Amy LeBleu-DeBartola

The Peptide Connection Between Meteorites & the Origin of Life on Earth

1
00:00:00,240 --> 00:00:11,169
[Music]

2
00:00:15,049 --> 00:00:13,159
before I start I just won't point out

3
00:00:18,260 --> 00:00:15,059
this is the talk I gave it up saikhan I

4
00:00:19,940 --> 00:00:18,270
promise you a different talk but um the

5
00:00:22,580 --> 00:00:19,950
equipment that I need to use for it the

6
00:00:24,770 --> 00:00:22,590
lcms has been broken for four months now

7
00:00:26,090 --> 00:00:24,780
so you're gonna get a taste of it in

8
00:00:30,350 --> 00:00:26,100
this talk but I'm also going to talk

9
00:00:32,569 --> 00:00:30,360
about a lot more meteorite stuff so um

10
00:00:36,229 --> 00:00:32,579
outline I'm gonna give you some

11
00:00:38,599 --> 00:00:36,239
background on both biochem and planetary

12
00:00:41,090 --> 00:00:38,609
science so you should be bored by at

13
00:00:42,470 --> 00:00:41,100

least one part of the intro I'm going to

14
00:00:44,509 --> 00:00:42,480
talk about the prebiotic simulations

15
00:00:46,669 --> 00:00:44,519
that I do and then I'm going to talk

16
00:00:49,369 --> 00:00:46,679
about nano ir maps and Raman maps of

17
00:00:50,630 --> 00:00:49,379
meteorites that I do I'm going to talk

18
00:00:52,369 --> 00:00:50,640
about the integration of all of these

19
00:00:54,319 --> 00:00:52,379
points the implications for planetary

20
00:00:58,279 --> 00:00:54,329
science and astrobiology and then I will

21
00:00:59,809 --> 00:00:58,289
take questions so very briefly planetary

22
00:01:01,819 --> 00:00:59,819
scientists use this will your chart to

23
00:01:05,770 --> 00:01:01,829
classify meteorites

24
00:01:10,970 --> 00:01:05,780
it is a chart where three is the least

25
00:01:13,310 --> 00:01:10,980
altered and as you have this way there's

26
00:01:17,600 --> 00:01:13,320
more water in them and as you go this

27
00:01:24,580 --> 00:01:17,610
way it's hotter of course you can have

28
00:01:29,210 --> 00:01:24,590
both water and therm alteration which

29
00:01:30,860 --> 00:01:29,220
makes organics here's a small list of

30
00:01:32,300 --> 00:01:30,870
different meteorites that are astro

31
00:01:35,270 --> 00:01:32,310
biologically important they all have a

32
00:01:37,520 --> 00:01:35,280
significant amount of organics you can

33
00:01:39,650 --> 00:01:37,530
note that they're pathological types are

34
00:01:43,370 --> 00:01:39,660
between 3 which is again pretty

35
00:01:45,230 --> 00:01:43,380
unaltered and one which means that it

36
00:01:49,400 --> 00:01:45,240
has a lot of water so this is kind of

37
00:01:51,560 --> 00:01:49,410
the sweet spot of organic chemistry

38
00:01:57,680 --> 00:01:51,570

temperatures and liquid water being

39
00:01:59,690 --> 00:01:57,690
present so here's an organics inventory

40
00:02:02,780 --> 00:01:59,700
of meteorites I'm particularly

41
00:02:04,160 --> 00:02:02,790
interested in these three I'm interested

42
00:02:06,890 --> 00:02:04,170
in amino acids which are the building

43
00:02:08,419 --> 00:02:06,900
blocks of proteins I'm interested in

44
00:02:10,699 --> 00:02:08,429
peptides which you can think of for the

45
00:02:12,800 --> 00:02:10,709
purposes of this talk as very short

46
00:02:15,020 --> 00:02:12,810
proteins you get

47
00:02:16,790 --> 00:02:15,030
this when you take you're gonna get this

48
00:02:20,510 --> 00:02:16,800
can take two of these and your removal

49
00:02:22,520 --> 00:02:20,520
water I'm interested in this because my

50
00:02:24,860 --> 00:02:22,530
laboratory simulations seem to show that

51
00:02:26,600 --> 00:02:24,870
in the presence of hydroxy acids you get

52
00:02:28,430 --> 00:02:26,610
a significantly higher peptide rate

53
00:02:31,430 --> 00:02:28,440
which is good because there are a lot of

54
00:02:33,290 --> 00:02:31,440
hydroxy acids and meteorites and then

55
00:02:35,930 --> 00:02:33,300
I'm also interested in all these as

56
00:02:37,780 --> 00:02:35,940
targets of opportunity and they should

57
00:02:44,449 --> 00:02:37,790
happen to show up in my nano IR maps

