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Great Pyramid of Giza's hidden chamber is discovered. Scientists uncover a mysterious 'big void' in 4,500-year-old monument that could reveal its ancient secrets

- Scientists mapping the Great Pyramid using cosmic-ray based imaging have found a massive hidden space
- The internal structure is located above the Grand Gallery - that links two of the pyramid's three burial chambers
- It traces a similar route for at least 30 metres (100ft) and has a volume of 60 cubic metres
- The precise design and purpose of the space is unknown and it has yet to be explored

By [HARRY PETTIT FOR MAILONLINE](#)

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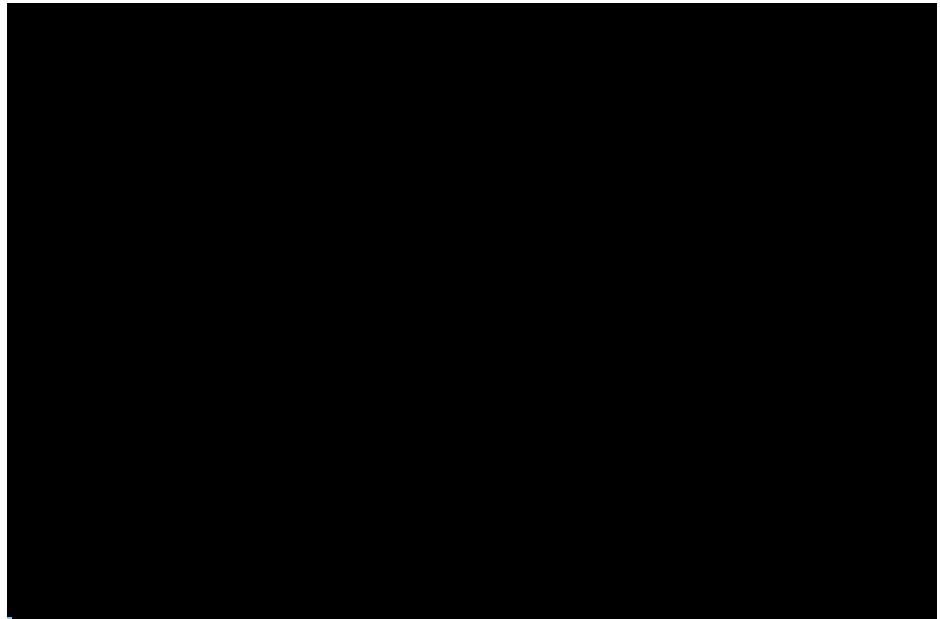
A long-hidden narrow void in the Great Pyramid of Giza has been found by scientists - and it could finally reveal the secrets of the 4,500-year-old monument.

The void stretches for at least 30 metres (100ft) above the Grand Gallery - an ascension passageway from the Queen's chamber to the King's in the heart of the pyramid.

It is not known why the void exists or if there are any valuable artefacts inside as yet.

But it has similar dimensions to the Gallery, which is 50 metres (164ft) long, eight metres (3.2ft) wide.

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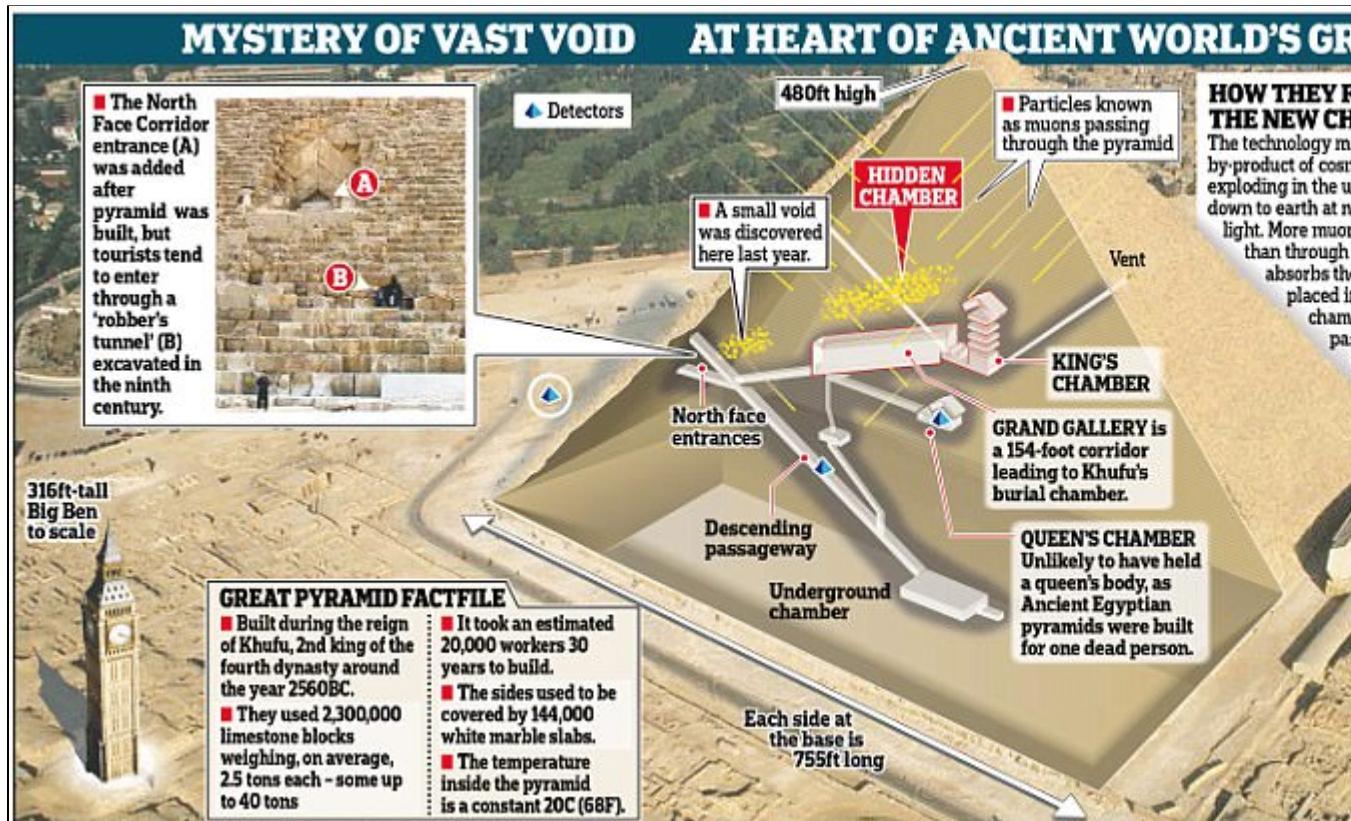
Researchers suggest it could be a 'construction gap' - part of a trench that allowed the Grand Gallery and King's Chamber while the rest of the pyramid was built.

