
ASK AN
ASTROBIOLOGIST
EPISODE 58: MAY 18, 2023
DR. MARY DROSER
#AskAstrobio
NASA

1
00:00:25,410 --> 00:00:00,470
[Music]

2
00:00:41,470 --> 00:00:25,420
[Applause]

3
00:00:44,209 --> 00:00:41,480
[Music]

4
00:00:46,010 --> 00:00:44,219
friends fellow earthlings and the

5
00:00:48,770 --> 00:00:46,020
results of billions of years of

6
00:00:51,950 --> 00:00:48,780
evolution on one small rock in the void

7
00:00:53,750 --> 00:00:51,960
this is ask an astrobiologist the show

8
00:00:55,490 --> 00:00:53,760
that celebrates the science and the

9
00:00:57,830 --> 00:00:55,500
scientists involved in our quest to

10
00:01:00,350 --> 00:00:57,840
understand the nature of life I'm your

11
00:01:01,729 --> 00:01:00,360
host Dr Graham the cosmo biologist Lao

12
00:01:04,210 --> 00:01:01,739
and as and as always we're brought to

13
00:01:06,530 --> 00:01:04,220

you by the NASA astrobiology program and

14
00:01:08,450 --> 00:01:06,540
segnet.org thank you so much for

15
00:01:10,310 --> 00:01:08,460
everyone for tuning in today as always

16
00:01:11,870 --> 00:01:10,320
we'd love to give a huge shout out to

17
00:01:13,850 --> 00:01:11,880
those of you out there engaging in

18
00:01:16,310 --> 00:01:13,860
conversation with me with our guests

19
00:01:18,710 --> 00:01:16,320
through the post on the NASA Astro bio

20
00:01:20,270 --> 00:01:18,720
Twitter account uh and for just sharing

21
00:01:22,130 --> 00:01:20,280
about our episodes and all the things

22
00:01:23,990 --> 00:01:22,140
that we're doing this month we want to

23
00:01:26,749 --> 00:01:24,000
give a special shout out to Dr Francis

24
00:01:29,210 --> 00:01:26,759
Rivera Hernandez for sharing about the

25
00:01:32,810 --> 00:01:29,220
show Dr Hernandez was a guest on the

26
00:01:35,270 --> 00:01:32,820
show previously for episode 38 20

27
00:01:37,670 --> 00:01:35,280
episodes ago she joined us along with

28
00:01:39,590 --> 00:01:37,680
Kendall Lynch and Svetlana scoliar to

29
00:01:41,810 --> 00:01:39,600
talk about the perseverance Rover and

30
00:01:43,190 --> 00:01:41,820
the geology of Mars and what we're

31
00:01:45,410 --> 00:01:43,200
looking at and trying to understand if

32
00:01:47,630 --> 00:01:45,420
Mars ever had life or currently has life

33
00:01:49,850 --> 00:01:47,640
and what we might find there

34
00:01:52,310 --> 00:01:49,860
but now with today's episode of ask an

35
00:01:54,710 --> 00:01:52,320
astrobiologist we're going to embark on

36
00:01:57,410 --> 00:01:54,720
a journey into the past for life on

37
00:01:59,149 --> 00:01:57,420
Earth As Told in the tapestry of the

38
00:02:01,249 --> 00:01:59,159

signs that remain in the Rock record

39
00:02:03,889 --> 00:02:01,259
we'll be diving into the ancient

40
00:02:06,050 --> 00:02:03,899
idiocran period a pivotal chapter in

41
00:02:09,290 --> 00:02:06,060
Earth's history that witnessed the

42
00:02:11,089 --> 00:02:09,300
awe-inspiring rise of animal phyla and a

43
00:02:13,729 --> 00:02:11,099
lot of experiments in evolution in

44
00:02:14,869 --> 00:02:13,739
biology an extraordinary biodiversity

45
00:02:17,330 --> 00:02:14,879
was occurring leading to what we

46
00:02:19,610 --> 00:02:17,340
currently see here on Earth now today's

47
00:02:22,250 --> 00:02:19,620
guest is a paleontologist and an expert

48
00:02:23,809 --> 00:02:22,260
on the edocrine period the range that

49
00:02:27,890 --> 00:02:23,819
living things existed in during the Ed

50
00:02:30,350 --> 00:02:27,900
octane was around 635 to 539 million

51
00:02:32,270 --> 00:02:30,360
years ago at a time when animal life as

52
00:02:34,729 --> 00:02:32,280
we know it was Rising onto this planet

53
00:02:36,229 --> 00:02:34,739
Dr Mary droser is a distinguished

54
00:02:38,449 --> 00:02:36,239
professor in the department of Earth and

55
00:02:40,729 --> 00:02:38,459
planetary Sciences at the University of

56
00:02:42,710 --> 00:02:40,739
California Riverside and someone who has

57
00:02:45,530 --> 00:02:42,720
dedicated her career to unraveling the

58
00:02:46,670 --> 00:02:45,540
mysteries of the ediacaran period her

59
00:02:48,229 --> 00:02:46,680
groundbreaking discoveries and

60
00:02:49,910 --> 00:02:48,239
meticulous studies of fossil assemblages

61
00:02:52,850 --> 00:02:49,920
have shed light on the early evolution

62
00:02:54,290 --> 00:02:52,860
of multicellular life Dr duracer's

63
00:02:56,390 --> 00:02:54,300

expertise has taken her to fascinating

64
00:02:58,009 --> 00:02:56,400
field sites around the world including

65
00:03:00,650 --> 00:02:58,019
her own work in helping us to develop

66
00:03:02,930 --> 00:03:00,660
the South Australia's nilpina idiacaran

67
00:03:04,670 --> 00:03:02,940
national park today she joins us to

68
00:03:06,710 --> 00:03:04,680
share her invaluable insight and take us

69
00:03:09,170 --> 00:03:06,720
on a captivating Journey Through Time as

70
00:03:11,089 --> 00:03:09,180
well as her own career so Dr Mary droser

71
00:03:12,890 --> 00:03:11,099
welcome to ask an astrobiologist great

72
00:03:14,750 --> 00:03:12,900
thanks for having me one thing I love to

73
00:03:16,790 --> 00:03:14,760
ask our guests when they first join us

74
00:03:19,130 --> 00:03:16,800
is to share with us their science or

75
00:03:21,470 --> 00:03:19,140
origin story the thing that inspired

76
00:03:23,750 --> 00:03:21,480
them to to pursue a career in The

77
00:03:25,250 --> 00:03:23,760
Sciences in the Realms of paleontology

78
00:03:27,290 --> 00:03:25,260
and other disciplines related to

79
00:03:30,050 --> 00:03:27,300
astrobiology what was it that that

80
00:03:32,149 --> 00:03:30,060
hooked you into a career in The Sciences

81
00:03:34,430 --> 00:03:32,159
oh I was very young when I got

82
00:03:36,710 --> 00:03:34,440
interested in the Sciences when I was um

83
00:03:38,509 --> 00:03:36,720
a little kid and like five years old

84
00:03:40,369 --> 00:03:38,519
wanted to be a marine biologist because

85
00:03:44,030 --> 00:03:40,379
of just floating around in the shallow

86
00:03:46,670 --> 00:03:44,040
Seas off off Long Island and then age 10

87
00:03:48,710 --> 00:03:46,680
I sort of got interested in geology

88
00:03:50,869 --> 00:03:48,720

um and it's a boring history the rest is

89
00:03:54,229 --> 00:03:50,879
history combining marine biology with

90
00:03:56,630 --> 00:03:54,239
geology and paleontology and I I was a

91
00:03:58,670 --> 00:03:56,640
freshman geology major which is not

92
00:04:01,190 --> 00:03:58,680
usual most people discovered geology

93
00:04:02,690 --> 00:04:01,200
during college so yeah very early on

94
00:04:04,610 --> 00:04:02,700
love science

95
00:04:06,289 --> 00:04:04,620
I love that so much I mean for me myself

96
00:04:08,330 --> 00:04:06,299
and I first started college I had no

97
00:04:09,770 --> 00:04:08,340
idea I'd be a geologist eventually I

98
00:04:11,210 --> 00:04:09,780
wanted to do marine biology and some

99
00:04:12,530 --> 00:04:11,220
other things and then just found geology

100
00:04:14,990 --> 00:04:12,540
along the way I think that's the case

101
00:04:16,729 --> 00:04:15,000
for for many of us so what in your

102
00:04:18,590 --> 00:04:16,739
career then took you into this realm of

103
00:04:20,270 --> 00:04:18,600
paleontology and specifically studying

104
00:04:24,650 --> 00:04:20,280
the idiacarin

105
00:04:27,050 --> 00:04:24,660
I I got into sort of interested in in

106
00:04:29,150 --> 00:04:27,060
how animals interact with sediments and

107
00:04:31,070 --> 00:04:29,160
interact with their environments and

108
00:04:33,890 --> 00:04:31,080
that got me into sort of this this world

109
00:04:35,330 --> 00:04:33,900
of looking at bioterbation and burrowing

110
00:04:36,890 --> 00:04:35,340
and Mobility

111
00:04:39,409 --> 00:04:36,900
um and I just kept going deeper and

112
00:04:41,510 --> 00:04:39,419
deeper in time my my dissertation was

113
00:04:44,450 --> 00:04:41,520

looking at sort of the Advent of

114
00:04:46,189 --> 00:04:44,460
mobility and and when and how animals

115
00:04:47,570 --> 00:04:46,199
first started moving and changing the

116
00:04:49,730 --> 00:04:47,580
sediment

117
00:04:51,770 --> 00:04:49,740
um and it just kept getting deeper

118
00:04:54,409 --> 00:04:51,780
um and eventually in the ediacron where

119
00:04:58,090 --> 00:04:54,419
Mobility first originated

120
00:05:00,590 --> 00:04:58,100
um and so uh that's I've never left

121
00:05:02,090 --> 00:05:00,600
I love that well I mean life has

122
00:05:03,650 --> 00:05:02,100
certainly left since that period and

123
00:05:05,390 --> 00:05:03,660
moved on and done a bunch of other

124
00:05:06,830 --> 00:05:05,400
interesting things and you know life on

125
00:05:10,129 --> 00:05:06,840
our planet we have good evidence maybe

126
00:05:12,469 --> 00:05:10,139
3.5 to 3.8 billion years ago some of us

127
00:05:14,870 --> 00:05:12,479
hypothesized maybe four billion years or

128
00:05:16,550 --> 00:05:14,880
even earlier uh life was happening on

129
00:05:18,409 --> 00:05:16,560
Earth but you know much of our our

130
00:05:20,990 --> 00:05:18,419
lifespan of the time of life on Earth

131
00:05:22,969 --> 00:05:21,000
was microbial life we had a lot of

132
00:05:25,010 --> 00:05:22,979
evolutionary change and adaptation we

133
00:05:27,189 --> 00:05:25,020
have the rise of oxygen thanks to life

134
00:05:30,230 --> 00:05:27,199
but it really was during this this

135
00:05:32,150 --> 00:05:30,240
period you know it's that that life kind

136
00:05:35,689 --> 00:05:32,160
of started really blossoming out into

137
00:05:37,430 --> 00:05:35,699
this more complex multicellular the

138
00:05:39,529 --> 00:05:37,440

organisms that we kind of know of today

139
00:05:41,570 --> 00:05:39,539
why do you think really drove that that

140
00:05:44,029 --> 00:05:41,580
complex Behavior to drive this this

141
00:05:46,490 --> 00:05:44,039
process forward to allow life to kind of

142
00:05:48,409 --> 00:05:46,500
emerge in that realm right well that is

143
00:05:50,210 --> 00:05:48,419
a big question right you need two things

144
00:05:52,189 --> 00:05:50,220
you need the environment to be correct

145
00:05:54,230 --> 00:05:52,199
and you need the genes you need the

146
00:05:56,570 --> 00:05:54,240
genetic Pathways for multicellularity

147
00:05:59,090 --> 00:05:56,580
and there are a lot of people looking at

148
00:06:00,890 --> 00:05:59,100
the Advent of multicellularity from

149
00:06:02,570 --> 00:06:00,900
biological and paleontological many

150
00:06:05,450 --> 00:06:02,580
perspectives

151
00:06:07,010 --> 00:06:05,460
um so there's two two ways in which we

152
00:06:08,870 --> 00:06:07,020
think this might have happened and and

153
00:06:12,170 --> 00:06:08,880
most diverse history has gone by before

154
00:06:15,110 --> 00:06:12,180
we get multicellular animals and um

155
00:06:17,029 --> 00:06:15,120
multicellular multicellularity arose in

156
00:06:19,969 --> 00:06:17,039
a lot of different unrelated clades many

157
00:06:22,790 --> 00:06:19,979
times but in terms of animals

158
00:06:24,529 --> 00:06:22,800
it is a question of did we have the

159
00:06:27,170 --> 00:06:24,539
genes and we needed the right level of

160
00:06:28,550 --> 00:06:27,180
oxygen and we didn't have that until the

161
00:06:29,990 --> 00:06:28,560
ediacran

162
00:06:32,210 --> 00:06:30,000
um is one of the sort of leading

163
00:06:35,270 --> 00:06:32,220

hypotheses that it all comes down to to

164
00:06:38,809 --> 00:06:35,280
oxygen we need oxygen

165
00:06:41,930 --> 00:06:38,819
um so that is what we we think may have

166
00:06:44,270 --> 00:06:41,940
uh have been that last last push for

167
00:06:47,029 --> 00:06:44,280
multicellularity and in animals anyway

168
00:06:48,890 --> 00:06:47,039
so we did ask our audience online we

169
00:06:51,050 --> 00:06:48,900
gave a little poll about some creatures

170
00:06:53,090 --> 00:06:51,060
of ediacarin period

171
00:06:54,890 --> 00:06:53,100
um and ask them which creature you know

172
00:06:57,469 --> 00:06:54,900
the images we shared wasn't from the

173
00:06:59,330 --> 00:06:57,479
ediacarin and it's an interesting image

174
00:07:01,010 --> 00:06:59,340
so three of those are actual artists

175
00:07:02,870 --> 00:07:01,020
Renditions of the kinds of fossils that

176
00:07:05,270 --> 00:07:02,880
you've discovered uh looking into this

177
00:07:08,210 --> 00:07:05,280
period of time one of them was an artist

178
00:07:10,670 --> 00:07:08,220
drawing of the Facehugger from the alien

179
00:07:12,230 --> 00:07:10,680
franchise of Science Fiction and

180
00:07:16,189 --> 00:07:12,240
interestingly we actually fooled about

181
00:07:18,230 --> 00:07:16,199
20 of the respondents did not know which

182
00:07:20,110 --> 00:07:18,240
was which and so there were some really

183
00:07:22,730 --> 00:07:20,120
interesting things going on during the

184
00:07:24,950 --> 00:07:22,740
where we had different you know kinds of

185
00:07:26,390 --> 00:07:24,960
uh adaptations they're different

186
00:07:28,730 --> 00:07:26,400
different kinds of things that life was

187
00:07:30,170 --> 00:07:28,740
doing how do you kind of Envision what

188
00:07:32,210 --> 00:07:30,180

life was actually doing at that time

189
00:07:35,930 --> 00:07:32,220
these new experiments that biology was

190
00:07:37,670 --> 00:07:35,940
up to yeah so I my my yeah my fantasy

191
00:07:39,350 --> 00:07:37,680
world is getting in Miss frizzle's Magic

192
00:07:40,490 --> 00:07:39,360
School Bus and going back to the EDI

193
00:07:43,610 --> 00:07:40,500
Akron

194
00:07:45,770 --> 00:07:43,620
um and I so I you know

195
00:07:47,450 --> 00:07:45,780
when I think about the IDI Akron or when

196
00:07:49,730 --> 00:07:47,460
I try to describe the ediacron the first

197
00:07:52,370 --> 00:07:49,740
thing I do is talk about the sea floor

198
00:07:54,589 --> 00:07:52,380
so the sea floor of the idiacron there

199
00:07:56,749 --> 00:07:54,599
were no borrowers you know going deep

200
00:07:59,570 --> 00:07:56,759
down we had Mobility but nobody really

201
00:08:01,430 --> 00:07:59,580
churning the sediment we didn't have the