58
00:02:45,949 --> 00:02:44,459
awesome so here is a small organics

59
00:02:49,550 --> 00:02:45,959
inventory of meteorites specifically the

60
00:02:52,009 --> 00:02:49,560
amino acids the number is again that

61
00:02:55,340 --> 00:02:52,019
Federer logical type the letters are

62
00:02:57,020 --> 00:02:55,350
kind of the chemical makeup there is a

63
00:02:59,780 --> 00:02:57,030

lot of amino acids that were delivered

64
00:03:01,820 --> 00:02:59,790
to earth so I still have late heavy

65
00:03:04,040 --> 00:03:01,830
bombardment on here but that's okay

66
00:03:05,900 --> 00:03:04,050
the you can think of this instead of two

67
00:03:07,220 --> 00:03:05,910
hundred million years all these

68
00:03:10,910 --> 00:03:07,230
calculations are from modern day

69
00:03:13,070 --> 00:03:10,920
meteorite flux so if you take the amount

70
00:03:15,199 --> 00:03:13,080
of carbon that was delivered over 200

71
00:03:17,509 --> 00:03:15,209
million years before life observed and

72
00:03:20,120 --> 00:03:17,519
I'm thinking just the average date that

73
00:03:21,560 --> 00:03:20,130
we think life originated roughly the

74
00:03:23,390 --> 00:03:21,570
amount of organics that survived are two

75
00:03:25,880 --> 00:03:23,400
point five grams the ten to the twenty

76
00:03:28,220 --> 00:03:25,890
second to put this into context

77
00:03:30,860 --> 00:03:28,230
realization this is more than all of the

78
00:03:32,449 --> 00:03:30,870
carbon in the current biosphere and if

79
00:03:35,810 --> 00:03:32,459
you were to cover the earth with it it

80
00:03:38,300 --> 00:03:35,820
would be a 40 meter deep layer of this

81
00:03:40,490 --> 00:03:38,310
you can find the amino acid amount by

82
00:03:42,729 --> 00:03:40,500
taking the soluble carbon which is just

83
00:03:45,590 --> 00:03:42,739
the stuff that's not karagin that like

84
00:03:48,890 --> 00:03:45,600
you know nice thing that you've showed

85
00:03:50,780 --> 00:03:48,900
miniatures shown earlier and you get

86
00:03:53,180 --> 00:03:50,790
some point six times ten to the sixteen

87
00:03:54,920 --> 00:03:53,190
to five point seven times ten to the 22

88
00:03:57,440 --> 00:03:54,930

grams depending on how pessimistic or

89
00:03:59,569 --> 00:03:57,450
optimistic you are and then you can do a

90
00:04:01,759 --> 00:03:59,579
rough count concentration and you find

91
00:04:03,949 --> 00:04:01,769
out that there could potentially be a

92
00:04:07,790 --> 00:04:03,959
very high concentration of amino acids

93
00:04:10,040 --> 00:04:07,800
in the early ocean so

94
00:04:12,080 --> 00:04:10,050
I'm kind of trying to get away with

95
00:04:14,810 --> 00:04:12,090
doing laboratory simulations that fit on

96
00:04:17,060 --> 00:04:14,820
to two that satisfy two environmental

97
00:04:19,160 --> 00:04:17,070
conditions the first one is the

98
00:04:21,800 --> 00:04:19,170
prebiotic earth where the average

99
00:04:24,350 --> 00:04:21,810
temperature we think was around 100 to

100
00:04:26,570 --> 00:04:24,360
200 C take this with a grain of salt

101
00:04:28,670 --> 00:04:26,580
because we've our lab has very recently

102
00:04:29,840 --> 00:04:28,680
learned about the fact that they have

103
00:04:31,670 --> 00:04:29,850
human Bartman's been called into

104
00:04:34,660 --> 00:04:31,680
question but there were certainly places

105
00:04:36,620 --> 00:04:34,670
on earth that had this temperature range

106
00:04:38,090 --> 00:04:36,630
besides when the organics that you get

107
00:04:39,710 --> 00:04:38,100
from lightning strikes and you know

108
00:04:43,160 --> 00:04:39,720
deep-sea volcanism you got a huge amount

109
00:04:44,540 --> 00:04:43,170
of organics delivered by impact the

110
00:04:46,280 --> 00:04:44,550
majority of your Earth's water would

111
00:04:48,860 --> 00:04:46,290
certainly also probably blow pardon this

112
00:04:50,780 --> 00:04:48,870
time and then you had cattle lake

113
00:04:53,920 --> 00:04:50,790

surfaces both from the Earth's geology

114
00:04:56,240 --> 00:04:53,930
and from meteorites themselves

115