The discovery was made after physicists took images of the inside of the pyramid from space.

These cosmic particles penetrate the rock in a similar way to X-rays, only much more slowly.

The collaborative effort, between archaeologists, historians and physicists, has led to a major discovery inside the Giza landmark since the 19th century.

Scroll down for video



The Great Pyramid of Giza has been shrouded in mystery for millennia, but now a long-hidden secret has been revealed thanks to particle physics. An apparent narrow void lying undiscovered deep within the structure has been found by scientists using cosmic-ray based imaging. An overview of the breakthrough follows.

Made under the watch of the Pharaoh Khufu and completed in around 2550 BC, Egypt's Great Pyramid, or the Pyramid of Giza, served as the world's tallest man-made construction for thousands of years.

The structure, also known as Khufu's Pyramid, is the sole survivor of the ancient Seven Wonders of the World.

How it was built has long been a bone of academic contention and there is no universal agreement about its creation.

Scientists say the latest discovery, published in the journal Nature, could help shed light on its construction.

To find out more about the pyramid, researchers from countries including France and Japan began a project to scan the structure in October 2015.

The scientists made the discovery using cosmic-ray imaging, recording the behaviour of subatomic particles called muons that penetrate the rock.

Detectors were set up inside the pyramid, including in the so-called Queen's Chamber.

This allowed the pyramid's insides to be seen without physically disturbing it, as the results showed empty space differently from rock.

The presence of the space, dubbed the ScanPyramids Big Void, was confirmed using three different detection technologies over several months after first being spotted, the paper said.

The results were then analysed three times.

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The ScanPyramids mission is made up of researchers from Egypt's Ministry of Ar and the non-profit organisation the Heritage Innovation Preservation (HIP) Institu

'ScanPyramids Big Void is not a room or a chamber - we don't know if it is horizontal by one or several successive structures, but it's big,' report author Mehdi Tayouk HIP Institute, told MailOnline.

'The Grand Gallery is an internal spectacular internal structure (47m long, 8m high) in the centre of the pyramid.



Described as a 'deep void', it is at least about 100 feet long and up to 230 feet above ground level. It's function is unknown, and scientists are now hoping a flying robot could be sent in to



The internal structure (white dots in image) is located above the Grand Gallery - that link traces a similar route for at least 30 metres (100ft), according to a study published in the horizontal or inclined (pictured) plane, the scientists said

MUON DETECTORS

Muon detectors have previously been used to map out the inside of the Fukushima's nuclear power plant, and researchers hope they can be used to explore other archaeological sites.

The detectors work by using cosmic particles known as muons that have the power to penetrate solid materials.

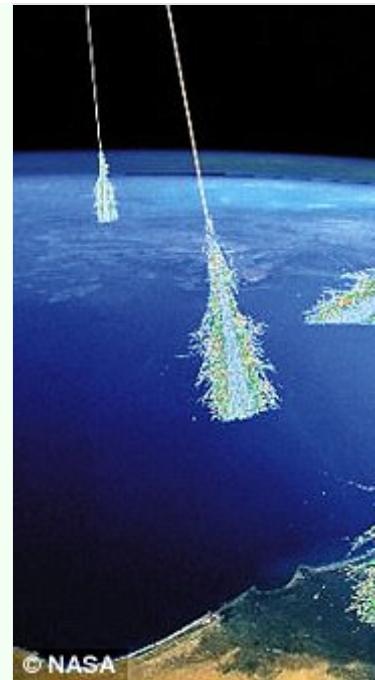
The subatomic particles require only a few special instruments because they rain down from space.

above.

Muons are created when the upper atmosphere reacts with cosmic rays, producing a shower of particles, some of which decay into muons.

The elementary particles, which weigh around 200 times more than electrons, can very easily pass through any structure, even large and thick rocks like mountains.

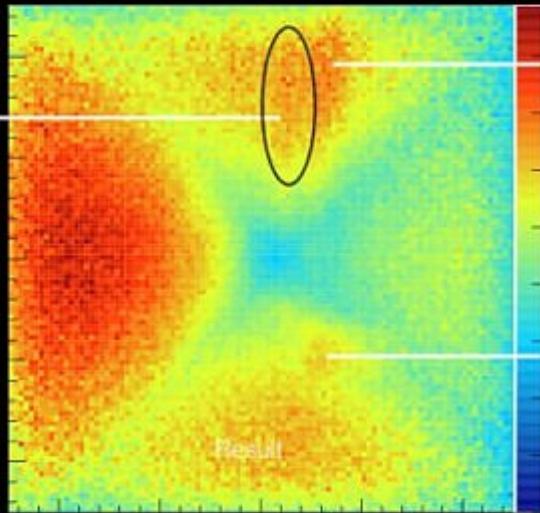
Researchers can use these tiny particles to measure the density of structures, just like X-rays pass through our bodies to visualise our skeleton.



Muons are created when cosmic rays enter the upper atmosphere, producing a shower of particles, some of which decay into neutrinos.

Nagoya University's muography result for position 1

Unknown void
(SP-BV)



