RANDOM HOUSE eBOOKS

Decoding the Heavens

Jo Marchant

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About the Book

In 1900 a group of sponge divers blown off course in the Mediterranean discovered an Ancient Greek shipwreck dating from around 70 BC.

Lying unnoticed for months amongst their hard-won haul was what appeared to be a formless lump of corroded rock, which turned out to be the most stunning scientific artefact we have from antiquity. For more than a century this ‘Antikythera mechanism’ puzzled academics, but now, more than 2000 years after the device was lost at sea, scientists have pieced together its intricate workings.

In *Decoding the Heavens*, Jo Marchant tells for the first time the story of the 100-year quest to understand this ancient computer. Along the way she unearths a diverse cast of remarkable characters – ranging from Archimedes to Jacques Cousteau – and explores the deep roots of modern technology not only in Ancient Greece, the Islamic world and medieval Europe.

About the Author

Jo Marchant is a consultant at *New Scientist* magazine. She has a PhD in medical microbiology and has been a science journalist for nine years. She spent three years of that as an editor at the journal *Nature*, and her articles have also appeared in the *Guardian* and *The Economist*. She lives in Brixton, London. *Decoding the Heavens* was shortlisted for the 2009 Royal Society Prize for Science Books.

Decoding the Heavens

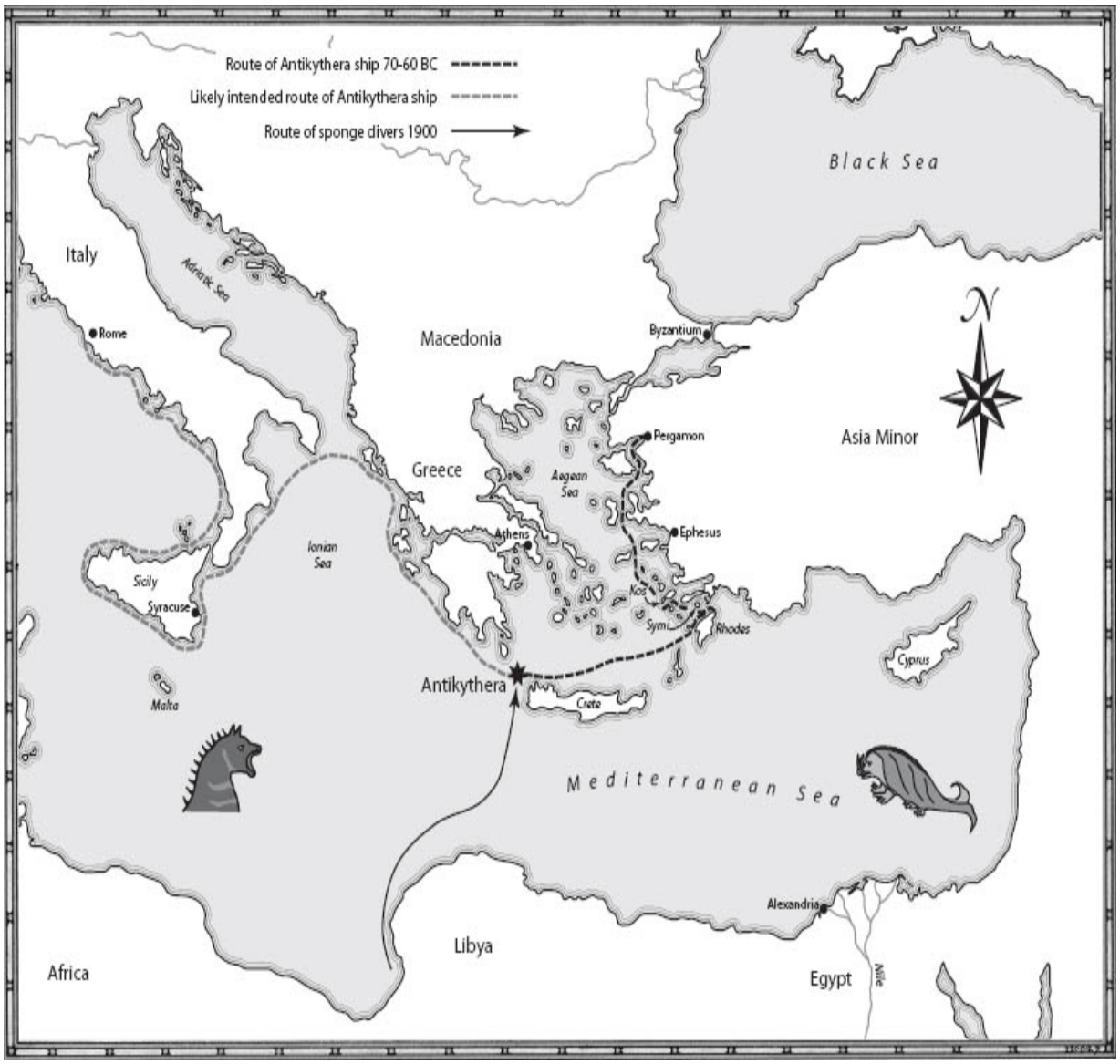
Solving the Mystery of the World's First Computer