00:05:00,710 --> 00:04:56,250
simultaneously you can also kind of get

116
00:05:05,420 --> 00:05:00,720
away with using this as the meteor

117
00:05:06,800 --> 00:05:05,430
parent body's environment so average

118
00:05:08,690 --> 00:05:06,810
temperature of meteorite parent body

119
00:05:10,040 --> 00:05:08,700
through specifically the carbonaceous

120
00:05:12,410 --> 00:05:10,050
chondrites which is the organic

121
00:05:13,760 --> 00:05:12,420
meteorites Murchison which you've all

122
00:05:16,850 --> 00:05:13,770
probably heard of is a carbonaceous

123
00:05:19,070 --> 00:05:16,860
chondrite varies between about 100 to

124
00:05:21,740 --> 00:05:19,080
200 C there are notable temperature

125
00:05:25,610 --> 00:05:21,750
outliers but let's focus on this for the

126
00:05:28,760 --> 00:05:25,620
sake of my experiments you have organics

127
00:05:32,270 --> 00:05:28,770
that are incorporated from the inner

128
00:05:34,520 --> 00:05:32,280
stellar nebula and the planetary nebula

129
00:05:35,300 --> 00:05:34,530
and then you have additional organics

130
00:05:36,470 --> 00:05:35,310
farm but I'm not going to talk about

131
00:05:38,000 --> 00:05:36,480
that

132
00:05:40,220 --> 00:05:38,010
you have mineral evidence for the

133
00:05:41,870 --> 00:05:40,230
presence of liquid water and you have

134
00:05:45,340 --> 00:05:41,880
catalytic surfaces that are found in the

135
00:05:48,080 --> 00:05:45,350
meteorites like olivine so you can

136
00:05:51,260 --> 00:05:48,090
simulate both of these using a biotic

137
00:05:53,210 --> 00:05:51,270
peptide simulations it's based on

138
00:05:54,970 --> 00:05:53,220

research that my boss started at Georgia

139
00:05:57,860 --> 00:05:54,980
Tech Center for chemical evolution

140
00:05:59,990 --> 00:05:57,870
basically we're using L amino acids

141
00:06:02,150 --> 00:06:00,000
hydroxy acids and a catalytic Rock of

142
00:06:03,830 --> 00:06:02,160
your choice but as long as everything is

143
00:06:06,200 --> 00:06:03,840
present meteorites it's kosher and on

144
00:06:07,700 --> 00:06:06,210
the table and your method is just you

145
00:06:09,950 --> 00:06:07,710
want to mix one part amino acids with

146
00:06:12,320 --> 00:06:09,960
one part hydroxy acids the reason for

147
00:06:14,810 --> 00:06:12,330
that is that's what you see in meteor

148
00:06:16,520 --> 00:06:14,820
observations we think hydroxy acids are

149
00:06:18,890 --> 00:06:16,530
mostly acting as catalysts so at some

150
00:06:20,820 --> 00:06:18,900
point I will reduce that but for now

151
00:06:22,440 --> 00:06:20,830
we're trying to follow nature

152
00:06:24,390 --> 00:06:22,450
you need to provide a very small amount

153
00:06:26,610 --> 00:06:24,400
of catalytic surface allow it to make

154
00:06:29,159 --> 00:06:26,620
some water and then you can bake it in

155
00:06:31,400 --> 00:06:29,169
an oven of various ranges we're focusing

156
00:06:33,240 --> 00:06:31,410
on the 65 to 200 degrees C range

157
00:06:34,980 --> 00:06:33,250
specifically because the Center for

158
00:06:37,080 --> 00:06:34,990
chemical evolution does colder and we

159
00:06:39,120 --> 00:06:37,090
don't want to step on their toes and

160
00:06:41,760 --> 00:06:39,130
also because we're interested in doing

161
00:06:43,230 --> 00:06:41,770
meteorite parent body stuff and then you

162
00:06:47,460 --> 00:06:43,240
can sample algorithmically to see the

163
00:06:49,860 --> 00:06:47,470

time evolution of your products so these

164
00:06:52,920 --> 00:06:49,870
are three graphs um this one's just

165
00:06:55,830 --> 00:06:52,930
glycine anse by itself you can the main

166
00:06:59,670 --> 00:06:55,840
thing to notice this one's like at the

167
00:07:03,120 --> 00:06:59,680
ten level if you add lactic acid you go

168
00:07:05,580 --> 00:07:03,130
up significantly um but also all three

169
00:07:07,650 --> 00:07:05,590
of these graphs show that as time goes

170
00:07:10,080 --> 00:07:07,660
on you do have more peptide formation

171
00:07:12,800 --> 00:07:10,090
you do make longer approach protein

172