202
00:08:04,070 --> 00:08:01,440
effective grazers that we have today

203
00:08:05,629 --> 00:08:04,080
things like cucumbers and whatnot and so

204
00:08:08,210 --> 00:08:05,639
the sea floor would have been covered

205
00:08:09,650 --> 00:08:08,220
with like goose and I mean the kind of

206
00:08:12,830 --> 00:08:09,660
thing you would never want to put your

207
00:08:14,990 --> 00:08:12,840
foot in right think Pond scum so when

208
00:08:16,430 --> 00:08:15,000
you start to Envision the ediacran

209
00:08:17,930 --> 00:08:16,440
marine environment and we're in the

210
00:08:19,730 --> 00:08:17,940
ocean of course first you start with

211
00:08:21,710 --> 00:08:19,740
your sea floor in the sort of green and

212
00:08:23,869 --> 00:08:21,720
blue and brown and disgusting sort of

213
00:08:25,369 --> 00:08:23,879

microbial mats and organic mattes on the

214
00:08:27,710 --> 00:08:25,379
seafloor

215
00:08:30,770 --> 00:08:27,720
and then put on that

216
00:08:32,690 --> 00:08:30,780
um organisms so what we think actually

217
00:08:34,490 --> 00:08:32,700
you imagine people think oh were they

218
00:08:37,490 --> 00:08:34,500
rare and little tiny little things here

219
00:08:39,409 --> 00:08:37,500
and there no neither rare nor small big

220
00:08:41,329 --> 00:08:39,419
and small so you start with that

221
00:08:43,850 --> 00:08:41,339
seafloor and you put frond like

222
00:08:46,130 --> 00:08:43,860
organisms that were as tall as I am

223
00:08:49,009 --> 00:08:46,140
you put some things that looked like

224
00:08:51,850 --> 00:08:49,019
bath mats that could be you know a meter

225
00:08:54,829 --> 00:08:51,860
long that would roam along the sea floor

226
00:08:56,329 --> 00:08:54,839
and you know lots of groups of organisms

227
00:08:59,389 --> 00:08:56,339
that would have just sitting there like

228
00:09:01,250 --> 00:08:59,399
little buttons on the sea floor and so

229
00:09:03,769 --> 00:09:01,260
if you were snorkeling around in the

230
00:09:06,110 --> 00:09:03,779
ediacron you'd be like all right this

231
00:09:09,050 --> 00:09:06,120
looks like an alien world it looks like

232
00:09:09,829 --> 00:09:09,060
something that somebody created

233
00:09:11,990 --> 00:09:09,839
um

234
00:09:13,490 --> 00:09:12,000
for some alien movie that takes place

235
00:09:15,170 --> 00:09:13,500
under the sea

236
00:09:16,730 --> 00:09:15,180
um that's kind of familiar but isn't

237
00:09:18,410 --> 00:09:16,740
really familiar

238
00:09:20,930 --> 00:09:18,420

um and so what we're trying to do is do

239
00:09:22,550 --> 00:09:20,940
the Deep dive no pun intended into

240
00:09:25,790 --> 00:09:22,560
figuring out

241
00:09:27,350 --> 00:09:25,800
what is there and how do they relate to

242
00:09:28,730 --> 00:09:27,360
life today

243
00:09:30,470 --> 00:09:28,740
um but it totally would have been an

244
00:09:32,090 --> 00:09:30,480
alien world and they're not familiar and

245
00:09:34,730 --> 00:09:32,100
when we show people The Fosters they're

246
00:09:37,550 --> 00:09:34,740
like yeah no I have no idea what this is

247
00:09:39,829 --> 00:09:37,560
um so yeah I'm not surprised that

248
00:09:42,110 --> 00:09:39,839
um it was 20 they are weird looking

249
00:09:44,210 --> 00:09:42,120
things yeah and I think if anything it

250
00:09:46,250 --> 00:09:44,220
was more that people saw the Facehugger

251
00:09:47,570 --> 00:09:46,260
and they knew that from Alien rather

252
00:09:49,250 --> 00:09:47,580
than knowing that the others weren't

253
00:09:50,990 --> 00:09:49,260
actually you know artist Renditions of

254
00:09:52,850 --> 00:09:51,000
some science fiction creature

255
00:09:54,769 --> 00:09:52,860
um now I have read of you that you

256
00:09:56,150 --> 00:09:54,779
you've had the opportunity to name a few

257
00:09:57,410 --> 00:09:56,160
of these fossil creatures that you've

258
00:09:59,329 --> 00:09:57,420
discovered including one that you named

259
00:10:01,310 --> 00:09:59,339
after your own mother uh one that you

260
00:10:02,509 --> 00:10:01,320
named after David Attenborough

261
00:10:03,949 --> 00:10:02,519
um what's he feel like to have like

262
00:10:05,210 --> 00:10:03,959
these these fossil creatures that we

263
00:10:07,250 --> 00:10:05,220

know of on Earth that you had a chance

264
00:10:09,170 --> 00:10:07,260
to actually give them the name and kind

265
00:10:11,990 --> 00:10:09,180
of share that with the world

266
00:10:14,090 --> 00:10:12,000
um it's crazy and exciting right so

267
00:10:17,810 --> 00:10:14,100
we've named I think 10 or 12 different

268
00:10:20,210 --> 00:10:17,820
organisms what's amazing right is is

269
00:10:22,009 --> 00:10:20,220
that um these are whole new body plans

270
00:10:24,170 --> 00:10:22,019
this isn't just a little tweak on

271
00:10:26,329 --> 00:10:24,180
something we've already known these are

272
00:10:28,370 --> 00:10:26,339
new body plans and and the way in which

273
00:10:31,130 --> 00:10:28,380
and sort of why we've discovered so many

274
00:10:33,110 --> 00:10:31,140
is that we're not doing paleontology the

275
00:10:35,050 --> 00:10:33,120
way others do Paleo so

276
00:10:36,949 --> 00:10:35,060
and liking it like normal

277
00:10:38,150 --> 00:10:36,959
paleontologists like the clink clink

278
00:10:39,470 --> 00:10:38,160
method you go out in the field you're

279
00:10:42,050 --> 00:10:39,480
like clink clink clink clink clink you

280
00:10:44,630 --> 00:10:42,060
take the fossil back to the museum

281
00:10:47,630 --> 00:10:44,640
um where we're working at what is now

282
00:10:50,269 --> 00:10:47,640
Neil Pina ediacra National Park we are

283
00:10:52,130 --> 00:10:50,279
able to excavate whole betting planes

284
00:10:55,009 --> 00:10:52,140
that represent snapshots of the

285
00:10:57,050 --> 00:10:55,019
idioacrancy floor so if you imagine you

286
00:10:58,970 --> 00:10:57,060
know going out to the sea floor today

287
00:11:01,970 --> 00:10:58,980
and a storm coming and dumping a bunch

288
00:11:04,970 --> 00:11:01,980

of sand on the sea floor and that sand

289
00:11:07,130 --> 00:11:04,980
becoming Rock and casting those

290
00:11:09,230 --> 00:11:07,140
organisms on the base we're Excavating

291
00:11:11,269 --> 00:11:09,240
these beds turning them over and

292
00:11:12,889 --> 00:11:11,279
literally have snapshots of the seafloor

293
00:11:15,769 --> 00:11:12,899
so what we're doing is we're mapping

294
00:11:18,290 --> 00:11:15,779
these beds and we're finding all sorts

295
00:11:19,970 --> 00:11:18,300
of new and and different body plans that

296
00:11:22,310 --> 00:11:19,980
are unlike other things so that's where

297
00:11:24,250 --> 00:11:22,320
it gets really weird you're like I have

298
00:11:27,590 --> 00:11:24,260
no idea what this is and we give them

299
00:11:29,930 --> 00:11:27,600
nicknames that are sort of what they

300
00:11:32,269 --> 00:11:29,940
look like so aten varieties look like a

301
00:11:34,310 --> 00:11:32,279
raisin so when we first saw it we'd be

302
00:11:36,590 --> 00:11:34,320
like oh here's a raisin you know and in

303
00:11:38,210 --> 00:11:36,600
my logbook it says raisin and then we

304
00:11:39,410 --> 00:11:38,220
found a bed that was covered with them

305
00:11:43,310 --> 00:11:39,420
and we're like all right we have to deal

306
00:11:45,050 --> 00:11:43,320
with this and and you know by by looking

307
00:11:46,730 --> 00:11:45,060
at it and doing all sorts of like

308
00:11:48,350 --> 00:11:46,740
looking at the preservation and the

309
00:11:51,110 --> 00:11:48,360
nature of morphology and everything we

310
00:11:53,269 --> 00:11:51,120
reconstruct it as not to take the

311
00:11:55,009 --> 00:11:53,279
analogy too far but as as sort of a

312
00:11:57,410 --> 00:11:55,019
grape-like organism or a sort of Tina

313
00:12:00,650 --> 00:11:57,420

four-like organism and so that's what's

314
00:12:02,810 --> 00:12:00,660
fun it's amazing it's a privilege to be

315
00:12:06,110 --> 00:12:02,820
able to look at these new body plans

316
00:12:08,269 --> 00:12:06,120
um and so yeah it's totally crazy

317
00:12:10,490 --> 00:12:08,279
um and exciting and trying to figure out

318
00:12:11,930 --> 00:12:10,500
where they fit in terms of the Tree of

319
00:12:14,030 --> 00:12:11,940
Life

320
00:12:16,850 --> 00:12:14,040
um I have a lot of wrinkles from just

321
00:12:18,470 --> 00:12:16,860
that so

322
00:12:19,550 --> 00:12:18,480
yeah I mean there's a lot to uncover

323
00:12:21,050 --> 00:12:19,560
there you know from those early Tina

324
00:12:22,790 --> 00:12:21,060
fours and sponges and then kind of

325
00:12:25,130 --> 00:12:22,800
coming up to where we're at in the adiac

326
00:12:27,110 --> 00:12:25,140
around you mentioned uh no Pina ediacra

327
00:12:29,030 --> 00:12:27,120
National Park which was uh created in

328
00:12:31,490 --> 00:12:29,040
2021 and you've had a hand in

329
00:12:33,170 --> 00:12:31,500
development of the park itself

330
00:12:35,569 --> 00:12:33,180
um can you speak to the importance of

331
00:12:38,090 --> 00:12:35,579
that site um in general not just for

332
00:12:39,650 --> 00:12:38,100
understanding this fossil assemblage but

333
00:12:42,949 --> 00:12:39,660
also that site in general and why it's

334
00:12:44,750 --> 00:12:42,959
such a compelling region yeah so we um

335
00:12:46,310 --> 00:12:44,760
you know I started working there about

336
00:12:48,769 --> 00:12:46,320
20 years ago with my colleague Jim

337
00:12:51,290 --> 00:12:48,779
galing at the South Australia Museum we

338
00:12:53,509 --> 00:12:51,300

knew about five probably two or three

339
00:12:55,190 --> 00:12:53,519
years in that this was a special special

340
00:12:58,790 --> 00:12:55,200
site

341
00:13:00,710 --> 00:12:58,800
um and so over the last 15 years and

342
00:13:01,970 --> 00:13:00,720
very much so over the last seven or

343
00:13:04,550 --> 00:13:01,980
eight years we've worked with the South

344
00:13:06,290 --> 00:13:04,560
Australian government the

345
00:13:08,569 --> 00:13:06,300
um pastoralist who owned the property

346
00:13:12,230 --> 00:13:08,579
the traditional landowners the Adnan

347
00:13:16,069 --> 00:13:12,240
matna to come together to recognize that

348
00:13:18,290 --> 00:13:16,079
this is a um a unique site and it's it's

349
00:13:20,990 --> 00:13:18,300
a site where

350
00:13:22,970 --> 00:13:21,000
um you know people can walk around both

351
00:13:25,850 --> 00:13:22,980
to bring science to the community which

352
00:13:28,069 --> 00:13:25,860
I think is hugely important as well as

353
00:13:31,790 --> 00:13:28,079
to conserve and preserve the fossils so

354
00:13:34,970 --> 00:13:31,800
it's a wonderful opportunity to have

355
00:13:37,009 --> 00:13:34,980
kids and adults and you know come and

356
00:13:39,590 --> 00:13:37,019
learn about fossils and learn that Earth

357
00:13:41,870 --> 00:13:39,600
has a history and that going back in

358
00:13:44,150 --> 00:13:41,880
time can can teach just about the future

359
00:13:46,129 --> 00:13:44,160
is important to understanding our life

360
00:13:47,990 --> 00:13:46,139
is important to understanding you know

361
00:13:49,129 --> 00:13:48,000
how we might look at life on another

362
00:13:52,190 --> 00:13:49,139
planet

363
00:13:55,370 --> 00:13:52,200

and uh Neil pianidiakra National Park

364
00:13:57,769 --> 00:13:55,380
and and the ediacra fossils there

365
00:14:00,889 --> 00:13:57,779
um are also part of a world heritage bed

366
00:14:02,690 --> 00:14:00,899
that we're doing for the region which is

367
00:14:04,850 --> 00:14:02,700
sort of the dawn of animal life which

368
00:14:06,530 --> 00:14:04,860
will take it from early eukaryotes into

369
00:14:07,490 --> 00:14:06,540
the Cambrian

370
00:14:09,470 --> 00:14:07,500
um and sort of when we have

371
00:14:11,629 --> 00:14:09,480
skeletonization and predation and things

372
00:14:13,190 --> 00:14:11,639
like that so we're looking at this you

373
00:14:14,990 --> 00:14:13,200
know hundreds a couple hundreds of

374
00:14:17,690 --> 00:14:15,000
millions of years period where we can

375
00:14:20,030 --> 00:14:17,700
track the crazy environmental changes

376
00:14:22,610 --> 00:14:20,040
which form the backdrop of all of this

377
00:14:24,710 --> 00:14:22,620
as well as these appearance of these

378
00:14:28,550 --> 00:14:24,720
evolutionary Innovations and so it's

379
00:14:31,670 --> 00:14:28,560
it's an astounding place um it is nearby

380
00:14:33,590 --> 00:14:31,680
is the gssp or Global strata type point

381
00:14:36,350 --> 00:14:33,600
for the ediacran literally there's a

382
00:14:38,990 --> 00:14:36,360
golden spike in there and so it's a it's

383
00:14:41,509 --> 00:14:39,000
an amazing site and I think just

384
00:14:43,370 --> 00:14:41,519
bringing science to the public and

385
00:14:46,189 --> 00:14:43,380
obviously for this particular Community

386
00:14:49,670 --> 00:14:46,199
it's also an economic help

387
00:14:51,530 --> 00:14:49,680
um which is not a bad thing so

388
00:14:53,990 --> 00:14:51,540

that's awesome well I want to share a

389
00:14:56,269 --> 00:14:54,000
quote that we had from you uh in a NASA

390
00:14:58,189 --> 00:14:56,279
astrobiology article that simply put

391
00:15:00,470 --> 00:14:58,199
this is the best record of the dawn of

392
00:15:01,970 --> 00:15:00,480
animal life on Earth uh looking in this

393
00:15:02,870 --> 00:15:01,980
nopina site

394
00:15:05,150 --> 00:15:02,880
um I'd like to connect us to

395
00:15:07,189 --> 00:15:05,160
astrobiology though how does this kind

396
00:15:08,990 --> 00:15:07,199
of impact our view of how life might

397
00:15:10,310 --> 00:15:09,000
change and evolve over time on other

398
00:15:12,470 --> 00:15:10,320
worlds

399
00:15:14,329 --> 00:15:12,480
yeah so I think you know I'm I'm I'm

400
00:15:15,949 --> 00:15:14,339
sort of at the tail end of what's

401
00:15:18,410 --> 00:15:15,959
interesting right when we think about

402
00:15:20,930 --> 00:15:18,420
astrobiology we think in terms of teeny

403
00:15:22,490 --> 00:15:20,940
tiny prokaryotes microorganisms and by

404
00:15:25,009 --> 00:15:22,500
the time you get to multicellularity