Nagoya University's muons emulsion film placed in the Queen's Chamber's Niche

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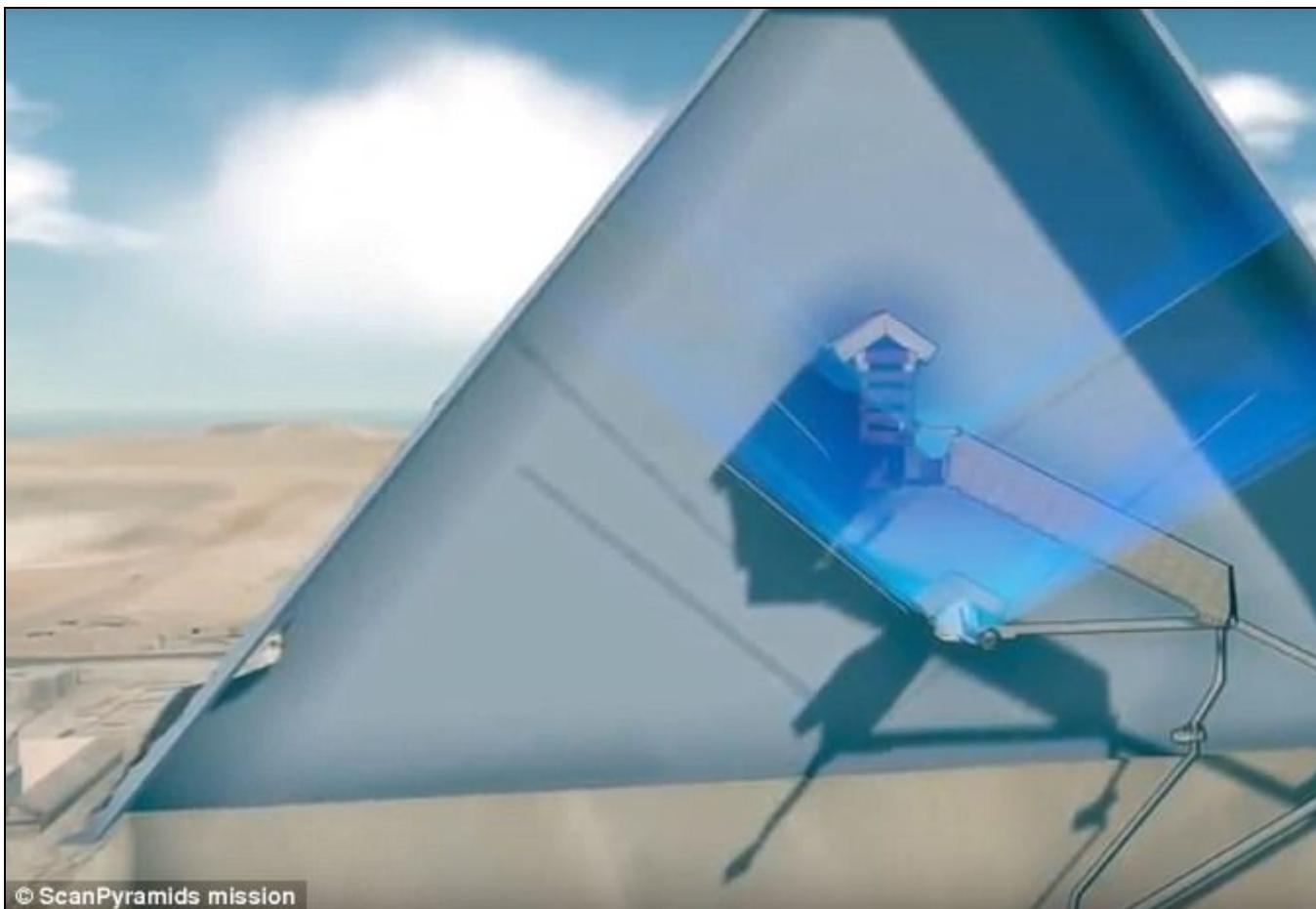
The detectors work by using cosmic particles known as muons that have the power to penetrate everything in their path. By measuring the energy loss of these particles as they pass through matter, scientists can use these tiny particles to measure the density of structures, just like X-rays pass through our bodies to reveal internal organs. Pictured is the results of one of the team's muography scans on the pyramid, which helped to reveal the hidden void.

'This Big Void, with same size characteristics as the Grand Gallery, could be successfully reached from the Queen's Chamber. Two hypotheses are possible.'

Despite the breakthrough, the newly discovered structure has yet to be reached.

Report author Mr Tayoubi said: 'This structure is not accessible, we don't see (the) way to reach it from the Queen's Chamber or from the Grand Gallery, to access the void which is above.'

'So this void was hidden, I think, since the construction of the pyramid, it was never reached.'



© ScanPyramids mission

To find out more about the pyramid, researchers from countries including France and Ja structure in October 2015. Researchers placed detectors in two rooms within the pyramid they fell from the sky, revealing the structure of the building like an X-ray reveals bone

WHAT THEY FOUND

An apparent void lying undiscovered deep inside the Great Pyramid of Giza has been d

The internal structure is located above the Grand Gallery - that links two of the pyramid

It traces a similar route for at least 30 metres (100ft).

While the precise design and purpose of the space is unknown, it was hailed by the tea discovery inside the Giza landmark since the 19th century.

'This was a study about physics, it was not about Egyptology - we are not claiming anyt void - we are just claiming that there is a void and that's all,' study author Mehdi Tayoub

Despite the breakthrough, the newly discovered structure has yet to be reached in per...



© ScanPyramids mission

The team employed by-products of the cosmic ray known as muons that are only partially noticeably different trajectories through air

'We needed this technique - the right technique at the right time - to be able to i

He added they were 'very confident' the results were correct.

Because no one has physically seen inside the void, what it was built for remains

Researchers claim the space could be on an incline, which means it could have blocks into the centre of the pyramid and was then left, experts said.

'This finding is very exciting, but I don't think it's likely to be some kind of secret archaeologist at the University of Cambridge who was not involved in the study,

HOW ARE SCIENTISTS PEERING INSIDE

Over the course of their lengthy study, the team have used several techniques to scan the pyramid.

Infrared thermography - Infrared detects infrared energy emitted from object, converting it into an image of its temperature distribution to reveal objects that may be hidden.

