



SCIENCE LIVE

WE JUST OPENED A

50 YEAR
OLD

MOON SAMPLE

1
00:00:23,800 --> 00:00:22,470
[Music]

2
00:00:46,880 --> 00:00:23,810
so

3
00:00:46,890 --> 00:00:55,590
[Music]

4
00:00:55,600 --> 00:00:59,840
but why some say the

5
00:00:59,850 --> 00:01:10,230
[Music]

6
00:01:21,030 --> 00:01:13,030
we have

7
00:01:21,040 --> 00:01:28,310
[Music]

8
00:01:42,870 --> 00:01:30,640
um

9
00:01:49,190 --> 00:01:46,069
hello and welcome to another episode of

10
00:01:51,830 --> 00:01:49,200
nasa science live an opportunity for you

11
00:01:54,469 --> 00:01:51,840
to interact with nasa experts and have

12
00:01:56,310 --> 00:01:54,479
your questions answered live my name is

13
00:01:58,950 --> 00:01:56,320

joy ung and i'm your host for today's

14

00:02:01,590 --> 00:01:58,960

show as we talk about some very exciting

15

00:02:03,830 --> 00:02:01,600

news the opening of one of the last

16

00:02:05,270 --> 00:02:03,840

pristine moon samples from the apollo

17

00:02:07,109 --> 00:02:05,280

lunar missions

18

00:02:10,150 --> 00:02:07,119

if you have questions send them in using

19

00:02:12,869 --> 00:02:10,160

the hashtag asknasa on social media or

20

00:02:14,869 --> 00:02:12,879

wherever you're watching the show today

21

00:02:17,510 --> 00:02:14,879

when apollo astronauts began bringing

22

00:02:19,030 --> 00:02:17,520

back samples from the moon to earth over

23

00:02:21,750 --> 00:02:19,040

50 years ago

24

00:02:23,510 --> 00:02:21,760

nasa chose to keep some samples unopened

25

00:02:25,990 --> 00:02:23,520

and untouched

26

00:02:28,710 --> 00:02:26,000

so why was that well nasa knew that

27

00:02:30,710 --> 00:02:28,720

science and technology would evolve

28

00:02:33,430 --> 00:02:30,720

so they wanted future scientists to be

29

00:02:35,270 --> 00:02:33,440

able to study these unique samples using

30

00:02:36,790 --> 00:02:35,280

new tools and state-of-the-art

31

00:02:39,110 --> 00:02:36,800

laboratories

32

00:02:42,309 --> 00:02:39,120

this became known as the apollo next

33

00:02:43,670 --> 00:02:42,319

generation sample analysis or the ansa

34

00:02:46,070 --> 00:02:43,680

initiative

35

00:02:48,790 --> 00:02:46,080

and this past monday and tuesday

36

00:02:51,589 --> 00:02:48,800

the very last pristine core sample of

37

00:02:53,830 --> 00:02:51,599

the moon from the apollo 17 mission

38

00:02:56,070 --> 00:02:53,840

was extracted from its vacuum sealed

39

00:02:58,149 --> 00:02:56,080

tube in one of the cleanest laboratory

40

00:02:59,110 --> 00:02:58,159

facilities at nasa's johnson space

41

00:03:01,190 --> 00:02:59,120

center

42

00:03:02,470 --> 00:03:01,200

which is the hub for extraterrestrial

43

00:03:04,710 --> 00:03:02,480

samples

44

00:03:06,630 --> 00:03:04,720

this process was months in the making

45

00:03:09,190 --> 00:03:06,640

and today we have some very special

46

00:03:12,390 --> 00:03:09,200

guests to tell us all about it

47

00:03:14,790 --> 00:03:12,400

i'm joined today by dr juliana gross

48

00:03:17,270 --> 00:03:14,800

deputy apollo curator

49

00:03:19,509 --> 00:03:17,280

and dr jacob bleacher nasa's chief

50

00:03:21,910 --> 00:03:19,519

exploration scientist who can tell us

51
00:03:24,309 --> 00:03:21,920
how data from this sample will inform

52
00:03:26,470 --> 00:03:24,319
future scientists and missions to the

53
00:03:28,149 --> 00:03:26,480
moon thank you so much for joining us

54
00:03:30,390 --> 00:03:28,159
today

55
00:03:33,030 --> 00:03:30,400
thank you so much for having us

56
00:03:35,589 --> 00:03:33,040
it's a pleasure to be here

57
00:03:38,149 --> 00:03:35,599
so juliana you've been involved in this

58
00:03:40,710 --> 00:03:38,159
months-long process to open and extract

59
00:03:42,470 --> 00:03:40,720
this pristine sample from the moon

60
00:03:44,470 --> 00:03:42,480
we're dying to know what that was like

61
00:03:46,229 --> 00:03:44,480
can you walk us through uh what these

62
00:03:48,149 --> 00:03:46,239
past few months have been like for you

63
00:03:50,390 --> 00:03:48,159

and your team

64

00:03:52,229 --> 00:03:50,400

of course um i'm happy to do that the

65

00:03:54,630 --> 00:03:52,239

process actually started about three

66

00:03:57,030 --> 00:03:54,640

years ago um and it involved a lot of

67

00:03:59,110 --> 00:03:57,040

planning and developing and testing and

68

00:04:00,630 --> 00:03:59,120

really was a collaboration between all

69

00:04:02,949 --> 00:04:00,640

sorts of different institutions that

70

00:04:06,070 --> 00:04:02,959

includes nasa and the european space

71

00:04:08,309 --> 00:04:06,080

agency um the university

72

00:04:10,309 --> 00:04:08,319

of new mexico washington university in

73

00:04:12,229 --> 00:04:10,319

saint blue is just to name a few

74

00:04:14,789 --> 00:04:12,239

um and so the sample we are talking

75

00:04:16,870 --> 00:04:14,799

about is actually a very special sample

76

00:04:19,430 --> 00:04:16,880

it is the lower part of a double drive

77

00:04:21,110 --> 00:04:19,440

tube um that the astronauts hammered

78

00:04:23,670 --> 00:04:21,120

into the ground on the lunar surface and

79

00:04:25,990 --> 00:04:23,680

that then filled with rocks and soil

80

00:04:28,710 --> 00:04:26,000

and the lower part of this drive tube

81

00:04:30,870 --> 00:04:28,720

was sealed into a vacuum container

82

00:04:33,350 --> 00:04:30,880

because it comes from deep within the

83

00:04:36,469 --> 00:04:33,360

lunar surface and it's very very cold

84

00:04:39,270 --> 00:04:36,479

there any potential gases and volatiles

85

00:04:41,909 --> 00:04:39,280

that are trapped down there um get

86

00:04:43,909 --> 00:04:41,919

sealed into this vacuum container and

87

00:04:45,590 --> 00:04:43,919

then get preserved there and so once

88

00:04:47,430 --> 00:04:45,600

that sample came back to earth it was

89

00:04:48,710 --> 00:04:47,440

placed in another vacuum container just

90

00:04:50,710 --> 00:04:48,720

to keep safe

91

00:04:53,030 --> 00:04:50,720

and really all and i'm just saying all

92

00:04:55,189 --> 00:04:53,040

that we had to do is just to you know

93

00:04:57,510 --> 00:04:55,199

figure out how to actually get the gas

94

00:04:59,110 --> 00:04:57,520

out of that container before we open it

95

00:05:00,310 --> 00:04:59,120

because we didn't want that to just

96

00:05:03,029 --> 00:05:00,320

escape

97

00:05:03,909 --> 00:05:03,039

and so esa developed a piercing tool for

98

00:05:06,070 --> 00:05:03,919

us

99

00:05:08,150 --> 00:05:06,080

and then the university of washington

100

00:05:09,590 --> 00:05:08,160

lewis they developed a gas extraction

101
00:05:11,430 --> 00:05:09,600
manifold

102
00:05:14,950 --> 00:05:11,440
for this particular purpose

103
00:05:16,710 --> 00:05:14,960
and so all of this about seven weeks ago

104
00:05:18,629 --> 00:05:16,720
all the pieces came together and they

105
00:05:20,150 --> 00:05:18,639
were they're now in our lab and we

106
00:05:22,790 --> 00:05:20,160
tested them

107
00:05:24,390 --> 00:05:22,800
and we were able to actually pierce the

108
00:05:26,710 --> 00:05:24,400
the vacuum container

109
00:05:28,150 --> 00:05:26,720
and release all these gases

110
00:05:30,629 --> 00:05:28,160
that are trapped in there and so you can

111
00:05:31,670 --> 00:05:30,639
see the manifold in the movie right here

112
00:05:34,710 --> 00:05:31,680
um

113
00:05:36,469 --> 00:05:34,720

and the the gas gets then stored in

114

00:05:37,350 --> 00:05:36,479

these canisters that you saw a minute

115

00:05:39,590 --> 00:05:37,360

ago

116

00:05:41,510 --> 00:05:39,600

and then we can we can take the gas from

117

00:05:42,950 --> 00:05:41,520

the canisters and distribute it to

118

00:05:44,710 --> 00:05:42,960

different scientists and so here you can

119

00:05:46,550 --> 00:05:44,720

see the piercing tool in the foreground

120

00:05:49,189 --> 00:05:46,560

with us doing measurements and actually

121

00:05:51,830 --> 00:05:49,199

piercing the actual sample

122

00:05:53,029 --> 00:05:51,840

and so the thing that we did after that

123

00:06:04,309 --> 00:05:53,039

um

124

00:06:05,830 --> 00:06:04,319

from medicine when doctors scan you to

125

00:06:07,350 --> 00:06:05,840

look inside you without actually cutting

126

00:06:09,749 --> 00:06:07,360

it open and we can do the same thing

127

00:06:11,590 --> 00:06:09,759

with ruxin so you can see our ct

128

00:06:13,430 --> 00:06:11,600

facility here

129

00:06:15,749 --> 00:06:13,440

and so that gave us the very first

130

00:06:18,070 --> 00:06:15,759

glimpse looking through the vacuum

131

00:06:19,909 --> 00:06:18,080

container into the actual sample what it

132

00:06:21,590 --> 00:06:19,919

looked like and it was a really good

133

00:06:24,150 --> 00:06:21,600

thing that we did that because it turns

134

00:06:26,070 --> 00:06:24,160

out the sample was overfilled which is a

135

00:06:28,550 --> 00:06:26,080

great problem to have

136

00:06:31,430 --> 00:06:28,560

but it it made it really hard for us to

137

00:06:33,590 --> 00:06:31,440

extrude so last week andrea mosey and i

138

00:06:35,749 --> 00:06:33,600

spent all of that week to figure out a

139

00:06:38,070 --> 00:06:35,759

new way of how to open that sealed

140

00:06:40,150 --> 00:06:38,080

vacuum container and take the sample out

141

00:06:41,510 --> 00:06:40,160

carefully without losing any of this

142

00:06:44,950 --> 00:06:41,520

extra salt

143

00:06:47,430 --> 00:06:44,960

and so just on monday or three days ago

144

00:06:49,909 --> 00:06:47,440

um is when we actually finally opened

145

00:06:52,150 --> 00:06:49,919

the the sealed vacuum container and took

146

00:06:53,909 --> 00:06:52,160

the sample out for the very first time

147

00:06:55,589 --> 00:06:53,919

you can see that here in the movie

148

00:06:58,390 --> 00:06:55,599

that's the very first glimpse that we

149

00:07:00,710 --> 00:06:58,400

got and so that is the first time

150

00:07:02,710 --> 00:07:00,720

anybody has seen this sample since it

151
00:07:05,189 --> 00:07:02,720
was sealed on them 50 years ago and so

152
00:07:07,510 --> 00:07:05,199
for us to be the first people to

153
00:07:10,469 --> 00:07:07,520
actually do this was extremely

154
00:07:12,309 --> 00:07:10,479
exciting um and fun to do so yeah it has

155
00:07:14,309 --> 00:07:12,319
been a long seven weeks but it's totally

156
00:07:16,629 --> 00:07:14,319
worth it

157
00:07:18,629 --> 00:07:16,639
wow that must be so exciting and the

158
00:07:20,230 --> 00:07:18,639
process is just incredible i bet most

159
00:07:22,629 --> 00:07:20,240
people at home thought you just twist

160
00:07:24,070 --> 00:07:22,639
the cap and open these tubes i had no

161
00:07:26,629 --> 00:07:24,080
idea that there were so many different

162
00:07:28,870 --> 00:07:26,639
steps and that it was so involved

163
00:07:31,670 --> 00:07:28,880

and so jake these samples were collected

164

00:07:33,670 --> 00:07:31,680

on the moon nearly 50 years ago and now

165

00:07:36,230 --> 00:07:33,680

nasa is planning to return to the lunar

166

00:07:38,870 --> 00:07:36,240

surface with the artemis program

167

00:07:42,870 --> 00:07:38,880

how will what we learn from this sample

168

00:07:45,029 --> 00:07:42,880

inform future human missions to the moon

169

00:07:46,309 --> 00:07:45,039

yeah joy it's a really good question at

170

00:07:48,230 --> 00:07:46,319

first i just want to say how super

171

00:07:50,309 --> 00:07:48,240

exciting this is i mean that's really

172

00:07:51,589 --> 00:07:50,319

cool to see that video juliana was just

173

00:07:53,830 --> 00:07:51,599

showing i mean

174

00:07:55,830 --> 00:07:53,840

that that soil hasn't been seen by

175

00:07:58,230 --> 00:07:55,840

anybody for 50 years which is so cool

176

00:08:00,550 --> 00:07:58,240

and now we're gonna learn about it

177

00:08:03,110 --> 00:08:00,560

