1
00:00:00,010 --> 00:00:03,230
[music]

2
00:00:03,250 --> 00:00:10,070
Beneath the thin atmosphere of Mars lies an enigma: a desert landscape shaped by flowing water.

3
00:00:10,090 --> 00:00:13,930
In the distant past, Mars must have had a warmer, wetter climate,

4
00:00:13,950 --> 00:00:18,120
but scientists wonder: just how wet was ancient Mars?

5
00:00:18,140 --> 00:00:24,680
[Villanueva] So in the ancient past, we have some indications that water was flowing on the surface, but how

6
00:00:24,700 --> 00:00:28,420
Are we talking about oceans, are we talking about small rivers, a little rain?

7
00:00:28,440 --> 00:00:32,830
So these definitions of how much water was on the planet was very undefined.

8
00:00:32,850 --> 00:00:40,230
[Mumma] A major question has been: how much water did Mars actually have when it was young, and how di

9
00:00:40,250 --> 00:00:44,900
To answer this question, a team of researchers at NASA's Goddard Space Flight Center

10
00:00:44,920 --> 00:00:50,000
used infrared telescopes on Earth to study water molecules in the Martian atmosphere.

11
00:00:50,020 --> 00:00:55,010
[Mumma] We used the world's three major telescopes for infrared astronomy.

12
00:00:55,030 --> 00:00:59,910
From the ground we could actually take a snapshot of the whole hemisphere of the planet on a single night.

13
00:00:59,930 --> 00:01:07,830

The new infrared maps reveal the atmospheric ratio of normal to heavy water molecules at different locations a

14
00:01:07,850 --> 00:01:12,110
Heavy water molecules contain a heavy isotope of hydrogen called deuterium,

15
00:01:12,130 --> 00:01:17,160
which remains trapped in the Martian water cycle while normal hydrogen is lost to space.

16
00:01:17,180 --> 00:01:21,630
The researchers found that water from the polar ice caps is highly enriched in deuterium,

17
00:01:21,650 --> 00:01:25,330
indicating that Mars has lost a tremendous quantity of water.

18
00:01:25,350 --> 00:01:33,330
Now we know that Mars water is much more enriched than terrestrial ocean water in the heavy form of water, t

19
00:01:33,350 --> 00:01:38,910
Immediately that permits us to estimate the amount of water Mars has lost since it was young.

20
00:01:38,930 --> 00:01:46,250
The findings indicate that only 13% of an ancient ocean remains on the planet today, now stored in the polar ic

21
00:01:46,270 --> 00:01:53,380
87% of this ocean has been lost to space. This means that early Mars would have looked much different than i

22
00:01:53,400 --> 00:01:56,880
with a significant portion of its surface covered by water.

23
00:01:56,900 --> 00:02:02,980
[Mumma] So the really interesting question is, could it form a sea or an ocean? And indeed, it would.

24
00:02:03,000 --> 00:02:07,420
In the northern plains, which is a relatively flat region but depressed from the rest of the planet,

25
00:02:07,440 --> 00:02:14,330
it would form an ocean that was approximately 20% of the planet's surface area.

26
00:02:14,350 --> 00:02:17,080
And so that is a respectable ocean.

27
00:02:28,550 --> 00:02:32,250
By combining Martian topography with the new estimate for water loss,

28
00:02:32,270 --> 00:02:37,380
the researchers were able to simulate Mars' ancient ocean, and its escape to space.

29
00:02:37,400 --> 00:02:43,660
As Mars lost its atmosphere over billions of years, it lost the pressure and heat needed to keep water liquid,

30
00:02:43,680 --> 00:02:46,760
causing the ocean to shrink and recede northward.

31
00:02:46,780 --> 00:02:54,600
The remaining water eventually condensed and froze over the north and south poles, giving Mars the ice caps

32
00:02:54,620 --> 00:03:01,530
This new scenario means that Mars would have stayed wet for longer than previously thought, expanding its ar

33
00:03:01,550 --> 00:03:08,780
We now know that Mars was wet for a much longer time than we thought before.

34
00:03:08,800 --> 00:03:13,180
Curiosity shows it was wet for one-and-a-half-billion years, already much longer

35
00:03:13,200 --> 00:03:16,880
than the period of time needed for life to develop on Earth,

36
00:03:16,900 --> 00:03:20,980
and now we see that Mars must have been wet for a period even longer.