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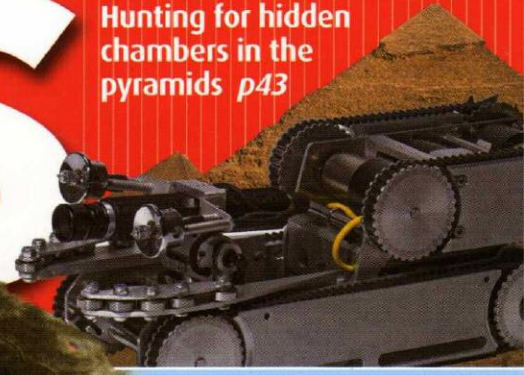
Egypt's robot tomb raider

Hunting for hidden chambers in the pyramids *p43*



Test tube daddy

Accompanies the major BBC series

IVF pioneer **Robert Winston** can genetically select the sex of your child. But should he?
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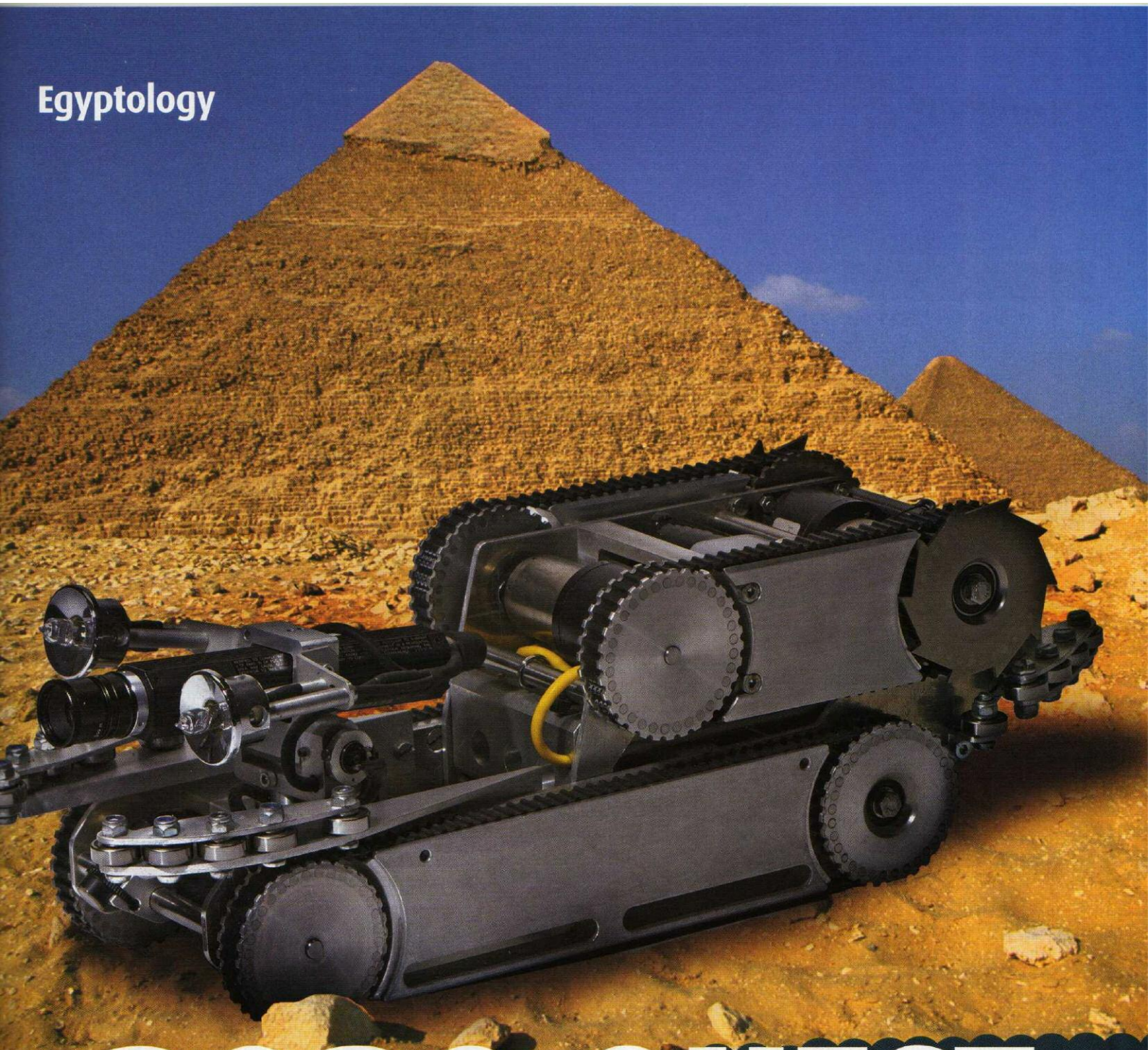
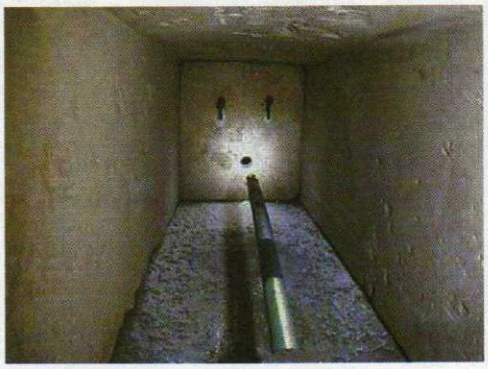