so you know this is really an extension

178

00:08:04,869 --> 00:08:03,120

of our lunar exploration right we went

179

00:08:06,869 --> 00:08:04,879

with apollo and now we're going with

180

00:08:08,629 --> 00:08:06,879

artemis but we're going to a very

181

00:08:10,309 --> 00:08:08,639

different place we're going to the south

182

00:08:12,469 --> 00:08:10,319

pole of the moon

183

00:08:15,189 --> 00:08:12,479

and in the south pole there are some

184

00:08:17,749 --> 00:08:15,199

locations because the sun is coming at a

185

00:08:19,350 --> 00:08:17,759

very oblique angle to the to the very

186

00:08:21,510 --> 00:08:19,360

bottom of the moon that south pole of

187

00:08:24,230 --> 00:08:21,520

the moon there are some depressions

188

00:08:25,909 --> 00:08:24,240

impact craters from where um debris from

189

00:08:27,749 --> 00:08:25,919

space has hit the moon in the past and

190

00:08:30,390 --> 00:08:27,759

made a depression

191

00:08:33,110 --> 00:08:30,400

they we never see sunlight down there

192

00:08:35,430 --> 00:08:33,120

and so these permanently shadowed

193

00:08:37,829 --> 00:08:35,440

regions we call them psrs permanently

194

00:08:40,310 --> 00:08:37,839

shadowed regions never see sunlight and

195

00:08:43,269 --> 00:08:40,320

so water that maybe was delivered to the

196

00:08:45,750 --> 00:08:43,279

moon by comets or potentially

197

00:08:48,310 --> 00:08:45,760

from within the moon itself uh that gets

198

00:08:50,790 --> 00:08:48,320

into one of these traps is stuck there

199

00:08:54,389 --> 00:08:50,800

we call these cold traps and so some of

200

00:08:56,389 --> 00:08:54,399

the samples that we hope to collect now

201
00:08:59,030 --> 00:08:56,399
in this mission in the artemis program

202
00:09:01,430 --> 00:08:59,040
would we hope have uh volatiles with

203
00:09:04,550 --> 00:09:01,440
them and so what we're hoping to learn

204
00:09:07,750 --> 00:09:04,560
from this apollo sample is how well did

205
00:09:10,550 --> 00:09:07,760
the container trap all of that material

206
00:09:12,870 --> 00:09:10,560
those gases that yuliana talked about

207
00:09:14,870 --> 00:09:12,880
any volatiles from the moon

208
00:09:17,670 --> 00:09:14,880
and whether or not anything leaked into

209
00:09:18,870 --> 00:09:17,680
that sample from from here on earth

210
00:09:22,710 --> 00:09:18,880
because that's really going to help

211
00:09:24,470 --> 00:09:22,720
inform us how to do this well when we go

212
00:09:26,630 --> 00:09:24,480
to the south pole

213
00:09:28,710 --> 00:09:26,640

and just like here on earth any job that

214

00:09:30,790 --> 00:09:28,720

you might do it's a little bit easier if

215

00:09:32,550 --> 00:09:30,800

you have the right tools so we want to

216

00:09:34,389 --> 00:09:32,560

make sure that we get the best samples

217

00:09:35,990 --> 00:09:34,399

from the south pole of the moon so that

218

00:09:38,310 --> 00:09:36,000

scientists can study it so we can

219

00:09:39,829 --> 00:09:38,320

understand the water cycle and whether

220

00:09:42,150 --> 00:09:39,839

or not the water could be used as a

221

00:09:44,070 --> 00:09:42,160

resource for our astronauts but to do

222

00:09:45,750 --> 00:09:44,080

that right we really need to design that

223

00:09:47,990 --> 00:09:45,760

right kind of tool the tools to pick up

224

00:09:50,389 --> 00:09:48,000

the samples and the tools to contain the

225

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

samples preserve them

226

00:09:54,949 --> 00:09:52,800

make sure we don't kind of get them

227

00:09:56,310 --> 00:09:54,959

contaminated with any of our gases from

228

00:09:58,790 --> 00:09:56,320

here on earth or inside of our

229

00:10:00,070 --> 00:09:58,800

spacecraft so it's really exciting not

230

00:10:02,150 --> 00:10:00,080

just to learn the science from this

231

00:10:03,990 --> 00:10:02,160

apollo sample but learn about the

232

00:10:05,750 --> 00:10:04,000

container that they put it into and how

233

00:10:08,150 --> 00:10:05,760

well it worked how well it kept those

234

00:10:09,509 --> 00:10:08,160

gases in there

235

00:10:11,110 --> 00:10:09,519

you can almost kind of think about this

236

00:10:12,710 --> 00:10:11,120

as an apollo sample but it's almost like

237

00:10:14,949 --> 00:10:12,720

the first of the artemis samples right

238

00:10:16,870 --> 00:10:14,959

we're just about to go and here we are

239

00:10:18,710 --> 00:10:16,880

opening up a new rock for the moon so

240

00:10:21,190 --> 00:10:18,720

it's really an exciting time for for all

241

00:10:24,949 --> 00:10:23,509

you've just opened this pristine moon

242

00:10:28,310 --> 00:10:24,959

rock sample

243

00:10:31,350 --> 00:10:28,320

what's next for you and your team

244

00:10:34,310 --> 00:10:31,360

okay so there are a couple next steps

245

00:10:37,030 --> 00:10:34,320

the first one we did on tuesday

246

00:10:39,430 --> 00:10:37,040

is once the core gets pushed out of its

247

00:10:41,910 --> 00:10:39,440

tube um basically onto a table that has

248

00:10:43,910 --> 00:10:41,920

a mold so it can hold the core

249

00:10:46,310 --> 00:10:43,920

and then we are we're scraping the very

250

00:10:48,389 --> 00:10:46,320

first millimeter off the surface very

251
00:10:51,030 --> 00:10:48,399
carefully because that surface has been

252
00:10:52,470 --> 00:10:51,040
in contact with the core tube basically

253
00:10:53,990 --> 00:10:52,480
and you can see me here in the video

254
00:10:55,590 --> 00:10:54,000
where i'm marking where we want to

255
00:10:57,509 --> 00:10:55,600
scrape the surface off yeah here you can

256
00:10:59,829 --> 00:10:57,519
see it's scraping

257
00:11:01,750 --> 00:10:59,839
and we do this because we want to expose

258
00:11:03,509 --> 00:11:01,760
the pristine sample underneath that has

259
00:11:05,910 --> 00:11:03,519
never been in contact with with any

260
00:11:07,590 --> 00:11:05,920
material basically from earth

261
00:11:08,949 --> 00:11:07,600
and so that cuts down on any potential

262
00:11:10,870 --> 00:11:08,959
contamination

263
00:11:14,069 --> 00:11:10,880

once that is done so we finished that on

264

00:11:15,670 --> 00:11:14,079

tuesday at the very moment we have

265

00:11:17,670 --> 00:11:15,680

researchers from the university of

266

00:11:19,350 --> 00:11:17,680

hawaii in our lab

267

00:11:21,670 --> 00:11:19,360

and they're going to do hyperstructural

268

00:11:23,350 --> 00:11:21,680

analysis on the core as it sits in the

269

00:11:25,430 --> 00:11:23,360

cabinet at the moment and that means

270

00:11:26,790 --> 00:11:25,440

they're shining light on it and then

271

00:11:28,949 --> 00:11:26,800

they're looking at the light that gets

272

00:11:30,630 --> 00:11:28,959

reflected off the coarse surface and

273

00:11:32,550 --> 00:11:30,640

they analyze that light

274

00:11:34,310 --> 00:11:32,560

and that gives us some indication of

275

00:11:36,949 --> 00:11:34,320

chemistry and how the chemistry might

276
00:11:38,710 --> 00:11:36,959
change um from top to bottom of the core

277
00:11:41,190 --> 00:11:38,720
and that can also be used for ground

278
00:11:42,949 --> 00:11:41,200
truthing any orbiters that we have going

279
00:11:44,069 --> 00:11:42,959
around the moon who look at reflected

280
00:11:48,949 --> 00:11:44,079
light

281
00:11:51,430 --> 00:11:48,959
and so once that is done

282
00:11:53,829 --> 00:11:51,440
next week monday is when we start the

283
00:11:55,590 --> 00:11:53,839
very tedious process of really

284
00:11:57,670 --> 00:11:55,600
dissecting the core and that means we're

285
00:11:59,190 --> 00:11:57,680
taking it apart bits by bits you know

286
00:12:00,710 --> 00:11:59,200
every half centimeter we're taking a

287
00:12:02,230 --> 00:12:00,720
sample and then we're storing that in

288
00:12:03,990 --> 00:12:02,240

little containers

289

00:12:05,110 --> 00:12:04,000

and we're doing that to preserve any

290

00:12:07,269 --> 00:12:05,120

potential

291

00:12:08,710 --> 00:12:07,279

layers that we can't really see with our

292

00:12:10,470 --> 00:12:08,720

eyes um

293

00:12:12,949 --> 00:12:10,480

and that then can be allocated to to

294

00:12:15,990 --> 00:12:12,959

scientists while we're doing this we're

295

00:12:18,389 --> 00:12:16,000

creating a preliminary examination and

296

00:12:21,509 --> 00:12:18,399

that means we're describing um what

297

00:12:24,310 --> 00:12:21,519

grain sizes we see what colors we see

298

00:12:26,550 --> 00:12:24,320

we will remove larger rock fragments and

299

00:12:28,790 --> 00:12:26,560

then we will ct scan them again to see

300

00:12:30,470 --> 00:12:28,800

the inside and the textures

301

00:12:32,470 --> 00:12:30,480

um and then we're creating this big

302

00:12:34,710 --> 00:12:32,480

catalog where people

303

00:12:36,710 --> 00:12:34,720

um from all over the world then can look

304

00:12:38,389 --> 00:12:36,720

at it and it's specifically really

305

00:12:41,269 --> 00:12:38,399

useful for researchers because then they

306

00:12:43,750 --> 00:12:41,279

can select the best sample possible to

307

00:12:45,750 --> 00:12:43,760

do their best signs possible

308

00:12:48,470 --> 00:12:45,760

and and so that's that's the next couple

309

00:12:51,110 --> 00:12:48,480

of months for us really

310

00:12:53,910 --> 00:12:51,120

well that's really exciting we have a

311

00:12:55,829 --> 00:12:53,920

lot of questions coming in online um if

312

00:12:57,350 --> 00:12:55,839

you have questions for our experts send

313

00:12:59,269 --> 00:12:57,360

them in by commenting in the stream

314

00:13:02,629 --> 00:12:59,279

wherever you're watching or by using the

315

00:13:05,590 --> 00:13:02,639

hashtag asknasa on social media

316

00:13:08,150 --> 00:13:05,600

so our first question is from vegan in

317

00:13:10,389 --> 00:13:08,160

the mirror on reddit and they ask if you

318

00:13:13,350 --> 00:13:10,399

take a sample from the moon and close a

319

00:13:15,269 --> 00:13:13,360

container airtight is it automatically

320

00:13:19,190 --> 00:13:15,279

vacuum sealed or do you need to do

321

00:13:20,949 --> 00:13:19,200

something with it so it is vacuum sealed

322

00:13:22,069 --> 00:13:20,959

and that's a very good question i can i

323

00:13:23,590 --> 00:13:22,079

can quickly

324

00:13:25,509 --> 00:13:23,600

give some insights and then maybe jake

325

00:13:27,829 --> 00:13:25,519

can follow up on it so when you take a

326

00:13:29,430 --> 00:13:27,839

container on the moon which is basically

327

00:13:31,750 --> 00:13:29,440

vacuum because the moon doesn't have an

328

00:13:33,590 --> 00:13:31,760

atmosphere and you just um close it you

329

00:13:35,430 --> 00:13:33,600

know like as tight as you can you just

330

00:13:37,110 --> 00:13:35,440

screw the lid on that doesn't really

331

00:13:38,949 --> 00:13:37,120

mean that it's airtight because there

332

00:13:40,710 --> 00:13:38,959

there might be grains you know from the

333

00:13:43,990 --> 00:13:40,720

lunar surface that got again attached in

334

00:13:46,150 --> 00:13:44,000

between it could be um little cracks or

335

00:13:49,670 --> 00:13:46,160

or um you know in between and so once

336

00:13:51,430 --> 00:13:49,680

you return that to earth our atmosphere

337

00:13:52,949 --> 00:13:51,440

which is so much more pressure than the

338

00:13:55,269 --> 00:13:52,959

vacuum that you have in the container it

339

00:13:57,590 --> 00:13:55,279

can seep into this container through all

340

00:13:59,990 --> 00:13:57,600

of these little cracks and nooks and

341

00:14:01,990 --> 00:14:00,000

like little little gaps basically

342

00:14:04,069 --> 00:14:02,000

so in order to really vacuum seal it you

343

00:14:06,550 --> 00:14:04,079

have to have kind of like a metal gasket

344

00:14:09,590 --> 00:14:06,560

or a metal ring that when you press down

345