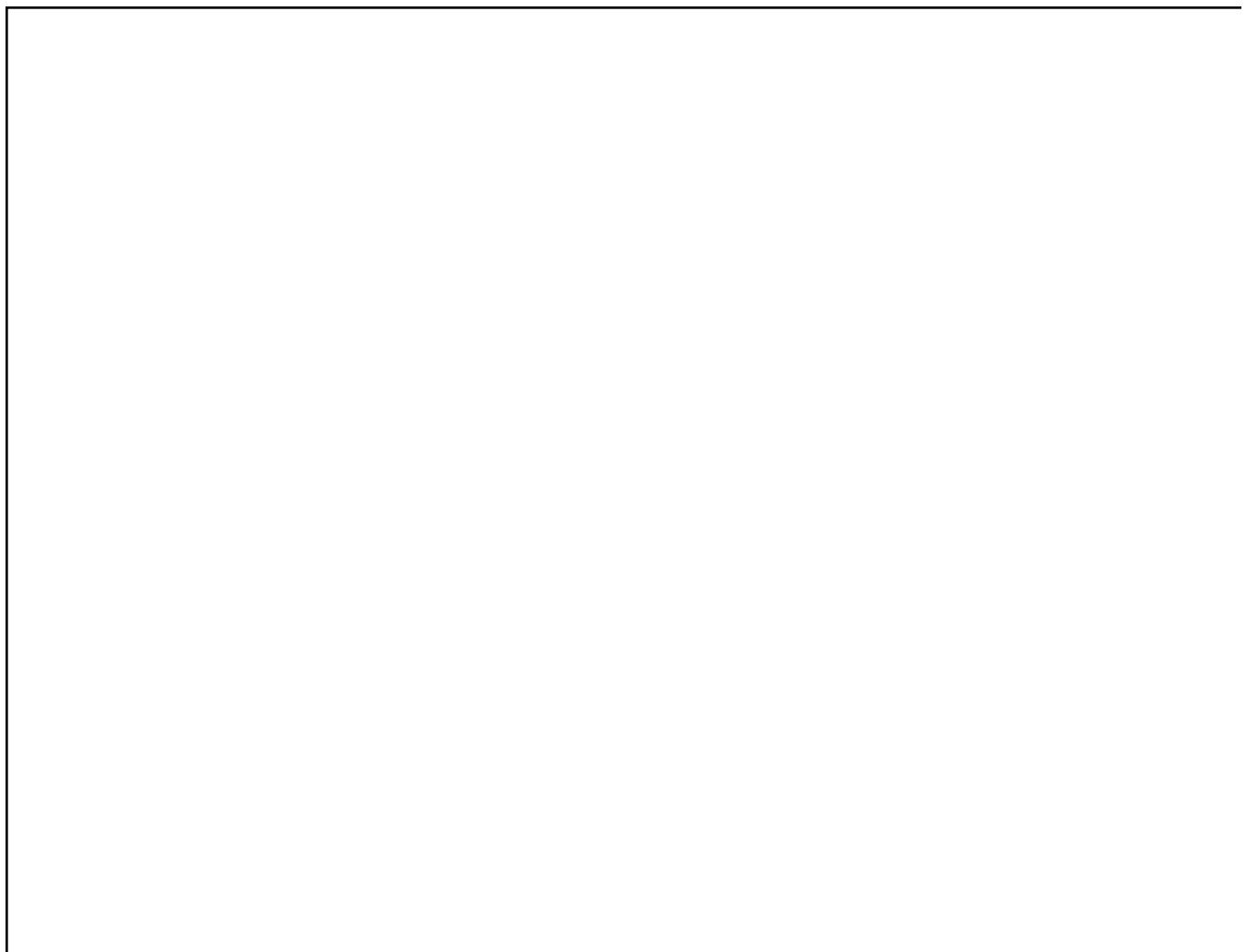
3D scans with lasers - Lasers bounce narrow pulses of light off the interiors of a structure. After many pulses have been sent and received, the data can be combined into a highly detailed 3-D model.

Cosmic-ray detectors - This detects muons that are created when cosmic rays hit the atmosphere. Muons pass through matter harmlessly through people and buildings.

Muons traveling through rock or other dense material will slow and eventually stop. These detectors record the time it takes for muons to travel through the pyramid and measure their energies and trajectories. Researchers can then use this information to map the interior of the pyramid and reveal hidden chambers.



Detectors were set up inside the pyramid, including in the so-called Queen's Chamber. To be visualised without physically disturbing it, as the results showed empty space differe



Muons (artist's impression) are created when the upper atmosphere reacts with cosmic some of which decay into muons. The elementary particles, which weigh around 200 tin easily pass through any structure, even large and thick rocks like mountains

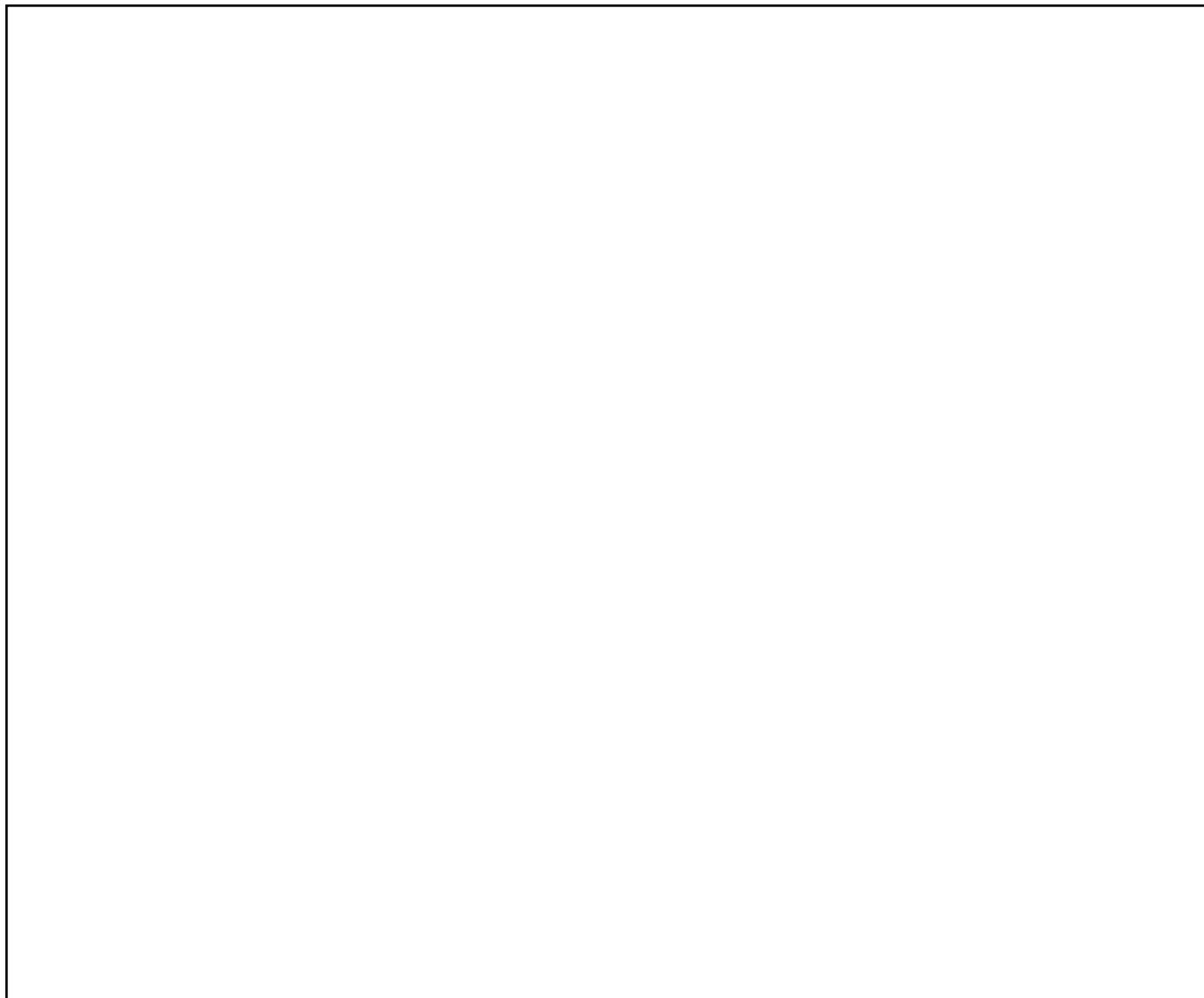
'I think it is an inclined ramp that was used to transport huge blocks into the cen
The orientation leads up to the huge granite roof struts at the top of the relieving

