



Enriched in *light* isotopes
(e.g. $^{12}\text{CO}_2$, $^{12}\text{CH}_4$, H_2O)

1
00:00:04,710 --> 00:00:02,470
hi i'd like to tell you about some

2
00:00:07,749 --> 00:00:04,720
recent numerical modeling work examining

3
00:00:09,910 --> 00:00:07,759
stable isotopes on enceladus

4
00:00:12,470 --> 00:00:09,920
as water vapor and other gases erupt

5
00:00:14,470 --> 00:00:12,480
from the ocean light isotopes erupt more

6
00:00:16,710 --> 00:00:14,480
easily which should make the plume

7
00:00:19,029 --> 00:00:16,720
isotopically lighter than the ocean and

8
00:00:20,790 --> 00:00:19,039
make the ocean isotopically heavier over

9
00:00:23,750 --> 00:00:20,800
time

10
00:00:26,150 --> 00:00:23,760
for carbon and co2 the ocean is probably

11
00:00:27,990 --> 00:00:26,160
only slightly heavier than the plume but

12
00:00:30,150 --> 00:00:28,000
if the current plume eruption rates have

13
00:00:32,069 --> 00:00:30,160

persisted over long time scales then the

14

00:00:35,270 --> 00:00:32,079

co2 in the ocean may have been

15

00:00:37,350 --> 00:00:35,280

isotopically lighter in the past

16

00:00:40,069 --> 00:00:37,360

if we assume methane started with the

17

00:00:41,990 --> 00:00:40,079

same isotopic ratio as co2 then a

18

00:00:45,029 --> 00:00:42,000

fractionation between these gases in the

19

00:00:47,350 --> 00:00:45,039

ocean can emerge over long time scales

20

00:00:49,270 --> 00:00:47,360

however the maximum we see here around

21

00:00:52,150 --> 00:00:49,280

two and a half per ml is still much

22

00:00:54,709 --> 00:00:52,160

smaller than biological fractionation

23

00:00:58,150 --> 00:00:54,719

so this process alone should not create

24

00:01:00,150 --> 00:00:58,160

false positive biosignatures

25

00:01:02,310 --> 00:01:00,160

the d to h ratio of water may have

26

00:01:04,710 --> 00:01:02,320

evolved similarly but even with

27

00:01:06,550 --> 00:01:04,720

persistent long-term eruption the d-h

28

00:01:08,310 --> 00:01:06,560

ratio of enceladus still seems

29

00:01:11,270 --> 00:01:08,320

consistent with an origin from