

## Has one of the mysteries of the ancient pyramids been solved?

*A painting in a 3000-year-old tomb suggests how the Ancient Egyptians may have transported the heavy stones used to build the pyramids.*

Ever since the discovery of the first pyramid, scientists have wondered how ancient Egyptians built these monumental structures that are visible even from space.

There are a number of theories about the construction techniques they used. **(1)**..... Egyptologists had always wondered how workers were able to move the giant limestone blocks. These weigh as much as 2.5 tons each, and the stone quarries from which they were cut were often located hundreds of kilometres away from the pyramid sites.

Dragging them on basic wooden sledges, similar to those people use to slide down snow-covered slopes in winter, was the obvious answer. **(2)**..... It now turns out that the workers probably did have some assistance – from ordinary water! What is even more amazing is that the answer to the Egyptologists' puzzle has been staring them in the face for many years, in a wall painting in the tomb of an ancient Egyptian king, or pharaoh.

The artwork, which depicts a pharaoh being pulled along by a large team of workers, has one significant detail that had so far been misinterpreted – a man pouring water in front of the sledge the pharaoh is being dragged upon. Egyptologists had always thought that the man was performing some kind of religious ritual. However, some scientists now believe that the water was being poured for a totally different reason. **(3)**.....

This revelation was made by researchers from the University of Amsterdam and the Foundation for Fundamental Research on Matter. The scientists arrived at this conclusion after conducting extensive testing in their laboratory, by sliding a weighted tray across both dry sand and sand that had been mixed with varying amounts of water. In dry sand, heaps formed in front of the tray as it was dragged along. **(4)**.....

However, as the researchers added water, the sand hardened, which helped reduce both the force needed to pull the tray and the friction against it. That's because the water helps form tiny water bridges, known as capillary bridges, between the sand particles, causing them to stick together. (5)..... The force required to pull the sledge would have been reduced by as much as 50% as the sand became stiffer, which meant that half as many workers were needed to move the heavy stones.

There was a tipping point, though. After the moisture exceeded a certain amount, the stiffness started to decrease and the capillary bridges melted away, causing the sand to clump up around the tray once again. According to the researchers, the perfect balance appears to be when the volume of the water is between 2 – 5% of the volume of sand. (6)..... And so another step has been taken towards understanding the incredible feat achieved by these ancient engineers. Now if we could only find a painting that would tell us how the workers erected these impressive structures without access to modern mechanics, that would be amazing!

- A** However, to do so would have required superhuman strength against the friction of the desert sand.
- B** This allowed them to work out exactly how much of it had been used every time.
- C** This slowed it down dramatically.
- D** One question, however, had been left unanswered.
- E** The pyramid builders seem to have realised that this was the correct proportion.
- F** The effect of this turns out to be significant.
- G** It was to help the sledge move more easily across the sand.