



1
00:00:13,910 --> 00:00:10,870

[Music]

2
00:00:16,910 --> 00:00:13,920

hi I'm Marissa I'm a postdoc currently

3
00:00:20,029 --> 00:00:16,920

at NASA Ames Research Center and I work

4
00:00:22,070 --> 00:00:20,039

on microbial sources of Hope annoyed

5
00:00:24,529 --> 00:00:22,080

lipid biomarkers in different hot spring

6
00:00:27,470 --> 00:00:24,539

environments today I'm going to be

7
00:00:30,050 --> 00:00:27,480

excitedly sharing with you some new

8
00:00:31,910 --> 00:00:30,060

potential microbial sources of two and

9
00:00:35,270 --> 00:00:31,920

three methylhopenoids that we were able

10
00:00:37,870 --> 00:00:35,280

to find in some of our anoxic acidic and

11
00:00:40,670 --> 00:00:37,880

sulfidic hydrothermal Springs

12
00:00:44,090 --> 00:00:40,680

I want to acknowledge my funding sources

13
00:00:47,030 --> 00:00:44,100

which is ori u NPP program National Park

14

00:00:49,250 --> 00:00:47,040

Service NASA and finally Stanford

15

00:00:51,889 --> 00:00:49,260

University because some of this research

16

00:00:54,709 --> 00:00:51,899

was done back my PhD as well

17

00:00:56,810 --> 00:00:54,719

um so yeah you might be wondering if you

18

00:00:58,610 --> 00:00:56,820

are an astronomer or anyone but a lipid

19

00:01:00,650 --> 00:00:58,620

chemist what are hopeenoids and what do

20

00:01:01,990 --> 00:01:00,660

they teach us in modern environment why

21

00:01:05,329 --> 00:01:02,000

should we care

22

00:01:07,370 --> 00:01:05,339

so hopeenoids are cyclic triterpenoid

23

00:01:08,929 --> 00:01:07,380

membrane lipids so they're complex

24

00:01:10,730 --> 00:01:08,939

they're a little bit different from some

25

00:01:12,130 --> 00:01:10,740

of the phospholipid membranes we've been

26

00:01:14,870 --> 00:01:12,140

seeing today

27

00:01:17,510 --> 00:01:14,880

hopeenoids are some of the most abundant

28

00:01:20,390 --> 00:01:17,520

bacterial lipid biomarkers on Earth so

29

00:01:22,789 --> 00:01:20,400

they're very worthy of studying

30

00:01:24,890 --> 00:01:22,799

um they are important geologically

31

00:01:28,130 --> 00:01:24,900

um they can withstand the lithification

32

00:01:29,749 --> 00:01:28,140

process uh and all the diagenetic forces

33

00:01:31,190 --> 00:01:29,759

that happen when you are becoming a

34

00:01:32,810 --> 00:01:31,200

fossil

35

00:01:34,850 --> 00:01:32,820

um and so they're actually one of the

36

00:01:37,069 --> 00:01:34,860

few really strong sources through deep

37

00:01:38,270 --> 00:01:37,079

time of microbial inputs into the Rock

38

00:01:41,149 --> 00:01:38,280

record

39

00:01:43,550 --> 00:01:41,159

um and they can be detected billions of

40

00:01:46,249 --> 00:01:43,560

years after a deposition

41

00:01:49,429 --> 00:01:46,259

um finally in modern acidic Springs we

42

00:01:52,910 --> 00:01:49,439

observe methylated hopeenoids oh sorry

43

00:01:56,569 --> 00:01:52,920

in in this work we in modern acidic

44

00:01:58,969 --> 00:01:56,579

Springs observed methylated hopeenoids

45

00:02:02,030 --> 00:01:58,979

um and we found these in an anoxic

46

00:02:04,370 --> 00:02:02,040

environment where no cyanobacteria and

47

00:02:07,969 --> 00:02:04,380

no methanotrophs were present these are

48

00:02:10,969 --> 00:02:07,979