00:14:11,189 --> 00:14:09,600

your lid it really seals it goes into

346

00:14:14,790 --> 00:14:11,199

all the little nooks and crannies and

347

00:14:16,550 --> 00:14:14,800

really seals um your sample inside and

348

00:14:19,030 --> 00:14:16,560

that's what the astronaut did with this

349

00:14:20,150 --> 00:14:19,040

with this um vacuum container there was

350

00:14:29,269 --> 00:14:20,160

a

351
00:14:31,829 --> 00:14:29,279
there

352
00:14:33,110 --> 00:14:31,839
jake do you want to follow up on that

353
00:14:35,269 --> 00:14:33,120
yeah that

354
00:14:37,509 --> 00:14:35,279
everything that you wanna just described

355
00:14:39,350 --> 00:14:37,519
is exactly what we want to understand

356
00:14:41,990 --> 00:14:39,360
how well that worked because we can

357
00:14:43,430 --> 00:14:42,000
update that somewhat as we move forward

358
00:14:45,509 --> 00:14:43,440
for artemis

359
00:14:47,990 --> 00:14:45,519
but it might be sufficient for what we

360
00:14:49,910 --> 00:14:48,000
need and another part to that is

361
00:14:52,790 --> 00:14:49,920
understanding how we're going to be

362
00:14:54,470 --> 00:14:52,800
collecting samples in the south pole so

363
00:14:56,710 --> 00:14:54,480

we know how these samples were collected

364

00:14:58,790 --> 00:14:56,720

and we know that this approach

365

00:15:00,629 --> 00:14:58,800

will yield a certain result which julian

366

00:15:02,470 --> 00:15:00,639

and her team and scientists around the

367

00:15:04,069 --> 00:15:02,480

world are going to understand over the

368

00:15:05,910 --> 00:15:04,079

next several weeks

369

00:15:08,310 --> 00:15:05,920

but we'll need to think about how that

370

00:15:10,470 --> 00:15:08,320

applies to where we will be sampling uh

371

00:15:12,470 --> 00:15:10,480

in the south pole because we're fairly

372

00:15:14,470 --> 00:15:12,480

certain there's water there but we don't

373

00:15:15,990 --> 00:15:14,480

know so much is what the status of that

374

00:15:17,750 --> 00:15:16,000

water is is it

375

00:15:19,910 --> 00:15:17,760

a little bit of water mixed with the

376

00:15:22,629 --> 00:15:19,920

lunar dust or regolith

377

00:15:24,389 --> 00:15:22,639

or is it bigger pieces of ice

378

00:15:25,189 --> 00:15:24,399

mixed in there is it actually just solid

379

00:15:27,509 --> 00:15:25,199

ice

380

00:15:30,470 --> 00:15:27,519

so there's a lot for us to learn um and

381

00:15:32,629 --> 00:15:30,480

so understanding really um how well this

382

00:15:34,629 --> 00:15:32,639

process that you and i just described uh

383

00:15:37,030 --> 00:15:34,639

worked for apollo how well it contained

384

00:15:38,790 --> 00:15:37,040

that over 50 years that's very critical

385

00:15:41,670 --> 00:15:38,800

for us as we start designing these cool

386

00:15:42,949 --> 00:15:41,680

groups forward

387

00:15:44,710 --> 00:15:42,959

and so a lot of

388

00:15:46,230 --> 00:15:44,720

people online are asking versions of

389

00:15:57,269 --> 00:15:46,240

this question

390

00:16:01,670 --> 00:15:59,269

that's a great question actually

391

00:16:03,910 --> 00:16:01,680

yeah that is a good question i mean the

392

00:16:06,310 --> 00:16:03,920

astronauts always describe it as it

393

00:16:09,350 --> 00:16:06,320

smells like gunpowder a little bit

394

00:16:11,189 --> 00:16:09,360

um we we don't really

395

00:16:14,710 --> 00:16:11,199

smell the sample so all the samples that

396

00:16:16,389 --> 00:16:14,720

we have are are backed in teflon bags in

397

00:16:18,389 --> 00:16:16,399

a nitrogen gas

398

00:16:21,030 --> 00:16:18,399

filled atmosphere and that's where they

399

00:16:23,509 --> 00:16:21,040

get stored and so we never ever take

400

00:16:25,990 --> 00:16:23,519

apollo samples out and expose them to

401
00:16:28,629 --> 00:16:26,000
air you know and sniff at them or or any

402
00:16:30,949 --> 00:16:28,639
any anything like that um and so

403
00:16:33,110 --> 00:16:30,959
i yeah and so you in this video here you

404
00:16:34,870 --> 00:16:33,120
can see us opening the core sample but

405
00:16:37,189 --> 00:16:34,880
it is within a glove box and that is

406
00:16:39,189 --> 00:16:37,199
filled with nitrogen gas

407
00:16:41,110 --> 00:16:39,199
so that and it's very dry so that the

408
00:16:43,509 --> 00:16:41,120
soil doesn't react with earth atmosphere

409
00:16:45,990 --> 00:16:43,519
so we're trying to keep the sample safe

410
00:16:47,350 --> 00:16:46,000
from any potential contamination so

411
00:16:49,030 --> 00:16:47,360
you really can't take it out and smell

412
00:16:50,949 --> 00:16:49,040
it so i don't i don't know the answer to

413
00:16:53,430 --> 00:16:50,959

that question

414

00:16:55,189 --> 00:16:53,440

but i think juliana the point you made

415

00:16:56,470 --> 00:16:55,199

um that smells like gunpowder is

416

00:16:58,470 --> 00:16:56,480

something that many of the apollo

417

00:17:00,629 --> 00:16:58,480

astronauts commented on so

418

00:17:03,189 --> 00:17:00,639

they actually put their suits on and

419

00:17:05,110 --> 00:17:03,199

took them off inside their their habitat

420

00:17:06,549 --> 00:17:05,120

basically like their living room sort of

421

00:17:08,309 --> 00:17:06,559

so they would put the suit on and go

422

00:17:09,829 --> 00:17:08,319

shuffle around and do the work and as

423

00:17:11,590 --> 00:17:09,839

you know from here on earth and go

424

00:17:14,390 --> 00:17:11,600

outside and you work outside you get

425

00:17:16,470 --> 00:17:14,400

dirty right and so the astronauts they

426

00:17:18,390 --> 00:17:16,480

had some of that lunar regolith on their

427

00:17:19,750 --> 00:17:18,400

suits in fact you can still see that on

428

00:17:21,909 --> 00:17:19,760

the suits today

429

00:17:24,470 --> 00:17:21,919

and so they did describe that smell as

430

00:17:26,710 --> 00:17:24,480

somewhat gun powder like so you know

431

00:17:28,230 --> 00:17:26,720

that's pretty much our best uh chance at

432

00:17:30,310 --> 00:17:28,240

knowing what lunar rocks smell like

433

00:17:31,510 --> 00:17:30,320

until maybe we go back and try that

434

00:17:32,710 --> 00:17:31,520

again that's a really interesting

435

00:17:34,150 --> 00:17:32,720

question

436

00:17:37,510 --> 00:17:34,160

yeah

437

00:17:39,909 --> 00:17:37,520

uh lara demozak on twitter asks why did

438

00:17:42,470 --> 00:17:39,919

the apollo 17 astronauts choose to

439

00:17:44,830 --> 00:17:42,480

sample from a landslide deposit did they

440

00:17:46,549 --> 00:17:44,840

also take a sample from flat

441

00:17:48,230 --> 00:17:46,559

terrain

442

00:17:50,630 --> 00:17:48,240

jake do you want to get a go with that

443

00:17:53,430 --> 00:17:50,640

sure they they collected a number of

444

00:17:55,110 --> 00:17:53,440

samples i don't know exactly how many uh

445

00:17:57,110 --> 00:17:55,120

but they did collect a significant

446

00:17:59,110 --> 00:17:57,120

number of samples so

447

00:18:01,830 --> 00:17:59,120

for any geologic problem that you're

448

00:18:03,430 --> 00:18:01,840

trying to tackle um you want to try to

449

00:18:05,110 --> 00:18:03,440

sample from

450

00:18:08,070 --> 00:18:05,120

several different locations so that you

451
00:18:10,549 --> 00:18:08,080
can understand processes that may be

452
00:18:12,230 --> 00:18:10,559
in effect across broader regions so as a

453
00:18:14,710 --> 00:18:12,240
landslide

454
00:18:16,470 --> 00:18:14,720
as noted here uh you would want to

455
00:18:18,710 --> 00:18:16,480
collect from inside the landslide

456
00:18:20,230 --> 00:18:18,720
adjacent to the landslide

457
00:18:22,390 --> 00:18:20,240
there were several different geologic

458
00:18:24,950 --> 00:18:22,400
processes that the apollo 17 astronauts

459
00:18:25,750 --> 00:18:24,960
were studying they also identified

460
00:18:27,350 --> 00:18:25,760
some

461
00:18:29,110 --> 00:18:27,360
really unique aspects of the lunar

462
00:18:31,669 --> 00:18:29,120
surface this is the mission in which

463
00:18:34,310 --> 00:18:31,679

they identified orange glass that's

464

00:18:36,070 --> 00:18:34,320

related to some volcanic processes so

465

00:18:38,150 --> 00:18:36,080

the reason we want to send the

466

00:18:39,029 --> 00:18:38,160

astronauts there is because we can train

467

00:18:41,590 --> 00:18:39,039

them

468

00:18:43,750 --> 00:18:41,600

to think quickly they see what is going

469

00:18:45,669 --> 00:18:43,760

on and they can make the best judgment

470

00:18:47,909 --> 00:18:45,679

call about what to pick up what's the

471

00:18:50,310 --> 00:18:47,919

most important sample to pick up and so

472

00:18:52,950 --> 00:18:50,320

in this case they're trying to get into

473

00:18:56,230 --> 00:18:52,960

that debris kind of pile if you think

474

00:18:58,070 --> 00:18:56,240

about a landslide one one thing that a

475

00:19:00,070 --> 00:18:58,080

landslide can do for you on the moon is

476
00:19:00,950 --> 00:19:00,080
bring you material from much farther

477
00:19:02,470 --> 00:19:00,960
away

478
00:19:04,470 --> 00:19:02,480
we're a little bit constrained by how

479
00:19:05,350 --> 00:19:04,480
far especially impala how far they could

480
00:19:07,669 --> 00:19:05,360
go

481
00:19:09,110 --> 00:19:07,679
apollo 17 had the lunar roving vehicle

482
00:19:10,710 --> 00:19:09,120
so they could which kind of looked like

483
00:19:13,270 --> 00:19:10,720
that dune buggy that they could drive

484
00:19:15,750 --> 00:19:13,280
around and they actually covered the

485
00:19:16,870 --> 00:19:15,760
longest distances of any of the missions

486
00:19:19,029 --> 00:19:16,880
still

487
00:19:20,870 --> 00:19:19,039
you look to things like impact craters

488
00:19:22,549 --> 00:19:20,880

or landslides

489

00:19:24,150 --> 00:19:22,559

to deliver material from farther away

490

00:19:26,390 --> 00:19:24,160

that you might not be able to get to

491

00:19:28,710 --> 00:19:26,400

another technique they used was to look

492

00:19:30,710 --> 00:19:28,720

up hills and see if any boulders had

493

00:19:32,390 --> 00:19:30,720

rolled down the hill and they did that

494

00:19:34,230 --> 00:19:32,400

as well in that mission they identified

495

00:19:36,630 --> 00:19:34,240

some places where rocks from

496

00:19:38,230 --> 00:19:36,640

a good distance away had come to them so

497

00:19:39,830 --> 00:19:38,240

they were able to sample them so you

498

00:19:42,150 --> 00:19:39,840

have to make those judgment calls about

499

00:19:44,070 --> 00:19:42,160

what you see around you and try to

500

00:19:45,909 --> 00:19:44,080

collect some sample of multiple

501
00:19:47,750 --> 00:19:45,919
different things that are going on as as

502
00:19:50,390 --> 00:19:47,760
part of that history that story that

503
00:19:52,310 --> 00:19:50,400
you're seeing in the rocks

504
00:19:55,110 --> 00:19:52,320
another reason why they particularly

505
00:19:57,270 --> 00:19:55,120
also sampled this region with the core

506
00:19:59,430 --> 00:19:57,280
sample that we have is that um the

507
00:20:01,909 --> 00:19:59,440
landslide deposit is very close to a

508
00:20:04,310 --> 00:20:01,919
fault which is basically a gigantic

509
00:20:06,390 --> 00:20:04,320
crack so to speak um and because they

510
00:20:08,950 --> 00:20:06,400
sampled so deep within the surface

511
00:20:10,950 --> 00:20:08,960
one of the the goals was to capture any

512
00:20:13,270 --> 00:20:10,960
potential gases and the hope was that

513
00:20:15,510 --> 00:20:13,280

the fault line would be a conduit to

514

00:20:17,350 --> 00:20:15,520

like half the gases that are from within

515

00:20:18,230 --> 00:20:17,360

the moon that slowly degas outside of

516

00:20:19,909 --> 00:20:18,240

the moon

517

00:20:22,149 --> 00:20:19,919

basically deliver into this landsat

518

00:20:24,070 --> 00:20:22,159

deposit that then can be captured by

519

00:20:25,990 --> 00:20:24,080

