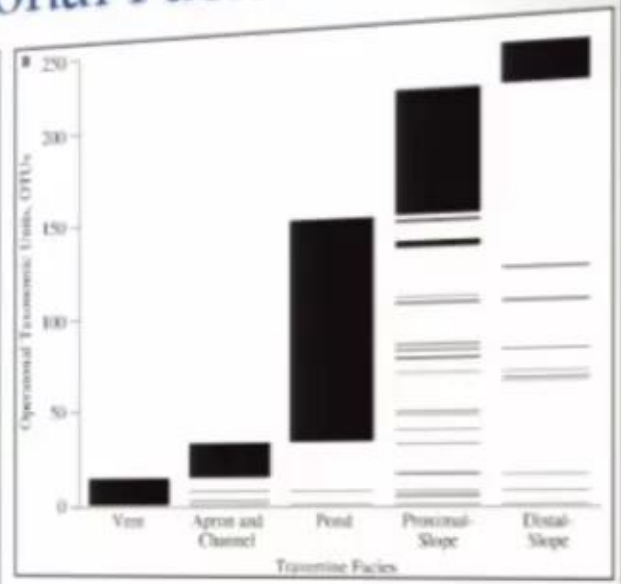
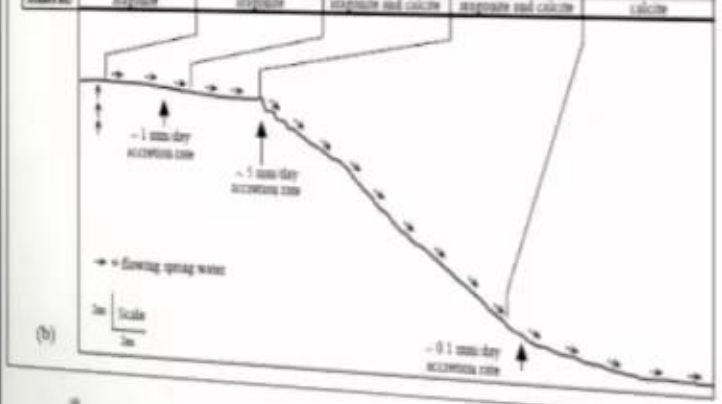
Travertine Depositional Facies



Facies	Vent	Apron and Channel	Pond	Proximal Slope	Distal Slope
T °C	72 - 88	70 - 80	62 - 70	65 - 75	44 - 58
pH	6.0 - 6.7	6.4 - 7.2	6.7 - 8.0	6.9 - 8.0	7.3 - 8.1
Minerals	aragonite	aragonite	aragonite and calcite	aragonite and calcite	calcite



- Lipid content analysis
- Travertine Depositional Facies are preserved in ancient samples

Fouke, 2011

Zhang et al., 2004; Butler, 2007 (unpublished)