ROBO QUEST

Are cutting-edge robotic explorers about to reveal some of ancient Egypt's most carefully guarded secrets? **Colin Reader** reports...

ON 17 SEPTEMBER 2002, A SMALL group of Egyptologists and a National Geographic camera crew were crowded into the Queen's Chamber deep inside Giza's famous Great Pyramid, all intently watching the progress of a small robot heading out of the chamber along a narrow shaft. As it crawled along, the robot, named Pyramid Rover, beamed images from its on-board camera to screens in the chamber and live around the world.

After almost 60 metres, Pyramid Rover reached its objective, a finely-worked limestone slab with a pair of copper handles. The group watched tensely as the robot drilled a small hole in the slab and inserted its tiny camera into the hole. For the first time



Gantenbrink's door (left) and the second 'door' beyond it (right)

➥ in 4500 years, what lay behind was revealed.

Since the slab was first discovered in the shaft in 1993 there has been tremendous speculation about what it was for and what might lie behind it. Was it a passage to let a dead King's soul travel to the next world? Was it a door, and if so, does a secret chamber lie beyond it? Or is it simply the closed end of a small airway, abandoned as the pyramid was constructed?

No two Egyptian pyramids are exactly alike, but the Great Pyramid of Giza stands out from all the others. Its tremendous size and precise shape are all the more remarkable given the pyramid's age. Although many of its features, such as chambers in its superstructure, can be seen as developments from earlier pyramid designs, there is one set of features found nowhere else – the mysterious shafts.