this drive tube um and that was one of

520

00:20:30,789 --> 00:20:26,000

the reasons why it was sealed in a

521

00:20:35,750 --> 00:20:33,909

um doc harry on reddit asks how do you

522

00:20:38,630 --> 00:20:35,760

account for what changes might have

523

00:20:40,630 --> 00:20:38,640

occurred due to time past compared to

524

00:20:44,950 --> 00:20:40,640

what they might have found if today's

525

00:20:48,230 --> 00:20:46,310

okay so

526
00:20:51,830 --> 00:20:48,240
um i mean one of the reasons why nasa

527
00:20:54,070 --> 00:20:51,840
kept these samples safe for 50 years was

528
00:20:56,789 --> 00:20:54,080
that they knew that technology will

529
00:21:00,070 --> 00:20:56,799
evolve with time um

530
00:21:01,990 --> 00:21:00,080
and so the the x-ray computed

531
00:21:03,669 --> 00:21:02,000
scanning the xct scanning that i talked

532
00:21:05,990 --> 00:21:03,679
about before that's a technology that

533
00:21:08,390 --> 00:21:06,000
didn't really exist to that extent 50

534
00:21:10,950 --> 00:21:08,400
years ago and that gives us the chance

535
00:21:13,909 --> 00:21:10,960
to take rocks you know like big rocks or

536
00:21:16,070 --> 00:21:13,919
drive tubes just we showed and and ct

537
00:21:18,950 --> 00:21:16,080
scan them which is a

538
00:21:21,270 --> 00:21:18,960

a method that we can use without hurting

539

00:21:23,110 --> 00:21:21,280

the samples and so we can look inside

540

00:21:24,870 --> 00:21:23,120

the sample and we can see the minerals

541

00:21:26,710 --> 00:21:24,880

and we can see the texture

542

00:21:28,630 --> 00:21:26,720

um and so we can learn a lot about where

543

00:21:31,029 --> 00:21:28,640

the sample comes from within the moon

544

00:21:33,590 --> 00:21:31,039

maybe and how it formed without actually

545

00:21:35,750 --> 00:21:33,600

contaminating it or breaking it

546

00:21:37,990 --> 00:21:35,760

mass spectrometers have evolved over

547

00:21:40,230 --> 00:21:38,000

time so now there's less samples that

548

00:21:42,230 --> 00:21:40,240

are needed and they get higher precision

549

00:21:44,789 --> 00:21:42,240

higher quality data

550

00:21:47,430 --> 00:21:44,799

and so again that wasn't possible 50

551
00:21:49,669 --> 00:21:47,440
years ago and with for the gas analysis

552
00:21:51,750 --> 00:21:49,679
for example that they knew that that

553
00:21:54,470 --> 00:21:51,760
wasn't possible 50 years ago and so now

554
00:21:57,669 --> 00:21:54,480
we have um technology where we can take

555
00:22:00,149 --> 00:21:57,679
that little bit of gas that we extracted

556
00:22:05,510 --> 00:22:00,159
and actually get data points and learn

557
00:22:10,390 --> 00:22:08,390
moose cahoots on reddit they ask

558
00:22:12,789 --> 00:22:10,400
are we still running projects with this

559
00:22:15,110 --> 00:22:12,799
sort of eye to the future it seems

560
00:22:16,870 --> 00:22:15,120
shockingly altruistic to gather samples

561
00:22:20,950 --> 00:22:16,880
that won't be examined in the project

562
00:22:25,029 --> 00:22:22,789
yeah so the question will we take a

563
00:22:26,950 --> 00:22:25,039

similar approach for artemis is that

564

00:22:29,590 --> 00:22:26,960

what the question is

565

00:22:32,149 --> 00:22:29,600

yeah okay like will we yeah

566

00:22:34,310 --> 00:22:32,159

real good question um so we certainly

567

00:22:36,950 --> 00:22:34,320

recognize the value in that now you know

568

00:22:39,029 --> 00:22:36,960

our nasa predecessors had tremendous

569

00:22:40,789 --> 00:22:39,039

foresight in their ability to uh to

570

00:22:42,390 --> 00:22:40,799

think through you know

571

00:22:44,230 --> 00:22:42,400

it's like imagine at christmas time

572

00:22:46,390 --> 00:22:44,240

trying to save a present or at a

573

00:22:48,310 --> 00:22:46,400

birthday trying to save a present for

574

00:22:49,830 --> 00:22:48,320

you know a year later

575

00:22:51,750 --> 00:22:49,840

uh i know i certainly couldn't get my

576

00:22:54,630 --> 00:22:51,760

children to do that but um

577

00:22:57,270 --> 00:22:54,640

it's uh you know we will certainly

578

00:22:59,350 --> 00:22:57,280

approach it in a similar way we'll try

579

00:23:00,950 --> 00:22:59,360

with the um amount of material that

580

00:23:01,990 --> 00:23:00,960

we're able to bring home on these

581

00:23:04,230 --> 00:23:02,000

missions

582

00:23:05,909 --> 00:23:04,240

and do the best job we can now and i

583

00:23:08,789 --> 00:23:05,919

would say it's probably likely that we

584

00:23:09,990 --> 00:23:08,799

will also save some sample for future

585

00:23:12,470 --> 00:23:10,000

analysis

586

00:23:13,990 --> 00:23:12,480

but there are also new techniques now

587

00:23:15,909 --> 00:23:14,000

that give us the capability of

588

00:23:17,909 --> 00:23:15,919

potentially doing some of the science

589

00:23:20,630 --> 00:23:17,919

without even opening the canisters so as

590

00:23:22,710 --> 00:23:20,640

julianna talked a little bit about

591

00:23:25,430 --> 00:23:22,720

as techniques improve it may be that we

592

00:23:27,590 --> 00:23:25,440

save some sample in containers but we

593

00:23:29,430 --> 00:23:27,600

can still do some science without even

594

00:23:31,270 --> 00:23:29,440

opening them right now so there's a

595

00:23:33,110 --> 00:23:31,280

number of different lines of thought on

596

00:23:34,630 --> 00:23:33,120

what we can do with this i think that we

597

00:23:36,149 --> 00:23:34,640

will always have an eye towards

598

00:23:38,470 --> 00:23:36,159

preserving

599

00:23:40,230 --> 00:23:38,480

material for future analysis while

600

00:23:43,669 --> 00:23:40,240

trying to do as much as we can right now

601
00:23:50,470 --> 00:23:46,630
um contour more on twitter asked does

602
00:23:52,630 --> 00:23:50,480
the moon have a core

603
00:23:53,430 --> 00:23:52,640
yes the answer is yes the moon has a

604
00:23:54,390 --> 00:23:53,440
core

605
00:23:57,590 --> 00:23:54,400
um

606
00:23:59,430 --> 00:23:57,600
it is debated how how large it is or how

607
00:24:03,269 --> 00:23:59,440
small it is but it does have

608
00:24:04,870 --> 00:24:03,279
a core so the moon is a planetary body

609
00:24:06,789 --> 00:24:04,880
and it went through a process that is

610
00:24:09,750 --> 00:24:06,799
called differentiation and that really

611
00:24:11,909 --> 00:24:09,760
means um just layering based on density

612
00:24:13,990 --> 00:24:11,919
so when the moon formed it was fully

613
00:24:16,310 --> 00:24:14,000

molten once upon a time

614

00:24:19,029 --> 00:24:16,320

and then all the heavy elements um they

615

00:24:21,029 --> 00:24:19,039

sink towards the center like iron and

616

00:24:23,350 --> 00:24:21,039

nickel and that forms the core and then

617

00:24:25,909 --> 00:24:23,360

all the very light elements um they're

618

00:24:27,510 --> 00:24:25,919

lighter than the melt um they rise

619

00:24:29,750 --> 00:24:27,520

towards the surface

620

00:24:30,950 --> 00:24:29,760

um and they build they make the crust

621

00:24:32,789 --> 00:24:30,960

and then all the minerals that are

622

00:24:35,029 --> 00:24:32,799

somewhere in between you know they built

623

00:24:36,710 --> 00:24:35,039

the mantle so the moon has layers a core

624

00:24:39,830 --> 00:24:36,720

a mantle and a crust

625

00:24:42,149 --> 00:24:39,840

and if it was orbiting the sun by itself

626

00:24:44,149 --> 00:24:42,159

you know had a nice clear orbit then it

627

00:24:45,190 --> 00:24:44,159

would would be potentially considered a

628

00:24:49,029 --> 00:24:45,200

planet

629

00:24:52,630 --> 00:24:49,039

body because it has it has layers just

630

00:24:57,990 --> 00:24:55,269

and a speed of light on twitter asks has

631

00:25:00,230 --> 00:24:58,000

there been any previous analysis of moon

632

00:25:04,310 --> 00:25:00,240

soil samples and have you found anything

633

00:25:04,320 --> 00:25:06,630

yes

634

00:25:11,669 --> 00:25:07,830

sure

635

00:25:13,830 --> 00:25:11,679

the the apollo uh missions have sampled

636

00:25:16,070 --> 00:25:13,840

um the surface uh

637

00:25:18,549 --> 00:25:16,080

in course but also in with rake samples

638

00:25:21,110 --> 00:25:18,559

or just just scooping up soils um that

639

00:25:22,870 --> 00:25:21,120

was an apollo 11 or that you know just

640

00:25:24,950 --> 00:25:22,880

took some some samples just in case

641

00:25:27,029 --> 00:25:24,960

things didn't really work out well um

642

00:25:28,950 --> 00:25:27,039

and so those are a lot of soil samples

643

00:25:31,190 --> 00:25:28,960

one of the big things that we learned

644

00:25:32,950 --> 00:25:31,200

from apollo 11 looking at these soil

645

00:25:34,710 --> 00:25:32,960

samples is that they found

646

00:25:38,710 --> 00:25:34,720

teeny white

647

00:25:41,029 --> 00:25:38,720

grains they're called inorthocite grains

648

00:25:43,430 --> 00:25:41,039

they're plagioclase grains

649

00:25:45,909 --> 00:25:43,440

and so before apollo 11 we really didn't

650

00:25:47,350 --> 00:25:45,919

understand how the moon formed um

651
00:25:49,830 --> 00:25:47,360
and with these grains when they were

652
00:25:52,549 --> 00:25:49,840
discovered the only way to explain their

653
00:25:53,990 --> 00:25:52,559
existence or or yeah their formation is

654
00:25:55,990 --> 00:25:54,000
that the moon at some point must have

655
00:25:58,070 --> 00:25:56,000
been fully molten

656
00:25:59,830 --> 00:25:58,080
so gigantic magma ball in space and the

657
00:26:02,310 --> 00:25:59,840
only way to do that is that you have to

658
00:26:04,149 --> 00:26:02,320
have a gigantic impact between two

659
00:26:06,310 --> 00:26:04,159
protoplanets

660
00:26:08,310 --> 00:26:06,320
that then made a lot of like debris

661
00:26:09,669 --> 00:26:08,320
cloud the inner

662
00:26:11,830 --> 00:26:09,679
parts then

663
00:26:13,430 --> 00:26:11,840

formed earth and then the debris part

664

00:26:15,830 --> 00:26:13,440

that went around it coalesced to form

665

00:26:18,070 --> 00:26:15,840

the moon and so if we hadn't looked at

666

00:26:19,190 --> 00:26:18,080

these soil samples then

667

00:26:21,510 --> 00:26:19,200

i mean who knows what would have

668

00:26:23,669 --> 00:26:21,520

happened but that that you know sparked

669

00:26:26,390 --> 00:26:23,679

the idea of the giant impact and the

670

00:26:27,830 --> 00:26:26,400

magma ocean for the moon

671

00:26:29,430 --> 00:26:27,840

wow that's i mean another really

672

00:26:31,830 --> 00:26:29,440

important thing that we've learned from

673

00:26:34,390 --> 00:26:31,840

lunar regolith is that it's you know

674

00:26:36,149 --> 00:26:34,400

might refer to it as lunar dust but it's

675

00:26:38,950 --> 00:26:36,159

very different from dust here on earth

676
00:26:41,830 --> 00:26:38,960
because there's no water flowing and no

677
00:26:43,269 --> 00:26:41,840
atmospheric water around the moon

678
00:26:46,549 --> 00:26:43,279
and so

679
00:26:48,630 --> 00:26:46,559
that dust that lunar dust is very sharp

680
00:26:49,830 --> 00:26:48,640
it's almost like small pieces of glass

681
00:26:52,070 --> 00:26:49,840
so every time

682
00:26:54,070 --> 00:26:52,080
every little circle you see on the moon

683
00:26:56,390 --> 00:26:54,080
is a place where a rock has hit the moon

684
00:26:58,310 --> 00:26:56,400
or something from space has hit the moon

685
00:27:00,470 --> 00:26:58,320
so what happens is you get this process

686
00:27:02,310 --> 00:27:00,480
of kind of shocking and melting little

687
00:27:04,149 --> 00:27:02,320
batches of the lunar surface again and

688
00:27:05,110 --> 00:27:04,159

then breaking them apart and shattering

689

00:27:06,710 --> 00:27:05,120

them

690

00:27:09,269 --> 00:27:06,720

and that's what makes up that regolith

691

00:27:11,269 --> 00:27:09,279

or that dust and so learning that

692

00:27:12,789 --> 00:27:11,279

process has taught us a lot about how

693