1
00:00:10,690 --> 00:00:08,440
okay so today I'm going to tell you a

2
00:00:13,360 --> 00:00:10,700
little bit about it phylogenetic that

3
00:00:15,160 --> 00:00:13,370
diversity that is preserved in something

4
00:00:17,560 --> 00:00:15,170
we call it travertine that maybe not all

5
00:00:20,920 --> 00:00:17,570
of you have heard of in how white that

6
00:00:22,870 --> 00:00:20,930
is important okay so test I already

7
00:00:24,550 --> 00:00:22,880
talked a whole lot about a stream of all

8
00:00:27,400 --> 00:00:24,560
so I don't naturally have to go through

9
00:00:29,560 --> 00:00:27,410
this so we already know their organisms

10
00:00:31,810 --> 00:00:29,570
that are capable of living in extreme

11
00:00:35,530 --> 00:00:31,820
environments and this could be a strange

12
00:00:37,930 --> 00:00:35,540
of temperature pH so in other conditions

13
00:00:40,390 --> 00:00:37,940

in the extreme environment that I'm

14
00:00:42,280 --> 00:00:40,400
interested in is the environments of hot

15
00:00:45,850 --> 00:00:42,290
springs sorry hot environments

16
00:00:48,490 --> 00:00:45,860
especially hot springs and this picture

17
00:00:52,090 --> 00:00:48,500
has already we've seen that number of

18
00:00:54,970 --> 00:00:52,100
times today so obviously once you think

19
00:00:57,460 --> 00:00:54,980
about hot springs or hot environments

20
00:00:59,770 --> 00:00:57,470
naturally what comes to mind is the

21
00:01:02,290 --> 00:00:59,780
early Earth and then you think about it

22
00:01:04,299 --> 00:01:02,300
um organisms that are able to live in

23
00:01:06,700 --> 00:01:04,309
this kind of hot springs are probably

24
00:01:08,679 --> 00:01:06,710
good candidates or really the best

25
00:01:12,489 --> 00:01:08,689
candidates for life on early Earth and

26
00:01:14,649 --> 00:01:12,499
probably other planets so we still have

27
00:01:16,539 --> 00:01:14,659
these thermal environments on earth

28
00:01:19,749 --> 00:01:16,549
currently and you can think of hot

29
00:01:21,700 --> 00:01:19,759
springs hydrothermal vents or black

30
00:01:24,190 --> 00:01:21,710
smokers and all those other hot

31
00:01:25,660 --> 00:01:24,200
environments so the hot springs that I'm

32
00:01:29,109 --> 00:01:25,670
interested in there are two of them

33
00:01:30,730 --> 00:01:29,119
which are really pretty in nature's

34
00:01:32,469 --> 00:01:30,740
talked about Yellowstone so i don't have

35
00:01:35,199 --> 00:01:32,479
to initially talked about those so this

36
00:01:37,239 --> 00:01:35,209
is mammoth hot springs in hot spring we

37
00:01:39,340 --> 00:01:37,249
have we have a lot of guises hot springs

38
00:01:41,349 --> 00:01:39,350

and all sorts of things and most of the

39
00:01:47,050 --> 00:01:41,359
hot springs actually precipitate calcite

40
00:01:48,910 --> 00:01:47,060
um silicates but the moment sorry the

41
00:01:50,440 --> 00:01:48,920
mammoth hot springs are the only springs

42
00:01:53,730 --> 00:01:50,450
are actually preceded what we call

43
00:01:56,260 --> 00:01:53,740
calcium carbonate so these um

44
00:01:58,590 --> 00:01:56,270
territorial Hot Springs they have the

45
00:02:01,539 --> 00:01:58,600
elect mo environments they have

46
00:02:03,190 --> 00:02:01,549
geothermal waters that erupts and when

47
00:02:05,289 --> 00:02:03,200
they do they cool in the during the

48
00:02:07,719 --> 00:02:05,299
process of cooling they lose some carbon

49
00:02:10,359 --> 00:02:07,729
dioxide and they are able to precipitate

50
00:02:12,570 --> 00:02:10,369
calcium carbonate in microbes also be

51
00:02:15,190 --> 00:02:12,580
implicated in the precipitation of this

52
00:02:17,740 --> 00:02:15,200
calcium carbonate during photosynthesis

53
00:02:18,830 --> 00:02:17,750
so think about sino bacteria as it

54
00:02:20,960 --> 00:02:18,840
photosynthesis

55
00:02:23,119 --> 00:02:20,970
it removes all the cost of carbon

56
00:02:26,119 --> 00:02:23,129
dioxide that is present in the water and

57
00:02:29,690 --> 00:02:26,129
