
AB
GRAD
CON23

1
00:00:13,910 --> 00:00:10,870
[Music]

2
00:00:17,390 --> 00:00:13,920
hi I'm Miriam and I'm here to talk about

3
00:00:19,910 --> 00:00:17,400
the salt of the earth and how they could

4
00:00:20,929 --> 00:00:19,920
help when looking for life in the solar

5
00:00:24,470 --> 00:00:20,939
system

6
00:00:25,550 --> 00:00:24,480
Earth can provide us with analogs that

7
00:00:27,589 --> 00:00:25,560
can

8
00:00:29,990 --> 00:00:27,599
mimic extra planetary environments and

9
00:00:32,210 --> 00:00:30,000
one of the most ones most often used for

10
00:00:34,970 --> 00:00:32,220
Mars is the Atacama Desert I'm really

11
00:00:38,510 --> 00:00:34,980
proud of this graphic

12
00:00:40,610 --> 00:00:38,520
so in the Atacama life has been shown to

13
00:00:43,490 --> 00:00:40,620

live off the deli questions of salts but

14
00:00:46,310 --> 00:00:43,500
uh can the salts that I studied

15
00:00:48,049 --> 00:00:46,320
deliquest in Autumn conditions so for my

16
00:00:50,389 --> 00:00:48,059
project I tried to answer two scientific

17
00:00:53,330 --> 00:00:50,399
questions could nitrate salts or their

18
00:00:55,010 --> 00:00:53,340
salt mixtures uptake water or release

19
00:00:58,970 --> 00:00:55,020
water

20
00:01:00,350 --> 00:00:58,980
autocom environmental conditions and

21
00:01:04,250 --> 00:01:00,360
could the temperature and relative

22
00:01:05,690 --> 00:01:04,260
humidity values lead to nitrate salt

23
00:01:08,450 --> 00:01:05,700
deloquiescence

24
00:01:10,670 --> 00:01:08,460
so to answer this we used a Ramen

25
00:01:12,469 --> 00:01:10,680
microscope attached to an environmental

26
00:01:14,090 --> 00:01:12,479
cell in which the temperature and

27
00:01:15,530 --> 00:01:14,100
relative humidity could be controlled

28
00:01:18,050 --> 00:01:15,540
and we used this to study the phase

29
00:01:19,730 --> 00:01:18,060
transitions of our salts of Interest

30
00:01:21,770 --> 00:01:19,740
so we can answer our first question

31
00:01:23,090 --> 00:01:21,780
could nitrate salts or salt mixtures

32
00:01:25,010 --> 00:01:23,100
take up water under autocommer

33
00:01:26,749 --> 00:01:25,020
conditions well yes and thank you for

34
00:01:28,310 --> 00:01:26,759
coming to my talk

35
00:01:30,230 --> 00:01:28,320
um so

36
00:01:31,609 --> 00:01:30,240
but let me tell you why and so the first

37
00:01:32,810 --> 00:01:31,619
thing that we're going to do is look at

38
00:01:35,090 --> 00:01:32,820

the spectral series of the pure

39
00:01:36,649 --> 00:01:35,100
magnesium nitrate

40
00:01:38,090 --> 00:01:36,659
um so if we look at the crystalline

41
00:01:40,010 --> 00:01:38,100
nitrate which is going to be shown by

42
00:01:41,510 --> 00:01:40,020
the black Spectra at the bottom it

43
00:01:45,289 --> 00:01:41,520
starts off at a higher wave number of

44
00:01:47,270 --> 00:01:45,299
1062 and as we increase the as we

45
00:01:48,649 --> 00:01:47,280
decrease the relative sorry increase the

46
00:01:50,690 --> 00:01:48,659
decrease the temperature and increase

47
00:01:52,069 --> 00:01:50,700
the relative humidity it's going to stay

48
00:01:53,749 --> 00:01:52,079
there until it reaches the deli

49
00:01:55,609 --> 00:01:53,759
questions relative humidity of 63

50
00:01:57,170 --> 00:01:55,619
percent

51
00:02:00,590 --> 00:01:57,180
um at which point it shifts the lower

52
00:02:01,670 --> 00:02:00,600
wave number of 1052 so it's going to

53
00:02:03,710 --> 00:02:01,680
stay here

54
00:02:06,590 --> 00:02:03,720