00:07:15,510 --> 00:07:12,810
strains um it's interesting to note that

173
00:07:17,670 --> 00:07:15,520
lactic acid tends to be incorporated as

174
00:07:20,730 --> 00:07:17,680
like the terminal or start and sometimes

175
00:07:21,900 --> 00:07:20,740
you will get to lactic acids something

176
00:07:23,640 --> 00:07:21,910
that I really want to present on but

177
00:07:26,430 --> 00:07:23,650
just didn't get to because my machines

178
00:07:28,140 --> 00:07:26,440
are all broken is where precisely the

179
00:07:29,640 --> 00:07:28,150
second lactic acid is if it's also

180
00:07:33,090 --> 00:07:29,650
terminal or if it's incorporated in the

181
00:07:35,010 --> 00:07:33,100
middle um so we're also doing something

182
00:07:38,550 --> 00:07:35,020
called NATO our real quick has anyone

183
00:07:41,250 --> 00:07:38,560
heard of me you know I know

184
00:07:44,159 --> 00:07:41,260
okay so nano IR is this really cool new

185
00:07:47,070 --> 00:07:44,169
materials technique in physics ah and

186
00:07:49,860 --> 00:07:47,080
what it is is all molecules will vibrate

187
00:07:52,529 --> 00:07:49,870
if you put the right opportunity to

188
00:07:55,830 --> 00:07:52,539

flight on them basically so you have a

189
00:07:58,950 --> 00:07:55,840
pulse tunable IR laser and you just pick

190
00:08:01,560 --> 00:07:58,960
a starting point and scale up through it

191
00:08:04,080 --> 00:08:01,570
and then you also have another laser

192
00:08:08,370 --> 00:08:04,090
that detects how high it is when you hit

193
00:08:09,540 --> 00:08:08,380
the right like frequency it expands so

194
00:08:11,219 --> 00:08:09,550
you can detect a whole bunch of

195
00:08:13,860 --> 00:08:11,229
different molecules using this and you

196
00:08:18,570 --> 00:08:13,870
can get it on extremely fine levels so

197
00:08:22,830 --> 00:08:18,580
you can make a hundred nanometer sized

198
00:08:25,500 --> 00:08:22,840
measurements so we're looking at I need

199
00:08:28,920 --> 00:08:25,510
one peaks at a me two peaks a little bit

200
00:08:29,940 --> 00:08:28,930
of a mean three I have the rotational

201
00:08:32,040 --> 00:08:29,950
and

202
00:08:36,210 --> 00:08:32,050
vibrational modes here that correspond

203
00:08:37,950 --> 00:08:36,220
to these Peaks and this is honor data

204
00:08:40,740 --> 00:08:37,960
this is someone else's data but we're

205
00:08:44,460 --> 00:08:40,750
working to do these maps as well and so

206
00:08:45,690 --> 00:08:44,470
here you can see CL double bond which is

207
00:08:47,010 --> 00:08:45,700
one of the main things we'll be looking

208
00:08:49,500 --> 00:08:47,020
for and you can see that it's pretty

209
00:08:53,360 --> 00:08:49,510
sparse so like here is probably some

210
00:08:58,530 --> 00:08:53,370
amino acids peptides and here and here

211
00:09:00,330 --> 00:08:58,540
um and we did this we tried to and it

212
00:09:03,690 --> 00:09:00,340
turns out the adhesives that we used

213
00:09:06,240 --> 00:09:03,700

showed up much more strongly manner

214
00:09:07,410 --> 00:09:06,250
I mean awesomes proteins so back to the

215
00:09:10,410 --> 00:09:07,420
drawing table because they had to figure

216
00:09:15,210 --> 00:09:10,420
out a new adhesive yeah here's just a

217
00:09:16,830 --> 00:09:15,220
nice better picture ok so here's the one

218
00:09:18,980 --> 00:09:16,840
part of my work that's gone really

219
00:09:20,940 --> 00:09:18,990
really well which is making ramen maps

220
00:09:22,830 --> 00:09:20,950
and it's the same kind of thing as a

221
00:09:25,800 --> 00:09:22,840
noir you can make really high-resolution

222
00:09:27,180 --> 00:09:25,810
maps using Raman spectroscopy and you

223
00:09:28,740 --> 00:09:27,190
can exchange a whole bunch of different

224
00:09:31,110 --> 00:09:28,750
environmental things about the

225
00:09:34,830 --> 00:09:31,120
meteorites so here's just a nice Tagish

226
00:09:38,340 --> 00:09:34,840
Lake temperature map you can find out

227
00:09:41,760 --> 00:09:38,350
you can fit the hottest point and the

228
00:09:44,100 --> 00:09:41,770
coldest point this is to carbon bands as