405
00:15:27,290 --> 00:15:25,019
you're like whoa you know major

406
00:15:29,389 --> 00:15:27,300
Innovations have already happened but I

407
00:15:31,310 --> 00:15:29,399
think what we're there are a couple

408
00:15:34,850 --> 00:15:31,320
things we're doing that I think that is

409
00:15:36,889 --> 00:15:34,860
important one looking at sort of rate

410
00:15:40,370 --> 00:15:36,899
and scale of evolutionary change and

411
00:15:43,430 --> 00:15:40,380
Innovations you know this these what we

412
00:15:45,769 --> 00:15:43,440
see in Alpena and the diversity and the

413
00:15:48,410 --> 00:15:45,779

biomass that comes along very quickly

414
00:15:49,550 --> 00:15:48,420
once conditions are right so that's a

415
00:15:51,889 --> 00:15:49,560
really important insight into

416
00:15:53,629 --> 00:15:51,899
understanding how life might evolve if

417
00:15:56,030 --> 00:15:53,639
the conditions are right it's just going

418
00:15:57,590 --> 00:15:56,040
to go and it's not gonna you know it's

419
00:15:59,389 --> 00:15:57,600
not rare

420
00:16:00,949 --> 00:15:59,399
um there it's diverse they do a lot of

421
00:16:03,710 --> 00:16:00,959
different things and I think that's one

422
00:16:05,810 --> 00:16:03,720
really important aspect what are the

423
00:16:08,750 --> 00:16:05,820
biological physical and chemical

424
00:16:10,009 --> 00:16:08,760
processes that get us to that point and

425
00:16:13,370 --> 00:16:10,019
those are the kinds of things we're

426
00:16:17,090 --> 00:16:13,380
trying to to get get a handle on we're

427
00:16:18,949 --> 00:16:17,100
also looking at aspects of

428
00:16:21,530 --> 00:16:18,959
um sort of what does life do to the

429
00:16:23,629 --> 00:16:21,540
record so the record of sediments that

430
00:16:26,389 --> 00:16:23,639
preserve these so one of the things

431
00:16:28,670 --> 00:16:26,399
we're interested in is I mentioned

432
00:16:31,610 --> 00:16:28,680
um you know the the sort of widespread

433
00:16:34,790 --> 00:16:31,620
microbial mats and when you have

434
00:16:37,210 --> 00:16:34,800
widespread microbial mats that changes

435
00:16:41,569 --> 00:16:37,220
the nature of how sediments are packaged

436
00:16:43,670 --> 00:16:41,579
and so we are currently looking at how

437
00:16:46,310 --> 00:16:43,680
we can recognize that from a

438
00:16:48,110 --> 00:16:46,320

cross-section and recognize just without

439
00:16:50,210 --> 00:16:48,120
seeing a microbial matter even the

440
00:16:52,249 --> 00:16:50,220
texture it is but from the cross section

441
00:16:54,410 --> 00:16:52,259
of looking at the side view of

442
00:16:57,050 --> 00:16:54,420
sedimentary rocks

443
00:16:58,129 --> 00:16:57,060
um how we might recognize that life was

444
00:17:03,290 --> 00:16:58,139
there

445
00:17:05,270 --> 00:17:03,300
structures that microbial mats imparted

446
00:17:06,770 --> 00:17:05,280
on sedimentary rocks

447
00:17:09,230 --> 00:17:06,780
um and that that would be a mechanism

448
00:17:11,449 --> 00:17:09,240
for looking at life on other planets but

449
00:17:13,189 --> 00:17:11,459
one of my graduate students Rachel

450
00:17:14,390 --> 00:17:13,199
soprenic came in my office and said I

451
00:17:15,949 --> 00:17:14,400
think we could do this through machine

452
00:17:18,350 --> 00:17:15,959
learning

453
00:17:19,970 --> 00:17:18,360
um that has led to us now developing you

454
00:17:22,250 --> 00:17:19,980
know um we've published a couple papers

455
00:17:24,710 --> 00:17:22,260
on this machine learning process of

456
00:17:26,689 --> 00:17:24,720
recognizing the types of sedimentary

457
00:17:28,970 --> 00:17:26,699
packaging that you get with microbial

458
00:17:30,289 --> 00:17:28,980
mats um good lesson for always listening

459
00:17:31,990 --> 00:17:30,299
to your graduate students they have

460
00:17:34,909 --> 00:17:32,000
great ideas

461
00:17:38,390 --> 00:17:34,919
but also you know there are multiple

462
00:17:40,610 --> 00:17:38,400
ways we can get at how life changes a

463
00:17:42,350 --> 00:17:40,620

planet and how life responds to

464
00:17:44,690 --> 00:17:42,360
planetary changes and those are the

465
00:17:46,190 --> 00:17:44,700
kinds of questions we're going for very

466
00:17:48,110 --> 00:17:46,200
cool it makes me think a lot about like

467
00:17:49,970 --> 00:17:48,120
the Mars sample return process right now

468
00:17:51,590 --> 00:17:49,980
going on as well we bring these samples

469
00:17:53,630 --> 00:17:51,600
back and if we have a side view of some

470
00:17:55,070 --> 00:17:53,640
of this sedimentary rock uh from Mars

471
00:17:56,810 --> 00:17:55,080
that could be a huge step forward then

472
00:17:59,150 --> 00:17:56,820
using that machine learning process to

473
00:18:01,549 --> 00:17:59,160
look at those samples that's right I I

474
00:18:04,190 --> 00:18:01,559
I'm I look very keenly when pictures

475
00:18:07,190 --> 00:18:04,200
come back from from Curiosity and

476
00:18:09,110 --> 00:18:07,200
perseverance so yeah exactly

477
00:18:11,029 --> 00:18:09,120
awesome well so you mentioned the EDI

478
00:18:13,490 --> 00:18:11,039
Akron kind of as like this period almost

479
00:18:16,010 --> 00:18:13,500
like an alien world occurring on our own

480
00:18:18,590 --> 00:18:16,020
Earth in the past we did ask another

481
00:18:20,150 --> 00:18:18,600
poll of our audience on YouTube

482
00:18:21,350 --> 00:18:20,160
um about the timing of the IDI Akron

483
00:18:23,510 --> 00:18:21,360
period

484
00:18:25,130 --> 00:18:23,520
um it started 635 million years ago and

485
00:18:26,810 --> 00:18:25,140
we asked you know how long was this

486
00:18:28,549 --> 00:18:26,820
period in general

487
00:18:31,070 --> 00:18:28,559
um and we had a lot of answers the

488
00:18:33,890 --> 00:18:31,080

correct answer was 96 million years

489
00:18:35,390 --> 00:18:33,900
um most people guessed 34 million years

490
00:18:37,310 --> 00:18:35,400
um there is some debate as to how the

491
00:18:39,650 --> 00:18:37,320
idiacarin came to an end and how we get

492
00:18:42,230 --> 00:18:39,660
into the Cambrian radiation or Cambrian

493
00:18:43,730 --> 00:18:42,240
explosion then of Life as we know it

494
00:18:46,070 --> 00:18:43,740
um what is the current thinking of how

495
00:18:48,169 --> 00:18:46,080
this period came to an end and we kind

496
00:18:50,690 --> 00:18:48,179
of lost some of those experiments yeah

497
00:18:54,789 --> 00:18:50,700
so the idiacron period

498
00:18:58,190 --> 00:18:54,799
um was was long ranged from 635 to

499
00:18:59,990 --> 00:18:58,200
539-ish the idiac rebiota inhabit a part

500
00:19:01,370 --> 00:19:00,000
of that so they are a part of the

501
00:19:05,210 --> 00:19:01,380
ediacron period there's just so many

502
00:19:05,990 --> 00:19:05,220
things named after ediacro itself so I

503
00:19:07,610 --> 00:19:06,000
think

504
00:19:09,710 --> 00:19:07,620
um you know I have the perspective of

505
00:19:12,409 --> 00:19:09,720
somebody who works on the idiacrobiota

506
00:19:14,090 --> 00:19:12,419
so in my mind the ediacrobiota is the

507
00:19:15,590 --> 00:19:14,100
fuse it's the beginning of the rise of

508
00:19:17,810 --> 00:19:15,600
animal life and by the end of the

509
00:19:19,430 --> 00:19:17,820
idiacrobiota we have most major body

510
00:19:21,409 --> 00:19:19,440
plans

511
00:19:24,830 --> 00:19:21,419
um there is a debate about what happened

512
00:19:27,710 --> 00:19:24,840
to elements of the idiacrobiota

513
00:19:29,870 --> 00:19:27,720

um my group would say that within the

514
00:19:32,510 --> 00:19:29,880
ediacran period during the time that the

515
00:19:34,430 --> 00:19:32,520
idiacrobiota reigned that there was an

516
00:19:36,770 --> 00:19:34,440
Extinction likely due to a drop in

517
00:19:38,270 --> 00:19:36,780
oxygen so that got rid of many of the

518
00:19:40,730 --> 00:19:38,280
things that are near and dear to my

519
00:19:42,289 --> 00:19:40,740
heart but what happened right at the end

520
00:19:44,150 --> 00:19:42,299
of the precamorean in the beginning of

521
00:19:47,029 --> 00:19:44,160
the Cambrian is the subject of debate

522
00:19:50,029 --> 00:19:47,039
whether it was environmental changes or

523
00:19:51,470 --> 00:19:50,039
the beginning of all of the things that

524
00:19:54,470 --> 00:19:51,480
come around in the Cambrian like

525
00:19:57,409 --> 00:19:54,480
bioterbaters and predators and did that

526
00:19:58,850 --> 00:19:57,419
cause the demise and that the verdict

527
00:20:00,710 --> 00:19:58,860
out is out on that I mean many people

528
00:20:03,409 --> 00:20:00,720
have very strong views but there isn't a

529
00:20:05,450 --> 00:20:03,419
consensus yet but a number of things in

530
00:20:09,110 --> 00:20:05,460
the ediacran do make it through so it's

531
00:20:10,250 --> 00:20:09,120
not it's not a failed experiment there

532
00:20:12,710 --> 00:20:10,260
was a lot of experimentation

533
00:20:16,070 --> 00:20:12,720
evolutionary experimentation but some of

534
00:20:18,049 --> 00:20:16,080
these things did in fact make it through

535
00:20:20,090 --> 00:20:18,059
very cool and that's kind of a fun segue

536
00:20:22,549 --> 00:20:20,100
then talking a bit more on the larger

537
00:20:24,610 --> 00:20:22,559
scale about life on Earth you are a

538
00:20:27,110 --> 00:20:24,620

co-lead on one of the NASA astrobiology

539
00:20:29,870 --> 00:20:27,120
rcns or research coordination networks

540
00:20:31,549 --> 00:20:29,880
indeed the newest one called life I

541
00:20:34,430 --> 00:20:31,559
wonder can you tell us the objectives of

542
00:20:38,210 --> 00:20:34,440
the life RCN and what we intend to find

543
00:20:40,669 --> 00:20:38,220
through this rcn's work yeah sure so um

544
00:20:42,110 --> 00:20:40,679
life is uh early sales to

545
00:20:45,289 --> 00:20:42,120
multicellularity

546
00:20:47,270 --> 00:20:45,299
um it's life all caps and um NASA is big

547
00:20:48,770 --> 00:20:47,280
on acronyms this is not an acronym so

548
00:20:50,510 --> 00:20:48,780
people always ask us what it means and

549
00:20:51,590 --> 00:20:50,520
we're like when we find out we'll let

550
00:20:53,270 --> 00:20:51,600
you know

551
00:20:57,470 --> 00:20:53,280
um just because that's how we feel about

552
00:20:59,690 --> 00:20:57,480
life so life is this newest of five

553
00:21:02,270 --> 00:20:59,700
research coordination networks and it's

554
00:21:04,909 --> 00:21:02,280
focused on the co-evolution of life and

555
00:21:07,250 --> 00:21:04,919
the environment on Earth

556
00:21:09,710 --> 00:21:07,260
um and so what we're looking at is we're

557
00:21:12,230 --> 00:21:09,720
bringing together scientists from all

558
00:21:16,070 --> 00:21:12,240
over disciplines so

559
00:21:17,930 --> 00:21:16,080
um you know from molecular biology to uh

560
00:21:20,990 --> 00:21:17,940
experimental to paleontologists

561
00:21:24,110 --> 00:21:21,000
biochemists Mission scientists to look

562
00:21:27,049 --> 00:21:24,120
at how you know to look at the nature of

563
00:21:29,029 --> 00:21:27,059

life's Innovations and how that changed

564
00:21:30,370 --> 00:21:29,039
what was the consequences of those and

565
00:21:33,110 --> 00:21:30,380
how

566
00:21:35,210 --> 00:21:33,120
chemical and physical processes on Earth

567
00:21:38,750 --> 00:21:35,220
impacted

568
00:21:41,450 --> 00:21:38,760
um the nature and Advent of these um

569
00:21:43,250 --> 00:21:41,460
of these Innovations and I think you

570
00:21:45,710 --> 00:21:43,260
know I I

571
00:21:47,390 --> 00:21:45,720
this RCN which brings together it's

572
00:21:49,909 --> 00:21:47,400
really it's to Foster Community

573
00:21:51,409 --> 00:21:49,919
collaboration but I think of it as sort

574
00:21:53,330 --> 00:21:51,419
of like your first day of kindergarten

575
00:21:54,649 --> 00:21:53,340
right or preschool you you're like wait

576
00:21:56,330 --> 00:21:54,659
what there's all these other

577
00:21:59,090 --> 00:21:56,340
five-year-olds

578
00:22:00,890 --> 00:21:59,100
um so we in these rcns

579
00:22:02,870 --> 00:22:00,900
sort of bring together people who are

580
00:22:05,210 --> 00:22:02,880
studying from my perspective say the

581
00:22:07,070 --> 00:22:05,220
Advent of multicellularity from so many

582
00:22:08,990 --> 00:22:07,080
different perspectives and these aren't

583
00:22:11,270 --> 00:22:09,000
people that I would normally interact

584
00:22:13,250 --> 00:22:11,280
with or even be on a zoom with and

585
00:22:15,669 --> 00:22:13,260
suddenly we're all brought together and

586
00:22:18,110 --> 00:22:15,679
we're in zooms or in the same room

587
00:22:20,649 --> 00:22:18,120
discussing these major evolutionary

588
00:22:23,149 --> 00:22:20,659

Innovations and getting out of our silos

589
00:22:25,070 --> 00:22:23,159
and talking you know people who are

590
00:22:26,930 --> 00:22:25,080
studying you know the Advent of

591
00:22:29,390 --> 00:22:26,940
metabolisms with somebody who's looking

592
00:22:32,029 --> 00:22:29,400
at the oldest fossils and it's so

593
00:22:35,510 --> 00:22:32,039
exciting and you know it's it would only

594
00:22:37,250 --> 00:22:35,520
happen in this sort of RCN framework and

595
00:22:39,409 --> 00:22:37,260
it's you know I think it's really

596
00:22:41,750 --> 00:22:39,419
bringing science forward much more

597
00:22:43,430 --> 00:22:41,760
rapidly than it would ever even if we're

598
00:22:45,710 --> 00:22:43,440
like yeah yeah I read those papers but

599
00:22:48,470 --> 00:22:45,720
like you know sitting down and talking

600
00:22:50,149 --> 00:22:48,480
to somebody is is an amazing thing and

601
00:22:51,350 --> 00:22:50,159
we're trying to bring together people

602
00:22:53,690 --> 00:22:51,360
who don't even know their

603
00:22:55,430 --> 00:22:53,700
astrobiologists or doing astrobio you

604
00:22:57,710 --> 00:22:55,440
know they may be doing modeling work or

605
00:23:00,230 --> 00:22:57,720
experiment work and not understand how

606
00:23:02,690 --> 00:23:00,240
relevant it is to

607
00:23:04,930 --> 00:23:02,700
um to what we're doing so very exciting

608
00:23:06,950 --> 00:23:04,940