and this is really cool it's going to

55
00:02:07,789 --> 00:02:06,600
stay here and as we increase the

56
00:02:09,529 --> 00:02:07,799
temperature and decrease the relative

57
00:02:11,750 --> 00:02:09,539
humidity it stays at that lower wave

58
00:02:14,690 --> 00:02:11,760
number until the efflorescence relative

59
00:02:17,210 --> 00:02:14,700
humidity of 23 and that means that

60
00:02:19,309 --> 00:02:17,220
magnesium nitrate the pure one can

61
00:02:23,630 --> 00:02:19,319
maintain a metal stable brine for over a

62
00:02:27,110 --> 00:02:25,490
um so we repeated these experiments

63
00:02:28,610 --> 00:02:27,120

multiple times over different

64
00:02:29,949 --> 00:02:28,620
temperatures and we made this lovely

65
00:02:32,330 --> 00:02:29,959
phase diagram

66
00:02:34,550 --> 00:02:32,340
uh and it's as temperature versus

67
00:02:36,530 --> 00:02:34,560
relative humidity so for the pure

68
00:02:37,729 --> 00:02:36,540
magnesium nitrate has a hydrate the Dell

69
00:02:40,010 --> 00:02:37,739
questions is going to be shown by the

70
00:02:42,830 --> 00:02:40,020
blue dots and the efflorescence is shown

71
00:02:44,330 --> 00:02:42,840
by the orange squares and it was a

72
00:02:47,150 --> 00:02:44,340
relatively temperature independent and

73
00:02:49,729 --> 00:02:47,160
occurred around 25 RH

74
00:02:51,530 --> 00:02:49,739
so magnesium nitrate exhibited a very

75
00:02:53,570 --> 00:02:51,540
large hysteresis which you can tell by

76
00:02:55,490 --> 00:02:53,580
the gap between the Dell questions and

77
00:02:56,809 --> 00:02:55,500
the fluorescence relative humidity and

78
00:03:00,710 --> 00:02:56,819
this is going to be our meta-stable

79
00:03:03,949 --> 00:03:00,720
brine region but I also mentioned salt

80
00:03:06,050 --> 00:03:03,959
regions so what about them so we

81
00:03:06,890 --> 00:03:06,060
did the exact same experiment but we

82
00:03:08,990 --> 00:03:06,900
used

83
00:03:11,149 --> 00:03:09,000
um different salts so we have magnesium

84
00:03:15,470 --> 00:03:11,159
nitrate so this is a one-to-one mixture

85
00:03:18,710 --> 00:03:15,480
and we have magnesium nitrate on the

86
00:03:21,710 --> 00:03:18,720
left and magnesium per chlorate on the

87
00:03:23,570 --> 00:03:21,720
right and we see that same shift in the

88
00:03:25,369 --> 00:03:23,580

nitrate Peak which we use to determine

89
00:03:27,050 --> 00:03:25,379
when dull questions would occur

90
00:03:30,170 --> 00:03:27,060
and so

91
00:03:32,210 --> 00:03:30,180
we took different ratios of chlorate and

92
00:03:34,070 --> 00:03:32,220
nitrate and we looked at how the pcori

93
00:03:35,869 --> 00:03:34,080
can influence the water uptake of the

94
00:03:38,390 --> 00:03:35,879
nitrate salts in the soil

95
00:03:40,309 --> 00:03:38,400
and so the blue dots once again are

96
00:03:43,309 --> 00:03:40,319
going to be the Dell questions and the

97
00:03:45,170 --> 00:03:43,319
orange triangles are the efflorescence

98
00:03:47,690 --> 00:03:45,180
um and then the lines in between is the

99
00:03:49,670 --> 00:03:47,700
average of the experiment so what we can

100
00:03:52,250 --> 00:03:49,680
see is that for chlorate seem to be

101
00:03:54,830 --> 00:03:52,260
helping or assisting with the magnesium

102
00:03:57,949 --> 00:03:54,840
nitrate water uptake or deloquiescence

103
00:04:00,830 --> 00:03:57,959
and so if we look at our overall picture

104
00:04:04,190 --> 00:04:00,840
so this is pure magnesium nitrate and

105
00:04:05,930 --> 00:04:04,200
its Dell questions is at 60 RH