kind of the typified known producers of

49

00:02:14,150 --> 00:02:10,979

these kinds of biomarkers so it was

50

00:02:16,250 --> 00:02:14,160

exciting to find them at all and uh yeah

51
00:02:18,589 --> 00:02:16,260
the work that once we found those

52
00:02:21,170 --> 00:02:18,599
methylated hopenoids and the follow-up

53
00:02:23,270 --> 00:02:21,180
work was able to lead to discovery of

54
00:02:25,490 --> 00:02:23,280
some new potential Source organisms for

55
00:02:27,290 --> 00:02:25,500
these lipid biomarkers um which if you

56
00:02:29,630 --> 00:02:27,300
are a biomarker nerd is always exciting

57
00:02:30,650 --> 00:02:29,640
and it's ever expanding so

58
00:02:32,930 --> 00:02:30,660
yeah

59
00:02:35,690 --> 00:02:32,940
this kind of new evidence of source

60
00:02:37,970 --> 00:02:35,700
organisms is important because uh these

61
00:02:39,530 --> 00:02:37,980
yeah kind of inoxic environments and

62
00:02:41,690 --> 00:02:39,540
knowing about them and the microbes that

63
00:02:44,570 --> 00:02:41,700

live in them today can have implications

64

00:02:46,070 --> 00:02:44,580

for us to reinterpret uh the sedimentary

65

00:02:48,110 --> 00:02:46,080

rock record on Earth but also

66

00:02:50,210 --> 00:02:48,120

potentially on mars or on other planets

67

00:02:53,270 --> 00:02:50,220

where we have a sedimentary rock record

68

00:02:55,430 --> 00:02:53,280

so my samples were taken in two sites

69

00:02:58,550 --> 00:02:55,440

one is in Yellowstone National Park and

70

00:03:00,830 --> 00:02:58,560

one is in Lassen Volcanic National Park

71

00:03:02,390 --> 00:03:00,840

um in both Springs you can see the mat

72

00:03:05,449 --> 00:03:02,400

is kind of similar there's a purple

73

00:03:07,430 --> 00:03:05,459

layer there's a like a acidic algae

74

00:03:09,470 --> 00:03:07,440

layer and then there's this white

75

00:03:11,149 --> 00:03:09,480

flocculent Elemental sulfur on top

76

00:03:12,890 --> 00:03:11,159

that's from the actual hydrothermal

77

00:03:15,890 --> 00:03:12,900

system itself

78

00:03:18,589 --> 00:03:15,900

um so what I did is I go into these

79

00:03:21,290 --> 00:03:18,599

Springs and I take samples and I go back

80

00:03:23,570 --> 00:03:21,300

to my lab and I extract for both DNA and

81

00:03:24,949 --> 00:03:23,580

for lipids and then from there I

82

00:03:27,290 --> 00:03:24,959

analyzed them

83

00:03:32,330 --> 00:03:27,300

so I found a bunch of different

84

00:03:33,890 --> 00:03:32,340

hopenoids so I did a lcms analysis on

85

00:03:35,449 --> 00:03:33,900

them and so I was able to actually look

86

00:03:38,330 --> 00:03:35,459

at the functionalized extended

87

00:03:40,610 --> 00:03:38,340

hopenoids and so as you can see there's

88

00:03:42,470 --> 00:03:40,620

a lot of colors on that graph every

89

00:03:44,449 --> 00:03:42,480

color is a different type of Hope noid

90

00:03:47,750 --> 00:03:44,459

uh that I was able to find in my Springs

91

00:03:49,250 --> 00:03:47,760

the green overlay on some of them and

92

00:03:51,649 --> 00:03:49,260

the pink overlays on some of them

93

00:03:55,369 --> 00:03:51,659

indicate a two-methyl for green or a

94

00:03:57,229 --> 00:03:55,379

three methyl for pink so we found a huge

95

00:03:57,949 --> 00:03:57,239

diversity of methylated