229
00:09:46,800 --> 00:09:44,110
things gets hotter it goes from this D

230
00:09:52,710 --> 00:09:46,810
which is like disorganised to this G

231
00:09:54,990 --> 00:09:52,720
which is graph e and here is a bigger

232
00:09:58,080 --> 00:09:55,000
better Murchison sample overlaid on the

233
00:10:00,390 --> 00:09:58,090
meteorite itself so you can do rough

234
00:10:03,240 --> 00:10:00,400
amounts of carbon you can do temperature

235
00:10:06,210 --> 00:10:03,250
you can do let me get out of the way

236
00:10:08,790 --> 00:10:06,220
olivine amounts you can do of the

237
00:10:10,860 --> 00:10:08,800
olivine what is the mg relative to Fe

238
00:10:13,020 --> 00:10:10,870

because those are the major ions that

239
00:10:14,820 --> 00:10:13,030
are incorporated into olivine and then

240
00:10:16,680 --> 00:10:14,830
you can take a single pixel and you can

241
00:10:18,780 --> 00:10:16,690
overlay all these things and compare

242
00:10:21,150 --> 00:10:18,790
them when you can add in the nanowire

243
00:10:22,440 --> 00:10:21,160
our Maps you can say okay what kind of

244
00:10:24,300 --> 00:10:22,450
organics are formed on a very small

245
00:10:26,310 --> 00:10:24,310
scale and what are the environmental

246
00:10:29,400 --> 00:10:26,320
things that contribute to that specific

247
00:10:31,410 --> 00:10:29,410
organic formation a good way to check

248
00:10:34,620 --> 00:10:31,420
this is with toph sense here's the top

249
00:10:36,930 --> 00:10:34,630
since we did of glycine all the scale

250
00:10:40,330 --> 00:10:36,940
were looking for you can see it's really

251
00:10:43,510 --> 00:10:40,340
good um the problem of toxins is

252
00:10:46,900 --> 00:10:43,520
ablates off the lair so if you want to

253
00:10:49,330 --> 00:10:46,910
do ramen on that layer it's gonna damage

254
00:10:51,610 --> 00:10:49,340
the organics if you do it first if you

255
00:10:54,220 --> 00:10:51,620
do this on the lair you can't do ramen

256
00:10:56,230 --> 00:10:54,230
afterwards so it's a good check to make

257
00:10:59,260 --> 00:10:56,240
sure nano our ramen interactions are

258
00:11:02,760 --> 00:10:59,270
working and it'll give you a higher

259
00:11:07,540 --> 00:11:02,770
resolution than NIR but its destructive

260
00:11:08,860 --> 00:11:07,550
so here's some fun implications so a

261
00:11:10,780 --> 00:11:08,870
range of organics were delivered

262
00:11:13,030 --> 00:11:10,790
including probably already formed

263
00:11:14,620 --> 00:11:13,040

peptides to the earth and they were

264
00:11:16,390 --> 00:11:14,630
distributed across the solar system if

265
00:11:18,010 --> 00:11:16,400
you can form peptides in space there is

266
00:11:19,480 --> 00:11:18,020
no reason that they can only be like

267
00:11:22,329 --> 00:11:19,490
that you can't assume that they were

268
00:11:24,550 --> 00:11:22,339
distributed everywhere you have cat

269
00:11:27,160 --> 00:11:24,560
alike services both on earth and in

270
00:11:29,470 --> 00:11:27,170
particular small dehydrating pools in

271
00:11:31,420 --> 00:11:29,480
this range are great places to farm even

272
00:11:40,060 --> 00:11:31,430
more peptides because we think that

273
00:11:41,230 --> 00:11:40,070
amino acids are still much more no much

274
00:11:44,140 --> 00:11:41,240
more abundant than peptides in

275
00:11:45,460 --> 00:11:44,150
meteorites and even taking a little

276
00:11:48,850 --> 00:11:45,470
estimates of conditions on earth in

277
00:11:51,460 --> 00:11:48,860
organics delivery you're gonna probably

278
00:11:52,870 --> 00:11:51,470
get catalytically active peptides being

279
00:11:56,560 --> 00:11:52,880
delivered everywhere across the solar

280
00:11:57,790 --> 00:11:56,570
system and some asteroid apparent bodies

281
00:11:59,860 --> 00:11:57,800
possess similar characteristics to

282
00:12:02,290 --> 00:11:59,870
prebiotic bodies you can get pressure

283
00:12:05,560 --> 00:12:02,300
volatiles including water organics and

284
00:12:07,120 --> 00:12:05,570
kind of like surfaces and you know

285
00:12:09,300 --> 00:12:07,130