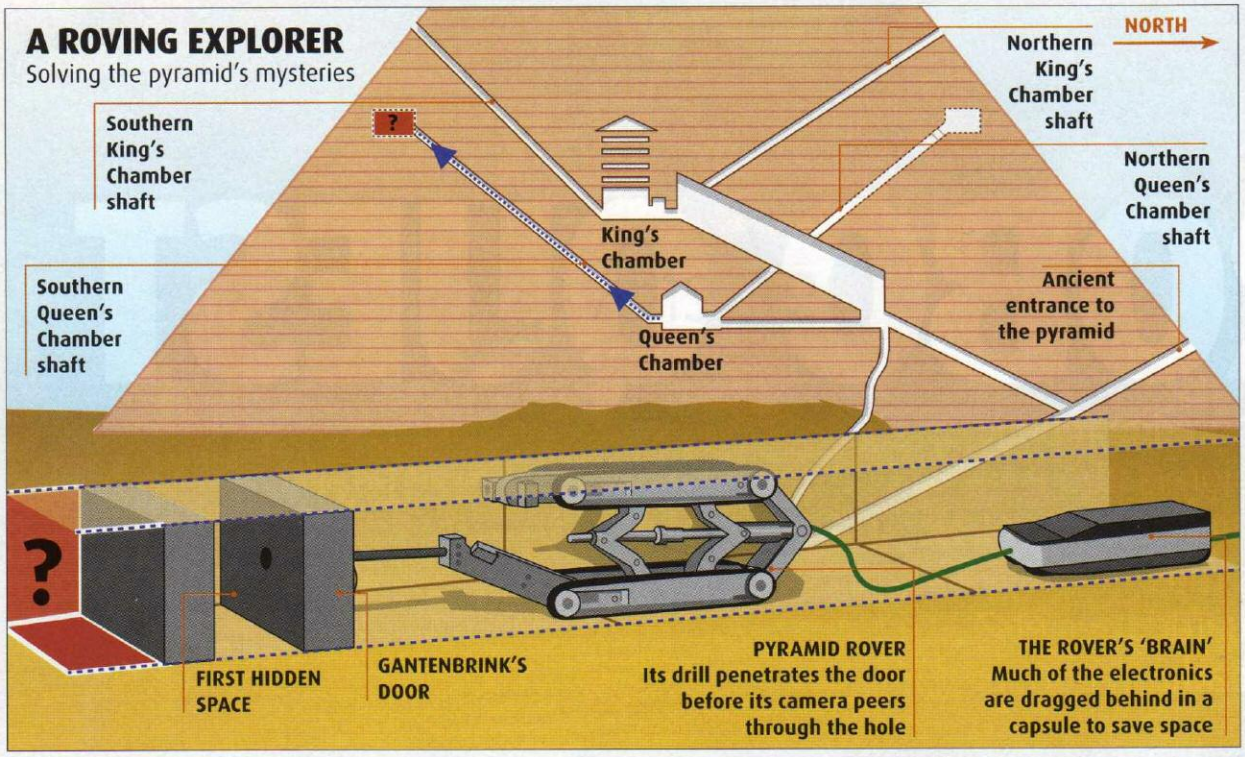
There are four shafts in all: small rectangular channels just 150mm high and 200mm wide, cut into the north and south walls of two chambers built into the pyramid's superstructure. Today we call these the King's Chamber and the Queen's Chamber, but like many features of this enigmatic structure, their real purpose remains a mystery.

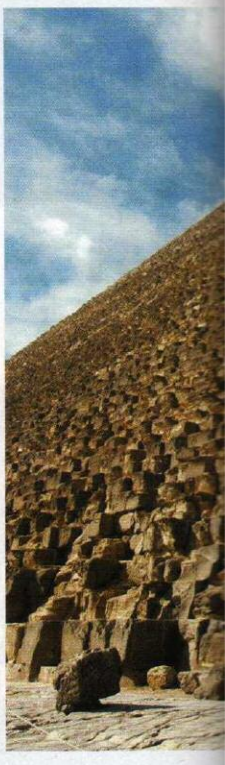
In the 1830s, British Army Colonel and Egyptologist Richard Howard Vyse spent a lot of time investigating the King's Chamber shafts. When he finally cleared thousands of years' worth of accumulated debris, he felt what he described in his report as an 'immediate rush of air'. As a result, he suggested that the shafts had been built to ventilate the pyramid.

Where there's smoke

Whether or not this was the original intention, the air rush meant the shafts ran right through the body of the pyramid. Vyse found their upper ends by lighting fires in the King's Chamber and watching for smoke outside the pyramid. He used rods to find out in which direction the shafts ran, and he poured water into the top of the shafts to see if they led to any chambers hidden in the body of the pyramid. He found none.