and we have great early career

609
00:23:08,870 --> 00:23:06,960
scientists with us and steering

610
00:23:10,250 --> 00:23:08,880
committees and so it's um yeah we've

611
00:23:12,649 --> 00:23:10,260
been around for about a year we have a

612
00:23:14,630 --> 00:23:12,659
new lecture series we've had one uh

613
00:23:17,210 --> 00:23:14,640

second one coming up these are open so

614
00:23:19,370 --> 00:23:17,220
we invite everybody to join us and we

615
00:23:21,409 --> 00:23:19,380
certainly invite uh astrobiologists

616
00:23:22,610 --> 00:23:21,419
interested in life to join us as well so

617
00:23:24,649 --> 00:23:22,620
very fun

618
00:23:26,510 --> 00:23:24,659
awesome yeah and that reminds me a lot

619
00:23:28,610 --> 00:23:26,520
of just astrobiology in general as a

620
00:23:30,049 --> 00:23:28,620
field it's it really is not a single

621
00:23:31,010 --> 00:23:30,059
discipline it's a large field of

622
00:23:33,169 --> 00:23:31,020
different discipline that's coming

623
00:23:34,730 --> 00:23:33,179
together I've often said one of the best

624
00:23:36,590 --> 00:23:34,740
and worst things we ever did to science

625
00:23:38,510 --> 00:23:36,600
was break it apart into all of these sub

626
00:23:40,010 --> 00:23:38,520
sub-disciplines because you ended up

627
00:23:41,270 --> 00:23:40,020
with physicists in one building and

628
00:23:43,909 --> 00:23:41,280
chemist and another building on the same

629
00:23:46,250 --> 00:23:43,919
campus not talking to each other and now

630
00:23:48,470 --> 00:23:46,260
with with astrobiology with rcns like

631
00:23:49,789 --> 00:23:48,480
life we have people communicating across

632
00:23:52,789 --> 00:23:49,799
those boundaries that we're holding them

633
00:23:54,770 --> 00:23:52,799
apart before to share ideas and so I

634
00:23:56,510 --> 00:23:54,780
really appreciate that Viewpoint so

635
00:23:58,070 --> 00:23:56,520
thanks for sharing that so much um

636
00:23:59,990 --> 00:23:58,080
something I shared recently on my own

637
00:24:02,090 --> 00:24:00,000
Twitter account was an image about

638
00:24:04,909 --> 00:24:02,100

convergent evolution and I asked my

639
00:24:05,990 --> 00:24:04,919
audience basically what forms of life do

640
00:24:08,029 --> 00:24:06,000
they think or what things do they think

641
00:24:09,590 --> 00:24:08,039
life would be converging upon for alien

642
00:24:11,330 --> 00:24:09,600
life and there were a lot of answers

643
00:24:12,590 --> 00:24:11,340
some of my own favorite are things like

644
00:24:13,850 --> 00:24:12,600
trees

645
00:24:15,409 --> 00:24:13,860
um you know amongst the Crustaceans we

646
00:24:18,110 --> 00:24:15,419
have several different convergences as I

647
00:24:19,130 --> 00:24:18,120
get to the crab body style

648
00:24:20,870 --> 00:24:19,140
um you know certain organisms like

649
00:24:22,130 --> 00:24:20,880
lizards losing their legs or mammals

650
00:24:23,990 --> 00:24:22,140
losing their legs to become marine

651
00:24:25,909 --> 00:24:24,000
mammals what are some of the the

652
00:24:28,490 --> 00:24:25,919
conversion things in evolution that we

653
00:24:30,169 --> 00:24:28,500
see coming through the ediacara and then

654
00:24:32,450 --> 00:24:30,179
towards the end that you think we would

655
00:24:33,770 --> 00:24:32,460
see was alien life as well

656
00:24:35,149 --> 00:24:33,780
ah

657
00:24:37,190 --> 00:24:35,159
um very interesting question I think

658
00:24:39,230 --> 00:24:37,200
Mobility

659
00:24:41,510 --> 00:24:39,240
um you know the and and not necessarily

660
00:24:43,430 --> 00:24:41,520
legs I think long squishy things that

661
00:24:46,010 --> 00:24:43,440
move think worm

662
00:24:49,190 --> 00:24:46,020
um you know Mobility is such a game

663
00:24:52,310 --> 00:24:49,200

changer with respect to life

664
00:24:55,310 --> 00:24:52,320
um and uh because it allows organisms to

665
00:24:57,950 --> 00:24:55,320
seek out a new environment and and or go

666
00:25:00,890 --> 00:24:57,960
get their food right and so I think you

667
00:25:02,630 --> 00:25:00,900
know and convergence in in a way to move

668
00:25:05,870 --> 00:25:02,640
your body

669
00:25:08,149 --> 00:25:05,880
um whether it's legs which we we see or

670
00:25:10,970 --> 00:25:08,159
um you know convergence and uh you know

671
00:25:13,070 --> 00:25:10,980
dolphins and fish and marine reptiles

672
00:25:15,289 --> 00:25:13,080
all have a streamlined body so that they

673
00:25:17,450 --> 00:25:15,299
can move in the water and I think those

674
00:25:20,149 --> 00:25:17,460
for me my immediate reaction would be

675
00:25:21,890 --> 00:25:20,159
convergence that allows you to move

676
00:25:24,529 --> 00:25:21,900
um would be my first

677
00:25:25,549 --> 00:25:24,539
um off the cuff answer any way and I

678
00:25:27,110 --> 00:25:25,559
love that yeah it makes me think a lot

679
00:25:28,909 --> 00:25:27,120
about what kinds of movement would be

680
00:25:30,529 --> 00:25:28,919
possible out there and like the idea of

681
00:25:32,630 --> 00:25:30,539
the little switchy kind of moving

682
00:25:34,310 --> 00:25:32,640
structures and other alien worlds who

683
00:25:35,750 --> 00:25:34,320
knows if they ever found fins and legs

684
00:25:37,549 --> 00:25:35,760
and wings and those things maybe they

685
00:25:39,649 --> 00:25:37,559
just kept on moving you know like worms

686
00:25:41,510 --> 00:25:39,659
and like little squishy things

687
00:25:43,430 --> 00:25:41,520
um it's entirely possible

688
00:25:45,169 --> 00:25:43,440

that's true yeah giant squishy things

689
00:25:46,909 --> 00:25:45,179
who knows that that's some of the fun of

690
00:25:49,610 --> 00:25:46,919
thinking about what alien life could be

691
00:25:50,930 --> 00:25:49,620
based on what we know of life here uh I

692
00:25:52,370 --> 00:25:50,940
do want to move on to our audience

693
00:25:54,590 --> 00:25:52,380
questions very soon so for those

694
00:25:55,850 --> 00:25:54,600
watching on YouTube right now please ask

695
00:25:57,169 --> 00:25:55,860
your questions in the chat we have

696
00:25:58,970 --> 00:25:57,179
moderators who are listening in to get

697
00:26:00,169 --> 00:25:58,980
those questions over to me

698
00:26:02,390 --> 00:26:00,179
um just a few more things for me myself

699
00:26:03,590 --> 00:26:02,400
then before the show we were discussing

700
00:26:05,330 --> 00:26:03,600
kind of you know some of your hobbies

701
00:26:07,250 --> 00:26:05,340
and interests and one thing you

702
00:26:09,470 --> 00:26:07,260
mentioned was that uh during your field

703
00:26:11,810 --> 00:26:09,480
your field excursions you've taken your

704
00:26:13,310 --> 00:26:11,820
family along with you on your excursions

705
00:26:15,049 --> 00:26:13,320
your children who've now grown up and

706
00:26:16,310 --> 00:26:15,059
are doing their own things

707
00:26:18,350 --> 00:26:16,320
um I wonder you know can you speak to

708
00:26:20,390 --> 00:26:18,360
the importance of family life for a

709
00:26:22,250 --> 00:26:20,400
scientist as well and and the impact

710
00:26:25,310 --> 00:26:22,260
that family has had on your own career

711
00:26:28,310 --> 00:26:25,320
yeah no uh great question yeah I mean

712
00:26:30,409 --> 00:26:28,320
I'm I do field work so I travel a lot my

713
00:26:33,350 --> 00:26:30,419

husband works in the Himalayas so you

714
00:26:35,149 --> 00:26:33,360
know also away so from when my kids were

715
00:26:36,769 --> 00:26:35,159
in diapers um they would come to south

716
00:26:38,390 --> 00:26:36,779
Australia with me and I didn't really

717
00:26:40,310 --> 00:26:38,400
give it a thought at the time in

718
00:26:42,110 --> 00:26:40,320
retrospect I look back on it and say wow

719
00:26:44,810 --> 00:26:42,120
you know and

720
00:26:46,370 --> 00:26:44,820
um my first 10 years my mom came along

721
00:26:48,710 --> 00:26:46,380
um I would have nieces and nephews come

722
00:26:51,710 --> 00:26:48,720
along to watch my kids

723
00:26:54,289 --> 00:26:51,720
um and then over time my uh two kids

724
00:26:55,789 --> 00:26:54,299
both got involved in the research and we

725
00:26:58,310 --> 00:26:55,799
would get them out working in the field

726
00:27:00,169 --> 00:26:58,320
and you know nieces and nephews who came

727
00:27:01,610 --> 00:27:00,179
before just to watch my kids started

728
00:27:04,610 --> 00:27:01,620
coming and and

729
00:27:08,930 --> 00:27:04,620
um working in the field and so

730
00:27:10,610 --> 00:27:08,940
um kind of a magical for me to have to

731
00:27:13,549 --> 00:27:10,620
have had my kids grow up in this way

732
00:27:15,049 --> 00:27:13,559
literally it was their summer vacations

733
00:27:16,850 --> 00:27:15,059
um I did wonder you know would they hit

734
00:27:18,289 --> 00:27:16,860
16 and say I want to you know go to the

735
00:27:19,730 --> 00:27:18,299
mall with my friends and that never

736
00:27:23,930 --> 00:27:19,740
happened

737
00:27:26,990 --> 00:27:23,940
um one one my daughter there is now

738
00:27:29,090 --> 00:27:27,000

studies uh ancient brines on Mars is on

739
00:27:31,310 --> 00:27:29,100
the Curiosity Mission which is a grad

740
00:27:35,029 --> 00:27:31,320
student at Georgia Tech where Francis is

741
00:27:36,890 --> 00:27:35,039
of course and my son as a first year

742
00:27:39,830 --> 00:27:36,900
graduate student at Harvard studying

743
00:27:42,169 --> 00:27:39,840
Marine microbiology and chemo symbionts

744
00:27:43,850 --> 00:27:42,179
and whatnot so paleo adjacent definitely

745
00:27:46,190 --> 00:27:43,860
not paleo but

746
00:27:47,990 --> 00:27:46,200
you know and and it's and and even

747
00:27:50,570 --> 00:27:48,000
nephews and nieces have gone into more

748
00:27:52,909 --> 00:27:50,580
science related fields so

749
00:27:55,610 --> 00:27:52,919
um I think I am really really really

750
00:27:58,310 --> 00:27:55,620
lucky to have had that level of support

751
00:27:59,870 --> 00:27:58,320
from my extended family as well as you

752
00:28:03,350 --> 00:27:59,880
know to have been able to bring my kids

753
00:28:05,810 --> 00:28:03,360
in the field and I do you know when I it

754
00:28:07,370 --> 00:28:05,820
was very unusual when I was young and a

755
00:28:09,049 --> 00:28:07,380
new mother to do something like that and

756
00:28:11,810 --> 00:28:09,059
people were horrified that I would do

757
00:28:15,169 --> 00:28:11,820
that and take my children to the Outback

758
00:28:17,630 --> 00:28:15,179
um but wow it came out well and and you

759
00:28:19,909 --> 00:28:17,640
know I do think that it's a way in in

760
00:28:21,950 --> 00:28:19,919
way that we can visualize how we can

761
00:28:23,570 --> 00:28:21,960
parent and still be scientists at the

762
00:28:25,610 --> 00:28:23,580
same time that's kind of an extreme but

763
00:28:28,190 --> 00:28:25,620

there are other examples of how we can

764
00:28:29,870 --> 00:28:28,200
we can do that so yeah I love that so

765
00:28:31,669 --> 00:28:29,880
much I think during the pandemic a lot

766
00:28:33,230 --> 00:28:31,679
of us you know we had our children with

767
00:28:34,789 --> 00:28:33,240
us during our Zoom calls and our

768
00:28:36,590 --> 00:28:34,799
meetings and I think they became kind of

769
00:28:38,390 --> 00:28:36,600
more Acceptance in some ways for some

770
00:28:39,769 --> 00:28:38,400
people that you know we also have our

771
00:28:41,390 --> 00:28:39,779
own families and our own lives outside

772
00:28:43,789 --> 00:28:41,400
of the science that we're doing and so

773
00:28:45,350 --> 00:28:43,799
if we can include in our families in our

774
00:28:46,730 --> 00:28:45,360
science in our lives that's all the

775
00:28:48,590 --> 00:28:46,740
better because it gives us a chance to

776
00:28:50,090 --> 00:28:48,600
kind of enjoy the community of having

777
00:28:52,370 --> 00:28:50,100
everyone together and learning and

778
00:28:54,230 --> 00:28:52,380
sharing in that way so I'm so thankful

779
00:28:56,090 --> 00:28:54,240
for you sharing that with us we are

780
00:28:58,130 --> 00:28:56,100
going to move on now to our faster than

781
00:28:59,990 --> 00:28:58,140
light segment this is where we have a

782
00:29:02,930 --> 00:29:00,000
few simple questions

783
00:29:04,070 --> 00:29:02,940
um requiring simple answers hopefully

784
00:29:06,230 --> 00:29:04,080
um about some of the things that we

785
00:29:08,450 --> 00:29:06,240
wonder about astrobiology and the

786
00:29:10,430 --> 00:29:08,460
history of life and things like this the

787
00:29:12,049 --> 00:29:10,440
first question comes from the idea of

788
00:29:13,310 --> 00:29:12,059

fermi's paradox which is more of a

789
00:29:15,350 --> 00:29:13,320
question

790
00:29:16,789 --> 00:29:15,360
um that you know where are they and so

791
00:29:18,169 --> 00:29:16,799
my question for you is what is your

792
00:29:21,350 --> 00:29:18,179
favorite answer to fermi's question

793
00:29:22,669 --> 00:29:21,360
where are they

794
00:29:25,190 --> 00:29:22,679
hmm

795
00:29:27,110 --> 00:29:25,200
good answer

796
00:29:28,430 --> 00:29:27,120
yeah absolutely that was the big thing I

797
00:29:30,289 --> 00:29:28,440
think a lot of people say it's just so

798
00:29:32,269 --> 00:29:30,299
vast can they even travel that fast

799
00:29:34,190 --> 00:29:32,279
across space and time how much time

800
00:29:35,510 --> 00:29:34,200
would it take to travel tens of

801
00:29:37,190 --> 00:29:35,520
thousands or hundreds of thousands or

802
00:29:38,630 --> 00:29:37,200
from other galaxies millions or billions

803
00:29:39,889 --> 00:29:38,640
of light years

804
00:29:42,590 --> 00:29:39,899
um the truth is we don't know a current

805
00:29:43,850 --> 00:29:42,600
propulsion yeah a long time

806
00:29:45,470 --> 00:29:43,860
um so here's one that's near dear to my

807
00:29:47,450 --> 00:29:45,480
heart since I love Science Fiction and

808
00:29:49,010 --> 00:29:47,460
Fantasy so much I love reading about

809
00:29:50,090 --> 00:29:49,020
what's possible and thinking about human

810
00:29:54,169 --> 00:29:50,100
stories

811
00:29:56,029 --> 00:29:54,179
inspired you to want to explore more

812