Jo Marchant

Jo Marchant

WINDMILL BOOKS

To Ian


Route of Antikythera ship 70-60 BC
Likely intended route of Antikythera ship
Route of sponge divers 1900
Black Sea
Italy
Adriatic Sea
Rome
Macedonia
Byzantium
N
Pergamon
Asia Minor
Greece
Aegean Sea
Athens
Ephesus
Ionian Sea
Sicily
Syracuse
Kos
Symi
Rhodes
Cyprus
Antikythera
Crete
Malta
Mediterranean Sea
Alexandria
Libya
Africa
Egypt
Nile

Prologue

IN A CORNER of the National Archaeological Museum in Athens is something that doesn't fit. It is nothing like the classical Greek statues and vases that fill the rest of the echoing hall. Three flat pieces of what looks like mouldy, green cardboard are delicately suspended inside a glass case.

Within each piece, layers of what was once metal have been squashed together and are now covered with corrosion products – from the whitish green of tin oxide to the dark bluish green of copper chloride. They've been under the sea for 2,000 years, and it shows.

Look closer though, and you'll see something impossible. Through the deposits, shadowy outlines are visible: engraved letters, a large wheel and part of an encrusted but precisely marked circular scale. Next to these strange items an X-ray image shows what's hidden inside. Beneath the ancient, calcified surfaces, delicate cogwheels of all sizes are jostling for space, their triangular teeth so perfectly formed it seems that any second they might start clicking round. The design of the mechanism is modern and immediately recognisable. It looks just like the inside of an alarm clock.

This is the Antikythera mechanism. Its fragments are now known to contain at least 30 gear wheels and urgent inscriptions are crammed onto every surviving surface. Rescued from an ancient shipwreck in 1901, it is one of the most stunning artefacts we have from antiquity and, according to everything we know about the technology of

the time, it shouldn’t exist. Nothing close to its sophistication appears again for well over a millennium, with the development of elaborate astronomical clocks in Renaissance Europe.

Never mind the statues that fill the rest of the museum. Never mind the riches from all the ancient shipwrecks discovered since. Beautiful and inspiring as they are, each individual piece of art merely fleshes out our appreciation of the Greek sculptor’s craft. This unassuming object is different. Although 2,000 years under the sea have left it dull and battered, the ideas and expertise it embodies have turned upside down our understanding of who the ancient Greeks were and what they were capable of, igniting a mystery that has taken more than a century to decode.

So what was it? Who on Earth could have made it? And once this complex technology arose, what caused it to be forgotten for so long? Since 1901 a number of men have devoted their lives to solving the mechanism and answering these questions, each unable to turn away from the mystery once it had found them. Many of them didn’t live to learn the whole truth, but each gleaned a part of it, and this book aims to tell their stories.

None of this could have happened, however, without Captain Kontos and his hardy crew of sponge divers, for without them the Antikythera fragments would still be languishing at the bottom of the sea. They discovered the wreck and risked their lives in the first ever attempt to salvage artefacts from a sunken ship; a daring adventure from which they did not all return.

1

I See Dead People

I might have reached my own land unscathed; but no, as I was doubling Cape Malea I was caught by wave and current and wind from the North and was driven off course and past Kythera. Then for nine days I was carried by ruthless winds over teeming ocean. On the tenth day we reached the land of the Lotus-Eaters, whose only fare is that fragrant fruit.