that can also lead to the precipitation

58
00:02:32,360 --> 00:02:29,700
of this cause calcium carbonates and

59
00:02:34,160 --> 00:02:32,370
these we call travertine and this is so

60
00:02:36,470 --> 00:02:34,170
rapid that you can actually stay there

61
00:02:38,509 --> 00:02:36,480
and watch them as they precipitate so

62
00:02:40,009 --> 00:02:38,519
what we think is that as this are

63
00:02:44,259 --> 00:02:40,019

precipitating it because it's really

64
00:02:47,479 --> 00:02:44,269
rapid you can have them basically

65
00:02:50,570 --> 00:02:47,489
trapped in and tell microbes as they do

66
00:02:52,880 --> 00:02:50,580
that and the good thing about those hot

67
00:02:57,740 --> 00:02:52,890
springs are that three time they

68
00:02:59,240 --> 00:02:57,750
actually are able to basically collect

69
00:03:01,309 --> 00:02:59,250
information at a time of your

70
00:03:02,750 --> 00:03:01,319
presentation so through time you can be

71
00:03:04,819 --> 00:03:02,760
able to study this and think about the

72
00:03:07,280 --> 00:03:04,829
climate the Paleo climate at a time of

73
00:03:09,110 --> 00:03:07,290
formation the microbial life in the

74
00:03:11,509 --> 00:03:09,120
hydrology I design presentation as well

75
00:03:13,460 --> 00:03:11,519
so my Hot Springs that I looked at at

76
00:03:15,140 --> 00:03:13,470
two of them and these are the largest

77
00:03:17,720 --> 00:03:15,150
travertine precipitating hot springs in

78
00:03:23,720 --> 00:03:17,730
the world from 13 and also from

79
00:03:27,259 --> 00:03:23,730
Yellowstone so a lot of work has already

80
00:03:29,599 --> 00:03:27,269
been done using travertine but mainly

81
00:03:31,699 --> 00:03:29,609
people have looked at what is in the

82
00:03:33,710 --> 00:03:31,709
water and also a lot of work has also

83
00:03:35,690 --> 00:03:33,720
been done on the rocks itself but

84
00:03:37,789 --> 00:03:35,700
looking at the rocks is what most people

85
00:03:40,960 --> 00:03:37,799
have only looked at physical biomarkers

86
00:03:44,140 --> 00:03:40,970
basically clear fossils and also like

87
00:03:47,210 --> 00:03:44,150
crystals that are present in these

88
00:03:48,589 --> 00:03:47,220

travertine samples so these are all good

89
00:03:51,890 --> 00:03:48,599
so the i'll just show you a few examples

90
00:03:54,349 --> 00:03:51,900
of what have being done so this work was

91
00:03:57,199 --> 00:03:54,359
done by allen in two thousand whether we

92
00:03:59,659 --> 00:03:57,209
china look at the position is that he

93
00:04:01,400 --> 00:03:59,669
can study on earth for astrobiology like

94
00:04:02,839 --> 00:04:01,410
where they go there what they can

95
00:04:04,759 --> 00:04:02,849
actually look out for so these are

96
00:04:07,339 --> 00:04:04,769
filaments that you can see is standing

97
00:04:09,770 --> 00:04:07,349
from pits of weathered calcite crystals

98
00:04:11,659 --> 00:04:09,780
and these are change of microbes that

99
00:04:15,349 --> 00:04:11,669
have been replaced by slick as spheres

100
00:04:17,390 --> 00:04:15,359
and these are also microbial forms they

101
00:04:19,400 --> 00:04:17,400
can see on calcite so this is all great

102
00:04:22,360 --> 00:04:19,410
you can see fossils in all those

103
00:04:24,980 --> 00:04:22,370
crystals when you look into the the

104
00:04:27,200 --> 00:04:24,990
double-slit the records but the problem

105
00:04:28,430 --> 00:04:27,210
then is it's not always that you can be

106
00:04:31,790 --> 00:04:28,440
sure that these are actually for

107
00:04:32,439 --> 00:04:31,800
microbial origins and the first thing

108
00:04:34,299 --> 00:04:32,449
that comes in

109
00:04:38,019 --> 00:04:34,309
if you all have heard of this video

110
00:04:40,929 --> 00:04:38,029
right alh84001 where there is all that

111
00:04:42,939 --> 00:04:40,939
create controversy about whether it is

112
00:04:44,920 --> 00:04:42,949
actually from a biological source or not

113
00:04:47,170 --> 00:04:44,930

so then is not good that we can use the