00:29:57,470 --> 00:29:56,039
about life

813
00:29:59,990 --> 00:29:57,480

um so I I'm gonna go back to my

814
00:30:02,570 --> 00:30:00,000
childhood again so I was and this is TV

815
00:30:04,490 --> 00:30:02,580
show so story

816
00:30:07,010 --> 00:30:04,500
um so as a little kid watching Star Trek

817
00:30:08,570 --> 00:30:07,020
and I remember an episode and they're on

818
00:30:10,789 --> 00:30:08,580
a planet and there are these rocks that

819
00:30:13,070 --> 00:30:10,799
are like it's a rock organism and and

820
00:30:15,289 --> 00:30:13,080
Captain Kirk is really like what you

821
00:30:16,970 --> 00:30:15,299
know and and Bones goes you know I think

822
00:30:19,610 --> 00:30:16,980
it was might have been Spock is like

823
00:30:21,769 --> 00:30:19,620
it's not a car that's not a carbon-based

824
00:30:23,810 --> 00:30:21,779
organism that's a silica-based organism

825
00:30:26,090 --> 00:30:23,820
and I remember being like wait there are

826
00:30:27,649 --> 00:30:26,100
silica based organisms you know and like

827
00:30:30,529 --> 00:30:27,659
you know I was like five years old but

828
00:30:33,049 --> 00:30:30,539
honestly that has stuck with me as sort

829
00:30:35,269 --> 00:30:33,059
of this way to conceptualize life on

830
00:30:37,430 --> 00:30:35,279
other planets and sort of watching this

831
00:30:41,210 --> 00:30:37,440
science fiction show and just being like

832
00:30:43,789 --> 00:30:41,220
wow that changes my view you know so

833
00:30:46,010 --> 00:30:43,799
anyway a little bit not not some great

834
00:30:47,810 --> 00:30:46,020
read but rather just having watched a TV

835
00:30:50,029 --> 00:30:47,820
show as a very little kid

836
00:30:52,430 --> 00:30:50,039
awesome I think Star Trek has impacted a

837
00:30:54,950 --> 00:30:52,440
lot of us who are in The Sciences now

838
00:30:56,690 --> 00:30:54,960

um so that's awesome so you've had a

839
00:30:58,909 --> 00:30:56,700
very prestigious career you've done so

840
00:31:00,830 --> 00:30:58,919
many incredible things but if you could

841
00:31:02,690 --> 00:31:00,840
take the knowledge you have now and go

842
00:31:05,029 --> 00:31:02,700
back to meet yourself at the beginning

843
00:31:07,490 --> 00:31:05,039
of your career what kind of advice would

844
00:31:08,990 --> 00:31:07,500
you give yourself

845
00:31:11,330 --> 00:31:09,000
um yeah as you said I've been very lucky

846
00:31:12,470 --> 00:31:11,340
if I if I were I I would say find your

847
00:31:14,990 --> 00:31:12,480
people

848
00:31:17,990 --> 00:31:15,000
um and I was really lucky past me was

849
00:31:20,029 --> 00:31:18,000
very lucky in terms of finding my people

850
00:31:22,070 --> 00:31:20,039
um but I think what I'd give advice to

851
00:31:24,590 --> 00:31:22,080
younger faculty or early career

852
00:31:26,389 --> 00:31:24,600
scientists is you know find your

853
00:31:28,190 --> 00:31:26,399
colleagues your students Junior and

854
00:31:31,310 --> 00:31:28,200
senior to you colleagues your family

855
00:31:33,769 --> 00:31:31,320
find your support group and find your

856
00:31:35,930 --> 00:31:33,779
colleagues that you respect and trust

857
00:31:37,669 --> 00:31:35,940
and who trust and respect you and and

858
00:31:39,529 --> 00:31:37,679
hold on to those people

859
00:31:41,389 --> 00:31:39,539
um and I think it is about the people

860
00:31:44,330 --> 00:31:41,399
you interact with not the institutions

861
00:31:47,090 --> 00:31:44,340
you go to but really who is it that you

862
00:31:49,909 --> 00:31:47,100
work with that you're learning from

863
00:31:51,470 --> 00:31:49,919

is really important and I was very very

864
00:31:53,269 --> 00:31:51,480
lucky on that score

865
00:31:54,649 --> 00:31:53,279
I love that

866
00:31:57,590 --> 00:31:54,659
um what is something that excites you

867
00:32:01,490 --> 00:31:59,690
um gosh right now I would say the early

868
00:32:03,529 --> 00:32:01,500
early career scientists getting into

869
00:32:05,750 --> 00:32:03,539
astrobiology so when I was young

870
00:32:07,909 --> 00:32:05,760
astrobiology wasn't a field I mean I was

871
00:32:11,389 --> 00:32:07,919
like mid-career before astrobiology was

872
00:32:13,610 --> 00:32:11,399
a was a field and and uh you have your

873
00:32:15,409 --> 00:32:13,620
graduates right now there is AB gradcon

874
00:32:18,529 --> 00:32:15,419
in San Diego which is bringing together

875
00:32:20,149 --> 00:32:18,539
graduate students in astrobiology

876
00:32:23,269 --> 00:32:20,159
um so it's The Graduate students Junior

877
00:32:26,149 --> 00:32:23,279
faculty young Mission scientists and you

878
00:32:27,830 --> 00:32:26,159
know coming together and bringing so

879
00:32:30,470 --> 00:32:27,840
many different perspectives and and

880
00:32:32,649 --> 00:32:30,480
diversity of backgrounds and scientific

881
00:32:36,049 --> 00:32:32,659
backgrounds and unconventional thinking

882
00:32:38,990 --> 00:32:36,059
and you know it's just bringing new

883
00:32:41,750 --> 00:32:39,000
voices to the table I think is so

884
00:32:43,909 --> 00:32:41,760
exciting and you know just coming at it

885
00:32:46,610 --> 00:32:43,919
from a very different perspective and

886
00:32:48,230 --> 00:32:46,620
different than you know starting off on

887
00:32:49,909 --> 00:32:48,240
siled so it's not saying oh we're

888
00:32:51,889 --> 00:32:49,919

bringing in molecular biologists these

889
00:32:53,029 --> 00:32:51,899
are starting off on siled which is

890
00:32:54,470 --> 00:32:53,039
terrific

891
00:32:56,750 --> 00:32:54,480
I love that good shout out for ab

892
00:32:58,310 --> 00:32:56,760
gradcon I was a past member eventually

893
00:32:59,930 --> 00:32:58,320
co-organizer eventually lead organizer

894
00:33:01,610 --> 00:32:59,940
for ab gradcon

895
00:33:02,510 --> 00:33:01,620
um and I love that you know everyone's

896
00:33:03,889 --> 00:33:02,520
learning all of these different

897
00:33:06,049 --> 00:33:03,899
disciplines together there aren't

898
00:33:07,549 --> 00:33:06,059
different sessions it's all one session

899
00:33:09,529 --> 00:33:07,559
where everyone's everyone's joining in

900
00:33:11,690 --> 00:33:09,539
together it's fabulous

901
00:33:15,350 --> 00:33:11,700
huge fan huge fan absolutely

902
00:33:16,909 --> 00:33:15,360
so what is the best part of your job

903
00:33:18,590 --> 00:33:16,919
um that I get to work on the ediac or

904
00:33:21,049 --> 00:33:18,600
biota where it was discovered

905
00:33:22,610 --> 00:33:21,059
um what a privilege and obviously the

906
00:33:24,049 --> 00:33:22,620
people I work with students and

907
00:33:25,970 --> 00:33:24,059
colleagues and family that I get to work

908
00:33:28,009 --> 00:33:25,980
there with but you know I go back in

909
00:33:29,750 --> 00:33:28,019
three weeks from now and I I get like

910
00:33:31,909 --> 00:33:29,760
antsy I can't wait I get out in the

911
00:33:34,490 --> 00:33:31,919
field and I'm like how is it that I am

912
00:33:36,669 --> 00:33:34,500
so lucky to sit here and uncover these

913
00:33:38,930 --> 00:33:36,679

fossils and honestly and this is my job

914
00:33:41,029 --> 00:33:38,940
that's crazy

915
00:33:42,529 --> 00:33:41,039
I love that so much

916
00:33:44,090 --> 00:33:42,539
um so one more question for our faster

917
00:33:45,529 --> 00:33:44,100
than light segment it's my favorite

918
00:33:48,230 --> 00:33:45,539
question of all

919
00:33:50,990 --> 00:33:48,240
what is one scientific fact that still

920
00:33:54,710 --> 00:33:53,570
um from a biological perspective I would

921
00:33:57,350 --> 00:33:54,720
say

922
00:33:59,570 --> 00:33:57,360
um it's the commonality of Developmental

923
00:34:01,490 --> 00:33:59,580
controls among animals and this is in my

924
00:34:03,049 --> 00:34:01,500
lifetime that we've figured this out you

925
00:34:06,230 --> 00:34:03,059
know the fact that there are similar

926
00:34:09,109 --> 00:34:06,240
genetic Pathways and genes involved in

927
00:34:11,270 --> 00:34:09,119
the body organization of all animals and

928
00:34:14,810 --> 00:34:11,280
disparate animal plans so we can you

929
00:34:16,790 --> 00:34:14,820
know that that idea of the same pathway

930
00:34:19,669 --> 00:34:16,800
um we wouldn't have ever imagined it and

931
00:34:22,190 --> 00:34:19,679
it's a way also of thinking about and

932
00:34:26,270 --> 00:34:22,200
interpreting the the idiacrobiota I

933
00:34:28,849 --> 00:34:26,280
think wow that's cool so yes I mean

934
00:34:31,490 --> 00:34:28,859
the number of exoplanets also very very

935
00:34:33,349 --> 00:34:31,500
cool but

936
00:34:36,710 --> 00:34:33,359
um the sort of genetic pathway and

937
00:34:37,849 --> 00:34:36,720
common theme that's amazing absolutely I

938
00:34:39,530 --> 00:34:37,859

love that so much we are going to

939
00:34:41,629 --> 00:34:39,540
transition now to our audience questions

940
00:34:43,490 --> 00:34:41,639
so for those watching live on YouTube

941
00:34:45,230 --> 00:34:43,500
right now you can ask your questions in

942
00:34:47,389 --> 00:34:45,240
the chat we'll try to get as many as we

943
00:34:48,889 --> 00:34:47,399
can in the teleprompter I see we have a

944
00:34:50,089 --> 00:34:48,899
large number already

945
00:34:52,490 --> 00:34:50,099
um but we wanted to start with kind of a

946
00:34:55,070 --> 00:34:52,500
fun one so as a geologist I think any of

947
00:34:56,450 --> 00:34:55,080
us who've done any kind of geology at

948
00:34:59,150 --> 00:34:56,460
some point someone's going to walk up to

949
00:34:59,990 --> 00:34:59,160
you and say Here's a rock I found what

950
00:35:01,070 --> 00:35:00,000
is it

951
00:35:02,089 --> 00:35:01,080
um I've had this happen with family

952
00:35:04,070 --> 00:35:02,099
members with what they think our

953
00:35:05,630 --> 00:35:04,080
meteorites I've had people I don't even

954
00:35:08,030 --> 00:35:05,640
really know bring up rocks to me and say

955
00:35:09,890 --> 00:35:08,040
what is this and we had a user on

956
00:35:11,750 --> 00:35:09,900
Twitter reach out uh for our questions

957
00:35:14,210 --> 00:35:11,760
and they wanted to know if you could

958
00:35:16,790 --> 00:35:14,220
identify a fossil for them uh user

959
00:35:19,190 --> 00:35:16,800
Brindley Ash on Twitter said they found

960
00:35:20,450 --> 00:35:19,200
this fossil in north Alabama and I think

961
00:35:22,490 --> 00:35:20,460
we have a picture of it going up right

962
00:35:24,710 --> 00:35:22,500
now and their question for you is could

963
00:35:26,450 --> 00:35:24,720

you identify this this fossil from this

964
00:35:28,490 --> 00:35:26,460
image

965
00:35:31,250 --> 00:35:28,500
um so thank you Brindley I love this

966
00:35:34,430 --> 00:35:31,260
kind of thing so I I uh did take a peek

967
00:35:37,190 --> 00:35:34,440
and so my first thing to say is you know

968
00:35:38,510 --> 00:35:37,200
I'm not sure right this isn't like it's

969
00:35:40,849 --> 00:35:38,520
a trilobite

970
00:35:42,950 --> 00:35:40,859
um what it most reminds me of and what

971
00:35:46,670 --> 00:35:42,960
my first gut would be is that it's a

972
00:35:48,950 --> 00:35:46,680
cannulaired which is an extinct organism

973
00:35:51,470 --> 00:35:48,960
um that had four sides sort of like a

974
00:35:53,270 --> 00:35:51,480
four-sided pyramid but a cone

975
00:35:54,890 --> 00:35:53,280
um if I'm looking at it correctly it

976
00:35:56,690 --> 00:35:54,900
looks like it's sort of on Moss or

977
00:35:58,970 --> 00:35:56,700
something which gives me a scale of

978
00:36:01,430 --> 00:35:58,980
about that big which would be consistent

979
00:36:02,089 --> 00:36:01,440
with cannulerin

980
00:36:05,290 --> 00:36:02,099
um

981
00:36:07,910 --> 00:36:05,300
it looks like it has some pustule things

982
00:36:09,890 --> 00:36:07,920
around the edge not sure what they are

983
00:36:12,170 --> 00:36:09,900
Conyers we don't think had pustule

984
00:36:13,910 --> 00:36:12,180
things around the outside so I could be

985
00:36:15,290 --> 00:36:13,920
completely often at some part of a

986
00:36:18,109 --> 00:36:15,300
vertebrate

987
00:36:20,930 --> 00:36:18,119
um but that would be my my first Port of

988
00:36:23,270 --> 00:36:20,940

Call what what I would do in this and

989
00:36:25,370 --> 00:36:23,280
and if it's a conularity we they have

990
00:36:27,829 --> 00:36:25,380
phosphate plates and this doesn't appear

991
00:36:30,170 --> 00:36:27,839
to so then we take it the next step and

992
00:36:32,089 --> 00:36:30,180
say is it a mold or a cast like you

993
00:36:33,890 --> 00:36:32,099
would have a cast on your arm and so

994
00:36:35,510 --> 00:36:33,900
this would be the outside of a of a

995
00:36:36,890 --> 00:36:35,520
canola

996
00:36:38,930 --> 00:36:36,900
um you know we look to see what age

997
00:36:41,210 --> 00:36:38,940
rockets and do we have other specimens

998
00:36:43,370 --> 00:36:41,220
from there and so on but

999
00:36:46,970 --> 00:36:43,380
um thank you for this that would be my

1000
00:36:47,750 --> 00:36:46,980
my first my first uh gut on that I love

1001
00:36:52,670 --> 00:36:47,760
it

1002
00:36:53,750 --> 00:36:52,680
you have to do some work sometimes to

1003
00:36:56,030 --> 00:36:53,760
figure out exactly what you're holding

1004
00:36:57,410 --> 00:36:56,040
in your hand sample as well our next

1005
00:37:02,510 --> 00:36:57,420
question

1006
00:37:04,130 --> 00:37:02,520
from Jim pass on Twitter uh Jim has

1007
00:37:06,109 --> 00:37:04,140
first off a question that I think I can

1008
00:37:08,210 --> 00:37:06,119
handle here a little bit asking about

1009
00:37:09,230 --> 00:37:08,220
risks to humans over time for exploring

1010
00:37:10,730 --> 00:37:09,240
Mars

1011
00:37:12,530 --> 00:37:10,740
um assuming they might be viruses or

1012
00:37:14,150 --> 00:37:12,540
bacteria there and whether or not they

1013
00:37:16,609 --> 00:37:14,160

can hurt us and I think the immediate

1014
00:37:18,829 --> 00:37:16,619
answer is what we really don't know if

1015
00:37:20,510 --> 00:37:18,839
they have a different origin and lineage

1016
00:37:23,150 --> 00:37:20,520
than us then they're probably less

