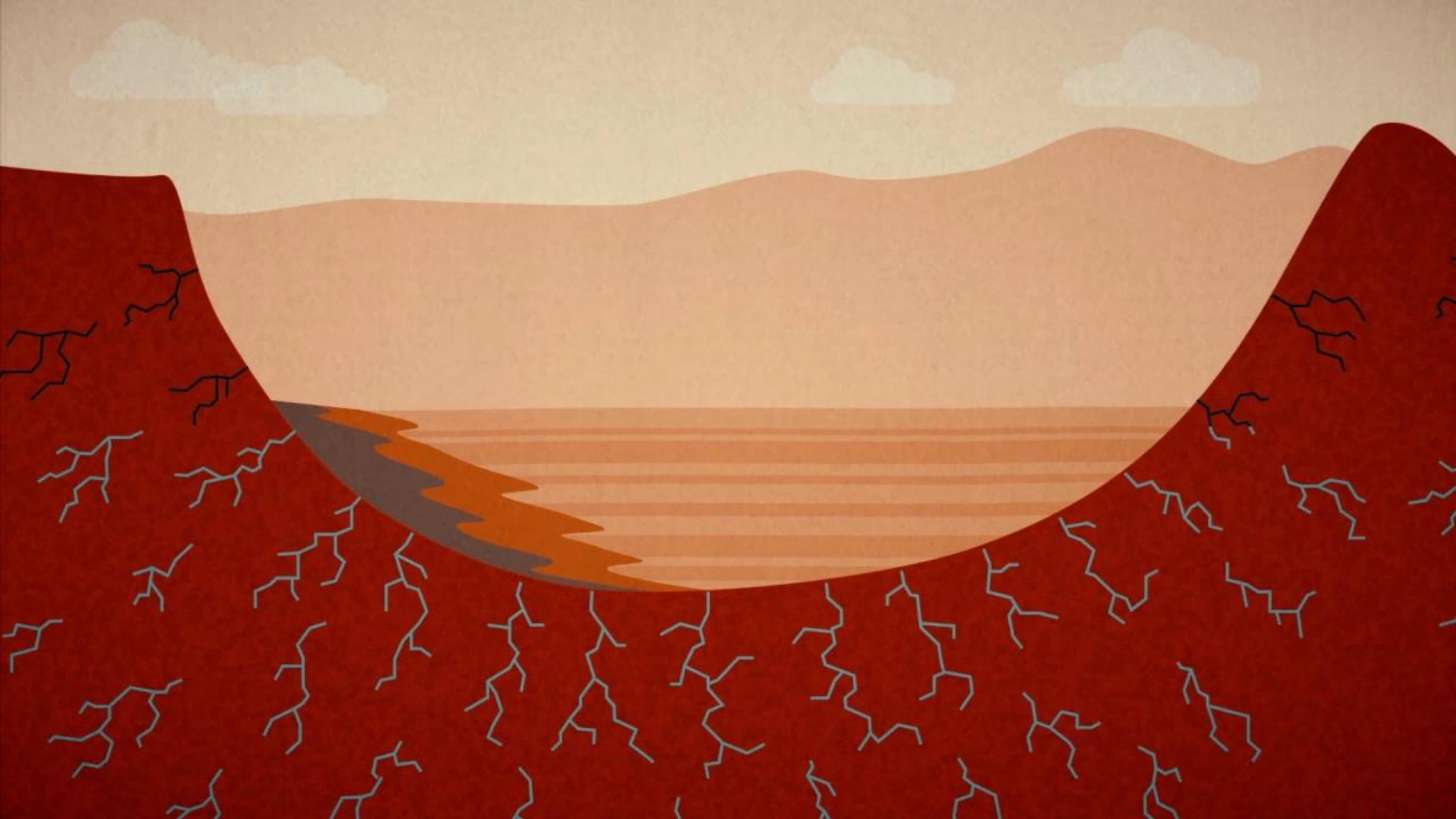

1
00:00:00,467 --> 00:00:01,401
[whoosh]

2
00:00:01,434 --> 00:00:04,303
In 2012 NASA's Curiosity rover
went to Mars

3
00:00:04,336 --> 00:00:05,972
to explore Gale Crater,

4
00:00:06,005 --> 00:00:07,306
a large impact basin

5
00:00:07,339 --> 00:00:10,109
with a massive, layered
mountain in the middle.

6
00:00:10,142 --> 00:00:12,445
How did this strange
landscape come to be?

7
00:00:12,478 --> 00:00:14,013
And what can its
history teach us

8
00:00:14,046 --> 00:00:16,149
about the potential
for life on Mars?

9
00:00:17,016 --> 00:00:18,584
After several years of
exploration,

10
00:00:18,617 --> 00:00:20,820
here's what we think
could have happened.