— HOMER, *THE ODYSSEY*

FOR THE ANCIENT Greeks, the ocean was the centre of the world. There was no single country with borders we'd recognise today as 'Greece'; instead the Greeks, bound by a common culture and language, retained their identity as they spread far across the Mediterranean Sea. By Homer's time, around the eighth century BC, Greek speakers from the ancient provinces of Attica, Boeotia, Laconia and Achaea had reached many far off lands – Macedonia and Thrace in the north; the scattered islands of the Aegean as well as Anatolia and the Asia Minor coast in the east; Egypt and Libya to the south; and Italy, Sicily, and France to the west.

The only practical way to get between these far-flung settlements was by water. For thousands of years, ships – not just from Greece, but also the rival civilisations of Egypt, Phoenicia and later Rome – crisscrossed the Mediterranean. As well as settlers, they carried soldiers,

slaves, diplomats and merchants. Goods transported as gifts and for trade included staples such as grain, wine and olive oil, but there were luxuries too from every corner: ostrich eggs from Libya, gold and ivory from Egypt, lapis lazuli from Afghanistan. Merchants carried amber beads from northern Europe and from the mines of Cyprus they brought copper – to forge the sought-after bronze weapons, armour and statues.

At the centre of this watery world lay the mountainous peninsula we now call Greece. To get between the island-filled Aegean Sea in the east and the more open waters of the west, captains like Odysseus had to navigate their ships through the treacherous and stormy passage between the peninsula's southern tip, Cape Malea, and the island of Crete.

Nearly 3,000 years after Homer's tale, this gateway hadn't lost any of its malice. More than a hundred generations since *The Odyssey* entranced its first listeners, another crew of Greek sailors was trying to pass Cape Malea, on the way home to the Aegean island of Symi. But they, too, were blown off course and taken on an epic adventure of their own.

It was the year 1900. The world was now dominated by the expanding British Empire of Queen Victoria and the spreading iron fingers of the Industrial Revolution. Together these forces were changing life beyond recognition. The first zeppelin flight had just taken place over Lake Constance in Germany and the first automobile show was opening in New York's Madison Square Garden. Seafaring was also being transformed. Britain's Royal Navy was preparing to drop its first submarine into the grey waters at Barrow-in-Furness. And for the first time, gleaming steamships traversing the world's oceans outnumbered vessels propelled by sail.

In the Mediterranean, the revolution had reached one of the most prominent local industries: sponge diving. Since

well before Homer's time, Greek divers had earned a living cutting sponges from the seabed; we know that the ancients routinely used them for bathing and for cleaning the house. In one of the most famous examples, after the wandering hero Odysseus finally returns home to take violent revenge on the men who have been wooing his wife in his absence, he has his maidservants sponge the corpses' blood from the tables (before he hangs them, too, for their disloyalty).

The sponge divers' profession changed little over thousands of years, from perhaps 6000 BC, when the earliest signs of agriculture appeared on Greek soil and the first ships ventured out across the Aegean Sea. The most accomplished and daring divers came from the south-eastern Dodecanese islands, especially Kalymnos and Symi, where the warm water nurtures particularly large specimens. Naked and armed with a sharp knife, the athletic sponge fishers would dive to around 30 metres, weighed down by a large, flat stone, and collect sponges in a net for as long as their lungs would allow.

But, in the nineteenth century the sponge-diving industry was transformed for ever. Perhaps the change was inevitable, but if you're looking for a particular individual to pin it on you could say it was down to a rather distinguished German engineer called Augustus Siebe. After learning metalworking in Berlin and serving as an artillery officer at the Battle of Waterloo, Siebe settled down in Soho, London. A prolific inventor, he had among other things a rotating water pump, a paper-making machine, a weighing scale and an icemaker to his name. Then in 1837 he invented a diving helmet, fitted to a watertight canvas suit.

Like all Siebe's inventions it was quite ingenious, although this contraption was to have a far greater impact than any of his others. Thanks to a valve in the helmet, a diver wearing the suit could breathe air fed through a hose

from a compressor in a boat above. For the first time divers could descend as deep as they liked, or as far as the air hose would reach anyway, and stay underwater for much longer periods. The potential economic benefits for sponge diving were huge and in the 1860s the new suits were brought to Symi by an enterprising local merchant called Fotios Masatoridis.