1017
00:37:24,950 --> 00:37:23,160
likely to actually be able to hurt us or

1018
00:37:26,569 --> 00:37:24,960
interact with us if they have the same

1019
00:37:28,250 --> 00:37:26,579
lineage though that actually could mean

1020
00:37:29,270 --> 00:37:28,260
that they have some potential to do some

1021
00:37:30,770 --> 00:37:29,280
harm

1022
00:37:32,089 --> 00:37:30,780
um but there's such a wide range of

1023
00:37:34,250 --> 00:37:32,099
possibility that we really don't know

1024
00:37:35,569 --> 00:37:34,260
however Jim has a second part to his

1025
00:37:37,370 --> 00:37:35,579
question that I think is actually kind

1026
00:37:39,349 --> 00:37:37,380
of interesting here he wants to know

1027
00:37:41,990 --> 00:37:39,359
what the status and roles for an astro

1028
00:37:43,790 --> 00:37:42,000
sociologist could could be

1029
00:37:45,710 --> 00:37:43,800
um in doing these kinds of missions and

1030
00:37:47,690 --> 00:37:45,720
given with the the nopina idiokura

1031
00:37:50,210 --> 00:37:47,700
national park you know it's not just

1032
00:37:52,550 --> 00:37:50,220
about the fossil bed it's also about the

1033
00:37:53,870 --> 00:37:52,560
people and the culture and the history I

1034
00:37:55,670 --> 00:37:53,880
wonder do you have a vision for how

1035
00:37:57,470 --> 00:37:55,680
sociologists fit into the work that

1036
00:37:59,210 --> 00:37:57,480
we're doing in astrobiology

1037
00:38:01,190 --> 00:37:59,220
oh I I think

1038
00:38:04,130 --> 00:38:01,200

um for many

1039
00:38:05,930 --> 00:38:04,140
in many different ways I would say in

1040
00:38:07,730 --> 00:38:05,940
terms of Neil Pina it is the traditional

1041
00:38:10,370 --> 00:38:07,740
lands of the adnanamatna people and that

1042
00:38:12,770 --> 00:38:10,380
is very very important to us and and and

1043
00:38:15,170 --> 00:38:12,780
will always be the traditional lands of

1044
00:38:16,370 --> 00:38:15,180
Vietnam people and I think that is

1045
00:38:18,710 --> 00:38:16,380
um

1046
00:38:20,569 --> 00:38:18,720
something that is important to us and

1047
00:38:23,089 --> 00:38:20,579
important for us to respect whether on

1048
00:38:26,450 --> 00:38:23,099
Earth or in fact on Mars

1049
00:38:28,910 --> 00:38:26,460
um in terms of uh working with people

1050
00:38:31,190 --> 00:38:28,920
you can't work on you can't work in

1051
00:38:32,630 --> 00:38:31,200
science without working with people and

1052
00:38:34,609 --> 00:38:32,640
understanding

1053
00:38:37,490 --> 00:38:34,619
um the culture either of the area where

1054
00:38:38,990 --> 00:38:37,500
you're doing field work or in fact

1055
00:38:41,630 --> 00:38:39,000
um you know asking the difficult

1056
00:38:43,849 --> 00:38:41,640
questions about you know

1057
00:38:45,410 --> 00:38:43,859
doing whether you're doing experiments

1058
00:38:47,930 --> 00:38:45,420
or going thinking about going to another

1059
00:38:49,130 --> 00:38:47,940
plan and of course we do we do worry

1060
00:38:51,410 --> 00:38:49,140
about that

1061
00:38:53,630 --> 00:38:51,420
um in terms of the impact of going to

1062
00:38:56,329 --> 00:38:53,640
another planet also on our own culture

1063
00:38:59,030 --> 00:38:56,339

so yes absolutely unequivocally

1064
00:39:02,270 --> 00:38:59,040
um astrobiology isn't just about science

1065
00:39:06,109 --> 00:39:02,280
it brings in all sorts of of disciplines

1066
00:39:08,690 --> 00:39:06,119
including sociology so yes absolutely

1067
00:39:11,150 --> 00:39:08,700
awesome uh we have two questions that

1068
00:39:13,790 --> 00:39:11,160
are fairly similar one from accelerator

1069
00:39:15,650 --> 00:39:13,800
712 on Twitter the other from Hilbert

1070
00:39:17,089 --> 00:39:15,660
Spectrum on Twitter

1071
00:39:18,589 --> 00:39:17,099
um the first one was what was earth's

1072
00:39:20,930 --> 00:39:18,599
ambient temperature during the early

1073
00:39:22,609 --> 00:39:20,940
formation of animal life but connected

1074
00:39:25,069 --> 00:39:22,619
to that is this other question of can

1075
00:39:26,930 --> 00:39:25,079
paleontology tell us about the history

1076
00:39:28,670 --> 00:39:26,940
of the environment and the environmental

1077
00:39:30,230 --> 00:39:28,680
history during periods like the

1078
00:39:32,870 --> 00:39:30,240
ediacaran when these things were

1079
00:39:35,329 --> 00:39:32,880
changing so much

1080
00:39:38,630 --> 00:39:35,339
um great questions so

1081
00:39:40,790 --> 00:39:38,640
um the Earth has had vastly different

1082
00:39:42,470 --> 00:39:40,800
climates than we do now when the

1083
00:39:44,750 --> 00:39:42,480
dinosaurs were around there were no

1084
00:39:46,490 --> 00:39:44,760
glaciers at the poles for example it's

1085
00:39:49,250 --> 00:39:46,500
been a lot lot colder and a lot lot

1086
00:39:50,990 --> 00:39:49,260
hotter and some of that evidence comes

1087
00:39:52,790 --> 00:39:51,000
from the fossil record and a lot of that

1088
00:39:56,569 --> 00:39:52,800

evidence comes from the geochemical

1089
00:39:59,569 --> 00:39:56,579
record that's preserved in rocks so in

1090
00:40:03,290 --> 00:39:59,579
terms of the ambient temperature when

1091
00:40:05,569 --> 00:40:03,300
the idiacrobiota were around the base of

1092
00:40:07,670 --> 00:40:05,579
the ediacran period is marked at the

1093
00:40:10,790 --> 00:40:07,680
base of what we at the end of what we

1094
00:40:13,310 --> 00:40:10,800
call snowball Earth which is

1095
00:40:15,410 --> 00:40:13,320
um the time we've evidenced that there

1096
00:40:17,750 --> 00:40:15,420
were glaciers actually down at the

1097
00:40:20,150 --> 00:40:17,760
equator and you know whether the Earth

1098
00:40:22,970 --> 00:40:20,160
was a snowballing completely covered in

1099
00:40:25,730 --> 00:40:22,980
snow and ice or whether it was more of a

1100
00:40:28,010 --> 00:40:25,740
slush fall and oceans were open we don't

1101
00:40:31,190 --> 00:40:28,020
know but that's a really different world

1102
00:40:35,170 --> 00:40:31,200
than we imagined today in terms of by

1103
00:40:37,010 --> 00:40:35,180
the time the idiacrobiota first appear

1104
00:40:39,650 --> 00:40:37,020
they lived in very different

1105
00:40:42,050 --> 00:40:39,660
environments and at different latitudes

1106
00:40:44,510 --> 00:40:42,060
so this is the oldest IDI acrobiota

1107
00:40:46,250 --> 00:40:44,520
lived in the deep sea not the ones at

1108
00:40:48,470 --> 00:40:46,260
nilpina but older than that that would

1109
00:40:49,930 --> 00:40:48,480
have been cold no matter what colder

1110
00:40:52,130 --> 00:40:49,940
than the shallow Parts

1111
00:40:55,010 --> 00:40:52,140
they spanned

1112
00:40:57,770 --> 00:40:55,020
certainly from the equator to well into

1113
00:40:59,569 --> 00:40:57,780

the higher latitude so the idiacrobiota

1114
00:41:01,970 --> 00:40:59,579
would have experienced a lot of

1115
00:41:03,829 --> 00:41:01,980
different different temperatures but we

1116
00:41:05,750 --> 00:41:03,839
were past

1117
00:41:07,970 --> 00:41:05,760
um past snowballers and in fact they

1118
00:41:10,550 --> 00:41:07,980
first appear after a second sort of

1119
00:41:12,470 --> 00:41:10,560
glaciation so I don't think they would

1120
00:41:14,390 --> 00:41:12,480
have they weren't around during times of

1121
00:41:17,210 --> 00:41:14,400
glaciation but

1122
00:41:19,130 --> 00:41:17,220
um the fossil record is is one of the

1123
00:41:22,670 --> 00:41:19,140
greatest insights into understanding

1124
00:41:25,490 --> 00:41:22,680
past climate change which helps us of

1125
00:41:28,370 --> 00:41:25,500
course understand and constrain future

1126
00:41:30,950 --> 00:41:28,380
climate change and and understanding the

1127
00:41:33,950 --> 00:41:30,960
past and how organisms responded to past

1128
00:41:37,490 --> 00:41:33,960
climate change informs future climate

1129
00:41:39,829 --> 00:41:37,500
change so great questions awesome uh

1130
00:41:41,210 --> 00:41:39,839
Larry Ryan on Twitter has asked what

1131
00:41:44,030 --> 00:41:41,220
your your most revealing or maybe

1132
00:41:46,790 --> 00:41:44,040
favorite Discovery has been so far

1133
00:41:49,430 --> 00:41:46,800
oof so many

1134
00:41:51,230 --> 00:41:49,440
um I I have to go back to sort of the

1135
00:41:52,370 --> 00:41:51,240
scientists rarely have light bulb

1136
00:41:54,050 --> 00:41:52,380
moments

1137
00:41:55,730 --> 00:41:54,060
um even when I uncover a new body plan

1138
00:41:57,530 --> 00:41:55,740

we're like yeah is that really a new

1139
00:42:00,109 --> 00:41:57,540
body plan or what is that so we've had

1140
00:42:01,910 --> 00:42:00,119
the excitement of discovering new body

1141
00:42:03,770 --> 00:42:01,920
plans and fossils some of which we're

1142
00:42:07,670 --> 00:42:03,780
still discovering

1143
00:42:10,970 --> 00:42:07,680
um one of my most favorite moments was

1144
00:42:12,710 --> 00:42:10,980
um actually I had two different

1145
00:42:15,530 --> 00:42:12,720
um fossils that I was trying to figure

1146
00:42:17,930 --> 00:42:15,540
out and I just didn't understand them um

1147
00:42:20,030 --> 00:42:17,940
and and literally having a light bulb

1148
00:42:21,710 --> 00:42:20,040
moment with a particular slab of rocks

1149
00:42:23,870 --> 00:42:21,720
when I could put them together and

1150
00:42:24,950 --> 00:42:23,880
realized one was the hold fast of the

1151
00:42:26,510 --> 00:42:24,960
other

1152
00:42:27,950 --> 00:42:26,520
um so you know the sort of root of the

1153
00:42:31,490 --> 00:42:27,960
other and this ultimately became

1154
00:42:34,490 --> 00:42:31,500
phenicia and we found lots and lots of

1155
00:42:36,710 --> 00:42:34,500
similar sized hold fests together

1156
00:42:38,329 --> 00:42:36,720
um with these similar sized phenicias so

1157
00:42:40,130 --> 00:42:38,339
that told us a lot about the

1158
00:42:42,650 --> 00:42:40,140
reproduction I'm going to make this long

1159
00:42:44,450 --> 00:42:42,660
story very short but basically evidence

1160
00:42:47,270 --> 00:42:44,460
of sexual reproduction

1161
00:42:48,890 --> 00:42:47,280
and so it was our oldest sort of pretty

1162
00:42:50,750 --> 00:42:48,900
definitive evidence of sexual

1163
00:42:53,030 --> 00:42:50,760

reproduction in animals

1164
00:42:54,890 --> 00:42:53,040
um that was really exciting and um led

1165
00:42:57,710 --> 00:42:54,900
to some very

1166
00:42:59,990 --> 00:42:57,720
um fun and sort of crazy media after

1167
00:43:01,430 --> 00:43:00,000
that um and you can imagine sort of the

1168
00:43:04,130 --> 00:43:01,440
roads in which um different

1169
00:43:07,190 --> 00:43:04,140
organizations picked that up but um that

1170
00:43:08,750 --> 00:43:07,200
was that was really a fun literal light

1171
00:43:10,430 --> 00:43:08,760
bulb moment of oh my gosh these two

1172
00:43:12,589 --> 00:43:10,440
parts go to the same animal that was

1173
00:43:14,870 --> 00:43:12,599
great that's awesome yeah and like the

1174
00:43:17,210 --> 00:43:14,880
the evolution of sexual reproduction

1175
00:43:19,490 --> 00:43:17,220
this ability for for organisms to swap

1176
00:43:22,069 --> 00:43:19,500
genes together like that allows for so

1177
00:43:23,750 --> 00:43:22,079
much more biodiversity and so much more

1178
00:43:26,390 --> 00:43:23,760
potential for evolutionists that's a

1179
00:43:28,910 --> 00:43:26,400
very huge moment I love that so much

1180
00:43:30,950 --> 00:43:28,920
uh we have uh user Jared Brunk on

1181
00:43:33,109 --> 00:43:30,960
Twitter wants to know first about Europa

1182
00:43:34,910 --> 00:43:33,119
Clipper and possibly finding life and

1183
00:43:37,910 --> 00:43:34,920
then also uh what you think about

1184
00:43:39,470 --> 00:43:37,920
europans in the Europa ocean possibly

1185
00:43:41,690 --> 00:43:39,480
being anything similar to what we've

1186
00:43:43,250 --> 00:43:41,700
seen here for the animal life on Earth

1187
00:43:45,109 --> 00:43:43,260
um I will personally start off by saying

1188
00:43:46,910 --> 00:43:45,119

that Europa Clipper is a wonderful

1189
00:43:49,130 --> 00:43:46,920
Mission it not it's not going to be

1190
00:43:51,170 --> 00:43:49,140
looking into the ocean of Europa

1191
00:43:52,670 --> 00:43:51,180
directly uh it'll be monitoring the

1192
00:43:54,050 --> 00:43:52,680
Surface by orbiting around Jupiter and

1193
00:43:55,910 --> 00:43:54,060
Europa together giving us an

1194
00:43:57,410 --> 00:43:55,920
understanding of the chemistry of the

1195
00:43:59,210 --> 00:43:57,420
surface helping us to understand the

1196
00:44:00,650 --> 00:43:59,220
depth of the ocean

1197
00:44:02,270 --> 00:44:00,660
um it might have a chance of sampling

1198
00:44:03,650 --> 00:44:02,280
some fluid if there are plumes coming

1199
00:44:06,290 --> 00:44:03,660
out of Europa we don't know if there's

1200
00:44:07,970 --> 00:44:06,300
there there yet or not for sure

1201
00:44:10,849 --> 00:44:07,980
um but it's not going to immediately be

1202
00:44:12,170 --> 00:44:10,859
testing the ocean however Dr duroser

1203
00:44:14,089 --> 00:44:12,180
what do you think of this possibility

1204
00:44:16,609 --> 00:44:14,099
for there to be a europan biosphere

1205
00:44:18,770 --> 00:44:16,619
anything like Earth's yeah I'm very

1206
00:44:20,569 --> 00:44:18,780
excited about the Europa mission um

1207
00:44:22,190 --> 00:44:20,579
because of course you know we think icy

1208
00:44:24,050 --> 00:44:22,200
world's Ocean World we're an ocean world

1209
00:44:26,329 --> 00:44:24,060
we have ocean life as far as we know

1210
00:44:29,690 --> 00:44:26,339
originated in the ocean so I'm very

1211
00:44:31,430 --> 00:44:29,700
excited and you know I think what what

1212
00:44:33,230 --> 00:44:31,440
we're trying to do there and the same

1213
00:44:35,809 --> 00:44:33,240

thing that we do when we go back in time

1214
00:44:37,490 --> 00:44:35,819
is constrain the environment was this an

1215
00:44:39,170 --> 00:44:37,500
environment that might have been

1216
00:44:40,790 --> 00:44:39,180
suitable for life and I think we'll get

1217
00:44:42,710 --> 00:44:40,800
a lot of those answers from this Mission

1218
00:44:45,290 --> 00:44:42,720