114
00:04:48,519 --> 00:04:47,180
fossils but can we really be sure that

115
00:04:51,760 --> 00:04:48,529
these actually up from biological

116
00:04:54,879 --> 00:04:51,770
sources not really so the golden of my

117
00:04:57,309 --> 00:04:54,889
study was to be able to go in and try to

118
00:05:00,189 --> 00:04:57,319
think of other sorts of biomarkers that

119
00:05:01,540 --> 00:05:00,199
we can use instead of fiscal biomarkers

120
00:05:04,089 --> 00:05:01,550
to see if we can actually be able to

121
00:05:06,929 --> 00:05:04,099
check these deficits back in time and

122
00:05:09,760 --> 00:05:06,939
look at what was present in them so

123
00:05:12,790 --> 00:05:09,770
that's the basic very Marquez avocado

124
00:05:14,409 --> 00:05:12,800
first was DNA which doesn't it's not

125
00:05:16,179 --> 00:05:14,419
long leaf so obviously we can go back

126
00:05:17,980 --> 00:05:16,189
into the billions of years so we tried

127
00:05:20,529 --> 00:05:17,990
to go back to at least a million year

128
00:05:22,989 --> 00:05:20,539
old deficit and see how far we can go

129
00:05:24,879 --> 00:05:22,999
inside and then also another option

130
00:05:26,110 --> 00:05:24,889
would be to the caliphates so this work

131
00:05:29,110 --> 00:05:26,120
is going to just look at what I did

132
00:05:31,629 --> 00:05:29,120
looking at DNA by Marcus so basically we

133
00:05:33,670 --> 00:05:31,639
have we hypothesized that microbial DNA

134
00:05:36,070 --> 00:05:33,680
can be stored or preserved in those

135
00:05:38,170 --> 00:05:36,080
deposits and three time we can be able

136
00:05:39,969 --> 00:05:38,180
to use them to reconstruct the

137
00:05:42,129 --> 00:05:39,979
phylogenetic and metabolic activities

138
00:05:46,029 --> 00:05:42,139

that were at the time of the formation

139
00:05:48,489 --> 00:05:46,039
of this deposits so basically to the two

140
00:05:50,589 --> 00:05:48,499
basic questions at what what can we find

141
00:05:53,050 --> 00:05:50,599
in there in how did they change of a

142
00:05:55,089 --> 00:05:53,060
geological time and also what are the

143
00:05:57,149 --> 00:05:55,099
metabolic potentials that are preserved

144
00:06:00,639 --> 00:05:57,159
or they had at the time of his

145
00:06:02,739 --> 00:06:00,649
precipitation so to do this one of the

146
00:06:04,989 --> 00:06:02,749
most important work becomes to mind or

147
00:06:07,209 --> 00:06:04,999
that helps me is this concept of

148
00:06:09,699 --> 00:06:07,219
trafficking the positional fascias that

149
00:06:12,939 --> 00:06:09,709
was established like my advisor in two

150
00:06:15,129 --> 00:06:12,949
thousand he basically look at the the

151
00:06:16,719 --> 00:06:15,139
foot path of destruction deficits and he

152
00:06:19,929 --> 00:06:16,729
was able to establish that there's

153
00:06:22,149 --> 00:06:19,939
actually come in five therefore self the

154
00:06:23,769 --> 00:06:22,159
positional fascias from the vent fishes

155
00:06:26,050 --> 00:06:23,779
all the way to the proximal slope and

156
00:06:27,790 --> 00:06:26,060
basically moving from one patients to

157
00:06:30,429 --> 00:06:27,800
the other you have differential

158
00:06:33,639 --> 00:06:30,439
chemistry different fabrics in different

159
00:06:36,129 --> 00:06:33,649
but microbial communities that are

160
00:06:38,379 --> 00:06:36,139
preserved and how why is this important

161
00:06:40,449 --> 00:06:38,389
because basically going back in time you

162
00:06:42,369 --> 00:06:40,459
can be able to track those fabrics and

163
00:06:43,929 --> 00:06:42,379

what they look like so then if you have

164
00:06:45,850 --> 00:06:43,939
a modern trafficking sample that is like

165
00:06:47,589 --> 00:06:45,860
a ten-year-old travertine

166
00:06:49,209 --> 00:06:47,599
track it all the way back like a million

167
00:06:51,779 --> 00:06:49,219
travertine sample and be sure that

168
00:06:54,640 --> 00:06:51,789
they're from the same the same from a

169