Each suit consisted of thick folds of canvas, tightly sealed with rubber and bolted onto a large bronze collar and breast-plate. Screwed on top was a round copper helmet, so heavy that it took two hands to lift it, and once imprisoned inside the diver had only little portholes made of reinforced glass to see through. It was impossible to swim in such armour. Instead the divers had to trudge along the bottom, dragging air hose and lifeline behind them, like primitive astronauts tethered to a hovering spaceship on some dense, high-gravity planet.

The expert divers were wary, to say the least, when confronted with these bizarre outfits. Then Masatoridis persuaded his pregnant wife to demonstrate. Obligingly clad, she clambered down the harbour steps until the waters met over her head. The helmet performed perfectly. Being upstaged by a woman – and a pregnant one at that – was unthinkable – so the suits were quickly accepted.

At first they seemed miraculous. After some practice, the divers routinely descended to 70 metres below the surface. There they could tramp around on the seabed, hunting for sponges and harvesting them at leisure, while communicating with the boat above by means of a string tied to one wrist. The vastly increased harvest transformed the industry and the merchants selling these bumper hauls (if not the divers themselves) made huge fortunes. At the industry’s height, between 1890 and 1910, thousands of divers worked each year, putting in perhaps a million hours of time on the sea bottom between them.

There was a tragic human cost for this financial success, however, as the suits brought with them a prolific and indiscriminate killer: the bends.

If you breathe compressed air at depth, the nitrogen in the air in your lungs is at a higher pressure than it is in your body, so it dissolves in your blood and tissues until an equilibrium is reached. This isn't a problem, until you want to return to the surface. Then, if you go up too fast and the pressure drops too quickly, the nitrogen in your body doesn't have a chance to pass back into the air. Instead it pops out of solution as bubbles – just like the dissolved carbon dioxide does when you pop the cork on a bottle of champagne.

The symptoms of the bends depend on where the bubbles form – most commonly they appear in the joints, causing excruciating pain and leaving you unable to straighten your limbs. In the brain the bubbles cause confusion, memory loss and headaches. In the spinal cord and nervous system they cause paralysis; in the skin they cause itching, and a sensation of tiny insects crawling over the body. Bubbles can clog up your veins, cut off the spinal nerves or cause a heart embolism. Severe cases are fatal, and it's not a nice way to go.

The first cases of the bends were reported in the 1840s, not in divers but in miners and bridge construction workers who were exposed to underground shafts in which the air was kept at high pressure to keep out the water. The condition got its name from workers digging the pier excavations of the Brooklyn Bridge in the 1870s. They often came up in tortured body positions that reminded their colleagues – rather callously, it has to be said – of an affected curve of the back that was a popular pose among women at the time, known as 'the Grecian bend'.

But the sponge divers who started using the new diving suits in the 1860s didn't know any of this. It wasn't long before they started dying, and in huge numbers. Between

1886 and 1910 around 10,000 divers died from the bends and 20,000 were paralysed; that's about half of those who went out on the boats each year.

The impact on the sponge-diving communities was enormous, with almost every family affected. Largely due to pressure from divers' wives and widows, the suit was soon banned in many countries, including Lebanon and Egypt. But a mixture of commercial pressures and pride kept the Dodecanese divers using it. Compared to a mundane life on dry land, diving gave them a chance for money and glory; as in war, every day was lived as if it were their last.

Now more than ever the sponge fishers were a tribe apart. Young, macho and proud, they faced great danger for the riches they brought home and were seen as glamorous heroes on the tiny islands from whence they came. Every spring, fleets of flimsy wooden boats would leave Symi and the surrounding islands, each carrying anything up to 15 divers who shared one battered suit and hand-powered air compressor. They would spend an exhausting summer living and working on the boat, travelling as far afield as North Africa. In the autumn those who survived would return, laden with cargo and ready to celebrate.

So it was that in the autumn of 1900, Captain Dimitrios Kontos and his crew were sailing home to Symi from their summer sponge-fishing grounds off the coast of Tunisia. Kontos was a former master diver himself, but was now in charge of two tiny sailing boats. Under his command were six divers as well as 20 oarsmen, so they could still make progress on windless days.

Their *caiques* or cutters were just a few metres long and built pretty much as sponge-divers' boats had been since before Homer's time – the outboard motor would not reach the Aegean for another couple of decades. Vertical beams wedged tightly inside a horizontal wooden frame formed

the delicate S-shape curve of the hull, while a spider web of ropes splayed down from the fragile masts, each proudly topped with a Greek flag. (Symi, along with the rest of the Dodecanese islands, remained under Turkish rule until 1923, but the inhabitants nevertheless saw themselves as fiercely Greek.) After six months' hard work the decks were so densely filled with drying sponges that there was hardly room to move, with yet more strung from every available inch of rigging.

