



**SIGGRAPH**

COMPUTER ANIMATION FESTIVAL

2021 OFFICIAL SELECTION



1  
00:00:00,166 --> 00:00:05,238



2  
00:00:05,238 --> 00:00:10,577

In December 2018, after traveling for two years,  
one hundred and one days,

3  
00:00:10,577 --> 00:00:12,879

and over one-point-two billion miles...

4  
00:00:12,879 --> 00:00:18,651

NASA's OSIRIS-REx spacecraft arrived at its target:  
near-Earth asteroid Bennu.

5  
00:00:19,185 --> 00:00:23,256

OSIRIS-REx is the first mission to explore this  
primitive remnant

6  
00:00:23,256 --> 00:00:30,363

from the origins of the solar system, designed to study  
the asteroid and return a sample to Earth.

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00:00:30,363 --> 00:00:34,634

Bennu is a dark, diminutive world, roughly the  
height of a skyscraper,

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00:00:34,634 --> 00:00:38,772

and now, the smallest body to be orbited  
by a spacecraft.

9  
00:00:38,772 --> 00:00:42,375

Prior to arrival, it was known to have low  
thermal inertia,

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00:00:42,375 --> 00:00:46,312

a characteristic of fine-grained materials like sand.

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00:00:46,312 --> 00:00:50,650

An infrared spectrometer on OSIRIS-REx

confirmed this property,

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00:00:50,650 --> 00:00:54,888

leading scientists to expect a predominantly smooth surface.

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00:00:54,888 --> 00:00:59,325

But the first close-up views of Bennu delivered a major surprise.

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00:00:59,325 --> 00:01:03,997

In exquisite detail, the mission's cameras revealed an unrelenting rock-scape,

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00:01:03,997 --> 00:01:06,066

dominated by boulders.

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00:01:06,066 --> 00:01:10,970

By combining these images from OSIRIS-REx with its laser altimetry data,

17

00:01:10,970 --> 00:01:14,741

we can take a tour of Bennu's remarkable terrain.

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00:01:14,741 --> 00:01:17,577

The first stop is Simurgh Saxum.

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00:01:17,577 --> 00:01:21,081

This prominent boulder defines the asteroid's prime meridian,

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00:01:21,081 --> 00:01:24,717

and serves as the basis of its coordinate system.

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00:01:24,717 --> 00:01:28,855

In Persian mythology, the Simurgh is a large and benevolent bird,

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00:01:28,855 --> 00:01:31,124

and the possessor of all knowledge

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00:01:31,124 --> 00:01:34,060

Saxum is Latin for "stone."

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00:01:34,060 --> 00:01:37,630

To the northeast lies the largest boulder on Bennu.

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00:01:37,630 --> 00:01:41,901

Measuring over three-hundred feet in length,  
Roc Saxum is a colossus,

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00:01:41,901 --> 00:01:44,137

longer than a football field.

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00:01:44,137 --> 00:01:48,441

It is also rich in a type of iron oxide called magnetite,

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00:01:48,441 --> 00:01:53,146

which was used by mariners as an early form  
of magnetic compass.

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00:01:53,146 --> 00:01:59,152

In Arab folklore, the Roc is an enormous bird of prey  
that can clasp elephants in its talons,

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00:01:59,152 --> 00:02:02,589

as well as stranded sailors, like the hero Sinbad.

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00:02:02,589 --> 00:02:04,290

■■■

32

00:02:04,290 --> 00:02:09,929

Continuing northeast, over the equatorial ridge,  
we arrive at Gargoyle Saxum.

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00:02:09,929 --> 00:02:13,032

This striking boulder is among the darkest on Bennu,

34  
00:02:13,032 --> 00:02:17,937  
though it clutches a much brighter rock that is  
about the size of a person.

35  
00:02:17,937 --> 00:02:23,176  
In Medieval legend, Gargoyles are dragon-like,  
winged monsters that can breathe fire,

36  
00:02:23,176 --> 00:02:27,280  
and that guard cathedrals from evil spirits.

37  
00:02:27,280 --> 00:02:30,750  
Our next destination takes us far to the east.

38  
00:02:30,750 --> 00:02:34,354  
At the northern end of a small crater lies Ocypete Saxum,

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00:02:34,354 --> 00:02:39,092  
a comparatively bright boulder measuring about  
thirty-three feet in diameter.

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00:02:39,092 --> 00:02:44,998  
Ocypete Saxum is located near one of three sites where  
Bennu ejected small particles into space

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00:02:44,998 --> 00:02:49,869  
in early 2019, displaying its dynamic and evolving nature.

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00:02:49,869 --> 00:02:55,074  
In Greek mythology, Ocypete is one of the three harpies –  
the half-maiden, half-bird

43  
00:02:55,074 --> 00:02:59,946  
personifications of storm winds, who would carry  
evildoers away from the Earth.

44  
00:02:59,946 --> 00:03:03,883



45

00:03:03,883 --> 00:03:06,519

In the creation stories of ancient Egypt,

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00:03:06,519 --> 00:03:11,324

the universe began as a formless, endless  
expanse of water.

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00:03:11,324 --> 00:03:16,462

From this primordial sea arose the  
primordial mound: Benben.

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00:03:16,462 --> 00:03:21,401

It was upon this rock that the god Atum settled,  
in the form of the Bennu bird,

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00:03:21,401 --> 00:03:24,804

and sent forth the call that shaped creation.

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00:03:24,804 --> 00:03:29,375

The story of Benben hearkens to the mounds of  
fertile silt that once emerged

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00:03:29,375 --> 00:03:31,744

from the receding floodwaters of the Nile

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00:03:31,744 --> 00:03:36,416

and it provides a fitting namesake for the tallest  
boulder on Bennu.

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00:03:36,416 --> 00:03:38,384

Protruding by over seventy feet,

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00:03:38,384 --> 00:03:42,989

Benben Saxum is so tall that it was first detected  
from Earth.

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00:03:42,989 --> 00:03:49,128

Now, we can appreciate this monumental feature  
in detail using data from OSIRIS-REx.

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00:03:49,128 --> 00:03:50,997



57

00:03:50,997 --> 00:03:55,301

The final stop on our tour is a cluster of exceptionally bright boulders,

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00:03:55,301 --> 00:03:57,837

scattered across the southern hemisphere.

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00:03:57,837 --> 00:04:00,607

They bear the spectral fingerprint of pyroxene

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00:04:00,607 --> 00:04:05,144

a mineral found in igneous rock, that is unlikely to have formed on Bennu.

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00:04:05,144 --> 00:04:09,482

These boulders most likely originated on the large asteroid Vesta,

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00:04:09,482 --> 00:04:13,186

and were delivered to Bennu's parent body through meteoroid impacts.

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00:04:13,186 --> 00:04:14,921



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00:04:14,921 --> 00:04:20,326

Although it is small in size, asteroid Bennu has proved to be a fascinating world...

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00:04:20,326 --> 00:04:24,998

abundant in geographic features that have defied our expectations.

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00:04:24,998 --> 00:04:28,301

Thanks to OSIRIS-REx, we can now explore Bennu

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00:04:28,301 --> 00:04:30,203

to uncover its composition...

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00:04:30,203 --> 00:04:31,371

its evolution...