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BBC Worldwide

Secrets of the Ancients

From the Obelisks of Ancient Egypt to the voyages of the Vikings: can we reconstruct the mysteries of the past.

On the sands of barren deserts, on the peaks of distant mountains and amid the bustle of our own cities, lie ruins from the greatest civilisations the world has ever seen - the Pharoahs, the Incas of Machu Pichu, the Romans, the Vikings, the Olmecs of Mexico...

The monuments they have left behind stand as testament to the great skill and dedication of these ancient builders. But with only basic technologies and without the aid of modern machines or computers, how were such great feats accomplished? In these enthralling programmes, we set out to discover just that: how ancient civilisations were able to complete awe-inspiring projects without the use of modern-day technology. Today's engineers, achaeologists and historians are challenged to replicate the construction of ancient monuments using the methods available at the time.

Documentary

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Episode Synopses

Episode One: Viking Voyage

From the eighth to the twelfth centuries the Vikings were the masters of the northern seas, sending their slender ships into the uncharted waters of the North Atlantic. They discovered the Faroe islands, Iceland and far-off Greenland and even found their way to North America. But how did they make such voyages in the days before even the simple magnetic compass? The navigational techniques used by the Vikings remain shrouded in mystery.

In Viking Voyage, world-renowned mariner Sir Robin Knox-Johnston and a Norwegian crew attempt a journey across the North Sea in a replica Viking ship. Not only do they navigate without modern charts or compasses - as did their Viking ancestors - but they also put to the test the Viking practice of portaging, by attempting to haul a 9 tonne cargo ship across a narrow strip of land in Shetland from the North Sea to the Atlantic.

Sir Robin Knox-Johnston, tests these navigational skills and leads a voyage across the North Sea from Norway to Shetland without modern magnetic compass or chart. He tries out the only piece of navigation equipment he thinks they may have had - a sun-compass. This wooden disc with a central hole and notches along the outer edge and a pin fixed in the centre may have acted as a compass; casting a shadow from the sun which would help seafarers head in the right direction. Sir Robin and the rest of the crew are amazed at the accuracy of this simple tool which, along with the aid of some fair winds, brings them safely to their destination.

On arrival in Shetland another challenge awaits the team. There is evidence in the sagas that Vikings hauled their smaller warships across narrow stretches of land to avoid lengthy and dangerous sea voyages - a practice known as portaging. But would they have been able to do this with a larger cargo ship like the one the team are using? With the help of some game locals and a bucket of rancid cod liver, the team discover that it really would have been possible to drag a boat literally from the North Sea to the Atlantic Ocean.

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Episode Synopses

Episode Two: Caesar's Bridge

In 55 BC Julius Caesar marched through Europe, crushing the rebellious tribes in the North. In mid-summer he arrived at the mighty Rhine. He was determined to get his legions across to teach the tribes on the other side a lesson, but considered it beneath the dignity of the Roman army to cross the river by boat. Consequently, he ordered his men to build a wooden bridge over a river which was at least 400 metres wide, up to 8 metres deep and flowing at 2 metres a second. In his account of 'The Gallic Wars' he claims that from the felling of the first tree to the completed bridge, this massive structure was built in only ten days.

This programme attempts to discover if Caesar was boasting.

Caesar left a surprisingly detailed account of how the bridge was built. Based on a series of trestles spaced across the river, it was unusual in a number of ways. For example, the pairs of timber piles that formed the trestles were driven in to the river bed at a slanting angle to provide more stability. This is much harder to achieve than the more usual vertical piling. Caesar tells us that 'the stability of the structure was so great and its character such that, the greater the force and thrust of the water, the tighter were the balks held in lock.'

But how did Caesar's engineers pile 8 metre long oak timbers into the pebbly bed of the Rhine at an angle? The first challenge is to design and build a Roman pile-driver, with no evidence to go on.

Engineer Chris Wise takes on the challenge and attempts to build a timber bridge across the North Tyne, in Hadrian's Wall country, another outpost of the Roman Empire, using the same techniques as the Romans had at their disposal. Chris has had a major role in building the Millennium bridge over the River Thames which will take a year to complete, and here again his main challenge is the time limit. Just like Caesar, he has only a matter of days to do the job with a small dedicated team - hardly the legions that Caesar had at his disposal.

He soon runs into trouble with his machine for driving piles into the river bed. It has to be built on a raft and the whole thing takes far longer than expected. Time is running short and he and his helpers from the local squadron of TA Royal Engineers from Tyneside struggle desperately to finish the bridge in time. (105 Field Squadron, 72 Engineer Regiment)

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Episode Two: Caesar's Bridge - continued

Damian Goodburn is an expert on Roman timber construction. He has excavated countless timber remains in London and is using original Roman wood-working techniques to replicate in oak one of the giant cross-beams for the bridge. He makes sure that the machines designed by Chris are genuinely Roman.

Mike O'Rorke is the project manager. His is the logistical challenge of the project. How could Caesar's army have cut down and prepared 400 timber piles in the time available?Horst Fehr is an archaeologist in Germany who recently discovered remains of a Roman timber bridge in the Rhine. It's a find that has sparked renewed interest in Caesar's project and Horst sheds new light on the Romans in the Rhineland and adds his views on how this bridge might have been constructed so quickly.

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Episode Synopses

Episode Three: The Claw

In 213 BC, the Romans sent a large force to capture the strategically vital Greek city state of Syracuse in Sicily. The siege was to go down in history because this mighty force was stopped in its tracks almost single-handedly by one man - Archimedes.