you're providing fuel all over your

286
00:12:11,440 --> 00:12:09,310
solar system and this is especially

287
00:12:14,100 --> 00:12:11,450
important for places that don't have

288
00:12:18,100 --> 00:12:14,110

deep sea hydrothermal vents for

289
00:12:20,290 --> 00:12:18,110
lightning reactions so if you want to

290
00:12:21,880 --> 00:12:20,300
create life somewhere that doesn't have

291
00:12:23,500 --> 00:12:21,890
the same conditions of Earth you can

292
00:12:26,680 --> 00:12:23,510
still do it because stuff was still

293
00:12:30,340 --> 00:12:26,690
being delivered so I have a lot of

294
00:12:31,870 --> 00:12:30,350
future work to do for media analysis I

295
00:12:34,590 --> 00:12:31,880
need to work on my sample prep because

296
00:12:37,060 --> 00:12:34,600
you know that adhesive is about adhesive

297
00:12:38,820 --> 00:12:37,070
we're also looking at doing alternative

298
00:12:41,800 --> 00:12:38,830
methods right now we use fast ion beam

299
00:12:43,720 --> 00:12:41,810
flattening where we just throw ions at

300
00:12:45,490 --> 00:12:43,730
it and it just kind of oblate stuff off

301
00:12:48,040 --> 00:12:45,500
but that's very expensive so we're

302
00:12:49,900 --> 00:12:48,050
looking into polishing as well problem

303
00:12:51,210 --> 00:12:49,910
with polishing is it introduces foreign

304
00:12:54,259 --> 00:12:51,220
matter

305
00:12:56,970 --> 00:12:54,269
Ramin we're trying to achieve even finer

306
00:12:59,340 --> 00:12:56,980
robbing mats the mass I showed you where

307
00:13:01,829 --> 00:12:59,350
micron scale we're looking to get to the

308
00:13:03,569 --> 00:13:01,839
300 nanometer scale this here and our

309
00:13:06,420 --> 00:13:03,579
ultimate goal is 10 to the 20 nanometer

310
00:13:08,999 --> 00:13:06,430
scale and in nano are we'd like to make

311
00:13:11,669 --> 00:13:09,009
larger not nano our ops because as you

312
00:13:14,309 --> 00:13:11,679
saw the organics and in particular amino

313
00:13:17,519 --> 00:13:14,319

acids are like clumped in certain areas

314
00:13:19,829 --> 00:13:17,529
and they're pretty rare overall so we

315
00:13:23,119 --> 00:13:19,839
need to make really large scale Maps if

316
00:13:26,939 --> 00:13:23,129
we want to see a lot of organics and

317
00:13:28,530 --> 00:13:26,949
then I'm kind of still always working on

318
00:13:30,470 --> 00:13:28,540
my data processing code and adding in

319
00:13:32,579 --> 00:13:30,480
more things that I can fit to raman

320
00:13:35,280 --> 00:13:32,589
between apps icon and now I've done

321
00:13:36,869 --> 00:13:35,290
phyllosilicates and if you have a

322
00:13:39,900 --> 00:13:36,879
suggestion for something in the visible

323
00:13:44,160 --> 00:13:39,910
ramadhan that I should be fitting come

324
00:13:45,660 --> 00:13:44,170
talk to me for laboratory simulations I

325
00:13:47,069 --> 00:13:45,670
really don't like to do the structure

326
00:13:51,809 --> 00:13:47,079
and the mechanisms of a biotic long

327
00:13:53,100 --> 00:13:51,819
chain long chain peptide formation you

328
00:13:54,929 --> 00:13:53,110
know I'd like to investigate effects

329
00:13:58,919 --> 00:13:54,939
that I can't see for my meteorites like

330
00:14:00,780 --> 00:13:58,929
pH changes and you know you can control

331
00:14:03,600 --> 00:14:00,790
very finely which amino acids you're

332
00:14:04,590 --> 00:14:03,610
putting in and then it also like to

333
00:14:06,210 --> 00:14:04,600
confirm relationships between

334
00:14:07,860 --> 00:14:06,220
temperature and peptide formation

335
00:14:09,360 --> 00:14:07,870
because the Raman laughs that I showed

336
00:14:12,840 --> 00:14:09,370
you and the temperatures that we predict

337
00:14:15,419 --> 00:14:12,850
are all from carbon fitting and that's

338
00:14:17,819 --> 00:14:15,429

just the peak metamorphic temperature so

339
00:14:20,429 --> 00:14:17,829
these may be forming at a colder or a

340
00:14:23,489 --> 00:14:20,439
warmer temperature we're just not sure

341
00:14:25,079 --> 00:14:23,499
we can only define the upper bound with

342