00:27:14,710 --> 00:27:12,799

we're going to move forward with artemis

694

00:27:16,549 --> 00:27:14,720

because i mentioned earlier that the

695

00:27:18,789 --> 00:27:16,559

apollo astronauts had a lot of dust on

696

00:27:20,710 --> 00:27:18,799

their suit but you can imagine if dust

697

00:27:22,389 --> 00:27:20,720

was really irritating to your eyes and

698

00:27:24,389 --> 00:27:22,399

your lungs which they did start to

699

00:27:26,870 --> 00:27:24,399

report on some of the later missions

700

00:27:30,070 --> 00:27:26,880

when they spent more time outside on

701
00:27:31,909 --> 00:27:30,080
extra vehicular activities or evas

702
00:27:34,549 --> 00:27:31,919
we've learned that maybe we've got to

703
00:27:36,310 --> 00:27:34,559
keep that dust out as much as we can so

704
00:27:38,149 --> 00:27:36,320
that's really helping inform the way we

705
00:27:40,710 --> 00:27:38,159
move forward and it tells us a lot about

706
00:27:43,350 --> 00:27:40,720
the processes that have uh have affected

707
00:27:45,110 --> 00:27:43,360
what we see on the moon today

708
00:27:47,269 --> 00:27:45,120
yeah a really really cool thing about

709
00:27:49,669 --> 00:27:47,279
lunar soil is that

710
00:27:51,750 --> 00:27:49,679
as jake said because there's no water or

711
00:27:52,470 --> 00:27:51,760
wind or atmosphere that interacts with

712
00:27:53,430 --> 00:27:52,480
it

713
00:27:55,990 --> 00:27:53,440

um

714

00:27:58,149 --> 00:27:56,000

the lunar surface has been preserved

715

00:27:59,909 --> 00:27:58,159

since its formation basically and so you

716

00:28:02,149 --> 00:27:59,919

can think of it as a museum for

717

00:28:04,789 --> 00:28:02,159

planetary science so everything that had

718

00:28:07,350 --> 00:28:04,799

happened over 4.5 billion years ago is

719

00:28:09,350 --> 00:28:07,360

recorded in that lunar soil and so you

720

00:28:11,990 --> 00:28:09,360

can think of the lunar soil as being an

721

00:28:14,310 --> 00:28:12,000

archive um that contains all the

722

00:28:15,909 --> 00:28:14,320

knowledge um the solar system climate

723

00:28:18,230 --> 00:28:15,919

you know how the sun output might have

724

00:28:20,230 --> 00:28:18,240

changed over time what materials have

725

00:28:22,789 --> 00:28:20,240

bombarded the surface that most likely

726

00:28:24,789 --> 00:28:22,799

also hit the earth and so all of that

727

00:28:26,310 --> 00:28:24,799

knowledge is stored in the lunar soil

728

00:28:28,630 --> 00:28:26,320

and all

729

00:28:34,149 --> 00:28:28,640

we have to do is learn how to read this

730

00:28:39,110 --> 00:28:36,950

so taylor on twitter asks did nasa come

731

00:28:41,990 --> 00:28:39,120

up with a better way to collect moon

732

00:28:44,310 --> 00:28:42,000

rock samples for artemis as compared to

733

00:28:47,350 --> 00:28:44,320

apollo

734

00:28:50,310 --> 00:28:47,360

yeah so we have certainly learned a lot

735

00:28:52,149 --> 00:28:50,320

about how to collect samples um but

736

00:28:54,789 --> 00:28:52,159

we'll probably still use some of the

737

00:28:56,870 --> 00:28:54,799

tried and tested approaches that apollo

738

00:28:59,110 --> 00:28:56,880

did i mean rakes are still really good

739

00:29:01,510 --> 00:28:59,120

at kind of sieving through the the

740

00:29:04,549 --> 00:29:01,520

regolith the lunar dust to pick up small

741

00:29:06,630 --> 00:29:04,559

bits that could be used to for instance

742

00:29:09,110 --> 00:29:06,640

get the date of the rock how old it is

743

00:29:11,029 --> 00:29:09,120

since the event that helped create that

744

00:29:13,510 --> 00:29:11,039

rock

745

00:29:15,430 --> 00:29:13,520

we will probably still use hammers if we

746

00:29:17,590 --> 00:29:15,440

see bigger pieces of rock to try to

747

00:29:19,909 --> 00:29:17,600

break off a smaller piece

748

00:29:21,590 --> 00:29:19,919

there are things like tongs that maybe

749

00:29:23,909 --> 00:29:21,600

help us pick something up that's kind of

750

00:29:25,510 --> 00:29:23,919

harder to get to or harder to reach and

751
00:29:27,269 --> 00:29:25,520
we're certainly going to continue to use

752
00:29:29,110 --> 00:29:27,279
things like drive tubes like the sample

753
00:29:31,510 --> 00:29:29,120
that we're talking about today from

754
00:29:33,350 --> 00:29:31,520
apollo i mean these are all you know

755
00:29:35,830 --> 00:29:33,360
fundamental techniques for how to

756
00:29:38,070 --> 00:29:35,840
collect samples i think what we'll see

757
00:29:39,190 --> 00:29:38,080
is little little changes to it you know

758
00:29:44,149 --> 00:29:39,200
the

759
00:29:46,149 --> 00:29:44,159
might articulate slightly differently or

760
00:29:48,389 --> 00:29:46,159
might not articulate if we found that it

761
00:29:49,430 --> 00:29:48,399
was difficult or it got kind of caught

762
00:29:51,669 --> 00:29:49,440
up and

763
00:29:52,710 --> 00:29:51,679

gets dusk in the gears or anything like

764

00:29:54,470 --> 00:29:52,720

that so

765

00:29:56,549 --> 00:29:54,480

um i think what you will see is kind of

766

00:29:57,590 --> 00:29:56,559

a refinement to the way we collect

767

00:29:59,830 --> 00:29:57,600

samples

768

00:30:02,549 --> 00:29:59,840

um until we get into some of these

769

00:30:04,630 --> 00:30:02,559

really dark places where we think we

770

00:30:06,310 --> 00:30:04,640

will find um

771

00:30:07,830 --> 00:30:06,320

larger amounts of water

772

00:30:09,750 --> 00:30:07,840

and really we're gonna have to learn

773

00:30:12,789 --> 00:30:09,760

what that environment is actually like

774

00:30:15,269 --> 00:30:12,799

how cold is it um i mentioned earlier

775

00:30:17,190 --> 00:30:15,279

we don't actually know what the makeup

776

00:30:19,430 --> 00:30:17,200

of the water is inside there and there's

777

00:30:21,909 --> 00:30:19,440

probably other volatiles mixed in some

778

00:30:24,630 --> 00:30:21,919

that aren't so good for us to maybe have

779

00:30:25,909 --> 00:30:24,640

uh have around us or be exposed to so

780

00:30:27,510 --> 00:30:25,919

what we're going to have to learn a lot

781

00:30:29,909 --> 00:30:27,520

about that environment

782

00:30:31,909 --> 00:30:29,919

before we can probably determine exactly

783

00:30:33,029 --> 00:30:31,919

how we want to collect those kinds of

784

00:30:35,110 --> 00:30:33,039

samples

785

00:30:36,950 --> 00:30:35,120

we also are going to have to learn

786

00:30:38,549 --> 00:30:36,960

and this sample from apollo will help us

787

00:30:39,909 --> 00:30:38,559

how to contain them

788

00:30:41,830 --> 00:30:39,919

but we also have to think about how to

789

00:30:44,149 --> 00:30:41,840

transport them so

790

00:30:46,470 --> 00:30:44,159

if we want to get a piece of ice from

791

00:30:48,549 --> 00:30:46,480

the moon back here to our colleagues at

792

00:30:50,950 --> 00:30:48,559

the johnson space center

793

00:30:52,470 --> 00:30:50,960

we have to have a whole system that

794

00:30:53,909 --> 00:30:52,480

keeps it cold

795

00:30:56,310 --> 00:30:53,919

and it might be that the first few we

796

00:30:57,909 --> 00:30:56,320

try to bring back don't stay cold enough

797

00:30:59,110 --> 00:30:57,919

and just like the sample we're talking

798

00:31:01,909 --> 00:30:59,120

about it may

799

00:31:03,750 --> 00:31:01,919

melt or vaporize into gas and we would

800

00:31:04,950 --> 00:31:03,760

have that gas trapped inside the

801
00:31:06,149 --> 00:31:04,960
container

802
00:31:07,750 --> 00:31:06,159
because of what we're learning from

803
00:31:09,669 --> 00:31:07,760
apollo

804
00:31:11,590 --> 00:31:09,679
but ultimately we'd really love to give

805
00:31:13,509 --> 00:31:11,600
the scientists a piece of you know

806
00:31:14,950 --> 00:31:13,519
honest to goodness lunar ice because

807
00:31:17,029 --> 00:31:14,960
that's what they tell us they really

808
00:31:18,549 --> 00:31:17,039
want to get to so we got to learn how to

809
00:31:21,110 --> 00:31:18,559
do that this is a whole process this

810
00:31:22,710 --> 00:31:21,120
really is fundamental exploration in the

811
00:31:23,990 --> 00:31:22,720
truest sense we're going to a place

812
00:31:25,830 --> 00:31:24,000
we've never been

813
00:31:28,870 --> 00:31:25,840

uh and we're going to do things we've

814

00:31:31,350 --> 00:31:28,880

never done before and so every bit of

815

00:31:33,110 --> 00:31:31,360

science and technology demonstration

816

00:31:35,590 --> 00:31:33,120

that we've done starting with apollo

817

00:31:37,509 --> 00:31:35,600

onto now uh is critical in understanding

818

00:31:39,350 --> 00:31:37,519

how to do that i mean we really

819

00:31:41,830 --> 00:31:39,360

are standing on the shoulders of giants

820

00:31:45,669 --> 00:31:41,840

who who started this process for us and

821

00:31:49,669 --> 00:31:47,509

so we have a question from holly hughes

822

00:31:53,110 --> 00:31:49,679

on youtube who asks

823

00:31:55,590 --> 00:31:53,120

why do we need to bring a rune mark a

824

00:32:00,789 --> 00:31:55,600

moon rock to earth what exactly do you

825

00:32:05,669 --> 00:32:03,350

i mean i can take a first crack at that

826

00:32:07,509 --> 00:32:05,679

you know we we can also take instruments

827

00:32:10,389 --> 00:32:07,519

to the moon okay so we've flown

828

00:32:11,750 --> 00:32:10,399

instruments on spacecraft um for

829

00:32:14,070 --> 00:32:11,760

instance the lunar reconnaissance

830

00:32:15,509 --> 00:32:14,080

orbiter has collected some of the images

831

00:32:18,389 --> 00:32:15,519

that you've shown

832

00:32:20,149 --> 00:32:18,399

while we were talking here

833

00:32:21,990 --> 00:32:20,159

other nations have sent spacecraft as

834

00:32:23,830 --> 00:32:22,000

well to collect data we can take those

835

00:32:25,909 --> 00:32:23,840

instruments to the surface apollo took

836

00:32:27,909 --> 00:32:25,919

instruments as well to the surface the

837

00:32:30,389 --> 00:32:27,919

problem is you can't take like the

838

00:32:32,470 --> 00:32:30,399

really best cutting edge type of thing

839

00:32:34,710 --> 00:32:32,480

the thing that really makes the good

840

00:32:38,070 --> 00:32:34,720

detailed analysis the reason we saved

841

00:32:39,990 --> 00:32:38,080

these samples until just now to open up

842

00:32:41,669 --> 00:32:40,000

you know some of these these

843

00:32:43,509 --> 00:32:41,679

these measurements are done by

844

00:32:44,950 --> 00:32:43,519

instruments that are big they're you

845

00:32:46,870 --> 00:32:44,960

know sometimes

846

00:32:48,149 --> 00:32:46,880

you know a whole room is where you put

847

00:32:49,750 --> 00:32:48,159

that instrument just to make a

848

00:32:53,029 --> 00:32:49,760

measurement of a tiny little piece of

849

00:32:54,630 --> 00:32:53,039

lunar material and we can't take that at

850

00:32:56,710 --> 00:32:54,640

least not now

851

00:32:58,310 --> 00:32:56,720

so it's a combination it's not really

852

00:33:00,149 --> 00:32:58,320

one or the other we're gonna go to the

853

00:33:02,630 --> 00:33:00,159

moon and make measurements

854

00:33:04,389 --> 00:33:02,640

uh we'll make observations uh and we'll

855

00:33:06,149 --> 00:33:04,399

collect material to bring back to put

856

00:33:08,389 --> 00:33:06,159

into those better instruments here on

857

00:33:10,230 --> 00:33:08,399

earth so we can really dig down in there

858

00:33:14,310 --> 00:33:10,240

and get the real detailed information

859

00:33:19,029 --> 00:33:16,230

well jake juliana we've got more

860

00:33:21,269 --> 00:33:19,039

questions for you later on in the show

861

00:33:23,590 --> 00:33:21,279

but first let's hear from a very special

862

00:33:26,630 --> 00:33:23,600

guest who knows a thing or two about how

863

00:33:28,970 --> 00:33:26,640

these samples were collected because he

864

00:33:30,470 --> 00:33:28,980

was there

865

00:33:32,149 --> 00:33:30,480

[Music]