00:06:56,140 --> 00:06:54,650
spacious and once you have the modern

170
00:06:57,490 --> 00:06:56,150
sample you know where you can find it a

171
00:06:59,439 --> 00:06:57,500
modern sample you should be able to

172
00:07:00,730 --> 00:06:59,449
basically see the same thing because

173
00:07:02,830 --> 00:07:00,740
it's the same conditions under which

174
00:07:05,110 --> 00:07:02,840
they were formed so then that gives you

175
00:07:10,839 --> 00:07:05,120
like a starting point for you to be able

176
00:07:14,350 --> 00:07:10,849
to move on okay so I went looking at

177
00:07:16,839 --> 00:07:14,360
five of samples one with an active

178
00:07:19,600 --> 00:07:16,849
sample that with water in a little bit

179
00:07:22,059 --> 00:07:19,610
of traveling travertine itself attorney

180
00:07:24,159 --> 00:07:22,069
also improved 4,000 year old thirty

181
00:07:25,749 --> 00:07:24,169
thousand year old in a 1 million year

182
00:07:27,700 --> 00:07:25,759
old so the one building your old one is

183
00:07:31,029 --> 00:07:27,710
from check mark and the Rays are all

184
00:07:32,679 --> 00:07:31,039
from Yellowstone so basically the

185
00:07:34,779 --> 00:07:32,689
problem that comes we had to work with

186
00:07:36,999 --> 00:07:34,789
inch and samples is a huge problem with

187
00:07:39,399 --> 00:07:37,009
contamination so there's a friend first

188
00:07:41,439 --> 00:07:39,409

one that we have is the dye generating

189
00:07:43,390 --> 00:07:41,449
alteration which we basically can do

190
00:07:44,709 --> 00:07:43,400
anything about it's basically everything

191
00:07:46,149 --> 00:07:44,719
that happens to their walk after is

192
00:07:48,219 --> 00:07:46,159
deposited so there's water rock

193
00:07:49,779 --> 00:07:48,229
interaction that's what I bring it in my

194
00:07:51,760 --> 00:07:49,789
crews from the environment and you can

195
00:07:54,219 --> 00:07:51,770
really change that okay and then the

196
00:07:57,249 --> 00:07:54,229
next the ones that we can actually bring

197
00:07:59,110 --> 00:07:57,259
in our drinks fill sampling so you want

198
00:08:01,240 --> 00:07:59,120
to do all the sampling under sterile

199
00:08:03,100 --> 00:08:01,250
conditions in also doing your

200
00:08:04,990 --> 00:08:03,110
instruction you have to do this in a

201
00:08:07,390 --> 00:08:05,000
clean room so all of the work that I did

202
00:08:09,610 --> 00:08:07,400
what was done in the clean room in I

203
00:08:11,800 --> 00:08:09,620
have to well really fancy suit and it's

204
00:08:13,269 --> 00:08:11,810
not fun when you are downstairs and hear

205
00:08:14,499 --> 00:08:13,279
the fire alarm go off and have to get

206
00:08:17,800 --> 00:08:14,509
out of this and try to get out of the

207
00:08:19,719 --> 00:08:17,810
building though I did all of that so

208
00:08:21,700 --> 00:08:19,729
most of my way currently was done under

209
00:08:24,730 --> 00:08:21,710
bull crook so basically I take the work

210
00:08:28,659 --> 00:08:24,740
and I crush it and I try to get a DNA

211
00:08:31,089 --> 00:08:28,669
out of those so what I got was basically

212
00:08:33,100 --> 00:08:31,099
a rapid decline in the amount or the

213
00:08:36,329 --> 00:08:33,110

concentration of DNA which is not

214
00:08:38,469 --> 00:08:36,339
surprising because basically active or

215
00:08:41,170 --> 00:08:38,479
active tissues able to repair

216
00:08:43,600 --> 00:08:41,180
efficiently their DNA but if you are

217
00:08:45,819 --> 00:08:43,610
inactive you basically build up a lot a

218
00:08:48,040 --> 00:08:45,829
bit of a lot of damage so over time you

219
00:08:49,870 --> 00:08:48,050
lose a lot and those was also done by

220
00:08:52,030 --> 00:08:49,880
willis live and they look up about four

221
00:08:55,360 --> 00:08:52,040
examples of different ages and they got

222
00:08:57,490 --> 00:08:55,370
exactly the same thing so i'll just show

223
00:08:59,180 --> 00:08:57,500
you basically what i'm trying to let you

224
00:09:01,910 --> 00:08:59,190