It wasn't until 1872 that similar shafts were found in the Queen's Chamber by two brothers, John and Waynman Dixon. Both shafts ran





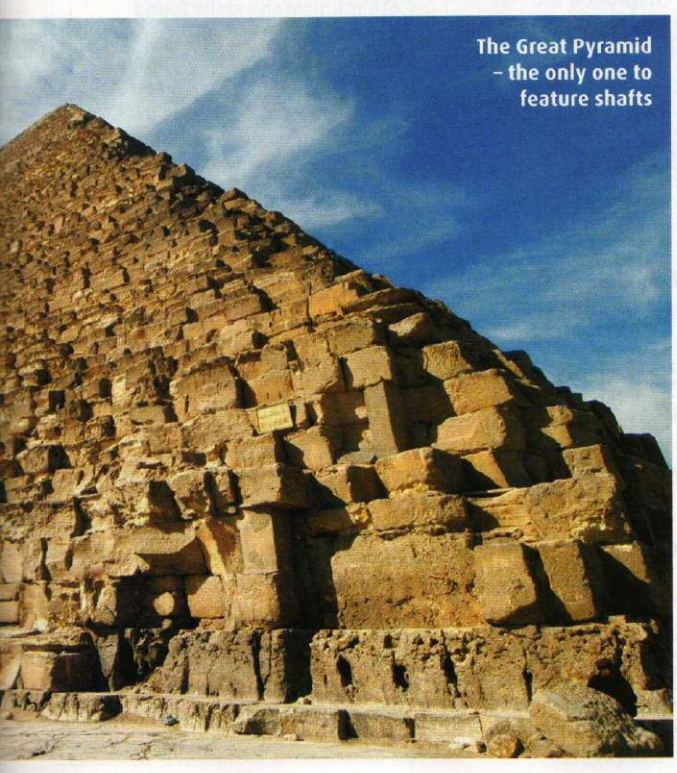
REUTERS, NATIONAL GEOGRAPHIC TELEVISION X2, RUDOLPH GANTENBRINK X3, CHRIS SONDREAL/NATIONAL GEOGRAPHIC TELEVISION, REX, ILLUSTRATION BY PAUL WOOLTON

Gregg Landry and Pavlo Rudakevych test the Pyramid Rover

horizontally for a short distance into the pyramid before ascending out of reach of the Victorian engineers and their wooden rods. When fires were lit in the chamber, no smoke could be seen emerging from the outer face of the pyramid, suggesting that the shafts did not pass all the way through the masonry as those in the King's Chamber did, so they clearly hadn't been built for ventilation.

During their exploration, the Dixons found a short section of wood, a stone ball and a bronze hook in the Queen's Chamber northern shaft. Given that the shaft had been sealed, these could only have come from the time when the pyramid was built. The presence of bronze lends weight to the argument that the ancient builders had some quite advanced skills in metalwork.

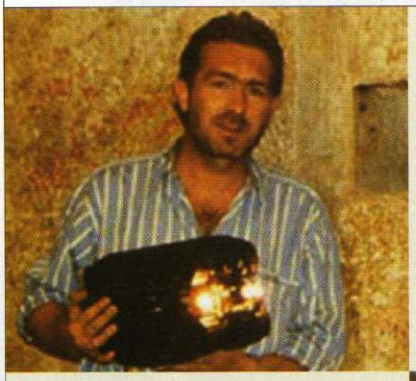
By the late 20th century, tourism was taking its toll, with humidity and salt levels inside the pyramid rising to worrying levels. The Egyptian authorities commissioned the German Archaeological Institute in Cairo and Rudolph Gantenbrink, a robotics engineer, to see if the King's Chamber shafts could be used to provide ventilation. ➥



The Great Pyramid – the only one to feature shafts

INTRODUCING THE ROBOTS

Four robots so far have explored the Great Pyramid's shafts on a quest to unlock its hidden secrets



FATHER OF UPUAUT

Named after an Egyptian war god, this was Rudolph Gantenbrink's first robot. It was the only one not to be built completely from metal, instead using tough plastic in many of its components. Father of Upuaut was powered by electric motors and could use its independent tracks for steering. Unfortunately, this robot had been built using many off-the-shelf components, which meant that it didn't perform as well as the demanding project required