Researchers from the Egyptian Ministry of Antiquities' scientific committee sugg
gap' - part of a trench that allowed workers to access the Grand Gallery and King
pyramid was built.

More simply, the void may have simply been left there to relieve weight from the
The finding opens up the possibility that the void could be linked to other differ
within the pyramid, the study claimed.

Crucially, the authors said, it could provide a method by which scientists can find out exactly how the pyramid was built.

Muon detectors (artist's impression) placed in known rooms within the Great Pyramid will map the interior by detecting particles they passed through layers of stone, meaning the scientists could map the pyramid with



The presence of the void, dubbed the ScanPyramids Big Void, was confirmed using three technologies over several months after first being spotted, the paper said. Pictured is the entrance hallway. The new structure is above this entrance-way

THE SCANPYRAMIDS PROJECT

The team's finding has been a long time coming after months spent trying to find the elusive void.

The researchers began using muon technology, thermal scanning and 3D laser mapping to map the structure in 2015.

Scanners placed in the Great Pyramid's grand descending corridor, as well as a tunnel

out by medieval explorers, found a small structure above the structure's entrance in 2016.

Thermal imaging of the pyramid confirmed a human-height, corridor-shaped void that ran parallel but above to the descending corridor.

Researchers realised this corridor, labelled the ScanPyramid Northfacing Corridor, must lead somewhere, and spent the following months using mapping technology to find where it led.

This has now led the team to the new structure, which sits above the pyramid's Grand Gallery.

After muon detectors detect a void, researchers often use thermal imaging to map its shape.

They added that the development 'show how modern particle physics can shed light on our shared archaeological heritage'.

'This was a study about physics, it was not about Egyptology - we are not claiming anything about the void - we are just claiming that there is a void and that's all,' Mr Tayoubi said.

Muon detectors have previously been used to map out the inside of the Fukushima Daiichi nuclear power plant, and it is hoped they can be used to explore other archaeological sites.

The detectors work by using cosmic particles known as muons that have the potential to pass through most materials.

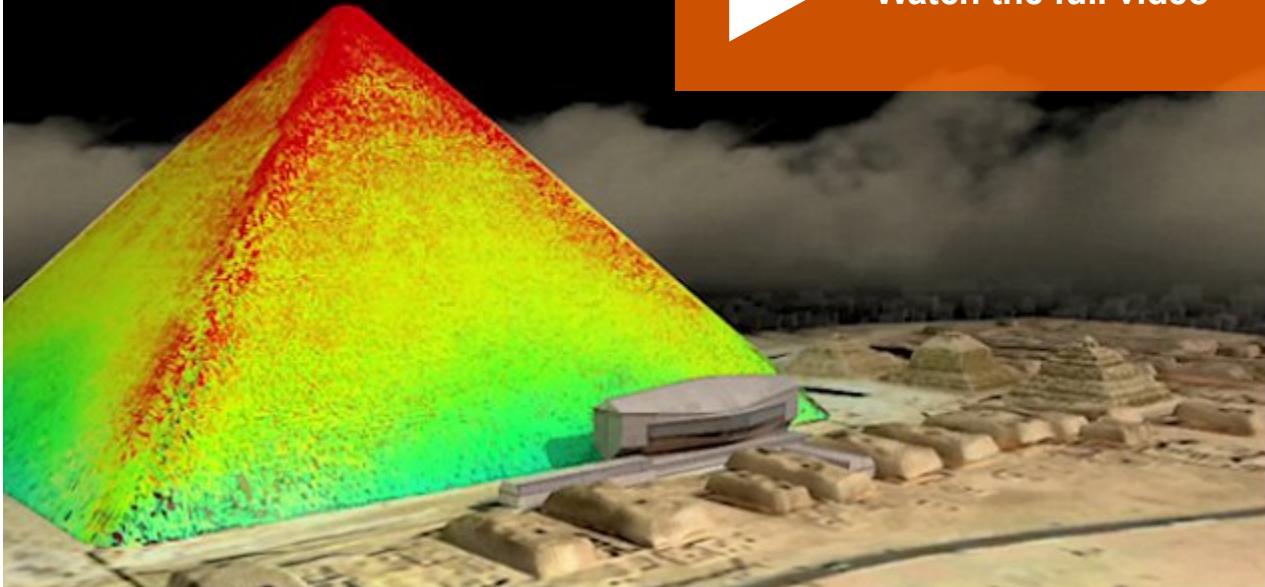


Despite the breakthrough, the newly discovered structure has yet to be reached in person. Several types of muon detector, which reads subatomic particles as they rain down from