The unfortunate Romans were by no means badly armed. Before he arrived in Syracuse, Marcellus made sure that he was equipped with the best available military technology, including a catapult so enormous that it had to be housed on the decks of eight ships lashed together. But the Greeks were able to unleash a number of Archimedes' innovations on their unprepared invaders. Most terrifying of them all was The Claw.

Archaeologist Roger Wilson tells the story of the siege as the ancient sources described it. Polybius talks about a battery of weapons directed against the Roman enemy. Catapults with different ranges were fired at them from the walls, but once the Romans had got through this barrage, coming up close to the walls to set up their siege engines, they thought they were out of range. They were wrong. Archimedes had designed great machines that dropped huge stones on the ships and a 'claw' which "lifted the ship's prow out of the water and stood it up vertically on its stern". Then the crane operator "fastened the machine to make it immovable, and then by some sort of release mechanism, cast off the grappling hook and chain. The ships then either capsized, listed badly or became filled with confusion and much sea-water".

Engineer and expert rock climber Jo da Silva and Brian Austen, an expert in putting up big tops for the circus take on the task of attempting to recreate Archimedes' invention on the sea front in Syracuse. They are assisted by mathematician and Archimedes expert Chris Rorres, who explains the two great laws of Archimedes - the law of the lever and the law of buoyancy - are used in practice in this ancient war machine. They begin by building a crane strong enough to lift a boat a third of the size of the original Roman warships but, as Jo struggles to get the huge 2 tonne lever balanced she starts to get into trouble. The local fishermen arrive at the eleventh hour to help her out of a potential disaster.

Finally, Jo's Claw is put to the test on a local Syracuse fishing boat weighing 25 tonnes which tests the structure to its limit.....

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Episode Four: Olmec Heads

Over three thousand years ago, in the fertile jungles of lowland Mexico, the first civilisation in the Americas was born. Five hundred years before Rome was founded, the Olmec were building great cities with pyramids and ball courts. Considered by most archaeologists to be the 'mother culture'of Mexico, the roots of the later Maya and Aztec cultures lie with the Olmec.

One of the most extraordinary feats of the ancient Olmec was their monumental sculptures. The inhabitants of the site of La Venta erected huge sculptures, some of which weighed up to 40 tonnes. The most famous of these are the massive stone heads. Believed to be portraits of their leaders, they are over two metres high and sculpted entirely without the help of metal tools. There are thousands of tonnes of stones at the site but, most extraordinarily of all, these sculptures are found in an area where there is no rock available. The area identified as the source of the Olmec boulders lies in the Tuxtla mountains over 160 kilometres away. And between these mountains and La Venta the land is criss-crossed with massive rivers and swamps which would have made the transportation even more difficult. So how did the stones get to La Venta?

Archaeologist Ponciano Ortiz believes the Olmec would have transported their stones by water wherever possible. But Anne Cyphers, who has excavated and moved large stone monuments at another Olmec site - San Lorenzo - is convinced that the stones would have been moved over land on sledges during the dry season using the simplest technology.

Engineer Peter Guthrie and rigger Bob Loew soon encounter the difficulties of moving a 12 tonne stone over land and on water with the most basic technology. Peter falls ill and cannot go to Mexico so Bob struggles on alone with Peter's preliminary sketches. Getting the stone on the sled and moving it over land proves far more difficult than expected but when Bob tries to manoeuvre the stone onto a massive raft and float it out into the lagoon he realises just what he's taken on.

But once they got the stones to the site, how on earth did the Olmec produce such stunning sculptures using only stone tools? Glynn Williams, professor of sculpture at the Royal College of Art, doggedly struggles to carve a stone head using only the stone tools that would have been available. He finishes with an even greater respect for the master sculptors of the Olmec.

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Episode Synopses

Episode Five: Hanging Gardens of Babylon

Millennia after its destruction, the city of Babylon remains a symbol of extravagance and wealth. Its most celebrated feature was one of the 'Seven Wonders of the World'. The so-called 'Hanging Gardens of Babylon' astounded and perplexed observers. In the first century BC Diodorus Siculus described them as 'gardens suspended in the air'. From a distance they were described as looking like a terraced hillside, or the rows of seats in a Greek theatre. They are said to have been built for a favoured wife of Nebuchadnezzar who came from the mountainous country in the North. Some experts even believe that the ancient chroniclers got the location wrong and that the gardens were not at Babylon at all, rather that they were built centuries earlier by King Sennacherib of Nineveh.

But wherever they were located the mystery remains - how could such elaborate gardens possibly have been irrigated? Ancient sources describe a mysterious, hidden system of irrigation which carried water to the summit. So what was this system and how did it work? Without any archaeological evidence for the gardens surviving this question becomes even more difficult to answer. The experts are divided.

John Oleson, an expert on ancient water-lifting devices, believes that a whole series of Shadufs may have been used. Commonly used to this day in the Near East, shadufs are basic levers with buckets at one end and a counterweight at the other. But Stephanie Dalley thinks not. Reading his ancient writings, she believes Sennacherib employed screws mounted within tubes to lift water. If this is true, then Sennacherib's engineers invented the Archimedes Screw centuries before Archimedes was born. Water engineer Jo Parker attempts to test both theories by reconstructing each method to see if they were feasible using the technology of the time.

However, there is one final challenge to face. Stephanie Dalley insists that the sources say that Sennacherib made his screw out of bronze. Experimental bronze caster Andrew Lacey attempts to cast a bronze screw using only the technology of ancient Mesopotamia. It is the largest object he has ever cast in the field and a highly dangerous process. But will it work?

Documentary

5 x 50 minutes