00:14:28,379 --> 00:14:25,089
laboratory simulations we can define

343
00:14:30,889 --> 00:14:28,389
what's the best temperature

344
00:14:32,790 --> 00:14:30,899
so here's references and acknowledgments

345
00:14:35,639 --> 00:14:32,800
thank you to a whole bunch of different

346
00:14:38,579 --> 00:14:35,649
groups we have the Georgia Institute of

347
00:14:41,280 --> 00:14:38,589
Technology Group people have moved so

348
00:14:44,069 --> 00:14:41,290
you can see University of Lille their

349
00:14:45,389 --> 00:14:44,079
team's does specialize setting so that's

350
00:14:48,179 --> 00:14:45,399
what we're getting out of our ramen and

351
00:14:49,980 --> 00:14:48,189
nano IR stuff from I mean we're working

352
00:14:53,069 --> 00:14:49,990
with several other people at University

353
00:14:58,670 --> 00:14:53,079
of Central Florida and I will not take

354
00:15:09,269 --> 00:15:06,780
great questions for me thank you when

355
00:15:12,240 --> 00:15:09,279
you were doing your calculation which

356
00:15:14,040 --> 00:15:12,250
resulted in this very significant

357
00:15:16,860 --> 00:15:14,050
estimates of amino acid concentrations

358
00:15:18,900 --> 00:15:16,870
in the ocean yeah um this seemed to

359
00:15:21,329 --> 00:15:18,910
assume that these amino acids were just

360
00:15:22,889 --> 00:15:21,339
accumulating over the 200 million year

361
00:15:25,380 --> 00:15:22,899
period that there was no significant

362
00:15:28,620 --> 00:15:25,390
sink removing these from the ocean is

363
00:15:31,019 --> 00:15:28,630

that assumption you do have reason to

364
00:15:35,340 --> 00:15:31,029
believe that during that time period so

365
00:15:36,960 --> 00:15:35,350
I think that um so I stole this from

366
00:15:38,519 --> 00:15:36,970
someone else's paper there in my

367
00:15:40,470 --> 00:15:38,529
references

368
00:15:42,180 --> 00:15:40,480
but I think that the idea is that yeah

369
00:15:43,740 --> 00:15:42,190
there isn't a significant sink unless

370
00:15:46,889 --> 00:15:43,750
you're forming some kind of you know

371
00:15:48,750 --> 00:15:46,899
advanced molecules I will say something

372
00:15:50,850 --> 00:15:48,760
that I myself have known in my research

373
00:15:53,069 --> 00:15:50,860
is when I'm doing these laboratory

374
00:15:54,870 --> 00:15:53,079
peptide simulations if you let all the

375
00:15:56,639 --> 00:15:54,880
water get away they do turn into what I

376
00:15:58,889 --> 00:15:56,649
think suspect is like the carriage and

377
00:16:00,870 --> 00:15:58,899
like substance they get black and tari I

378
00:16:04,199 --> 00:16:00,880
would imagine that happened to a good

379
00:16:09,389 --> 00:16:04,209
percent of these so I would say that

380
00:16:19,790 --> 00:16:09,399
this is probably an upper limit however

381
00:16:24,049 --> 00:16:22,129
yeah thanks Amy really sweet talk um

382
00:16:25,939 --> 00:16:24,059
have you tried doing multiple wedding

383
00:16:29,090 --> 00:16:25,949
drying cycles and see if that change

384
00:16:30,439 --> 00:16:29,100
anything yeah so um that's something on

385
00:16:33,019 --> 00:16:30,449
my long list of things that I'll be

386
00:16:35,329 --> 00:16:33,029
doing with these but right now no I'm

387
00:16:37,280 --> 00:16:35,339
trying to basically I'm adding water

388
00:16:41,389 --> 00:16:37,290

once and I'm monitoring over 48 hours

389
00:16:45,139 --> 00:16:41,399
yeah and it typically dries out by the

390
00:16:47,269 --> 00:16:45,149
last measurement yeah not always though

391
00:16:49,850 --> 00:16:47,279
because sometimes my undergrad seals it

392
00:16:53,389 --> 00:16:49,860
too tight um so it's something that I am

393
00:16:54,619 --> 00:16:53,399
interested in looking into you when you

394
00:16:56,720 --> 00:16:54,629
monitor you know you taking it out of

395
00:16:58,910 --> 00:16:56,730
the oven and then doing an in putting it

396
00:17:04,460 --> 00:16:58,920
back in okay you're good Institute yeah

397
00:17:07,730 --> 00:17:04,470
so so what I'm doing is I have these

398
00:17:10,399 --> 00:17:07,740