Researchers close to uncovering secret chamber in Khufu pyramid



Watch the full video



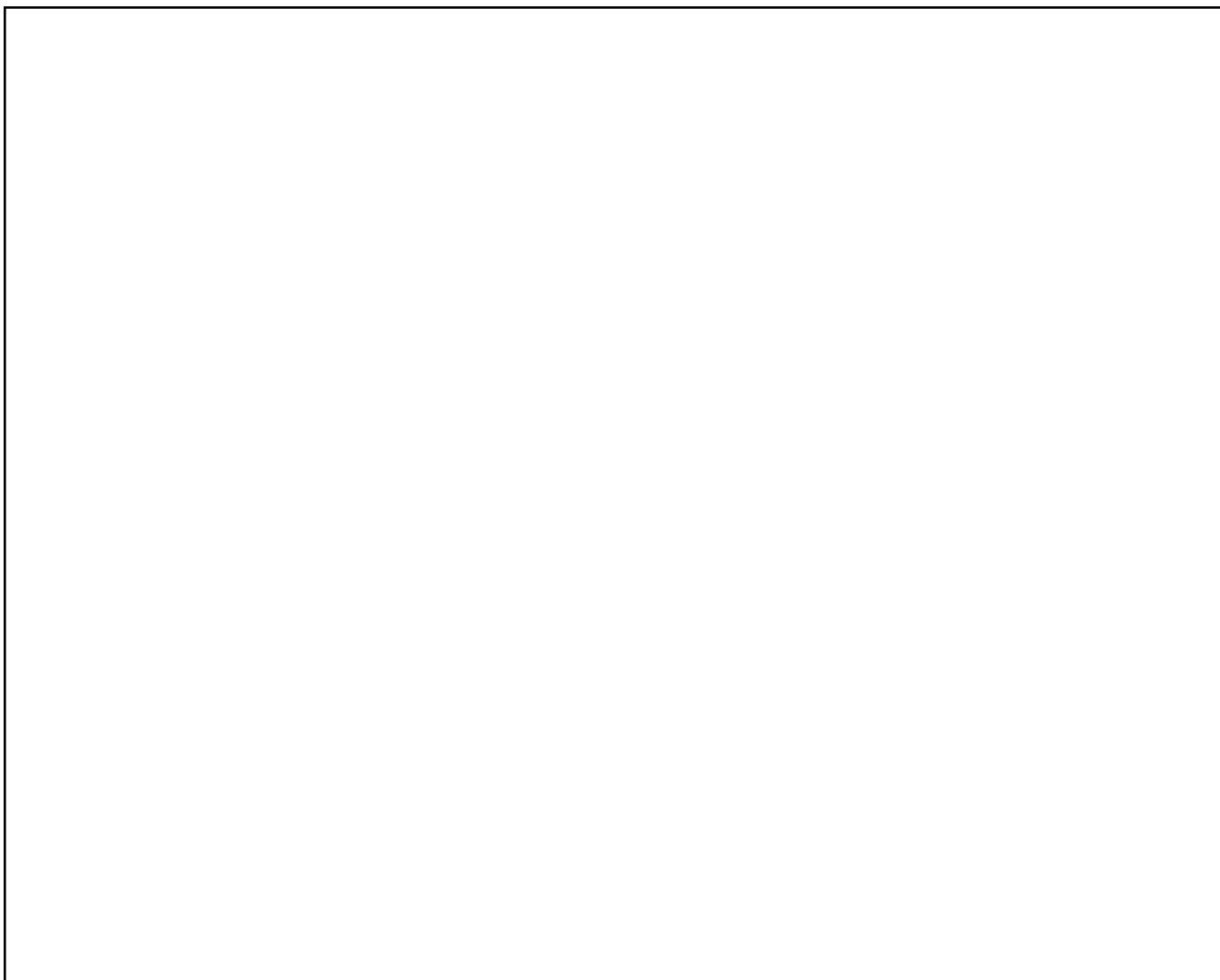
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The finding opens up the possibility that the void could be linked to other different and unknown parts of the pyramid, the study claimed. Pictured is a virtual reality layout of what we know of the pyramid's interior, including the newly found structure, pictured as white dots next to the King's chamber

THE PYRAMID OF GIZA

For more than 4,500 years, Egypt's pyramids have kept their secrets hidden deep within chambers that lie inside their towering stone structures.

But the long-running row over whether the Great Pyramid of Giza is hiding a network of secret rooms behind its stone walls has now been answered.

The researchers confirmed the find using cosmic particles known as muons to scan the

They used the scans to create maps to reveal the internal structure of the 479 feet (146m) high pyramid.

Last year thermal scanning identified a major anomaly in the Great Pyramid, the largest and oldest of the pyramids at Giza and one of the seven Wonders of the Ancient World.

Those scans identified three adjacent stones at its base which registered higher temperatures than others.

Those scans identified three adjacent stones at its base which registered higher temperatures than others.

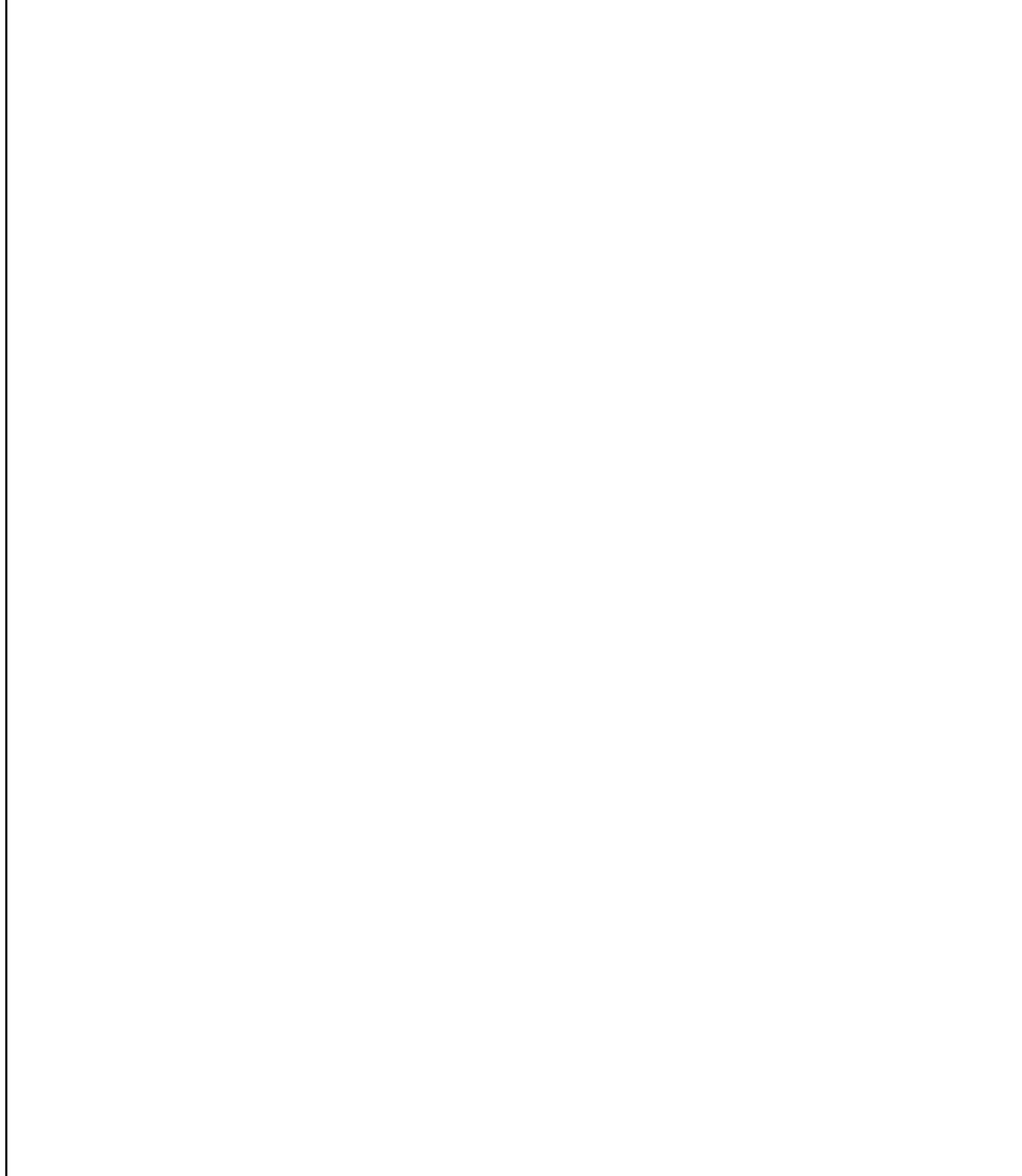
This led to theories that they may be hiding a secret chamber that had yet to be discovered.