The way home took Kontos and his men northeast from Tunisian waters and up to Cape Malea. But like so many sea travellers following the route before them they fell foul of a violent gale, and were blown towards a barely habited islet.

This island has been given many names in its long history. The ancient Greeks called it Aigilia, which the handful of locals later morphed into Sijiljo, while passing sailors who spoke the Italian-based lingua franca of the Mediterranean called it Cerigotto. These days, however, it is known as Antikythera (pronounced with the accent on 'kyth', to rhyme with pith). A lozenge shape just three kilometres wide, Antikythera sits 40 kilometres south of Kythera – and right in the middle of the passageway between Cape Malea and Crete. Centuries ago, Antikythera was covered in lush greenery, but the inhabitants cut down the forest to build ships. They couldn't have known the effect it would have. Without the tree roots to hold it in place the soil was gradually carried off by the incessant winds, leaving the island beautiful but barren.

Stormwaters around this deadly shard of rock are not for the faint-hearted. The sea turns almost black and angry waves attack the rocks; any ship unlucky enough to find itself in the way is likely to be deftly dashed to pieces. But Kontos was a skilled skipper and he managed to guide his men to shelter in the island's only harbour, a tiny cove on the northern coast called Potamos, where a handful of

white houses are scattered like sugar cubes over the dark, rocky soil.

After three days the winds died, the waters returned to a smooth, glistening blue and the divers' thoughts turned to checking out what was beneath them. Always hoping to find late additions to their hard-earned haul, Kontos took one of the boats out around the sharp, rocky headland just to the east of the port, to a submarine shelf known by the locals as Pinakakia. He dropped anchor about 20 metres from the steep cliffs.

Elias Stadiatis was the first diver into the water that morning. He sank down quickly to the sloping shelf 60 metres below, but reappeared just five minutes later, clearly agitated. His comrades hurriedly hauled him aboard and twisted off his hefty copper helmet.

A huge mound of men, women and horses. Decaying, rotting. Must have come from a wrecked ship. Stadiatis breathlessly recounted what he had seen lying on the seabed. No part of the ship itself was visible – any wood exposed to the water would have long ago been devoured by ship-worms. But its ghostly cargo was plain to see.

Kontos pulled the dripping suit off his gabbling friend and donned it himself to investigate. After he had dropped through the cold water for a couple of minutes, a tumbled mass of figures, parallel to the shore and about 50 metres long, loomed out of the blue. They weren't corpses but statues – corroded and encrusted with marine sediment, yet for the most part clearly recognisable. Some were marble, while the shafts of sunlight penetrated just deep enough to reveal that others had a green tint: the tell-tale sign of ancient bronze. As his boots sank into the slanting mud and his air hose snaked up through the water to the dim shadow of the boat suspended far above, Kontos struggled to keep his breathing steady. This wreck had been carrying treasure.

He grabbed a bronze arm from one of the statues as proof of the find, attached it to his life line and headed triumphantly back to the surface.

Sources differ about what happened next. The official Greek version is that Kontos ordered his men to measure and record the location of the wreck, before they finally sailed home to Symi. After enjoying the customary heroes' welcome, Kontos informed the island's elders of the find and asked them what to do. Full of patriotic pride, they recommended that he leave immediately to report the discovery to the Greek government in Athens.

But perhaps they weren't in such a rush. Peter Throckmorton, an American archaeologist, journalist and diver who was involved in excavations of several Mediterranean wreck sites in the 1950s and 60s, studied the Antikythera finds and interviewed people on Symi. Few who remembered the discovery were still alive, but stories of it were still eagerly told in the taverns along the seafront. According to Throckmorton, the locals' story was that Kontos and his men first used ropes to lift whatever they could from the wreck site for themselves before the weather changed that autumn. He points out that there are rumours of many small bronze statues being sold in Alexandria between 1902 and 1910, and that the lead bars from the ship's anchors have never been found. Lead would have been precious to the divers, for use as weights. When they could salvage nothing else with their tiny boats, the divers went to the Government in the hope of a reward.