866

00:33:33,750 --> 00:33:32,159

one of the most important tools that we

867

00:33:34,870 --> 00:33:33,760

had was this

868

00:33:37,669 --> 00:33:34,880

core 2

869

00:33:40,149 --> 00:33:37,679

double drive tube and you could drive

870

00:33:41,350 --> 00:33:40,159

these into the surface now still very

871

00:33:42,870 --> 00:33:41,360

difficult

872

00:33:46,630 --> 00:33:42,880

it was the best we had and we got a

873

00:33:49,110 --> 00:33:46,640

quite a number of very good cores that

874

00:33:51,110 --> 00:33:49,120

are giving us new information it was

875

00:33:53,110 --> 00:33:51,120

anticipated early on in the apollo

876

00:33:56,310 --> 00:33:53,120

program that

877

00:33:58,789 --> 00:33:56,320

analytical technology would mature would

878

00:34:00,789 --> 00:33:58,799

become much more sophisticated with time

879

00:34:03,110 --> 00:34:00,799

that we could gain new information from

880

00:34:05,350 --> 00:34:03,120

the same old samples it makes it

881

00:34:11,109 --> 00:34:05,360

very very exciting for everybody in fact

882

00:34:16,470 --> 00:34:14,069

i'm now joined by andrea mozi apollo

883

00:34:19,669 --> 00:34:16,480

processor who has worked in the moon

884

00:34:21,589 --> 00:34:19,679

sample lab for 46 years

885

00:34:24,069 --> 00:34:21,599

andre is part of the team responsible

886

00:34:27,669 --> 00:34:24,079

for this historic sample opening thank

887

00:34:31,430 --> 00:34:27,679

you so much for being with us here today

888

00:34:33,750 --> 00:34:31,440

thanks for inviting me it's my pleasure

889

00:34:35,510 --> 00:34:33,760

so andrea you are in the room where it

890

00:34:37,909 --> 00:34:35,520

happened can you tell us what that was

891

00:34:43,990 --> 00:34:41,349

it was very exciting the entire process

892

00:34:45,510 --> 00:34:44,000

of removing the sample from the core

893

00:34:48,629 --> 00:34:45,520

cabinet

894

00:34:50,710 --> 00:34:48,639

assisting with the gas analysis team

895

00:34:55,109 --> 00:34:50,720

then moved the sample over in the core

896

00:34:58,230 --> 00:34:55,119

cabinet for opening up and the extrusion

897

00:35:00,230 --> 00:34:58,240

it was historical it was very exciting

898

00:35:03,109 --> 00:35:00,240

this is the first time

899

00:35:04,390 --> 00:35:03,119

that anyone got to see the sample and we

900

00:35:07,349 --> 00:35:04,400

were the first

901
00:35:09,670 --> 00:35:07,359
ones to lay eyes upon it yes that was

902
00:35:11,910 --> 00:35:09,680
amazing

903
00:35:13,030 --> 00:35:11,920
and you've seen many lunar samples

904
00:35:17,349 --> 00:35:13,040
opened

905
00:35:19,589 --> 00:35:17,359
how was this one different for you

906
00:35:22,790 --> 00:35:19,599
the samples we processed daily were

907
00:35:25,670 --> 00:35:22,800
returned by the astronauts in rock boxes

908
00:35:29,030 --> 00:35:25,680
and bags those samples

909
00:35:32,470 --> 00:35:29,040
were then weighed packaged back and

910
00:35:34,790 --> 00:35:32,480
stored in our pristine sample vault

911
00:35:38,069 --> 00:35:34,800
they remain there until scientists

912
00:35:40,230 --> 00:35:38,079
researchers request them for allocations

913
00:35:43,589 --> 00:35:40,240

the samples that we're opening now the

914

00:35:45,270 --> 00:35:43,599

core samples have never been open

915

00:35:47,910 --> 00:35:45,280

never seen

916

00:35:50,550 --> 00:35:47,920

never researched by anyone so for them

917

00:35:52,790 --> 00:35:50,560

to be open now and we were the first to

918

00:35:56,710 --> 00:35:52,800

open the container and the first to see

919

00:36:00,150 --> 00:35:58,390

that is so exciting

920

00:36:02,470 --> 00:36:00,160

andrea thank you so much for being with

921

00:36:04,950 --> 00:36:02,480

us and huge congratulations on a

922

00:36:07,109 --> 00:36:04,960

successful luna sample opening best of

923

00:36:09,829 --> 00:36:07,119

luck over the coming months

924

00:36:11,750 --> 00:36:09,839

thank you so much

925

00:36:14,230 --> 00:36:11,760

now don't go anywhere we'll be back to

926
00:36:16,230 --> 00:36:14,240
answer more of your questions but first

927
00:36:21,829 --> 00:36:16,240
let's take a look at what this luna

928
00:36:27,030 --> 00:36:24,790
for over 50 years nasa astronauts and

929
00:36:29,190 --> 00:36:27,040
scientists have explored the universe

930
00:36:31,430 --> 00:36:29,200
searching for ways to study the elements

931
00:36:33,270 --> 00:36:31,440
and materials that make up the solar

932
00:36:35,430 --> 00:36:33,280
system

933
00:36:37,510 --> 00:36:35,440
in nasa's early days the apollo

934
00:36:39,589 --> 00:36:37,520
astronauts walked the lunar surface to

935
00:36:41,510 --> 00:36:39,599
collect moon rocks and soil for study

936
00:36:44,349 --> 00:36:41,520
back on earth

937
00:36:48,310 --> 00:36:44,359
in all apollo explorers sampled

938
00:36:51,030 --> 00:36:48,320

842 pounds of lunar material

939

00:36:53,430 --> 00:36:51,040

today those precious samples are curated

940

00:36:56,150 --> 00:36:53,440

within nasa's astro materials research

941

00:36:57,910 --> 00:36:56,160

and exploration science division or

942

00:36:59,990 --> 00:36:57,920

aries

943

00:37:01,750 --> 00:37:00,000

many of those lunar samples are stored

944

00:37:04,310 --> 00:37:01,760

in their lunar sample laboratory

945

00:37:06,310 --> 00:37:04,320

facility at nasa's johnson space center

946

00:37:08,310 --> 00:37:06,320

in houston texas

947

00:37:10,150 --> 00:37:08,320

nasa curators work to preserve the

948

00:37:11,990 --> 00:37:10,160

samples for ongoing and future

949

00:37:14,310 --> 00:37:12,000

scientific research

950

00:37:17,030 --> 00:37:14,320

the samples are protected in secure and

951
00:37:19,270 --> 00:37:17,040
environmentally controlled vaults

952
00:37:21,510 --> 00:37:19,280
each sample is sorted by mission and

953
00:37:23,510 --> 00:37:21,520
stored in teflon based bags that are

954
00:37:24,790 --> 00:37:23,520
kept in cabinets filled with nitrogen

955
00:37:25,990 --> 00:37:24,800
gas

956
00:37:28,069 --> 00:37:26,000
to this day

957
00:37:29,990 --> 00:37:28,079
scientists from around the world study

958
00:37:31,750 --> 00:37:30,000
and analyze the samples to answer

959
00:37:34,069 --> 00:37:31,760
important questions about the moon's

960
00:37:36,230 --> 00:37:34,079
formation and history

961
00:37:38,230 --> 00:37:36,240
to preserve their integrity nasa

962
00:37:40,150 --> 00:37:38,240
curators follow strict safety and

963
00:37:41,510 --> 00:37:40,160

handling processes when working with

964

00:37:43,910 --> 00:37:41,520

samples

965

00:37:45,109 --> 00:37:43,920

it begins with a laminar airflow change

966

00:37:47,349 --> 00:37:45,119

room

967

00:37:50,390 --> 00:37:47,359

this minute-long air shower keeps the

968

00:37:52,790 --> 00:37:50,400

labs where they work pristinely clean

969

00:37:55,910 --> 00:37:52,800

airy scientists must also wear special

970

00:37:58,390 --> 00:37:55,920

gear including a whole body non-particle

971

00:38:00,230 --> 00:37:58,400

shedding polyester bunny suit and triple

972

00:38:02,470 --> 00:38:00,240

layered gloves

973

00:38:05,109 --> 00:38:02,480

they also use custom tools to protect

974

00:38:07,349 --> 00:38:05,119

the samples moon rocks may only be

975

00:38:09,430 --> 00:38:07,359

touched with teflon aluminum or

976

00:38:12,310 --> 00:38:09,440

stainless steel tools and the dry

977

00:38:14,150 --> 00:38:12,320

nitrogen atmosphere around them

978

00:38:16,069 --> 00:38:14,160

this allows curators to carefully

979

00:38:19,349 --> 00:38:16,079

examine samples while maintaining their

980

00:38:21,510 --> 00:38:19,359

original condition this process ensures

981

00:38:24,069 --> 00:38:21,520

the samples are not contaminated or

982

00:38:27,030 --> 00:38:24,079

destroyed and can be used to produce

983

00:38:29,270 --> 00:38:27,040

scientifically accurate results

984

00:38:31,190 --> 00:38:29,280

technological advancements including

985

00:38:33,910 --> 00:38:31,200

next generation microscopes and other

986

00:38:36,230 --> 00:38:33,920

devices allow researchers to examine the

987

00:38:38,230 --> 00:38:36,240

samples through new methods resulting in

988

00:38:42,150 --> 00:38:38,240

important discoveries that answer some

989

00:38:45,670 --> 00:38:43,750

we have a lot of questions coming in

990

00:38:47,349 --> 00:38:45,680

online if you have questions for our

991

00:38:48,950 --> 00:38:47,359

experts send them in by commenting in

992

00:38:51,910 --> 00:38:48,960

the stream wherever you're watching or

993

00:38:52,950 --> 00:38:51,920

by using the hashtag asknasser on social

994

00:38:56,230 --> 00:38:52,960

media

995

00:38:58,390 --> 00:38:56,240

so let's dig in uh bassboy logos on

996

00:39:00,870 --> 00:38:58,400

youtube asks are there plans to bring

997

00:39:03,109 --> 00:39:00,880

out bring back more lunar samples with

998

00:39:06,069 --> 00:39:03,119

the starship human landing system or

999

00:39:08,710 --> 00:39:06,079

artemis programs

1000

00:39:10,550 --> 00:39:08,720

well the artemis program absolutely has

1001
00:39:12,310 --> 00:39:10,560
objectives associated with bringing back

1002
00:39:13,990 --> 00:39:12,320
samples and

1003
00:39:15,670 --> 00:39:14,000
the way that we're doing the missions

1004
00:39:17,589 --> 00:39:15,680
now is working with our commercial

1005
00:39:19,430 --> 00:39:17,599
partners to build many of the key

1006
00:39:22,230 --> 00:39:19,440
elements um

1007
00:39:24,150 --> 00:39:22,240
so the uh the spacex starship that was

1008
00:39:26,230 --> 00:39:24,160
referred to in the question is one of

1009
00:39:27,910 --> 00:39:26,240
the parts of the pathway

1010
00:39:30,710 --> 00:39:27,920
that's going to get us to the surface

1011
00:39:32,710 --> 00:39:30,720
for artemis iii uh so it's going to be

1012
00:39:35,510 --> 00:39:32,720
able to transport our astronauts from a

1013
00:39:37,589 --> 00:39:35,520

lunar orbit uh where our space launch

1014

00:39:39,109 --> 00:39:37,599

system and orion spacecraft will deliver

1015

00:39:40,790 --> 00:39:39,119

the astronauts so they'll go into a

1016

00:39:41,750 --> 00:39:40,800

lunar orbit and then they'll get on

1017

00:39:43,829 --> 00:39:41,760

board

1018

00:39:45,430 --> 00:39:43,839

with the spacex lander and then they'll

1019

00:39:46,870 --> 00:39:45,440

go to the surface

1020

00:39:49,190 --> 00:39:46,880

they'll do their work and then that will

1021

00:39:51,270 --> 00:39:49,200

bring them back up to lunar orbit so

1022

00:39:53,750 --> 00:39:51,280

it's a critical piece of the pathway and

1023

00:39:55,030 --> 00:39:53,760

i mentioned earlier how you have these

1024

00:39:57,030 --> 00:39:55,040

samples are going to go through a

1025

00:39:58,630 --> 00:39:57,040

pathway to get them back here to earth

1026
00:39:59,829 --> 00:39:58,640
and so each part of that pathway is

1027
00:40:02,310 --> 00:39:59,839
critical

1028
00:40:03,910 --> 00:40:02,320
so and every part of it is is working

1029
00:40:06,630 --> 00:40:03,920
with a different partner out there in

1030
00:40:08,630 --> 00:40:06,640
our commercial community so really is an

1031
00:40:10,309 --> 00:40:08,640
exciting time to be thinking about

1032
00:40:12,470 --> 00:40:10,319
sending our astronauts there bringing

1033
00:40:13,910 --> 00:40:12,480
them home with rocks from the moon i

1034
00:40:16,069 --> 00:40:13,920
mean it's just a it's a really cool

1035
00:40:17,589 --> 00:40:16,079
process and we're really looking forward

1036
00:40:20,710 --> 00:40:17,599
to all the collaboration we have with so

1037
00:40:27,109 --> 00:40:23,510
erisius on twitter asked why were the

1038
00:40:29,670 --> 00:40:27,119

samples sealed for 50 years

1039

00:40:32,150 --> 00:40:29,680

okay so the samples were sealed because

1040

00:40:33,349 --> 00:40:32,160

nasa had the good foresight they knew

1041

00:40:35,670 --> 00:40:33,359

that

1042

00:40:37,430 --> 00:40:35,680

technology will evolve with time they

1043

00:40:38,790 --> 00:40:37,440

knew that um

1044

00:40:42,710 --> 00:40:38,800