A team of experts then set up the ScanPyramid's project to use muons, tiny subatomic particle that are typically produced by cosmic rays smash into atoms on Earth, to peer through the pyramid's huge stone blocks, some of which weight up to 15 tons.

Dr Hawass has in the past been sceptical of the usefulness of conducting such scans.

He recently clashed publicly with British Egyptologists over their theory that a secret b
behind the walls of Tutankhamun's tomb in his pyramid in the Valley of the Kings.

The Great Pyramid, also known as the Pyramid of Khufu, is the only survivor of the ancient Seven Wonders of the World.



Egypt's Great Pyramid of Giza has been shrouded in mystery for millennia, but now a long-known secret is about to be revealed thanks to particle physics

The subatomic particles require only a few special instruments because they rail

atmosphere above.

Muons are created when the upper atmosphere reacts with cosmic rays, producing a shower of particles, some of which decay into muons.

The elementary particles, which weigh around 200 times more than electrons, can very easily pass through any structure, even large and thick rocks like mountains.

Researchers can use these tiny particles to measure the density of structures, just like X-rays pass through our bodies to visualise our skeleton.

The team's finding has been a long time coming after months spent trying to find the elusive 'void'.

The researchers began using muon technology, thermal scanning and 3D laser mapping to lay out the pyramid's internal structure in 2015.

Scanners placed in the Great Pyramid's grand descending corridor, as well as a tunnel near the north facing entrance dug out by medieval explorers, found a small structure above the structure's entrance in 2016.

Thermal imaging of the pyramid confirmed a human-height, corridor-shaped void that ran parallel but above to the descending corridor.

Researchers realised this corridor, labelled the ScanPyramid Northfacing Corridor, spent the following months using mapping technology to find where it led.

Some archaeologists have used sophisticated technology to find the hidden chamber, including a team led by Dr. Zahi Hawass, who believe it may be the final resting place of the legendary queen Nefernefruaten Nefertiti.

