06:09,680
uh

1707
01:06:13,430 --> 01:06:11,839
first of all congratulations i mean

1708
01:06:15,349 --> 01:06:13,440
really incredible and i know it's been

1709
01:06:18,309 --> 01:06:15,359
you know years of hard work to get this

1710
01:06:19,910 --> 01:06:18,319
far i used to uh to hike around as a

1711
01:06:22,069 --> 01:06:19,920
young boy with a rock hammer and a

1712
01:06:23,829 --> 01:06:22,079
collection bag here on earth trying to

1713
01:06:25,910 --> 01:06:23,839

find interesting samples and i have

1714
01:06:27,990 --> 01:06:25,920
boxes of of rocks

1715
01:06:31,270 --> 01:06:28,000
uh you know i was always on the quest

1716
01:06:33,109 --> 01:06:31,280
for fossils very hard to find on earth

1717
01:06:34,390 --> 01:06:33,119
you know even if you know you know where

1718
01:06:35,750 --> 01:06:34,400
to look for them

1719
01:06:37,910 --> 01:06:35,760
but you know this has just been an

1720
01:06:39,910 --> 01:06:37,920
incredible adventure uh just to get to

1721
01:06:41,829 --> 01:06:39,920
this point and so early in the mission

1722
01:06:43,029 --> 01:06:41,839
uh that that you must all be very happy

1723
01:06:44,870 --> 01:06:43,039
you know someone asked well how do you

1724
01:06:46,470 --> 01:06:44,880
feel just sitting in the audience here i

1725
01:06:49,029 --> 01:06:46,480
feel giddy

1726
01:06:49,829 --> 01:06:49,039
because i have an image now

1727
01:06:52,630 --> 01:06:49,839
of

1728
01:06:53,670 --> 01:06:52,640
you know possibly a lake a freshwater

1729
01:06:55,190 --> 01:06:53,680
lake

1730
01:06:57,510 --> 01:06:55,200
on a mars with probably a thicker

1731
01:07:00,549 --> 01:06:57,520
atmosphere maybe a snowcap mount sharp i

1732
01:07:02,789 --> 01:07:00,559
mean who knows and so now we have

1733
01:07:05,029 --> 01:07:02,799
the food to imagine a very different

1734
01:07:07,670 --> 01:07:05,039
mars than the one that you see behind us

1735
01:07:10,069 --> 01:07:07,680
now the modern mars the martin gale

1736
01:07:11,430 --> 01:07:10,079
crater which is a very dry foreboding

1737
01:07:13,349 --> 01:07:11,440
place

1738
01:07:15,670 --> 01:07:13,359

having said that though and looking at

1739
01:07:17,990 --> 01:07:15,680
the image and thinking about the work

1740
01:07:20,789 --> 01:07:18,000
that you're doing with curiosity on mars

1741
01:07:22,470 --> 01:07:20,799
uh it makes me want to go

1742
01:07:24,309 --> 01:07:22,480
and so let me just ask you i mean how

1743
01:07:26,549 --> 01:07:24,319
many of you now would like to go to mars

1744
01:07:27,589 --> 01:07:26,559
and be able to go with a rock hammer and

1745
01:07:28,950 --> 01:07:27,599
maybe a little more modern

1746
01:07:33,029 --> 01:07:28,960
instrumentation

1747
01:07:34,549 --> 01:07:33,039
uh so well at least one hand goes up

1748
01:07:37,109 --> 01:07:34,559
just just make the

1749
01:07:39,510 --> 01:07:37,119
the trip short between here and there

1750
01:07:40,870 --> 01:07:39,520
okay i'll go john so you can get me back

1751
01:07:43,190 --> 01:07:40,880
yeah well i think that's a critical

1752
01:07:44,630 --> 01:07:43,200
element absolutely and in fact we we are

1753
01:07:46,950 --> 01:07:44,640
going you know i mean the fact is that

1754
01:07:49,750 --> 01:07:46,960
we are on mars we're exploring mars with

1755
01:07:51,829 --> 01:07:49,760
curiosity we still have uh opportunity

1756
01:07:54,230 --> 01:07:51,839
roving mars reconnaissance orbiter

1757
01:07:57,109 --> 01:07:54,240
odyssey uh collaboration with with east

1758
01:07:59,589 --> 01:07:57,119
on mars express we have maven on the way

1759
01:08:01,589 --> 01:07:59,599
hopefully this year that's the plan uh

1760
01:08:02,710 --> 01:08:01,599
to orbit mars we have insight planning

1761
01:08:05,510 --> 01:08:02,720
to land

1762
01:08:07,589 --> 01:08:05,520
uh in mid-decade we are participating

1763
01:08:09,990 --> 01:08:07,599

with esa on their exomars program and

1764
01:08:13,029 --> 01:08:10,000
then as michael myers said we're working

1765
01:08:15,190 --> 01:08:13,039
on a mars 2020 rover kind of the cousin

1766
01:08:16,630 --> 01:08:15,200
of curiosity and i think it's the

1767
01:08:18,149 --> 01:08:16,640
questions that you're answering today

1768
01:08:20,630 --> 01:08:18,159
and you know i mean this is a pretty big

1769
01:08:22,229 --> 01:08:20,640
one is did mars i mean this is a huge

1770
01:08:24,789 --> 01:08:22,239
science question a planetary science

1771
01:08:26,309 --> 01:08:24,799
question did mars ever have a habitable

1772
01:08:28,149 --> 01:08:26,319
environment and we now have an answer i

1773
01:08:29,510 --> 01:08:28,159
think that's incredible and we'll be

1774
01:08:32,390 --> 01:08:29,520
able to follow that up with what we do

1775
01:08:34,309 --> 01:08:32,400
on on a rover later in this decade

1776
01:08:35,349 --> 01:08:34,319
in and 2020. i think that's pretty

1777
01:08:37,510 --> 01:08:35,359
exciting

1778
01:08:39,189 --> 01:08:37,520
so with that i just want to give you my

1779
01:08:41,110 --> 01:08:39,199
thanks for all the hard work and and

1780
01:08:43,990 --> 01:08:41,120
keep it up i'm sure there's a lot more

1781
01:08:51,590 --> 01:08:44,000
surprises that mars has for us as we we

1782
01:08:55,349 --> 01:08:52,950
okay ladies and gentlemen that will do

1783
01:08:57,189 --> 01:08:55,359
it for us i want to thank you for uh

1784
01:09:00,630 --> 01:08:57,199
staying with us a little longer uh

1785
01:09:02,470 --> 01:09:00,640
congratulations to the team and again uh

1786
01:09:04,829 --> 01:09:02,480
keep the conversation going it is going

1787
01:09:07,669 --> 01:09:04,839
on twitter and social media

1788
01:09:09,910 --> 01:09:07,679

www.nasa.gov mars for the latest results

1789
01:09:11,510 --> 01:09:09,920
and if you need to talk the media that

1790
01:09:13,990 --> 01:09:11,520
did not get a chance to ask questions or

1791
01:09:17,269 --> 01:09:14,000
would like interviews please contact my

1792
01:09:19,990 --> 01:09:17,279
office headquarters jpl aims public

1793
01:09:21,990 --> 01:09:20,000
affairs and guarded public affairs it's

1794
01:09:25,110 --> 01:09:22,000
a big family here with uh incredible