UPUAUT 1

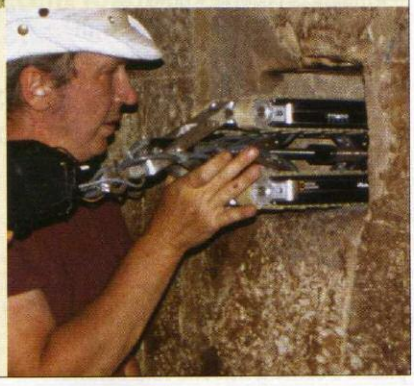
Gantenbrink produced a simplified robot for the next phase of his work. Upuaut 1 was built from a number of custom-built components and had no drive unit. Effectively a camera-sled, the device was pulled through the King's Chamber airshafts on a winch. It's size was kept to an absolute minimum to avoid it getting stuck in the shafts. A laser measuring device was fitted to the front of Upuaut 1 so the dimensions of the shafts could be accurately surveyed

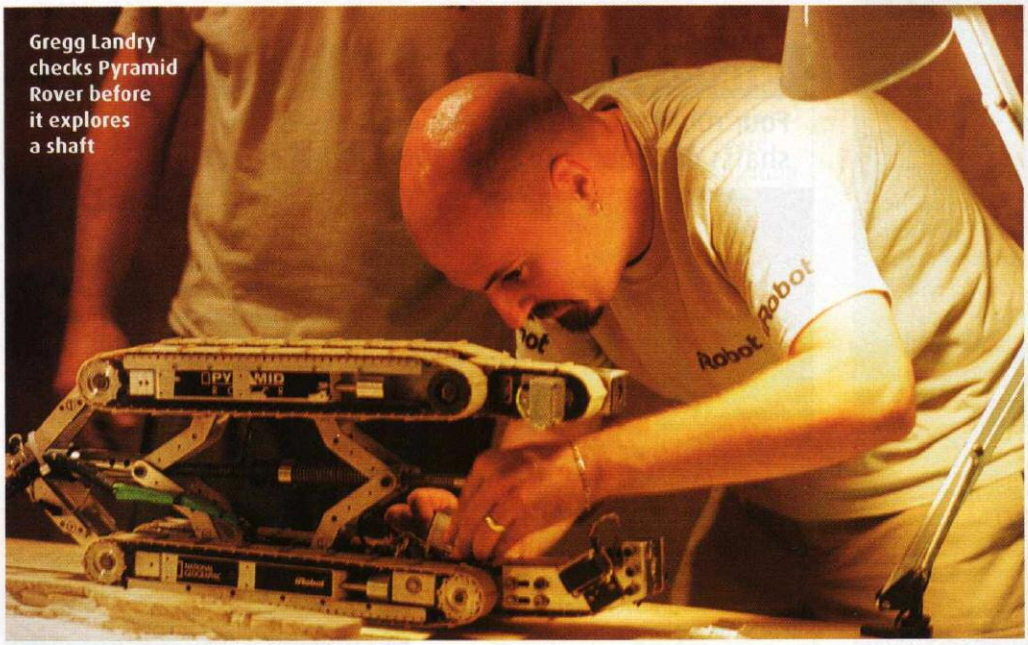
UPUAUT 2

The exploration of the Queen's Chamber shafts, with their closed upper ends, required a specially designed powered robot. Upuaut 2 was built mostly from metal. Traction was provided by two sets of tracks and the robot was equipped with lights, a camera and a laser guidance system. Upuaut 2 was accompanied by the 'Rope Climber', a second robot which attached to umbilical wires that trailed behind Upuaut 2 and measured the angle of the shafts

PYRAMID ROVER

This is the only SCA/National Geographic robot used so far in the exploration of the pyramid shafts and was built by iRobot of Boston, USA. Like Upuaut 2, Pyramid Rover has top and bottom mounted tracks and carries lights and a video camera. It also carried additional equipment, including extra front mounted tracks to help to deal with any obstacles or debris in the shafts, a thickness-measuring sensor and a drill to penetrate Gantenbrink's door





Gregg Landry checks Pyramid Rover before it explores a shaft

AP/EMPICS

After much trial and error with prototypes, Gantenbrink took his laser-equipped robot, Upuaut 1, to Egypt in May 1992. The robot was winched into place to produce the first ever video and laser survey of the mysterious shafts. Gantenbrink successfully installed a mechanical ventilation system inside them.