know i'll show you here is

225
00:09:03,260 --> 00:09:01,920
this is the active sample this is the

226
00:09:05,330 --> 00:09:03,270
modern sample and these are the ancient

227
00:09:07,960 --> 00:09:05,340
samples and one thing you see is the

228
00:09:10,220 --> 00:09:07,970
difference and what is dominating and

229
00:09:12,620 --> 00:09:10,230
quickly I just went out that the modern

230
00:09:14,900 --> 00:09:12,630
sample was dominated dominated mostly by

231
00:09:18,640 --> 00:09:14,910
proteobacteria and a little bit of sign

232
00:09:21,380 --> 00:09:18,650
of bacteria and then the active spring

233
00:09:23,330 --> 00:09:21,390
the modern spraying a modern struggling

234
00:09:25,910 --> 00:09:23,340
samples mostly by cyanobacteria which is

235
00:09:27,920 --> 00:09:25,920
what you respect from a hot spring but

236
00:09:29,810 --> 00:09:27,930
the interesting thing is shifting to the

237
00:09:31,730 --> 00:09:29,820
ancient samples it was all merely

238
00:09:33,860 --> 00:09:31,740

Firmicutes which is also not too

239
00:09:35,720 --> 00:09:33,870
surprising because most of the works

240
00:09:37,760 --> 00:09:35,730
that have been done looking at malkova

241
00:09:39,560 --> 00:09:37,770
communities through time you have a lot

242
00:09:42,170 --> 00:09:39,570
of friendly hoods dominating with

243
00:09:46,130 --> 00:09:42,180
ancient samples basically because these

244
00:09:47,960 --> 00:09:46,140
are really sport for main microbes and

245
00:09:49,760 --> 00:09:47,970
be able to withstand all the harsh

246
00:09:51,410 --> 00:09:49,770
conditions that you find in their

247
00:09:53,330 --> 00:09:51,420
environment three times so relatively

248
00:09:57,800 --> 00:09:53,340
they able you're able to preserve those

249
00:09:59,690 --> 00:09:57,810
over time so this is a principal

250
00:10:01,390 --> 00:09:59,700
component analysis that showing that

251
00:10:04,670 --> 00:10:01,400
shows basically that the main difference

252
00:10:07,130 --> 00:10:04,680
that we see in these communities is

253
00:10:08,690 --> 00:10:07,140
mainly due to the age of the of these

254
00:10:09,980 --> 00:10:08,700
samples and not because of where they

255
00:10:11,480 --> 00:10:09,990
are from so basically the Jewish

256
00:10:13,670 --> 00:10:11,490
collocations don't really are

257
00:10:16,070 --> 00:10:13,680
complications on matter it is the age of

258
00:10:17,360 --> 00:10:16,080
the samples don't matter so the quick

259
00:10:19,310 --> 00:10:17,370
sample is basically all gonna have

260
00:10:20,690 --> 00:10:19,320
thought about so moving on that's just

261
00:10:23,450 --> 00:10:20,700
the phylum level that's like really

262
00:10:25,880 --> 00:10:23,460
really huge you don't really see much or

263
00:10:27,860 --> 00:10:25,890

you can really pinpoint a lot of things

264
00:10:29,690 --> 00:10:27,870
so what I did from there was to look at

265
00:10:32,770 --> 00:10:29,700
family level diversity so I went into

266
00:10:36,130 --> 00:10:32,780
all their samples and look at what the

267
00:10:38,780 --> 00:10:36,140
different families that I represented in

268
00:10:41,150 --> 00:10:38,790
with that I went into the literature to

269
00:10:42,740 --> 00:10:41,160
see what organisms are present in those

270
00:10:44,660 --> 00:10:42,750
families and what they are known to do

271
00:10:47,090 --> 00:10:44,670
so then I came up with this thing we

272
00:10:49,520 --> 00:10:47,100
call physio types basically Chinese tell

273
00:10:51,500 --> 00:10:49,530
you what they are known to do so these

274
00:10:54,940 --> 00:10:51,510
are like metabolic metabolic potentials

275
00:10:57,050 --> 00:10:54,950
and because we didn't actually do um

276
00:10:58,760 --> 00:10:57,060
metagenomics to look at the functional

277
00:11:00,140 --> 00:10:58,770
genes or anything we can specifically

278
00:11:02,840 --> 00:11:00,150
say this is what they do by these are

279
00:11:05,150 --> 00:11:02,850
potentials of what they can they could