11
00:00:20,853 --> 00:00:23,623
A Guide to Gale Crater

12
00:00:23,656 --> 00:00:26,125
Around 3.7 billion years ago

13
00:00:26,158 --> 00:00:28,961
a large meteor impact blasts out
the initial crater,

14
00:00:28,994 --> 00:00:30,062
[boom]

15
00:00:30,095 --> 00:00:31,964
cracking the rock below and
leaving a central peak

16
00:00:31,997 --> 00:00:34,534
as the surface rebounds.

17
00:00:34,567 --> 00:00:36,803
It's a wetter time
in Mars' history.

18
00:00:36,836 --> 00:00:38,638
Groundwater seeps into
the new crater,

19
00:00:38,671 --> 00:00:42,642
while rivers fed by rain or
melting snow also flow in,

20
00:00:42,675 --> 00:00:44,143
forming a large lake--

21
00:00:44,176 --> 00:00:47,980
and carrying in gravel,
sand and silt.

22
00:00:48,013 --> 00:00:51,150
This material keeps building up

over millions of years.

23
00:00:51,183 --> 00:00:53,019
And as each layer
cements into rock,

24
00:00:53,052 --> 00:00:57,557
it records a snapshot of the
environment that shaped it.

25
00:00:57,590 --> 00:01:01,461
In time, the gradual drying
of Mars shuts off the rivers.

26
00:01:01,494 --> 00:01:02,962
But sediment keeps piling up

27
00:01:02,995 --> 00:01:05,498
as sand and dust blow
into the crater,

28
00:01:05,531 --> 00:01:09,402
deeply burying the deposits
laid down in water.

29
00:01:09,435 --> 00:01:14,474
Meanwhile, groundwater remains
deep below the dusty surface.

30
00:01:14,507 --> 00:01:17,443
At some point, winds that
once carried sediment in

31
00:01:17,476 --> 00:01:19,846
begin scouring it back out.

32
00:01:19,879 --> 00:01:21,881
In areas closer to
the crater rim

33
00:01:21,914 --> 00:01:25,318
these winds dig all the way down
into the ancient lake deposits.

34
00:01:25,351 --> 00:01:28,554
And as the heavy weight above is
lifted, these layers crack,

35
00:01:28,587 --> 00:01:31,324
which helps groundwater flow
through and alter them again

36
00:01:31,357 --> 00:01:33,659
before they dry out.

37
00:01:33,692 --> 00:01:35,595
By about 3 billion years ago,

38
00:01:35,628 --> 00:01:38,264
we're left with the basic form
we see today.

39
00:01:38,297 --> 00:01:40,099
It's in this version
of Gale Crater

40
00:01:40,132 --> 00:01:43,102
that Curiosity has helped
piece together the story.

41
00:01:44,203 --> 00:01:46,973
Sediment patterns show a
lot of water was present,

42
00:01:47,006 --> 00:01:49,942
continually, over many
millions of years--

43
00:01:49,975 --> 00:01:53,279

both as persistent groundwater
and a long-standing lake

44
00:01:53,312 --> 00:01:55,281
(with occasional dry spells).

45
00:01:56,215 --> 00:01:57,917
Mineral and chemical
readings show

46
00:01:57,950 --> 00:02:00,153
that water from both the
lake and subsurface

47
00:02:00,186 --> 00:02:03,122
was friendly for
potential microbes.

48
00:02:04,223 --> 00:02:06,893
Drill samples from the lakebed
show key elements,

49
00:02:06,926 --> 00:02:09,996
organic molecules, nutrients
and energy sources

50
00:02:10,029 --> 00:02:12,832
that microbes could have used.

51
00:02:12,865 --> 00:02:14,967
Water flowing through
underground fractures

52
00:02:15,000 --> 00:02:17,970
could have supported life
even in deeply buried rocks.

53
00:02:19,104 --> 00:02:21,207
And the composition of
some layers makes them

54
00:02:21,240 --> 00:02:24,210
good for preserving potential
signs of past life.

55
00:02:26,011 --> 00:02:28,981
Taken together, the evidence
points to Gale Crater

56
00:02:29,014 --> 00:02:30,216
(and Mars in general)

57
00:02:30,249 --> 00:02:32,752
as a place where life
--if it ever arose--

58
00:02:32,785 --> 00:02:35,988
might have survived
for some time.

59
00:02:36,021 --> 00:02:37,757
With our primary mission
fulfilled,

60
00:02:37,790 --> 00:02:41,260
we continue exploring:
uncovering the history of Mars

61
00:02:41,293 --> 00:02:44,564
and learning more abut how and
where future missions

62
00:02:44,597 --> 00:02:47,200
can search for the signatures
that ancient life

63
00:02:47,233 --> 00:02:49,902
may have left behind.

64

00:02:50,636 --> 00:02:52,305
NASA Jet Propulsion Laboratory