What lies beyond?

Gantenbrink returned to Giza in 1993 with Upuaut 2 and was using this robot's twin lights and miniature video camera when he discovered the slab of limestone placed across the southern shaft of the Queen's Chamber. The workmanship of both the slab and the surrounding walls was far better than anything Gantenbrink had seen before. The images suggested the slab – which has become known as Gantenbrink's door – was set with a pair of copper handles. Most intriguingly, its lower right hand corner appeared to be broken, and the shadows beneath hinted at a space beyond.

The Egyptian Authorities commissioned National Geographic to design a new robot to investigate what lay beyond the slab. On 17 September 2002, the Pyramid Rover's exploration was broadcast live. Millions watched as the robot drilled through the 'door' and placed a camera into the void behind.

There was a space behind the door, though at only 21cm deep it was not the impressive chamber some had hoped for. Beyond this was a limestone block, which has been described as a second door.

The next day, Pyramid Rover also explored the northern Queen's Chamber shaft and, at a similar distance of about 64m, found another 'door' complete with copper handles.

Further exploration is planned, but following criticism of the first drilling, experts are keen to find a way to get beyond the door without damaging it. The Egyptian Supreme Council of Antiquities (SCA) has been approached by a number of institutions, including the University of Manchester, all keen to continue exploring the shafts to see what, if anything, lies behind the second limestone blockage.

While some experts are excited about the prospect of hidden chambers within the pyramid, others feel that the truth may be more mundane and that the shafts end at solid blocks of limestone, some of the millions used to build the Great Pyramid. Perhaps the biggest thrill is that we still simply don't know. Yet.

Colin Reader is an engineering geologist interested in Ancient Egypt

» FIND OUT MORE

Treasure of the Pyramids
by Zahi Hawass, (White Star, £45). This beautifully illustrated book includes a short chapter on the exploration of the shafts

Giza: The Truth
by Ian Lawton and Chris Ogilvie-Herald (Virgin Books, £10.99). Examine the intrigue of Giza, including the exploration of the shafts and the Dixon relics

www.cheops.org
Rudolph Gantenbrink's website describing his work at the Great Pyramid, with superbly detailed drawings of his findings

www.guardians.net/hawass
Dr Zahi Hawass's website which includes updates on the exploration of the shafts

ASK THE EXPERT

Dr Zahi Hawass, Egyptian Supreme Council of Antiquities

What plans do you have for the next phase of robot exploration of the shafts?
We are currently speaking with experts from the Universities of Singapore, Hong Kong and Manchester to determine the best robot that will fit with our needs. When we are positive that it will be done safely, we will do it.

When will the next phase of exploration take place?
A date has not yet been set. We first have to choose the team and after we have decided on the method that we want to use, then we will know the date.

Will the work be televised like last time?
No, the work will not be televised. The scientific work must be done first.

What do you think lies beyond the other limestone slabs found by Pyramid Rover?
I believe that Cheops, the pharaoh who built the pyramid, had a secret chamber that could be hidden in this area. Later, when the ancient Egyptians' religious ideas were written down in hieroglyphs, they tell of secrets concerning Cheops which were sacred to the god Thoth and relate to the design of the burial chamber. I do have evidence for this theory. But we will have to wait and see what is behind the second door of the southern shaft and the door in the northern shaft.

Do you think the 'Dixon relics' – the bronze hook, stone ball and piece of wood – were placed in the Queen's Chamber shafts during the building of the pyramid or later on?
I believe they were placed there during the building of the pyramid because the shafts were sealed until Dixon found and opened them. There is some evidence that bronze was in use when the pyramid was built.