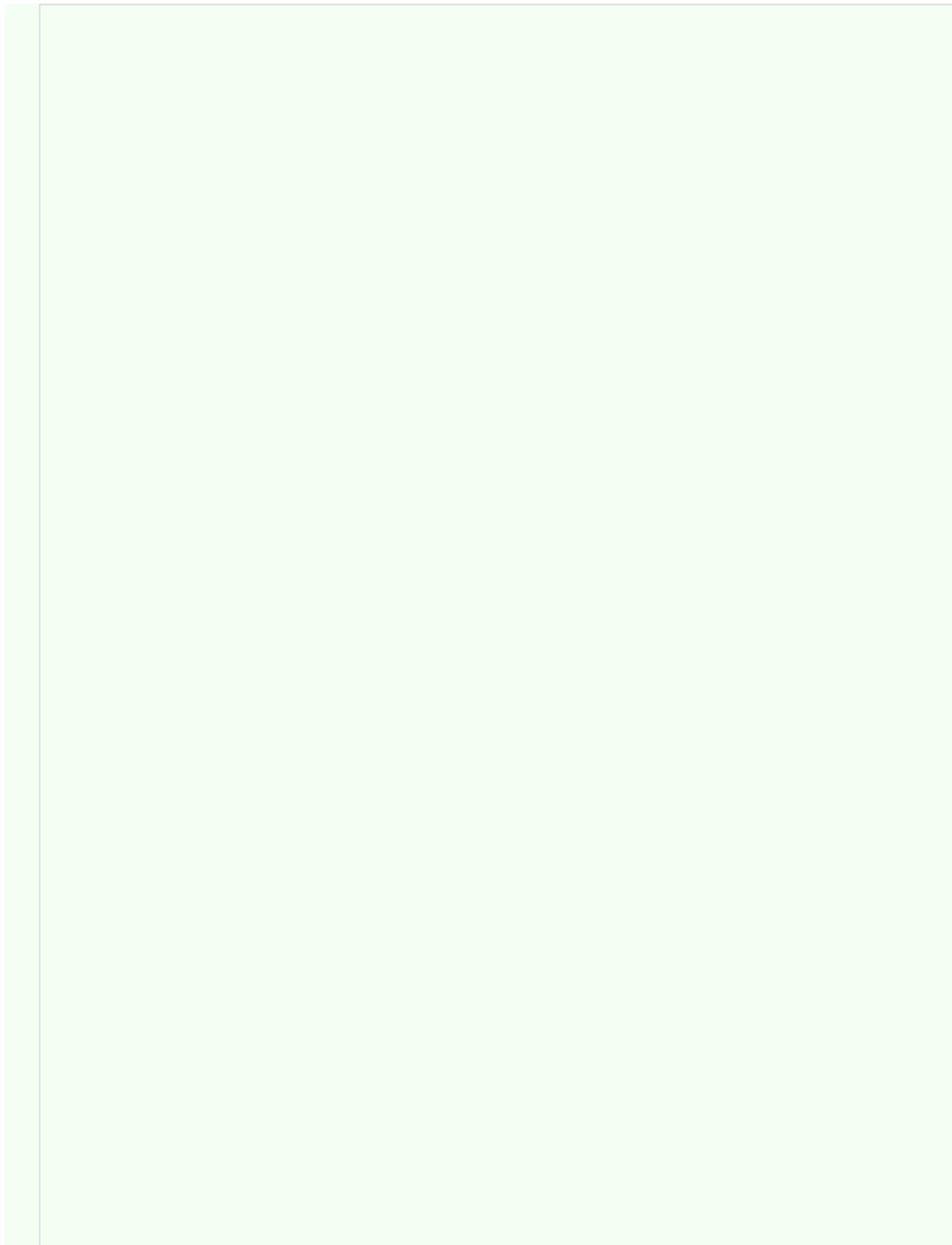
GREAT PYRAMID'S CURSED TOMB REOPENED

Yesterday it was reported that archaeologists in Egypt have reopened a 'cursed tomb' containing the remains of the people who built the Great Pyramid of Giza to visitors.

It is the first time it has been opened to the public since its discovery almost 30 years ago.

The area dates back 4,500 years and is located in the 'tribal mountain' area, near the Pyramids of Giza.

The Press Office of the Ministry of Antiquities shared the revelation on Instagram with a post featuring a photo of the site and the caption: 'Opening the workers cemetery site at Giza Plateau to visit'.



Yesterday it was reported that archaeologists in Egypt have reopened a 'cursed tomb' (pictured) of who built the Great Pyramid of Giza to visitors

The newly opened area contains a cemetery of workers along with the graves of the supervisor of the construction workers and a man of significance who was buried with Newsweek.

The site has been closed off since 1990.

Archaeologists from the Ministry of Antiquities believe the man who supervised the works curses to protect the dead from thieves.

This has now led the team to find the new structure, which sits above the pyramid.

Some archaeologists have pinned hopes on using the sophisticated technology of the legendary queen Nefertiti.

The wife of King Akhenaten, who initiated a monotheistic cult in ancient Egypt, is best known for a bust depicting her that is now on exhibition in Berlin's Neues Museum.

A British Egyptologist, Nicholas Reeves, believed her remains were hidden in a secret tomb of Tutankhamun, in the southern Valley of the Kings.

In 2015, archaeologists scanned the tomb with radar hoping to find clues.

Both Reeves's theory and the inconclusive results have been dismissed by other experts.

One of them, former antiquities minister Zahi Hawass, said that an adept of the sun god had not been allowed to be buried in the Valley of the Kings.

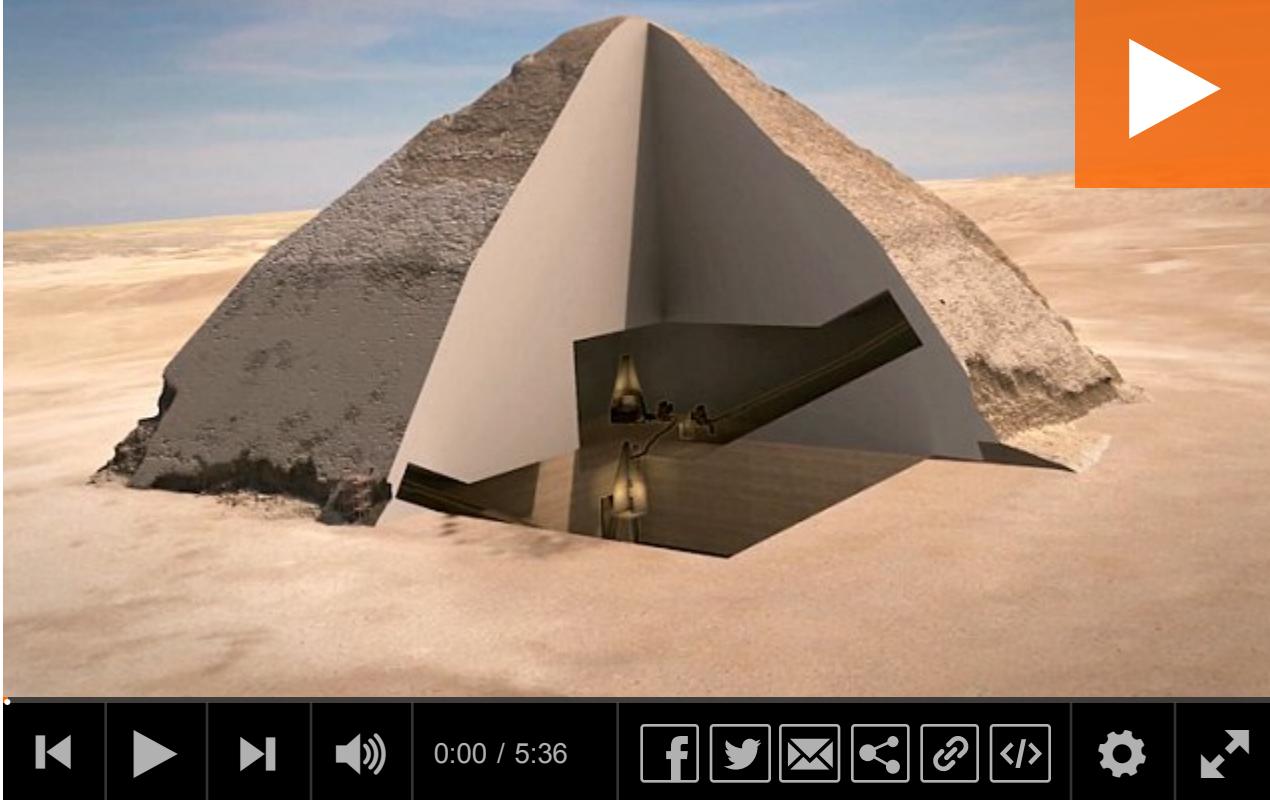
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Mysterious void in Great Pyramid of Giza could finally reveal how pyramids were built

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