we

1045

00:40:45,030 --> 00:40:42,720

didn't even know how to ask or why to

1046

00:40:46,630 --> 00:40:45,040

ask in the past and so the more we learn

1047

00:40:48,630 --> 00:40:46,640

about the moon and the moon earth

1048

00:40:50,950 --> 00:40:48,640

formation seems to have a a shared

1049

00:40:53,349 --> 00:40:50,960

formation history the more questions we

1050

00:40:55,990 --> 00:40:53,359

can ask um and the more technology gets

1051

00:40:57,990 --> 00:40:56,000

evolved the the more detailed of

1052

00:40:59,829 --> 00:40:58,000

questions we can ask to really you know

1053

00:41:02,309 --> 00:40:59,839

extract the information that are stored

1054

00:41:04,470 --> 00:41:02,319

in these in these samples and nasa knew

1055

00:41:06,950 --> 00:41:04,480

that 50 years ago and so that's why they

1056

00:41:09,829 --> 00:41:06,960

kept a subset of samples

1057

00:41:11,910 --> 00:41:09,839

sealed and safe so that future

1058

00:41:14,069 --> 00:41:11,920

generations of lunar scientists get a

1059

00:41:15,829 --> 00:41:14,079

chance to like look at samples that

1060

00:41:18,710 --> 00:41:15,839

haven't been opened before and haven't

1061

00:41:23,430 --> 00:41:18,720

been contaminated to to any degree

1062

00:41:26,069 --> 00:41:23,440

and so that was really great and uh yeah

1063

00:41:29,510 --> 00:41:26,079

arthur on twitter asks what is it like

1064

00:41:35,190 --> 00:41:32,870

that's a really great question um

1065

00:41:37,349 --> 00:41:35,200

so we don't really touch the moon rocks

1066

00:41:39,829 --> 00:41:37,359

when we work with them because we're our

1067

00:41:41,589 --> 00:41:39,839

hands are gloved so in the movies you

1068

00:41:44,150 --> 00:41:41,599

have seen that we're wearing these bunny

1069

00:41:45,829 --> 00:41:44,160

suits right and then we have gloves on

1070

00:41:47,670 --> 00:41:45,839

and then you work with the samples

1071

00:41:50,230 --> 00:41:47,680

inside the glove box so you're sticking

1072

00:41:51,510 --> 00:41:50,240

your hands inside these these these big

1073

00:41:53,030 --> 00:41:51,520

black gloves that you see here in the

1074

00:41:55,910 --> 00:41:53,040

movie right now

1075

00:41:57,510 --> 00:41:55,920

um and so when you handle these these

1076

00:41:58,470 --> 00:41:57,520

samples

1077

00:42:00,710 --> 00:41:58,480

um

1078

00:42:02,870 --> 00:42:00,720

you can't really feel them you can you

1079

00:42:04,630 --> 00:42:02,880

can and the samples are back themselves

1080

00:42:06,390 --> 00:42:04,640

you know in teflon themselves and so you

1081

00:42:08,309 --> 00:42:06,400

can maybe feel the weight and how heavy

1082

00:42:09,589 --> 00:42:08,319

it is but you can't

1083

00:42:11,270 --> 00:42:09,599

you know really touch them with your

1084

00:42:13,670 --> 00:42:11,280

bare hands because we don't want to

1085

00:42:15,349 --> 00:42:13,680

contaminate the samples our our hands

1086

00:42:17,670 --> 00:42:15,359

are dirty no matter how well you wash

1087

00:42:19,670 --> 00:42:17,680

them there's there are always particles

1088

00:42:21,589 --> 00:42:19,680

and and and organics on it and so we

1089

00:42:23,670 --> 00:42:21,599

don't want to contaminate the samples of

1090

00:42:25,910 --> 00:42:23,680

any of that because researchers might

1091

00:42:27,990 --> 00:42:25,920

actually look at potential you know

1092

00:42:29,670 --> 00:42:28,000

organic building blocks um that might

1093

00:42:30,630 --> 00:42:29,680

have been existed on the lunar surface

1094

00:42:32,550 --> 00:42:30,640

and so

1095

00:42:34,309 --> 00:42:32,560

we really try very hard to keep the

1096

00:42:37,349 --> 00:42:34,319

samples as

1097

00:42:39,430 --> 00:42:37,359

protected from us as possible and that's

1098

00:42:40,710 --> 00:42:39,440

why nobody you know

1099

00:42:41,829 --> 00:42:40,720

grabs them and take them out of the

1100

00:42:45,270 --> 00:42:41,839

cabinet and it holds in their head

1101

00:42:47,670 --> 00:42:45,280

that's just not what we do

1102

00:42:49,829 --> 00:42:47,680

jordan on twitter asks how many lunar

1103

00:42:52,870 --> 00:42:49,839

samples does nasa hope to collect with

1104

00:42:53,670 --> 00:42:52,880

the artemis missions

1105

00:42:56,470 --> 00:42:53,680

well

1106

00:42:58,550 --> 00:42:56,480

we think about it more in a sense of how

1107

00:43:00,710 --> 00:42:58,560

much mass we can bring back because you

1108

00:43:03,589 --> 00:43:00,720

have to remember we're launching off of

1109

00:43:06,309 --> 00:43:03,599

the surface of the moon with rockets and

1110

00:43:07,829 --> 00:43:06,319

depending on how that that vehicle is

1111

00:43:10,309 --> 00:43:07,839

designed it can carry a certain amount

1112

00:43:12,230 --> 00:43:10,319

of mass and in fact that's why we are

1113

00:43:13,990 --> 00:43:12,240

trying to work with multiple different

1114

00:43:16,390 --> 00:43:14,000

partners because we want to see what

1115

00:43:18,870 --> 00:43:16,400

kind of creative solutions they have to

1116

00:43:21,030 --> 00:43:18,880

uh to launching launching mass off the

1117

00:43:23,030 --> 00:43:21,040

surface so the objectives that we have

1118

00:43:24,790 --> 00:43:23,040

on any given mission

1119

00:43:26,470 --> 00:43:24,800

yeah all the samples are also very

1120

00:43:29,030 --> 00:43:26,480

different so if you think about it you

1121

00:43:31,829 --> 00:43:29,040

know the astronauts can pick up like big

1122

00:43:33,750 --> 00:43:31,839

chunks of rocks or they can take um core

1123

00:43:36,230 --> 00:43:33,760

samples that just like we talked about

1124

00:43:37,750 --> 00:43:36,240

you know today here they can take like

1125

00:43:40,230 --> 00:43:37,760

they're just you know scrapes of the

1126

00:43:42,150 --> 00:43:40,240

surface and so it really is driven by

1127

00:43:44,710 --> 00:43:42,160

what kind of science question you want

1128

00:43:47,829 --> 00:43:44,720

to want to answer and that will also

1129

00:43:49,990 --> 00:43:47,839

drive what type of samples to collect um

1130

00:43:52,470 --> 00:43:50,000

and then and then as jake explained how

1131

00:43:54,230 --> 00:43:52,480

much mass you want for those samples and

1132

00:43:55,589 --> 00:43:54,240

so there's there's a lot of discussion

1133

00:43:58,309 --> 00:43:55,599

going on between all sorts of different

1134

00:44:00,230 --> 00:43:58,319

groups and scientists and engineers and

1135

00:44:02,630 --> 00:44:00,240

yeah

1136

00:44:08,150 --> 00:44:02,640

hopefully we bring that

1137

00:44:13,109 --> 00:44:10,790

um adesha on twitter asks doesn't the

1138

00:44:15,030 --> 00:44:13,119

oxygen and nitrogen in our atmosphere

1139

00:44:18,630 --> 00:44:15,040

react with the samples when they're

1140

00:44:20,309 --> 00:44:18,640

opened from the vacuum container

1141

00:44:23,109 --> 00:44:20,319

that's a very good question and the

1142

00:44:25,349 --> 00:44:23,119

answer is yes if we would take the

1143

00:44:26,630 --> 00:44:25,359

vacuum container and just pop the lid

1144

00:44:28,069 --> 00:44:26,640

open here

1145

00:44:29,990 --> 00:44:28,079

it would totally

1146

00:44:32,069 --> 00:44:30,000

interact and react and there's also

1147

00:44:34,230 --> 00:44:32,079

water in our atmosphere so you know that

1148

00:44:37,510 --> 00:44:34,240

would interact and that's why we don't

1149

00:44:39,030 --> 00:44:37,520

do that we have these special cabinets

1150

00:44:41,109 --> 00:44:39,040

in the apollo lab and they're filled

1151

00:44:42,950 --> 00:44:41,119

with nitrogen atmosphere

1152

00:44:45,670 --> 00:44:42,960

so it's just nitrogen which is inert so

1153

00:44:48,309 --> 00:44:45,680

it doesn't like to react with anything

1154

00:44:51,670 --> 00:44:48,319

and so that's why we open the vacuum

1155

00:44:53,910 --> 00:44:51,680

sealed containers in in there so that it

1156

00:44:55,510 --> 00:44:53,920

cannot react with anything and it stays

1157

00:44:56,950 --> 00:44:55,520

as pristine

1158

00:44:58,470 --> 00:44:56,960

as possible

1159

00:45:00,309 --> 00:44:58,480

yeah you can see me brushing off some of

1160

00:45:01,829 --> 00:45:00,319

the excess soil away there and so that's

1161

00:45:04,550 --> 00:45:01,839

the very very first picture that was

1162

00:45:06,390 --> 00:45:04,560

ever taken from this particular core

1163

00:45:09,670 --> 00:45:06,400

once we had it open now it's on monday

1164

00:45:14,550 --> 00:45:12,710

and so max on youtube asks was this

1165

00:45:16,630 --> 00:45:14,560

sample spoil

1166

00:45:20,710 --> 00:45:16,640

is it like soil on earth and did it

1167

00:45:22,390 --> 00:45:20,720

contain rope or any other organic marker

1168

00:45:23,990 --> 00:45:22,400

that's a very good question so part of

1169

00:45:26,390 --> 00:45:24,000

the angsa program

1170

00:45:28,470 --> 00:45:26,400

um is to look at the

1171

00:45:31,349 --> 00:45:28,480

the soil and we call it soil which i

1172

00:45:33,910 --> 00:45:31,359

guess is not quite correct on earth soil

1173

00:45:36,470 --> 00:45:33,920

the word soil is meant for um

1174

00:45:37,829 --> 00:45:36,480

dirt that has organic material in it um

1175

00:45:40,069 --> 00:45:37,839

we don't really have that on the moon

1176

00:45:41,829 --> 00:45:40,079

the correct term would be regolith um

1177

00:45:44,069 --> 00:45:41,839

which is our like the you know the

1178

00:45:46,630 --> 00:45:44,079

finely pulverized layer of the lunar

1179

00:45:48,710 --> 00:45:46,640

surface basically

1180

00:45:51,990 --> 00:45:48,720

and within the angsta team there are

1181

00:45:54,069 --> 00:45:52,000

people that look at the organic

1182

00:45:55,190 --> 00:45:54,079

compounds or organic building blocks so

1183

00:45:57,270 --> 00:45:55,200

to speak

1184

00:45:58,710 --> 00:45:57,280

and whether they can detect any in this

1185

00:46:01,109 --> 00:45:58,720

lunar soil

1186

00:46:02,950 --> 00:46:01,119

that's very very hard to do um because

1187

00:46:04,790 --> 00:46:02,960

the the moon doesn't have an atmosphere

1188

00:46:06,390 --> 00:46:04,800

and so the the solar radiation is

1189

00:46:07,589 --> 00:46:06,400

basically sterilizing

1190

00:46:10,150 --> 00:46:07,599

everything

1191

00:46:12,870 --> 00:46:10,160

and there's always the chance of that um

1192

00:46:14,710 --> 00:46:12,880

we have we are contaminating the sample

1193

00:46:16,710 --> 00:46:14,720

potentially you know

1194

00:46:18,309 --> 00:46:16,720

even if we try to have it in a very

1195

00:46:20,950 --> 00:46:18,319

pristine environment with nitrogen

1196

00:46:23,349 --> 00:46:20,960

atmosphere and so this particular study

1197

00:46:25,030 --> 00:46:23,359

from engsa is very important

1198

00:46:26,710 --> 00:46:25,040

for these researchers to look at what

1199

00:46:28,950 --> 00:46:26,720

they can find

1200

00:46:31,349 --> 00:46:28,960

and so when we're sending them samples

1201
00:46:33,430 --> 00:46:31,359
from this particular core we're also

1202
00:46:35,829 --> 00:46:33,440
sending them something that's called a

1203
00:46:38,390 --> 00:46:35,839
witness foil so when we open the sample

1204
00:46:40,630 --> 00:46:38,400
we are also opening a baked out aluminum

1205
00:46:42,790 --> 00:46:40,640
foil that sits in the cabinet that could

1206
00:46:44,950 --> 00:46:42,800
collect any potential contamination that

1207
00:46:46,950 --> 00:46:44,960
comes from earth basically and so then

1208
00:46:49,109 --> 00:46:46,960
they can compare their organics that

1209
00:46:51,109 --> 00:46:49,119
they find on the foil to the organic

1210
00:46:53,349 --> 00:46:51,119
compounds they find in the in the lunar

1211
00:46:54,870 --> 00:46:53,359
soil and then really understand whether

1212
00:46:56,550 --> 00:46:54,880
what they're seeing

1213
00:46:58,630 --> 00:46:56,560

uh is actually from the moon or what

1214

00:47:02,790 --> 00:46:58,640

they're seeing is from earth that got in

1215

00:47:08,309 --> 00:47:05,190

debbie schultz on facebook asks

1216