not necessarily hey there's a

1219
00:44:48,050 --> 00:44:45,300
dickinsonia on the sea floor

1220
00:44:49,910 --> 00:44:48,060
um in terms of what might be there or a

1221
00:44:51,950 --> 00:44:49,920
way to find life

1222
00:44:54,290 --> 00:44:51,960
um I think we're

1223
00:44:55,910 --> 00:44:54,300
you know if people ask me about oh are

1224
00:44:57,589 --> 00:44:55,920
you going to find ediograph fossils on

1225
00:44:59,329 --> 00:44:57,599
other planets and my answer to that is

1226
00:45:02,150 --> 00:44:59,339
you know no I don't think we will

1227
00:45:03,950 --> 00:45:02,160
because Evolution would by chance or

1228
00:45:05,690 --> 00:45:03,960
different conditions take a different

1229
00:45:08,270 --> 00:45:05,700
pathway

1230
00:45:10,190 --> 00:45:08,280
um so we might find life there um we

1231
00:45:12,589 --> 00:45:10,200
might find microbial life a very very

1232
00:45:14,990 --> 00:45:12,599
simple life but it's understanding the

1233
00:45:17,630 --> 00:45:15,000
chemical and biological processes that

1234
00:45:19,010 --> 00:45:17,640
might give us that life that that I

1235
00:45:20,690 --> 00:45:19,020
think is really interesting and that

1236
00:45:22,849 --> 00:45:20,700
that we're going for I'd love to find a

1237
00:45:24,349 --> 00:45:22,859
needy Akron fossil on the sea floor of

1238
00:45:25,670 --> 00:45:24,359

Europa

1239
00:45:27,170 --> 00:45:25,680
um pretty sure that's not going to

1240
00:45:29,210 --> 00:45:27,180
happen but it would kind of be a big day

1241
00:45:30,250 --> 00:45:29,220
for me yeah I think it'd be a big day

1242
00:45:32,809 --> 00:45:30,260
for all of us

1243
00:45:35,150 --> 00:45:32,819
yeah it would be a big day any life

1244
00:45:36,710 --> 00:45:35,160
would be a big day absolutely so coming

1245
00:45:38,870 --> 00:45:36,720
back to Earth now we kind of mentioned

1246
00:45:40,430 --> 00:45:38,880
this idea of of understanding some of

1247
00:45:42,890 --> 00:45:40,440
the Earth's uh environmental record

1248
00:45:44,690 --> 00:45:42,900
temperature record through paleontology

1249
00:45:46,309 --> 00:45:44,700
we have two fairly similar questions we

1250
00:45:48,950 --> 00:45:46,319
have one from rendering reality 3D

1251
00:45:50,990 --> 00:45:48,960
animations on YouTube asking about the

1252
00:45:53,390 --> 00:45:51,000
chemistry of the sea water during the

1253
00:45:56,030 --> 00:45:53,400
idiacaran but then we also have user SL

1254
00:45:58,490 --> 00:45:56,040
on YouTube has said uh they're at UC

1255
00:46:00,109 --> 00:45:58,500
Berkeley biology major planetary science

1256
00:46:01,730 --> 00:46:00,119
minor

1257
00:46:03,410 --> 00:46:01,740
um and they want to know if the edacaran

1258
00:46:06,349 --> 00:46:03,420
correlated with the Cambrian explosion

1259
00:46:08,089 --> 00:46:06,359
Cambrian radiation and the goe which we

1260
00:46:09,950 --> 00:46:08,099
kind of discussed already can you kind

1261
00:46:12,530 --> 00:46:09,960
of give us a vision then of kind of the

1262
00:46:15,109 --> 00:46:12,540
understanding of Earth's changes leading

1263
00:46:16,190 --> 00:46:15,119

through to the E Akron period yeah okay

1264
00:46:20,450 --> 00:46:16,200
so

1265
00:46:22,370 --> 00:46:20,460
years ago and that's the great

1266
00:46:24,650 --> 00:46:22,380
oxygenation event and it's the first

1267
00:46:27,650 --> 00:46:24,660
timer we really sort of reach high

1268
00:46:31,130 --> 00:46:27,660
levels of oxygen and and or higher

1269
00:46:33,670 --> 00:46:31,140
levels of oxygen and between then and

1270
00:46:37,069 --> 00:46:33,680
the um sort of when we see the

1271
00:46:39,829 --> 00:46:37,079
idiacrabiota oxygen changed a lot and

1272
00:46:42,290 --> 00:46:39,839
and shifted um and there are many people

1273
00:46:44,210 --> 00:46:42,300
who are trying to really pull apart and

1274
00:46:47,089 --> 00:46:44,220
tease apart the history of oxygen during

1275
00:46:49,130 --> 00:46:47,099
that time and how it relates to say the

1276
00:46:51,710 --> 00:46:49,140
first appearance of eukaryotes which

1277
00:46:55,910 --> 00:46:51,720
would is a very big event obviously

1278
00:46:58,849 --> 00:46:55,920
um in terms of uh sort of the sea water

1279
00:46:59,870 --> 00:46:58,859
during the idiacran as as we come up to

1280
00:47:03,349 --> 00:46:59,880
it

1281
00:47:05,089 --> 00:47:03,359
um the big the big part of the chemistry

1282
00:47:06,410 --> 00:47:05,099
of the sea water we're interested in is

1283
00:47:08,089 --> 00:47:06,420
the oxygen

1284
00:47:10,130 --> 00:47:08,099
um and as I mentioned earlier organisms

1285
00:47:11,870 --> 00:47:10,140
need oxygen the idiacrobiota would have

1286
00:47:13,910 --> 00:47:11,880
needed oxygen

1287
00:47:15,470 --> 00:47:13,920
um there's a lot of evidence that oxygen

1288
00:47:17,390 --> 00:47:15,480

increased

1289
00:47:19,730 --> 00:47:17,400
um right before the Advent of the

1290
00:47:21,109 --> 00:47:19,740
ediacrobiota and I think we're not

1291
00:47:23,569 --> 00:47:21,119
surprised about that and we think that

1292
00:47:25,730 --> 00:47:23,579
that was a factor and that even the

1293
00:47:28,790 --> 00:47:25,740
history of the idiacrobiota was tied to

1294
00:47:31,550 --> 00:47:28,800
changing oxygen levels in the ediacran

1295
00:47:34,010 --> 00:47:31,560
um and we we tease apart the the oxygen

1296
00:47:35,870 --> 00:47:34,020
from geochemical proxies that give us an

1297
00:47:36,470 --> 00:47:35,880
idea of this

1298
00:47:38,569 --> 00:47:36,480
um

1299
00:47:41,270 --> 00:47:38,579
and the but the Cambrian radiation

1300
00:47:45,230 --> 00:47:41,280
happened after the ediacran period um

1301
00:47:47,990 --> 00:47:45,240
and after the ediacrobiota uh many of

1302
00:47:49,970 --> 00:47:48,000
which would have been extinct before the

1303
00:47:51,470 --> 00:47:49,980
sort of Cambrian radiation from my

1304
00:47:53,930 --> 00:47:51,480
perspective

1305
00:47:56,210 --> 00:47:53,940
um I think of the ediacran is just the

1306
00:47:58,130 --> 00:47:56,220
beginning the the sort of fuse that led

1307
00:48:00,470 --> 00:47:58,140
to the Cambrian radiation and that there

1308
00:48:02,390 --> 00:48:00,480
were extinctions within that but it was

1309
00:48:04,309 --> 00:48:02,400
one continuous

1310
00:48:06,470 --> 00:48:04,319
um sort of radiation my husband works on

1311
00:48:09,170 --> 00:48:06,480
the Cambrian he's you know he likes to

1312
00:48:11,089 --> 00:48:09,180
think the action was in the Cameron but

1313
00:48:13,750 --> 00:48:11,099

um but I think of it as really much more

1314
00:48:16,970 --> 00:48:13,760
of a continuous radiation of animals

1315
00:48:19,849 --> 00:48:16,980
that was with a backdrop of very

1316
00:48:22,910 --> 00:48:19,859
dramatic changing conditions on Earth

1317
00:48:24,470 --> 00:48:22,920
many of which had to do with oxygen some

1318
00:48:26,510 --> 00:48:24,480
of which had to do with physical changes

1319
00:48:28,870 --> 00:48:26,520
like sea level change

1320
00:48:31,970 --> 00:48:28,880
um the Advent changing biochemistry

1321
00:48:34,490 --> 00:48:31,980
Advent of skeletonizers and what that

1322
00:48:36,470 --> 00:48:34,500
does to Ocean geochemistry so lots of

1323
00:48:37,910 --> 00:48:36,480
changes um going on during this time

1324
00:48:40,730 --> 00:48:37,920
great questions

1325
00:48:42,890 --> 00:48:40,740
awesome uh user Blue List on YouTube

1326
00:48:43,910 --> 00:48:42,900
first off they're a geology student and

1327
00:48:45,710 --> 00:48:43,920
said that they love the idea of

1328
00:48:47,510 --> 00:48:45,720
Exploring Life and rock interactions so

1329
00:48:50,030 --> 00:48:47,520
yeah geology

1330
00:48:51,410 --> 00:48:50,040
um how important are microfossils for

1331
00:48:56,210 --> 00:48:51,420
astrobiology

1332
00:48:58,370 --> 00:48:56,220
oh huge huge I mean microfossils are how

1333
00:49:00,829 --> 00:48:58,380
we understand

1334
00:49:02,870 --> 00:49:00,839
um life before we get multi you know

1335
00:49:04,370 --> 00:49:02,880
before we get like the IDI acrobiota and

1336
00:49:07,250 --> 00:49:04,380
multicellular

1337
00:49:10,069 --> 00:49:07,260
um algae that we can see so to be honest

1338
00:49:11,630 --> 00:49:10,079

for most of our record it is the record

1339
00:49:14,569 --> 00:49:11,640
of microfossils whether they're

1340
00:49:17,950 --> 00:49:14,579
microfossils of eukaryotes or micro

1341
00:49:22,370 --> 00:49:17,960
fossils of prokaryotes so hugely

1342
00:49:25,910 --> 00:49:22,380
important aspect of our understanding of

1343
00:49:28,010 --> 00:49:25,920
um life as it evolved on our planet we

1344
00:49:29,569 --> 00:49:28,020
need to understand our planet first I

1345
00:49:31,970 --> 00:49:29,579
mean we have a record we can understand

1346
00:49:33,530 --> 00:49:31,980
it and microfossils play a very very

1347
00:49:36,890 --> 00:49:33,540
important role in that

1348
00:49:38,329 --> 00:49:36,900
absolutely we have another two very

1349
00:49:40,849 --> 00:49:38,339
similar questions I'm gonna bring them

1350
00:49:42,109 --> 00:49:40,859
together first off Sean M on YouTube

1351
00:49:44,329 --> 00:49:42,119
wanted to know if there was any

1352
00:49:46,069 --> 00:49:44,339
indication you've seen so far for the

1353
00:49:49,190 --> 00:49:46,079
IDI Akron um that there were the right

1354
00:49:50,930 --> 00:49:49,200
conditions for evolution were localized

1355
00:49:52,910 --> 00:49:50,940
kind of to the regions we've seen so far

1356
00:49:55,690 --> 00:49:52,920
or if we think what was happening during

1357
00:49:58,430 --> 00:49:55,700
the idiacran really was planetary scale

1358
00:50:01,550 --> 00:49:58,440
and then connected to that is arunov

1359
00:50:02,809 --> 00:50:01,560
upadar who has been a past researcher

1360
00:50:05,030 --> 00:50:02,819
with Blue Marble space Institute of

1361
00:50:08,510 --> 00:50:05,040
science is currently a graduate student

1362
00:50:10,970 --> 00:50:08,520
in zwalbard so he's made a big move from

1363
00:50:12,530 --> 00:50:10,980

India to the high Arctic and he wants to

1364
00:50:15,290 --> 00:50:12,540
know if IDI Akron fossils have been

1365
00:50:17,089 --> 00:50:15,300
found in the Arctic and if so are they

1366
00:50:18,530 --> 00:50:17,099
different from places in lower latitudes

1367
00:50:20,690 --> 00:50:18,540
and so I think those two questions kind

1368
00:50:22,550 --> 00:50:20,700
of merge well together how what was the

1369
00:50:23,990 --> 00:50:22,560
global extent of the IDI Akron to our

1370
00:50:25,970 --> 00:50:24,000
knowledge

1371
00:50:27,130 --> 00:50:25,980
um so as far as we know they were

1372
00:50:31,970 --> 00:50:27,140
globally

1373
00:50:33,770 --> 00:50:31,980
organisms so right off the bat you're

1374
00:50:35,990 --> 00:50:33,780
trying to preserve soft-bodied organisms

1375
00:50:37,430 --> 00:50:36,000
in the fossil record that's hard there

1376
00:50:40,309 --> 00:50:37,440
were a number of conditions in the

1377
00:50:42,170 --> 00:50:40,319
ediacran that led to

1378
00:50:43,970 --> 00:50:42,180
um ways in which it was easier to

1379
00:50:45,589 --> 00:50:43,980
preserve soft-bodied fossils than than

1380
00:50:47,569 --> 00:50:45,599
it is now

1381
00:50:49,910 --> 00:50:47,579
um but the same fossils that we found

1382
00:50:52,370 --> 00:50:49,920
many of the same fossils that we find at

1383
00:50:54,589 --> 00:50:52,380
nilpina are found say in the White Sea

1384
00:50:57,770 --> 00:50:54,599
of Russia and even when you reconstruct

1385
00:51:00,650 --> 00:50:57,780
paleo tectonics that they were not close

1386
00:51:03,530 --> 00:51:00,660
together so that's we think they were

1387
00:51:06,410 --> 00:51:03,540
pretty Global and that it is a function

1388
00:51:08,329 --> 00:51:06,420

of the rock record and the the right

1389
00:51:11,569 --> 00:51:08,339
environments of the time and then

1390
00:51:14,390 --> 00:51:11,579
preserving those rocks um now over half

1391
00:51:17,030 --> 00:51:14,400
a billion years later we do have a high

1392
00:51:20,030 --> 00:51:17,040
level of my city so there were some

1393
00:51:21,589 --> 00:51:20,040
things that were very local

1394
00:51:22,970 --> 00:51:21,599
um but we have other tax even at the

1395
00:51:24,829 --> 00:51:22,980
species level that were all over the

1396
00:51:28,250 --> 00:51:24,839
place things

1397
00:51:31,010 --> 00:51:28,260
um in terms of ediacran fossils at the

1398
00:51:34,190 --> 00:51:31,020
Arctic and the Arctic at the time

1399
00:51:36,230 --> 00:51:34,200
um we don't have evidence of that

1400
00:51:38,030 --> 00:51:36,240
um because we don't have fossils from

1401
00:51:40,430 --> 00:51:38,040
places we don't have rocks from places

1402
00:51:43,309 --> 00:51:40,440
that were actually at the poles during

1403
00:51:45,890 --> 00:51:43,319
the ediacran um so again that comes back

1404
00:51:47,870 --> 00:51:45,900
to the Rock record

1405
00:51:50,329 --> 00:51:47,880
um we do find we have a handful of

1406
00:51:52,730 --> 00:51:50,339
really good localities of ediacran

1407
00:51:54,950 --> 00:51:52,740
fossils but we have

1408
00:51:56,630 --> 00:51:54,960
um scraps then that's not a very nice

1409
00:51:58,970 --> 00:51:56,640
word to say about fossils but bits and

1410
00:52:01,190 --> 00:51:58,980
pieces of fossils at a lot of localities

1411
00:52:03,290 --> 00:52:01,200
around the world and that helps us

1412
00:52:05,510 --> 00:52:03,300
understand their distribution even if we

1413
00:52:08,150 --> 00:52:05,520

find you know a single part of one that

1414
00:52:10,130 --> 00:52:08,160
we can identify that still puts an

1415
00:52:12,950 --> 00:52:10,140
ediacran fossil there

1416
00:52:14,510 --> 00:52:12,960
so also great questions yeah I think for

1417
00:52:16,250 --> 00:52:14,520
arunova it could help to go online too

1418
00:52:18,530 --> 00:52:16,260
just look at how the continents

1419
00:52:20,270 --> 00:52:18,540
themselves have moved over time and

1420
00:52:21,829 --> 00:52:20,280
where Continental things were at at that

1421
00:52:23,030 --> 00:52:21,839
period of time as well it might help you