280
00:11:09,060 --> 00:11:05,160
they should be able to do so basically

281
00:11:15,150 --> 00:11:11,610
it shows just what we got from the file

282
00:11:17,490 --> 00:11:15,160
a phylum level diversity basically the

283
00:11:21,900 --> 00:11:17,500
end of the active sample is slightly

284
00:11:24,930 --> 00:11:21,910
different mainly you have a lot of Kim

285
00:11:27,000 --> 00:11:24,940
aleesha traffic activity going on the

286
00:11:29,310 --> 00:11:27,010
active spring the modern screen has a

287
00:11:31,140 --> 00:11:29,320
lot of oxygen leak for the trucks and

288
00:11:32,580 --> 00:11:31,150

non oxygen for those trucks because of

289
00:11:35,340 --> 00:11:32,590
the sound of bacterial community that we

290
00:11:38,040 --> 00:11:35,350
have and all the ancient sample as we

291
00:11:40,230 --> 00:11:38,050
saw before also merely they are all key

292
00:11:42,420 --> 00:11:40,240
morgana troughs mostly dominating that

293
00:11:44,190 --> 00:11:42,430
so basically the good thing about this

294
00:11:45,510 --> 00:11:44,200
weekend really I can hundred percent say

295
00:11:47,370 --> 00:11:45,520
that the communities that I have seen in

296
00:11:49,590 --> 00:11:47,380
this ancient samples are the ancient

297
00:11:51,390 --> 00:11:49,600
communities at the point of formation

298
00:11:52,980 --> 00:11:51,400
but the good thing here is that there

299
00:11:54,720 --> 00:11:52,990
are subsets of the modern samples

300
00:11:56,400 --> 00:11:54,730
everything you see in the ancient

301
00:11:58,140 --> 00:11:56,410
samples are basically present in the

302
00:12:01,770 --> 00:11:58,150
morning samples and since we go through

303
00:12:03,420 --> 00:12:01,780
back with the fishes a model we are

304
00:12:06,420 --> 00:12:03,430
going to show that this is what we have

305
00:12:09,900 --> 00:12:06,430
seen so moving forward you're basically

306
00:12:11,790 --> 00:12:09,910
trying to do make the in sections and

307
00:12:14,010 --> 00:12:11,800
try to do what we call fluid inclusions

308
00:12:16,050 --> 00:12:14,020
going to dissolute inclusions and eat

309
00:12:17,460 --> 00:12:16,060
their primary fluid inclusions we be

310
00:12:20,880 --> 00:12:17,470
able to tell that this was what was

311
00:12:22,320 --> 00:12:20,890
present at a time of formation when at

312
00:12:25,230 --> 00:12:22,330
the time of precipitation of this

313
00:12:26,730 --> 00:12:25,240

deficits so yeah this of course a

314
00:12:29,220 --> 00:12:26,740
million-year-old is nothing compared to

315
00:12:31,590 --> 00:12:29,230
4.5 3.5 billion year old show otherwise

316
00:12:33,420 --> 00:12:31,600
but moving forward if you're able to go

317
00:12:40,530 --> 00:12:33,430
back in time this is as much as I've

318
00:12:59,050 --> 00:12:42,579
all right I have time for a few

319
00:13:03,519 --> 00:12:59,060
questions do we find travertine anywhere

320
00:13:05,769 --> 00:13:03,529
in the solar system um very um I think

321
00:13:08,530 --> 00:13:05,779
on Mars actually there's like two firs

322
00:13:11,470 --> 00:13:08,540
and strawberries that cause is that this

323
00:13:12,699 --> 00:13:11,480
is basically a carbonate deposits so if

324
00:13:14,350 --> 00:13:12,709
you have carbonate deposits so the

325
00:13:16,030 --> 00:13:14,360
difference people think the difference

326
00:13:18,370 --> 00:13:16,040
between two fire and travertine is just

327
00:13:19,960 --> 00:13:18,380
the temperature difference I believe

328
00:13:22,480 --> 00:13:19,970
it's for my low temperatures people

329
00:13:25,389 --> 00:13:22,490
think it's travatan but i have seen one

330
00:13:27,009 --> 00:13:25,399
crystal geyser in color or something and

331
00:13:30,100 --> 00:13:27,019
it looks exactly like Yellowstone even

332
00:13:35,230 --> 00:13:30,110
though it's au yeung window it's a low

333
00:13:46,660 --> 00:13:35,240
temperature thank you any other

334
00:13:48,970 --> 00:13:46,670
questions ok um see here um I guess we