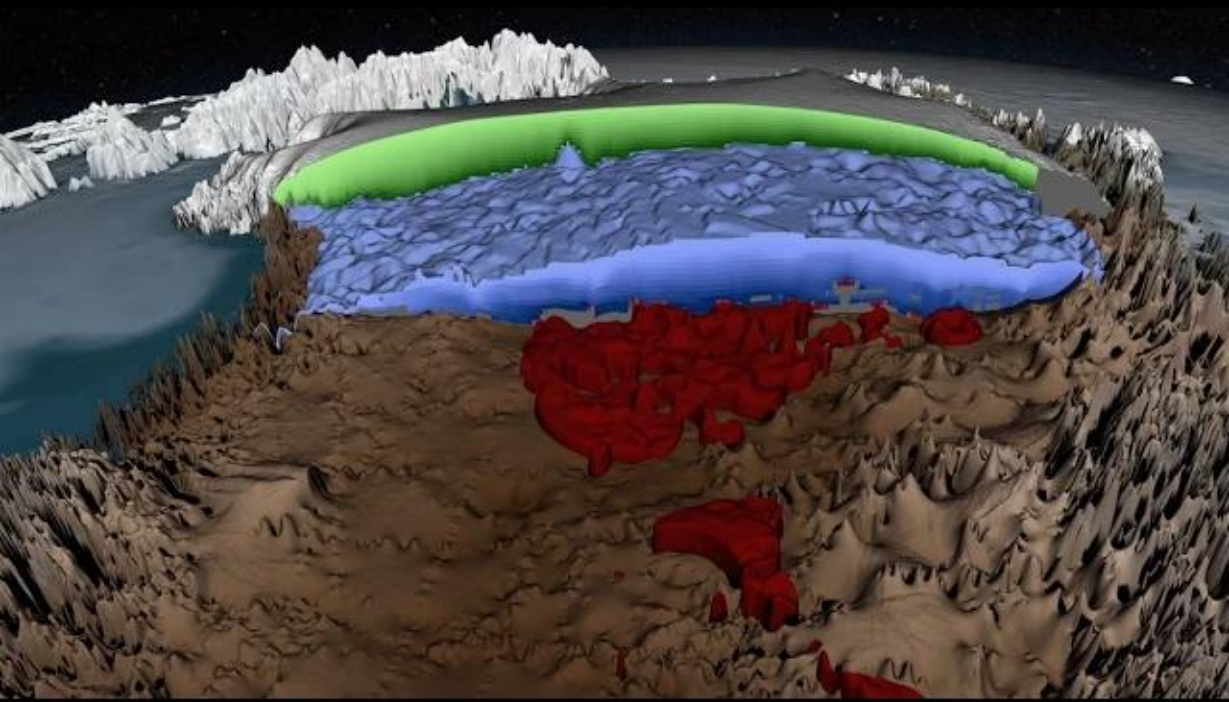

1
00:00:00,010 --> 00:00:04,200
[music]

2
00:00:04,220 --> 00:00:08,220
For decades, scientists have been probing the Greenland Ice Sheet from the ground, air

3
00:00:08,240 --> 00:00:12,230
and space. Now a new study uses those observations

4
00:00:12,250 --> 00:00:16,420
to see within the ice sheet…laying bare a tale more than

5
00:00:16,440 --> 00:00:20,620
one hundred thousand years in the making.

6
00:00:20,640 --> 00:00:24,630
When we look inside an ice sheet, we can see distinct layers formed by thousands of years of snowfall.

7
00:00:24,650 --> 00:00:28,650
As snow accumulates, these layers get

8
00:00:28,670 --> 00:00:32,660
progressively compacted into ice, which then flows under its own weight.