1422
00:52:25,970 --> 00:52:23,040
envision then kind of what the world

1423
00:52:28,130 --> 00:52:25,980
looked like at that period of time

1424
00:52:30,109 --> 00:52:28,140
we have a question from user AC on

1425
00:52:31,790 --> 00:52:30,119
YouTube they want to know and I guess

1426
00:52:33,530 --> 00:52:31,800
this is kind of going into genetics now

1427
00:52:35,750 --> 00:52:33,540
if we can connect the genetics to the

1428
00:52:37,849 --> 00:52:35,760
fossils they want to know how body plans

1429
00:52:39,290 --> 00:52:37,859
of organisms evolved along with the

1430
00:52:40,970 --> 00:52:39,300
genetics as controlled by things like

1431
00:52:42,349 --> 00:52:40,980
Hawks genes

1432
00:52:44,690 --> 00:52:42,359
um in your work and in your

1433
00:52:46,430 --> 00:52:44,700
collaborations do we have good ways to

1434
00:52:48,349 --> 00:52:46,440
tie our knowledge of of the the

1435
00:52:50,510 --> 00:52:48,359
genotypes of organisms and changes in

1436
00:52:52,549 --> 00:52:50,520
genetics to the microfossils that we

1437
00:52:57,349 --> 00:52:52,559
found

1438
00:52:59,630 --> 00:52:57,359

um so uh yes what I'd say is you know

1439
00:53:01,490 --> 00:52:59,640
one of the things that that we can do

1440
00:53:03,410 --> 00:53:01,500
with IDI acrobiota and one of the the

1441
00:53:05,930 --> 00:53:03,420
ways that we're starting to think about

1442
00:53:09,170 --> 00:53:05,940
it is

1443
00:53:11,270 --> 00:53:09,180
um what can we say about these organisms

1444
00:53:13,010 --> 00:53:11,280
were they bilaterally symmetrical could

1445
00:53:15,829 --> 00:53:13,020
they move

1446
00:53:18,770 --> 00:53:15,839
um and what does it take to do that how

1447
00:53:21,170 --> 00:53:18,780
did they eat for example and so what are

1448
00:53:23,750 --> 00:53:21,180
the genes that are required in Mobility

1449
00:53:26,750 --> 00:53:23,760
what are the genes that are required in

1450
00:53:29,390 --> 00:53:26,760
having a nervous system that tells you

1451
00:53:31,549 --> 00:53:29,400
to move you know go after ah there's

1452
00:53:34,069 --> 00:53:31,559
good mat over there and to go after that

1453
00:53:35,150 --> 00:53:34,079
or go after a dead animal so in that

1454
00:53:37,309 --> 00:53:35,160
sense

1455
00:53:41,450 --> 00:53:37,319
um yeah we're starting to do that sort

1456
00:53:43,790 --> 00:53:41,460
of Evo Devo work with certain types of

1457
00:53:47,150 --> 00:53:43,800
of Arts with certain taxa that we have

1458
00:53:49,010 --> 00:53:47,160
in order to sort of we understand them

1459
00:53:51,470 --> 00:53:49,020
better looking at them from this

1460
00:53:53,150 --> 00:53:51,480
perspective as well as well as

1461
00:53:54,950 --> 00:53:53,160
understanding where they fit in the tree

1462
00:53:57,829 --> 00:53:54,960
of life can we constrain it was it a

1463
00:54:00,589 --> 00:53:57,839

true animal was it a EU medicine was it

1464
00:54:03,230 --> 00:54:00,599
you know do we have any idea and so I

1465
00:54:05,630 --> 00:54:03,240
think it's it's we're never gonna know

1466
00:54:08,510 --> 00:54:05,640
but I think by using what we understand

1467
00:54:10,130 --> 00:54:08,520
about modern Evo Devo we can then start

1468
00:54:12,470 --> 00:54:10,140
to think about these questions for the

1469
00:54:14,930 --> 00:54:12,480
80 acrobiota which I think is a really

1470
00:54:17,450 --> 00:54:14,940
important Way Forward in understanding

1471
00:54:20,030 --> 00:54:17,460
how they fit and how these crazy body

1472
00:54:21,230 --> 00:54:20,040
plans that don't look familiar fit on

1473
00:54:24,109 --> 00:54:21,240
the tree of life

1474
00:54:26,870 --> 00:54:24,119
wonderful user AC similarly had a

1475
00:54:27,770 --> 00:54:26,880
question of what determines body plan

1476
00:54:28,970 --> 00:54:27,780
um and that is an interesting question

1477
00:54:30,589 --> 00:54:28,980
that connects to exactly what you just

1478
00:54:32,150 --> 00:54:30,599
said kind of connecting to you know

1479
00:54:33,770 --> 00:54:32,160
Evolution development and connecting to

1480
00:54:36,290 --> 00:54:33,780
our genes but then we have this like

1481
00:54:39,049 --> 00:54:36,300
this change in body plan and so I want

1482
00:54:41,270 --> 00:54:39,059
to expand that a little bit and and kind

1483
00:54:42,829 --> 00:54:41,280
of again speculate about possible alien

1484
00:54:44,329 --> 00:54:42,839
life out there

1485
00:54:46,730 --> 00:54:44,339
um do you think we'll have similar body

1486
00:54:48,410 --> 00:54:46,740
plans to what happened here or does some

1487
00:54:50,569 --> 00:54:48,420
of the things you found so far from the

1488
00:54:52,970 --> 00:54:50,579

IDI Akron suggest that there could have

1489
00:54:58,309 --> 00:54:52,980
been much different body plans leading

1490
00:55:02,750 --> 00:55:00,770
what I'd say about the EDI Akron is we

1491
00:55:06,049 --> 00:55:02,760
look at different body plans but in a

1492
00:55:08,450 --> 00:55:06,059
way they're all variation on a theme

1493
00:55:11,030 --> 00:55:08,460
um so going back to Mobility you know if

1494
00:55:12,349 --> 00:55:11,040
you move you have to have certain

1495
00:55:13,490 --> 00:55:12,359
constraints

1496
00:55:15,650 --> 00:55:13,500
um you know where bilaterally

1497
00:55:16,849 --> 00:55:15,660
symmetrical which helps us move and so

1498
00:55:19,430 --> 00:55:16,859
on

1499
00:55:21,230 --> 00:55:19,440
um we have body plans in the ediacran

1500
00:55:23,990 --> 00:55:21,240
that we don't have today that are you

1501
00:55:26,150 --> 00:55:24,000
know we have tri-radial symmetry right

1502
00:55:28,490 --> 00:55:26,160
which is there's nothing today that's

1503
00:55:30,470 --> 00:55:28,500
tri-radial and people will get a bunch

1504
00:55:32,150 --> 00:55:30,480
of replies and they'll say oh but I

1505
00:55:34,670 --> 00:55:32,160
found this and it's tri-rated but really

1506
00:55:36,470 --> 00:55:34,680
genuine tri-radial body plan we have a

1507
00:55:39,890 --> 00:55:36,480
pile of things that have tri-radial

1508
00:55:42,349 --> 00:55:39,900
symmetry that is an extinct body plan

1509
00:55:44,450 --> 00:55:42,359
um but it is an organism that sat on the

1510
00:55:46,970 --> 00:55:44,460
sea floor and probably suspension fed

1511
00:55:47,750 --> 00:55:46,980
and and whatnot so I think

1512
00:55:50,630 --> 00:55:47,760
um

1513
00:55:52,849 --> 00:55:50,640

there's I think it's sort of both ways

1514
00:55:55,309 --> 00:55:52,859
if there are certain constraints that we

1515
00:55:57,770 --> 00:55:55,319
have in terms of doing animals doing

1516
00:55:59,569 --> 00:55:57,780
certain things on the other hand

1517
00:56:01,910 --> 00:55:59,579
um we have

1518
00:56:04,370 --> 00:56:01,920
pretty significant body plans that are

1519
00:56:05,750 --> 00:56:04,380
no longer around today so maybe we'll go

1520
00:56:08,450 --> 00:56:05,760
to another planet and find something

1521
00:56:11,950 --> 00:56:08,460
with very very different symmetry

1522
00:56:14,030 --> 00:56:11,960
um and so on so I'm very open-minded

1523
00:56:15,589 --> 00:56:14,040
yeah I think you have to be when you see

1524
00:56:18,410 --> 00:56:15,599
all these weird things that life was

1525
00:56:20,690 --> 00:56:18,420
doing and what could be possible

1526
00:56:22,370 --> 00:56:20,700
um it's so fun to think about I will ask

1527
00:56:23,390 --> 00:56:22,380
one more question from the audience this

1528
00:56:25,849 --> 00:56:23,400
comes from one of our production

1529
00:56:27,349 --> 00:56:25,859
assistants Anna root mohanty anaroop

1530
00:56:29,990 --> 00:56:27,359
wants to know why paleontologists and

1531
00:56:32,270 --> 00:56:30,000
geologists like ourselves Define time

1532
00:56:34,670 --> 00:56:32,280
looking back in millions or billions of

1533
00:56:36,890 --> 00:56:34,680
years ago I guess as opposed to like you

1534
00:56:38,150 --> 00:56:36,900
know years from the beginning

1535
00:56:40,010 --> 00:56:38,160
um and won't that scale make things

1536
00:56:41,650 --> 00:56:40,020
tricky for geologists millions of years

1537
00:56:43,609 --> 00:56:41,660
from now

1538
00:56:46,849 --> 00:56:43,619

great question

1539
00:56:49,549 --> 00:56:46,859
um yeah I mean I think it's it it's how

1540
00:56:50,690 --> 00:56:49,559
we communicate right so now is what we

1541
00:56:52,970 --> 00:56:50,700
know

1542
00:56:55,069 --> 00:56:52,980
um and of course as we have gotten

1543
00:56:57,349 --> 00:56:55,079
better and better over the history of

1544
00:56:59,450 --> 00:56:57,359
geology right going back 200 years when

1545
00:57:01,430 --> 00:56:59,460
we didn't know how old the Earth was the

1546
00:57:02,809 --> 00:57:01,440
logical place is to start now and look

1547
00:57:04,910 --> 00:57:02,819
back

1548
00:57:07,970 --> 00:57:04,920
um and and it's so it's both a way of

1549
00:57:08,589 --> 00:57:07,980
communicating as well as just

1550
00:57:11,089 --> 00:57:08,599
um

1551
00:57:14,690 --> 00:57:11,099
showing our under our increasing

1552
00:57:17,329 --> 00:57:14,700
understanding of geologic time and how

1553
00:57:18,589 --> 00:57:17,339
old the Earth is and how we have learned

1554
00:57:20,750 --> 00:57:18,599
that

1555
00:57:22,670 --> 00:57:20,760
um I look forward to geologists millions

1556
00:57:24,650 --> 00:57:22,680
of years having trouble with this issue

1557
00:57:25,490 --> 00:57:24,660
I think that would be a great problem to

1558
00:57:28,670 --> 00:57:25,500
have

1559
00:57:31,270 --> 00:57:28,680
um yeah yeah I'm hoping that there are

1560
00:57:33,049 --> 00:57:31,280
geologists millions of years from now

1561
00:57:34,549 --> 00:57:33,059
yeah

1562
00:57:36,530 --> 00:57:34,559
um so you know for our audience who are

1563
00:57:38,750 --> 00:57:36,540

watching you know with Dr Mary jeruser

1564
00:57:40,430 --> 00:57:38,760
here we talked about the idiacaran

1565
00:57:42,170 --> 00:57:40,440
um how you know this was really an alien

1566
00:57:44,210 --> 00:57:42,180
environment and it gives us an idea of

1567
00:57:46,069 --> 00:57:44,220
what other alien environments might be

1568
00:57:47,750 --> 00:57:46,079
out there right now one thing I've been

1569
00:57:49,490 --> 00:57:47,760
discussing a lot with people lately

1570
00:57:51,530 --> 00:57:49,500
right now is the emergence of these

1571
00:57:53,030 --> 00:57:51,540
large language models and how machine

1572
00:57:55,430 --> 00:57:53,040
learning and artificial intelligences

1573
00:57:57,470 --> 00:57:55,440
are really taking off right now and it

1574
00:57:59,569 --> 00:57:57,480
makes some of us wonder whether the

1575
00:58:01,490 --> 00:57:59,579
first form of alien intelligence with

1576
00:58:03,770 --> 00:58:01,500
which we communicate might be one of our

1577
00:58:05,569 --> 00:58:03,780
own creation do you think maybe these

1578
00:58:07,130 --> 00:58:05,579
large language models and AIS that we're

1579
00:58:09,950 --> 00:58:07,140
creating right now will become the very

1580
00:58:11,690 --> 00:58:09,960
first aliens that we meet if you have

1581
00:58:14,210 --> 00:58:11,700
any input on that feel free to reach out

1582
00:58:16,190 --> 00:58:14,220
to me I'm at cosmobiologist across the

1583
00:58:18,589 --> 00:58:16,200
interwebs you can reach out on the at

1584
00:58:20,690 --> 00:58:18,599
Nasa astrobio Twitter account or go to

1585
00:58:22,069 --> 00:58:20,700
Sega net.org and drop us a line there

1586
00:58:24,290 --> 00:58:22,079
we'd love to hear from you and hear your

1587
00:58:25,670 --> 00:58:24,300
opinions I also want to say if you are

1588
00:58:28,430 --> 00:58:25,680

interested in learning more about the

1589
00:58:30,170 --> 00:58:28,440
neopini nilpina idiokara national park

1590
00:58:32,089 --> 00:58:30,180
there is a website from the national

1591
00:58:33,890 --> 00:58:32,099
parks and wildlife services of South

1592
00:58:35,150 --> 00:58:33,900
Australia it's a really beautiful

1593
00:58:36,589 --> 00:58:35,160
website there's some information there

1594
00:58:38,990 --> 00:58:36,599
you can find maybe even if you want to

1595
00:58:41,270 --> 00:58:39,000
go and tour the the area yourself and

1596
00:58:42,829 --> 00:58:41,280
see this National Park in the future of

1597
00:58:44,450 --> 00:58:42,839
course for those who are tuning in right

1598
00:58:46,609 --> 00:58:44,460
now live or watching the YouTube video

1599
00:58:49,069 --> 00:58:46,619
later uh if you want to sign up for the

1600
00:58:51,049 --> 00:58:49,079
NASA astrobiology mailing list you'll

1601
00:58:52,730 --> 00:58:51,059
get information about our show about

1602
00:58:55,670 --> 00:58:52,740
articles being published by NASA

1603
00:58:58,190 --> 00:58:55,680
astrobiology of many other events

1604
00:59:00,049 --> 00:58:58,200
conferences meetings ways to get

1605
00:59:01,430 --> 00:59:00,059
involved in this realm of astrobiology

1606
00:59:04,670 --> 00:59:01,440
being conducted through the NASA

1607
00:59:06,589 --> 00:59:04,680
astrobiology program so Dr Mary dresser

1608
00:59:08,329 --> 00:59:06,599
thank you so much for joining us for all

1609
00:59:10,190 --> 00:59:08,339
of your Insight and for answering the

1610
00:59:12,289 --> 00:59:10,200
questions our audience had for you

1611
00:59:13,910 --> 00:59:12,299
thanks for having me that's been great

1612
00:59:15,710 --> 00:59:13,920
and we do want to give a special

1613
00:59:17,210 --> 00:59:15,720

acknowledgment as well to credit for

1614
00:59:20,690 --> 00:59:17,220
some of the images and video we've

1615
00:59:22,490 --> 00:59:20,700
showed to Sam Oster Robert Lang and the

1616
00:59:24,530 --> 00:59:22,500
South Australian government department

1617
00:59:25,910 --> 00:59:24,540
for environment and water for sharing

1618
00:59:28,609 --> 00:59:25,920
those images with us so we can share

1619
00:59:31,069 --> 00:59:28,619
them with you as well so to our audience

1620
00:59:33,049 --> 00:59:31,079
tuning in as always thank you for

1621
00:59:41,660 --> 00:59:33,059
joining and until next time

1622
00:59:53,950 --> 00:59:51,830
[Music]

1623
00:59:55,930 --> 00:59:53,960
[Applause]