00:47:14,069 --> 00:47:08,319

has any of the moon dust been exposed

1217

00:47:17,910 --> 00:47:15,750

i'm sorry i kind of broke up there can

1218

00:47:20,309 --> 00:47:17,920

you say the request question again

1219

00:47:23,190 --> 00:47:20,319

yeah of course has any of the moon dust

1220

00:47:27,670 --> 00:47:23,200

being exposed to earth's atmosphere and

1221

00:47:32,710 --> 00:47:30,069

so when researchers and scientists

1222

00:47:36,069 --> 00:47:32,720

request lunar samples

1223

00:47:38,390 --> 00:47:36,079

sometimes they they they want to do

1224

00:47:39,990 --> 00:47:38,400

measurements um in

1225

00:47:41,910 --> 00:47:40,000

which they have to open the sample and

1226
00:47:44,390 --> 00:47:41,920
put it inside an instrument for example

1227
00:47:45,910 --> 00:47:44,400
so when we allocate them the samples um

1228
00:47:48,150 --> 00:47:45,920
we put them in containers and we seal

1229
00:47:49,270 --> 00:47:48,160
them in a teflon wax we send them out

1230
00:47:51,670 --> 00:47:49,280
but then

1231
00:47:53,670 --> 00:47:51,680
in their labs they will actually open

1232
00:47:55,030 --> 00:47:53,680
the teflon bags you know the nitrogen

1233
00:47:57,030 --> 00:47:55,040
atmosphere escapes and then they will

1234
00:47:58,549 --> 00:47:57,040
open the little containers and pour the

1235
00:48:00,069 --> 00:47:58,559
soil out

1236
00:48:03,109 --> 00:48:00,079
onto a surface that then they can

1237
00:48:05,829 --> 00:48:03,119
analyze it and so yes soil definitely

1238
00:48:07,270 --> 00:48:05,839

has been exposed through research to

1239

00:48:09,270 --> 00:48:07,280

earth atmosphere

1240

00:48:11,829 --> 00:48:09,280

um

1241

00:48:14,870 --> 00:48:11,839

and i don't know how

1242

00:48:17,589 --> 00:48:14,880

that would change the soil over time if

1243

00:48:19,109 --> 00:48:17,599

you have it exposed long term in earth

1244

00:48:20,470 --> 00:48:19,119

atmosphere you know it could maybe

1245

00:48:22,470 --> 00:48:20,480

change slightly just because we have

1246

00:48:24,069 --> 00:48:22,480

water in our atmosphere and so that can

1247

00:48:25,670 --> 00:48:24,079

interact with iron and maybe form a

1248

00:48:28,390 --> 00:48:25,680

little bit of rust

1249

00:48:33,030 --> 00:48:28,400

but i don't think that it changes a lot

1250

00:48:37,430 --> 00:48:34,950

and so the last question i have for you

1251
00:48:39,430 --> 00:48:37,440
is one of my own uh what advice would

1252
00:48:41,589 --> 00:48:39,440
you give to someone aspiring to get

1253
00:48:45,910 --> 00:48:41,599
involved with nasa's sample curation

1254
00:48:45,920 --> 00:48:49,190
i'm going to like take answer

1255
00:48:53,829 --> 00:48:51,750
okay i'll take it first i'll go first um

1256
00:48:56,470 --> 00:48:53,839
yeah that's a wonderful question i i

1257
00:48:58,630 --> 00:48:56,480
love this question um you know the way i

1258
00:48:59,349 --> 00:48:58,640
like to answer this question is first of

1259
00:49:01,829 --> 00:48:59,359
all

1260
00:49:03,030 --> 00:49:01,839
figure out what you like to do

1261
00:49:04,710 --> 00:49:03,040
what really

1262
00:49:06,069 --> 00:49:04,720
motivates you to get out of bed in the

1263
00:49:07,750 --> 00:49:06,079

morning what are you excited about when

1264

00:49:10,150 --> 00:49:07,760

you wake up because i can almost

1265

00:49:11,670 --> 00:49:10,160

guarantee you whatever that is nasa has

1266

00:49:14,790 --> 00:49:11,680

people that do that

1267

00:49:16,870 --> 00:49:14,800

so think about that you know try not

1268

00:49:18,630 --> 00:49:16,880

necessarily to be exactly what you think

1269

00:49:20,549 --> 00:49:18,640

nasa needs today

1270

00:49:22,549 --> 00:49:20,559

it's more about what nasa's going to

1271

00:49:24,790 --> 00:49:22,559

need to do in the future

1272

00:49:27,430 --> 00:49:24,800

how you know just like this this apollo

1273

00:49:29,750 --> 00:49:27,440

50 or this sample from 50 years ago from

1274

00:49:31,750 --> 00:49:29,760

apollo is a great example

1275

00:49:33,829 --> 00:49:31,760

if we had only ever tried to build

1276

00:49:35,430 --> 00:49:33,839

instruments the way they were back then

1277

00:49:37,349 --> 00:49:35,440

we wouldn't have even needed to preserve

1278

00:49:39,030 --> 00:49:37,359

a sample this long but it's all the

1279

00:49:41,430 --> 00:49:39,040

creativity

1280

00:49:43,430 --> 00:49:41,440

everything we've learned in 50 years

1281

00:49:44,390 --> 00:49:43,440

that has put us in a position to do this

1282

00:49:48,870 --> 00:49:44,400

all the

1283

00:49:50,790 --> 00:49:48,880

the folks who think about that

1284

00:49:54,230 --> 00:49:50,800

they're the ones who really enabled us

1285

00:49:58,069 --> 00:49:54,240

to do what we're doing now um artemis

1286

00:50:00,470 --> 00:49:58,079

is just this exciting complicated

1287

00:50:02,870 --> 00:50:00,480

solution to a really difficult problem

1288

00:50:06,069 --> 00:50:02,880

going to the south pole of the moon to

1289

00:50:08,870 --> 00:50:06,079

collect samples make observations i i

1290

00:50:11,910 --> 00:50:08,880

can all but guarantee you that we need

1291

00:50:13,990 --> 00:50:11,920

such a diverse group of folks to work on

1292

00:50:16,710 --> 00:50:14,000

these problems

1293

00:50:18,630 --> 00:50:16,720

so you know that said you know

1294

00:50:20,390 --> 00:50:18,640

understanding math science and

1295

00:50:23,349 --> 00:50:20,400

engineering you know those are really

1296

00:50:25,589 --> 00:50:23,359

key things here um but we we're going to

1297

00:50:27,349 --> 00:50:25,599

have to work with partners so you know

1298

00:50:29,510 --> 00:50:27,359

understanding how to talk to our

1299

00:50:31,990 --> 00:50:29,520

international partners so

1300

00:50:34,069 --> 00:50:32,000

overcoming language barriers you know we

1301
00:50:36,230 --> 00:50:34,079
need help communicating there there's

1302
00:50:38,309 --> 00:50:36,240
just so many different ways that you

1303
00:50:41,109 --> 00:50:38,319
could end up working for nasa it's

1304
00:50:43,030 --> 00:50:41,119
really hard to say one i'm a geologist i

1305
00:50:43,829 --> 00:50:43,040
study geology for

1306
00:50:45,510 --> 00:50:43,839
um

1307
00:50:49,190 --> 00:50:45,520
my whole way through school to i got a

1308
00:50:51,510 --> 00:50:49,200
phd and then you know now i work in a

1309
00:50:53,670 --> 00:50:51,520
community that's almost all engineers so

1310
00:50:55,990 --> 00:50:53,680
now my job is to communicate with people

1311
00:50:58,549 --> 00:50:56,000
like juliana who still do the science

1312
00:51:01,190 --> 00:50:58,559
all the time and you know so you never

1313
00:51:03,349 --> 00:51:01,200

know where your path is going to lead so

1314

00:51:05,670 --> 00:51:03,359

find something you really like

1315

00:51:07,750 --> 00:51:05,680

and start learning how that fits into or

1316

00:51:10,870 --> 00:51:07,760

maybe solves a problem down the road for

1317

00:51:13,430 --> 00:51:10,880

us because that's what we really need

1318

00:51:15,589 --> 00:51:13,440

yeah yeah i my answer is pretty similar

1319

00:51:17,030 --> 00:51:15,599

to what jay just said you know if you

1320

00:51:17,910 --> 00:51:17,040

figure out what you're really passionate

1321

00:51:19,589 --> 00:51:17,920

about

1322

00:51:21,270 --> 00:51:19,599

and and that can then be your driving

1323

00:51:23,270 --> 00:51:21,280

force and because you're passionate and

1324

00:51:24,630 --> 00:51:23,280

excited about it that automatically

1325

00:51:26,390 --> 00:51:24,640

means that you're also going to be good

1326
00:51:27,190 --> 00:51:26,400
at it because that's what you want to do

1327
00:51:28,710 --> 00:51:27,200
right

1328
00:51:30,790 --> 00:51:28,720
and so once you figure that out there

1329
00:51:32,390 --> 00:51:30,800
are so many ways to get involved also

1330
00:51:34,870 --> 00:51:32,400
with curation

1331
00:51:37,030 --> 00:51:34,880
and processing these samples i also have

1332
00:51:38,950 --> 00:51:37,040
a geology background but my ideology

1333
00:51:41,109 --> 00:51:38,960
background started with earth so i

1334
00:51:42,710 --> 00:51:41,119
studied earth and then

1335
00:51:44,390 --> 00:51:42,720
when i

1336
00:51:46,470 --> 00:51:44,400
got a phd

1337
00:51:48,549 --> 00:51:46,480
after that um that was still

1338
00:51:50,870 --> 00:51:48,559

earth-related i switched fields and then

1339

00:51:53,109 --> 00:51:50,880

became a planetary scientist afterwards

1340

00:51:54,470 --> 00:51:53,119

and so you know if you go to school and

1341

00:51:55,990 --> 00:51:54,480

even to university and you're not

1342

00:51:58,230 --> 00:51:56,000

exactly sure where you fit or what you

1343

00:51:59,829 --> 00:51:58,240

want to do um just because you started

1344

00:52:01,750 --> 00:51:59,839

out in one field doesn't mean that you

1345

00:52:03,349 --> 00:52:01,760

cannot end up in a different field you

1346

00:52:05,270 --> 00:52:03,359

know and so there are so many

1347

00:52:07,829 --> 00:52:05,280

opportunities and that you know ranges

1348

00:52:09,349 --> 00:52:07,839

from geologists to engineers to to

1349

00:52:11,030 --> 00:52:09,359

medical people you know we need to

1350

00:52:12,390 --> 00:52:11,040

understand what the dust really does to

1351

00:52:15,030 --> 00:52:12,400

the bod the human bodies once the

1352

00:52:18,069 --> 00:52:15,040

astronauts are on the on the surface um

1353

00:52:20,309 --> 00:52:18,079

artists and and outreach people you know

1354

00:52:22,150 --> 00:52:20,319

all of everybody is really important um

1355

00:52:25,109 --> 00:52:22,160

for these missions and because

1356

00:52:27,349 --> 00:52:25,119

artemis is a is a plan to actually stay

1357

00:52:30,150 --> 00:52:27,359

on the lunar surface you know there are

1358

00:52:32,630 --> 00:52:30,160

so many years to come and i i get so

1359

00:52:35,030 --> 00:52:32,640

excited about it when i think about our

1360

00:52:37,589 --> 00:52:35,040

kids right like they will grow up with

1361

00:52:39,750 --> 00:52:37,599

artemis and they get to

1362

00:52:41,589 --> 00:52:39,760

maybe even go to the moon and like look

1363

00:52:44,309 --> 00:52:41,599

at these samples that are being brought

1364

00:52:45,990 --> 00:52:44,319

back and so that's all really really

1365

00:52:49,829 --> 00:52:46,000

exciting and so just you know keep

1366

00:52:54,230 --> 00:52:52,150

well that is all we have time for today

1367

00:52:55,990 --> 00:52:54,240

juliana jake thank you so much for

1368

00:52:58,470 --> 00:52:56,000

joining us and answering so many

1369

00:52:59,829 --> 00:52:58,480

questions from everyone online

1370

00:53:01,030 --> 00:52:59,839

you're very welcome this was a lot of

1371

00:53:02,630 --> 00:53:01,040

fun

1372

00:53:04,150 --> 00:53:02,640

yeah i'm glad people have so many

1373

00:53:05,990 --> 00:53:04,160

questions this is this is what it's all

1374

00:53:07,910 --> 00:53:06,000

about

1375

00:53:10,790 --> 00:53:07,920

and thank you to everyone online for

1376

00:53:12,630 --> 00:53:10,800

participating in today's episode to stay

1377

00:53:15,190 --> 00:53:12,640

updated on all the science planned for

1378

00:53:18,390 --> 00:53:15,200

the moon follow nasa moon on facebook

1379

00:53:20,549 --> 00:53:18,400

and twitter you can also visit nasa.gov

1380

00:53:22,630 --> 00:53:20,559

moon for the latest news

1381

00:53:24,309 --> 00:53:22,640

nasa plans to send science technology

1382

00:53:26,309 --> 00:53:24,319

and humans to the moon with the artemis

1383

00:53:28,230 --> 00:53:26,319

program and the first launch of the

1384

00:53:31,270 --> 00:53:28,240

rocket that will send humans to the moon

1385

00:53:33,750 --> 00:53:31,280

happens this year and so for updates

1386

00:53:34,870 --> 00:53:33,760

follow nasa artemis on facebook and

1387

00:53:39,610 --> 00:53:34,880

twitter

1388

00:54:11,510 --> 00:53:50,830

[Music]

1389

00:54:15,589 --> 00:54:13,750

i have a feather

1390

00:54:17,430 --> 00:54:15,599

and my right hand a hammer