96

00:04:00,589 --> 00:03:57,959

um

97

00:04:03,470 --> 00:04:00,599

yeah methylated hopeenoid compounds over

98

00:04:05,750 --> 00:04:03,480

to the far right you can see my controls

99

00:04:07,729 --> 00:04:05,760

we had pretty low diversity of

100

00:04:09,410 --> 00:04:07,739

methylated compounds so

101

00:04:11,089 --> 00:04:09,420

it was really interesting in the

102

00:04:12,770 --> 00:04:11,099

environmental samples to see so many

103

00:04:14,390 --> 00:04:12,780

different kinds which is what sent us on

104

00:04:15,890 --> 00:04:14,400

our DNA work

105

00:04:18,770 --> 00:04:15,900

um so the first thing that we did was do

106

00:04:22,069 --> 00:04:18,780

success amplicon analysis of our

107

00:04:24,650 --> 00:04:22,079

extracted DNA in that we didn't see any

108

00:04:27,590 --> 00:04:24,660

obvious sources or classical sources of

109

00:04:29,990 --> 00:04:27,600

those methylated hopenoids which was

110

00:04:31,850 --> 00:04:30,000

pretty exciting so that then led us to

111

00:04:34,070 --> 00:04:31,860

go back and then do some metagenomics

112

00:04:37,550 --> 00:04:34,080

and then when we were able to analyze

113

00:04:39,409 --> 00:04:37,560

that metagenomic data we saw many

114

00:04:39,950 --> 00:04:39,419

potential sources

115

00:04:44,150 --> 00:04:39,960

um

116

00:04:46,430 --> 00:04:44,160

of Novel yeah 2-methylhopenoid producers

117

00:04:49,730 --> 00:04:46,440

um mostly anaerobic water and soil

118

00:04:52,310 --> 00:04:49,740

dwelling microbes but way more sources

119

00:04:55,730 --> 00:04:52,320

than are currently understood and this

120

00:04:58,070 --> 00:04:55,740

is just from looking into Hot Springs so

121

00:05:01,370 --> 00:04:58,080

a case for doing field work to expand

122

00:05:03,050 --> 00:05:01,380

our knowledge in the lab we also saw a

123

00:05:05,870 --> 00:05:03,060

ton of potential novel sources of three

124

00:05:07,550 --> 00:05:05,880

methylhopenoids these were also so these

125

00:05:09,230 --> 00:05:07,560

were mostly anaerobic and acidic

126
00:05:12,230 --> 00:05:09,240
environment dwellers that we found them

127
00:05:14,629 --> 00:05:12,240
tagging against and

128
00:05:17,450 --> 00:05:14,639
yeah it was pretty exciting so if you

129
00:05:21,290 --> 00:05:17,460
want to know more about either lipids or

130
00:05:22,969 --> 00:05:21,300
DNA analyzes or a microbial Ecology of

131
00:05:24,950 --> 00:05:22,979
these acidic Springs please come check

132
00:05:27,830 --> 00:05:24,960
out my poster later and find me I'll be

133
00:05:29,930 --> 00:05:27,840
at board 22 at this next session and

134
00:05:33,050 --> 00:05:29,940
also because I am in a room full of

135
00:05:36,230 --> 00:05:33,060
early career researchers I coordinate a

136
00:05:38,210 --> 00:05:36,240
division seminar at NASA Ames and we

137
00:05:40,189 --> 00:05:38,220
would love to hear you guys give talks

138
00:05:43,129 --> 00:05:40,199

so if you would like to give a talk at

139

00:05:44,390 --> 00:05:43,139

NASA Ames at any point please come find

140

00:05:46,010 --> 00:05:44,400

me at my poster and I'd love to write

141

00:05:48,350 --> 00:05:46,020

your information down and we would love

142

00:05:51,010 --> 00:05:48,360

to have you give a talk so