1
00:00:01,101 --> 00:00:04,004
We want to know: has
life ever existed on Mars?

2
00:00:04,004 --> 00:00:07,441
Do pockets of life
persist on Mars today?

3
00:00:07,441 --> 00:00:10,143
NASA's approach to answering
these questions is to break them

4
00:00:10,143 --> 00:00:13,313
down into smaller
and smaller steps.

5
00:00:13,313 --> 00:00:16,416
First, we need to know if
ancient Mars was habitable.

6
00:00:16,416 --> 00:00:19,086
Did it once have the right
climate, and the right chemistry

7
00:00:19,086 --> 00:00:20,621
to support life?

8
00:00:20,621 --> 00:00:23,190
The Curiosity rover is
investigating these questions by

9
00:00:23,190 --> 00:00:26,326
looking for organic
molecules: containing carbon.

10
00:00:26,326 --> 00:00:29,863
Organic molecules are the
backbone of all life on Earth,

11

00:00:29,863 --> 00:00:33,000
though they can also come
from non-living sources.

12
00:00:33,000 --> 00:00:36,103
Today the surface of Mars
readily destroys organics,

13
00:00:36,103 --> 00:00:40,207
making them difficult to detect.

14
00:00:40,207 --> 00:00:44,077
Six years ago, Curiosity landed
in Gale Crater, on an ancient

15
00:00:44,077 --> 00:00:45,312
lakebed.

16
00:00:45,312 --> 00:00:48,749
A few months after arrival, it
drilled into sedimentary rocks

17
00:00:48,749 --> 00:00:52,052
and detected traces of organic
molecules using an instrument

18
00:00:52,052 --> 00:00:53,921
called SAM.

19
00:00:53,921 --> 00:00:57,090
Now, Curiosity is climbing
the mound in the middle of Gale

20
00:00:57,090 --> 00:01:00,294
Crater, and SAM has made
a subsequent detection of

21
00:01:00,294 --> 00:01:01,161
organics.

22
00:01:01,161 --> 00:01:04,064
This new detection is exciting
because it comes from rocks that

23
00:01:04,064 --> 00:01:05,999
are billions of years old.

24
00:01:05,999 --> 00:01:08,702
That means that the
organic material within them is

25
00:01:08,702 --> 00:01:10,103
extremely ancient.

26
00:01:10,103 --> 00:01:13,740
Some of the organics that SAM
has detected contain sulfur,

27
00:01:13,740 --> 00:01:17,110
likely introduced
through geological processes.

28
00:01:17,110 --> 00:01:20,080
Sulfur can act as a
preservative, binding organic

29
00:01:20,080 --> 00:01:22,816
molecules together to make them
tougher, and protecting them

30
00:01:22,816 --> 00:01:23,817
from oxidation.

31
00:01:23,817 --> 00:01:27,654
In fact, sulfur is the element
that makes hair and fingernails

32
00:01:27,654 --> 00:01:30,223
tough, as well as

vulcanized rubber.

33
00:01:30,223 --> 00:01:34,127
Martian sulfur has probably had
a similar effect on these old

34
00:01:34,127 --> 00:01:37,798
organic molecules, helping to
preserve them over geological

35
00:01:37,798 --> 00:01:40,634
timescales.

36
00:01:40,634 --> 00:01:43,804
SAM made the new detections by
heating samples of crushed rock

37
00:01:43,804 --> 00:01:47,140
to very high temperatures, above
a thousand degrees Fahrenheit.

38
00:01:47,140 --> 00:01:50,310
This vaporized the samples
and released several species of

39
00:01:50,310 --> 00:01:53,347
small hydrocarbons,
like benzene and propane.

40
00:01:53,347 --> 00:01:56,116
Because the hydrocarbons
were released at such high

41
00:01:56,116 --> 00:01:59,219
temperatures, they may be the
fragments of bigger, heavier

42
00:01:59,219 --> 00:02:02,656
molecules within the
rock similar to kerogens.

43
00:02:02,656 --> 00:02:06,994
On Earth, kerogens are found in
rocks like black shale and coal,

44
00:02:06,994 --> 00:02:11,999
and are the products of
ancient plant and bacteria.

45
00:02:11,999 --> 00:02:15,635
We don't know if the recently
discovered organics on Mars are

46
00:02:15,635 --> 00:02:18,639
of biological origin, but
it's exciting to find such old

47
00:02:18,639 --> 00:02:20,807
material preserved
right at the surface.

48
00:02:20,807 --> 00:02:24,277
This finding is also encouraging
for future exploration.

49
00:02:24,277 --> 00:02:27,714
NASA and the European Space
Agency are preparing to send the

50
00:02:27,714 --> 00:02:31,585
next generation of rovers to
Mars in 2020, carrying new

51
00:02:31,585 --> 00:02:35,155
technologies to search for
signs of microbial life.

52
00:02:35,155 --> 00:02:39,393
In the distant past, Mars was
much warmer and wetter than it

53
00:02:39,393 --> 00:02:40,627
is today.

54
00:02:40,627 --> 00:02:44,498
The rocks at Gale Crater tell us
it was once an environment where

55
00:02:44,498 --> 00:02:47,367
life as we know it
could have survived.

56
00:02:47,367 --> 00:02:51,238
The discovery of ancient organic
molecules shows that another

57
00:02:51,238 --> 00:02:54,741
ingredient of life was present
at that time, and it broadens

58
00:02:54,741 --> 00:02:58,211
our understanding of
habitability of both ancient and

59
00:02:58,211 --> 00:02:59,446
modern Mars.