9
00:00:32,680 --> 00:00:36,680
To get a precise history of a particular spot on

10
00:00:36,700 --> 00:00:40,690
an ice sheet, scientists drill into it and recover ice cores,

11
00:00:40,710 --> 00:00:44,710
which provide a record of the ice’s age and what the past

12
00:00:44,730 --> 00:00:48,740
climate was like. Seasonal variations, along with ash

13
00:00:48,760 --> 00:00:52,750

from volcanic eruptions show up in the cores allowing us

14
00:00:52,770 --> 00:00:56,770
to date the ice and correlate samples from different sites.

15
00:00:56,790 --> 00:01:00,800
To extend this age information across the ice sheet,

16
00:01:00,820 --> 00:01:04,820
the best tool that we have is ice-penetrating radar, mounted on aircraft

17
00:01:04,840 --> 00:01:08,840
flying low over the surface. Radar transmits

18
00:01:08,860 --> 00:01:12,870
electromagnetic pulses into the ice and records the reflected signals,

19
00:01:12,890 --> 00:01:17,050
allowing us to track the depth of the layers detected in the ice.

20
00:01:17,070 --> 00:01:21,070
Since 2009, NASA’s Operation IceBridge has

21
00:01:21,090 --> 00:01:25,080
flown over Greenland more than one hundred times with a wide variety of instruments,

22
00:01:25,100 --> 00:01:29,090
including radar, and generated vast quantities of data,

23
00:01:29,110 --> 00:01:33,110
adding to the work from many other missions. This has allowed researchers

24
00:01:33,130 --> 00:01:37,140
to generate a three dimensional map depicting the age of the ice throughout

25
00:01:37,160 --> 00:01:41,150
the Greenland Ice sheet. This 3D age map

26
00:01:41,170 --> 00:01:45,340
shows that three distinct periods of climate are evident within the ice sheet:

27
00:01:45,360 --> 00:01:49,430
The Holocene, shown here in green. The last ice age,

28
00:01:49,450 --> 00:01:53,540
shown in blue. And the Eemian, shown here in red.

29
00:01:53,560 --> 00:01:57,560
The top layers from the Holocene Period, formed during the last

30
00:01:57,580 --> 00:02:01,570
11.7 thousand years and are fairly flat and uniform,

31
00:02:01,590 --> 00:02:05,590
though the thickness varies depending on how much snowfall occurred.

32
00:02:05,610 --> 00:02:09,600
Below this, deeper within the ice sheet, we see layers that formed

33
00:02:09,620 --> 00:02:13,620
during the last ice age. Layers from this period are darker

34
00:02:13,640 --> 00:02:17,640
and more complex, having been further squeezed and sometimes folded

35
00:02:17,660 --> 00:02:21,660
as they flowed over the rugged bedrock below.

36
00:02:21,680 --> 00:02:25,690
Deeper still are layers of ice leftover from the warm period before the last ice age,

37
00:02:25,710 --> 00:02:29,710
more than one hundred fifteen thousand years ago.

38
00:02:29,730 --> 00:02:33,730

Eemian ice can reveal how the ice sheet responded to a period of warmth

39
00:02:33,750 --> 00:02:37,750
similar to the one we are experiencing today.

40
00:02:37,770 --> 00:02:41,810
Several ice cores have recovered Eemian ice, but it is difficult to interpret.

41
00:02:41,830 --> 00:02:45,820
This new map of the age of the ice sheet shows that there

42
00:02:45,840 --> 00:02:50,000
is more Eemian ice than expected in northern Greenland, where it may be easier

43
00:02:50,020 --> 00:02:54,010
for scientists to collect and analyze.

44
00:02:54,030 --> 00:02:58,030
This new analysis reveals a 3D map of the age

45
00:02:58,050 --> 00:03:02,050
of the Greenland ice sheet , from the oldest Eemian ice,

46
00:03:02,070 --> 00:03:06,250
to the layers deposited during the last ice age, to the ice that formed during the Holocene.

47
00:03:06,270 --> 00:03:10,260
The response of the ice sheet to past climate change

48
00:03:10,280 --> 00:03:14,270
led to its current age structure. Further study will help us

49
00:03:14,290 --> 00:03:18,290
to better understand how the Greenland Ice Sheet will respond to today’s changing climate.