106
00:04:08,210 --> 00:04:05,940
however if we look at our pechlorate

107
00:04:10,009 --> 00:04:08,220
mixtures we can see that the water

108
00:04:11,750 --> 00:04:10,019
uptake seems to be assisted by that and

109
00:04:13,009 --> 00:04:11,760
we see this with the downward facing

110
00:04:15,050 --> 00:04:13,019
Trend

111
00:04:16,610 --> 00:04:15,060
um so we also wanted to look at what

112
00:04:18,590 --> 00:04:16,620
affects a less hygroscopic or

113
00:04:20,629 --> 00:04:18,600

deliquisite salt would have on that and

114
00:04:22,790 --> 00:04:20,639
so we did a one-to-one mixture with

115
00:04:24,469 --> 00:04:22,800
sulfate nitrates and we saw that this

116
00:04:26,749 --> 00:04:24,479
did not inhibit the water uptake of

117
00:04:28,730 --> 00:04:26,759
nitrate because it's still below the

118
00:04:31,490 --> 00:04:28,740
deloquiescence relative humidity of

119
00:04:34,790 --> 00:04:31,500
magnesium nitrate so finally we can

120
00:04:36,290 --> 00:04:34,800
answer our last question

121
00:04:38,390 --> 00:04:36,300
which is could the temperature and

122
00:04:40,790 --> 00:04:38,400
relative humidity values lead to nitrate

123
00:04:44,510 --> 00:04:40,800
salt deloquistence in the soil

124
00:04:45,890 --> 00:04:44,520
um so we took our phase diagram and we

125
00:04:47,450 --> 00:04:45,900
took relative humidity and temperature

126
00:04:49,909 --> 00:04:47,460
datus from these two sites in the

127
00:04:51,770 --> 00:04:49,919
Atacama Desert and both of these sites

128
00:04:54,290 --> 00:04:51,780
contain nitrates perchlorates in the

129
00:04:57,650 --> 00:04:54,300
soil composition and also sulfates so

130
00:04:59,570 --> 00:04:57,660
site a which you see above was

131
00:05:02,450 --> 00:04:59,580
relatively close to the ocean and was

132
00:05:04,550 --> 00:05:02,460
therefore warmer and more humid this was

133
00:05:06,590 --> 00:05:04,560
likely a contributor to why the nitrate

134
00:05:08,090 --> 00:05:06,600
cells in the soil could maintain a

135
00:05:09,590 --> 00:05:08,100
stable liquid brine which is shown by

136
00:05:11,210 --> 00:05:09,600
the dark blue highlights and a

137
00:05:12,950 --> 00:05:11,220
metastable line which is the light blue

138
00:05:16,730 --> 00:05:12,960

highlights throughout most of the year

139
00:05:18,650 --> 00:05:16,740
then if we look at site B this was more

140
00:05:21,710 --> 00:05:18,660
Inland and therefore significantly drier

141
00:05:23,870 --> 00:05:21,720
and colder but despite this we do have

142
00:05:27,110 --> 00:05:23,880
points throughout the year in which the

143
00:05:29,870 --> 00:05:27,120
salts could uptake and deliquest and

144
00:05:32,390 --> 00:05:29,880
maintain a medicinal place so of course

145
00:05:33,350 --> 00:05:32,400
this is very highly variable and that

146
00:05:35,570 --> 00:05:33,360
could be due to the different

147
00:05:37,670 --> 00:05:35,580
environmental conditions as well as the

148
00:05:39,830 --> 00:05:37,680
different soil compositions and would

149
00:05:41,330 --> 00:05:39,840
need to be further studied

150
00:05:43,310 --> 00:05:41,340
so

151
00:05:46,189 --> 00:05:43,320
um if you have any questions comments

152
00:05:47,570 --> 00:05:46,199
concerns or a job please stop by my

153
00:05:50,170 --> 00:05:47,580
poster

154
00:05:53,770 --> 00:05:50,180
um which is number 23 so thank you

155
00:05:54,330 --> 00:05:53,780
[Applause]

156
00:05:57,110 --> 00:05:54,340
[Music]

157
00:05:59,930 --> 00:05:57,120
[Applause]