really nice they're called like

399
00:17:13,069 --> 00:17:10,409
autoclaves and they're tough on lined

400
00:17:13,760 --> 00:17:13,079
and they seal up really nice and this is

401
00:17:15,230 --> 00:17:13,770
good because you don't get

402
00:17:17,720 --> 00:17:15,240
cross-contamination so I can run like

403
00:17:19,429 --> 00:17:17,730
multiple samples or because my boss

404
00:17:24,620 --> 00:17:19,439
likes a lot of blinks I have four blanks

405
00:17:26,389 --> 00:17:24,630
and a sample running every time and so a

406
00:17:28,399 --> 00:17:26,399
lot of times when people are doing these

407
00:17:30,139 --> 00:17:28,409
kinds of experiments they'll just put

408
00:17:33,379 --> 00:17:30,149
stuff into the oven and it'll evaporate

409
00:17:36,070 --> 00:17:33,389
and cross contaminate if you steal it

410
00:17:38,570 --> 00:17:36,080
well enough that some water can escape

411
00:17:40,850 --> 00:17:38,580
so that it doesn't explode on you when

412
00:17:44,930 --> 00:17:40,860
you open it because oh god you learned

413
00:17:47,600 --> 00:17:44,940

that real fast um you can still like

414
00:17:49,399 --> 00:17:47,610
prevent a lot of cross-contamination but

415
00:17:50,899 --> 00:17:49,409
the converse is when you want to take a

416
00:17:52,129 --> 00:17:50,909
sample measurement you have to take it

417
00:17:54,940 --> 00:17:52,139
out wait for it to cool down enough for

418
00:17:57,200 --> 00:17:54,950
it to not explode on you sample it and

419
00:18:06,420 --> 00:17:57,210
when you open it up you're going to lose

420
00:18:14,080 --> 00:18:10,890
okay um did you try to do heterogeneous

421
00:18:15,550 --> 00:18:14,090
peptides like not only glancing but try

422
00:18:20,010 --> 00:18:15,560
to mix it up with different women as it

423
00:18:22,090 --> 00:18:20,020
may be non-biological ones yeah um so

424
00:18:24,160 --> 00:18:22,100
eventually what I'd like to do is be

425
00:18:28,000 --> 00:18:24,170
using stuff something like this you know

426
00:18:29,890 --> 00:18:28,010
take a meteorite class add in amino

427
00:18:32,790 --> 00:18:29,900
acids and the ratios that you see in

428
00:18:34,900 --> 00:18:32,800
those meteorites and see what happens

429
00:18:38,050 --> 00:18:34,910
I'm not sure if I but on here I'm using

430
00:18:41,070 --> 00:18:38,060
L for the sake of cost but I'd also like

431
00:18:44,050 --> 00:18:41,080
to see what incorporating D does as well

432
00:18:46,390 --> 00:18:44,060
so all amino acids are LRD we have that

433
00:18:50,110 --> 00:18:46,400
nice chirality talk that's the shorthand

434
00:18:53,830 --> 00:18:50,120
for the two kinds of cairo yeah so I

435
00:18:57,130 --> 00:18:53,840
would be really interested in that on a

436
00:18:58,780 --> 00:18:57,140
purely methods note the next one that I

437
00:19:01,270 --> 00:18:58,790
do will probably have serine or tyrosine

438
00:19:03,280 --> 00:19:01,280

in it just because it is terrible

439
00:19:08,590 --> 00:19:03,290
terrible getting my glycine only

440
00:19:10,180 --> 00:19:08,600
peptides off the column yes so at the

441
00:19:14,490 --> 00:19:10,190
very least I'm gonna start adding charge

442
00:19:17,200 --> 00:19:14,500
things and just for ease of methodology

443
00:19:20,950 --> 00:19:17,210
my question was about chirality so you

444
00:19:22,990 --> 00:19:20,960
just answered that awesome okay yeah so

445
00:19:24,370 --> 00:19:23,000
well probably like when I put out my

446
00:19:26,500 --> 00:19:24,380
first paper I'll probably have a little

447
00:19:29,440 --> 00:19:26,510
section and it talks about you know I'm

448
00:19:32,200 --> 00:19:29,450
only using L so here you know it's the

449
00:19:35,710 --> 00:19:32,210
statistical chances of a twenty peptide

450
00:19:37,480 --> 00:19:35,720
being all L which is very low there's a

451
00:19:38,950 --> 00:19:37,490
slight if you're towards all amino acids

452
00:19:40,170 --> 00:19:38,960
in our solar system but it's pretty

453
00:19:44,380 --> 00:19:40,180
slight

454
00:19:49,070 --> 00:19:44,390
alright any other questions for Amy all