Either way, at some point Kontos and Stadiatis, with the bronze arm in tow, went to see a Professor A. Ikonomu, an archaeologist at the University of Athens who came originally from Symi. On 6 November 1900 he took them to the office of the Minister of Education, Spyridon Staïs.

It was good timing. No archaeological survey of a wreck had ever been undertaken, in Greece or elsewhere, but the Government, led by Georgios Theotokis's New Party, had

just begun to realise the potential of raising ancient riches from the seabed. Sixteen years earlier it had funded a survey to look for remains from the greatest sea-battle in Greek history, when the fleet of the Persian king Xerxes was crushed by the Greek navy in the straits of Salamis in 480 BC.

A few noteworthy items had previously been recovered from the sea, including a bronze chest protector found in Pylos harbour in southern Greece, ancient timbers and two life-size marble statues at Piraeus, Athens' port, and an inscribed lead anchor from the harbour at Symi. All had been discovered by chance, either by sponge divers or dragged up in fishermen's nets.

So it was quite a bold move when in 1884 the Archaeological Society of Athens, with the Government's backing, decided to go out and actively search for submerged artefacts. Modern Greece was a young, relatively insecure country, having escaped Turkish rule only in 1830, and the Government cannily thought that recovering the remains of past glories would do wonders for national pride. Unfortunately the society didn't know of any wreck sites to explore, so after much pondering it chose the straits of Salamis as its expedition site. In the frenzied battle there nearly 2,400 years before, the Greeks had lost 40 triremes (wooden warships, named after the three rows of oarsmen on each side), while the Persians lost a whopping 200. The sea floor was surely strewn with their remains.

It was a much harder mission than the archaeologists had bargained for. The water was only 20 metres deep, but bad weather meant the hired divers could only work twelve days out of the month that had been scheduled. Even on calmer days the choppy sea stirred up mud from the bottom so the divers couldn't see what they were doing. And in any case there was so much seaweed and clay everywhere it was impossible to tell what lay beneath. For

a cost of precisely 1548.50 drachmas (worth around £8,000 today), the team came back with a few fragments of amphoras, a nearly intact vase and a wooden plank that broke as it was being brought up to the surface.

In a dejected report to the Archaeological Society later that year, Christos Tsoundas, who had supervised the expedition, described it as a ‘complete failure’. Looking back, however, that was a little harsh. For the first time in history a professional archaeologist had led a team of divers, taken rough measurements, recorded what was found and reported back. The idea of underwater archaeological surveys carried out by the state had taken root, even if the disappointing outcome meant that no other projects were attempted for the next few years.

The expedition also caused a fair amount of excitement in the press at the time (before the final haul was known, at least) and it may have been the memory of this that encouraged Kontos and his elders to reveal their find at Antikythera to the Government. Officials at the education ministry initially met Kontos’s claims with disbelief. No sunken ship had ever been found in Greek waters and the divers’ story seemed too good to be true. But the evidence of the bronze arm, and the potential value of the find, won them over. This project promised to yield everything that the Salamis mission had failed to. According to Kontos’s account, a wreck had already been located and the divers had already established that it contained treasures to be salvaged. If it had bronze statues on board, the ship was surely close to 2,000 years old, for no such artefacts were made after Greek civilisation fragmented in the early centuries AD, and any that survived (unless buried somewhere or out of reach at the bottom of the sea) were soon melted down as scrap metal.

If the Government would provide the necessary equipment to winch the sunken objects up from the seabed, Kontos told the minister Staïs, his men would dive for them

– provided they were paid the full value of whatever they recovered. Slightly nervously, Staïs agreed to Kontos's terms, as long as an official archaeologist was on board to oversee the project. Professor Ikonomu was appointed and Kontos handed over the arm.

Staïs moved fast. Once the location of the wreck got out, looting was a strong possibility. And perhaps Kontos would change his mind. So within a few days a navy transport ship called the *Mykale* took Ikonomu to Antikythera, accompanied by Kontos, the divers and the oarsmen, in their two little fishing boats. After being slightly delayed by bad weather, they all arrived at the wreck site on 24 November. The divers – Elias Stadiatis, Kyriakos and Georg Mundiadis, Johann Pilliu, Giorgios Kritikos and Basilios Katzaras – began their work.

At the wreck site, the cliffs of Antikythera drop vertically to about 50 metres below the sea's surface. Then there's a shelf of sandy mud, on which the ancient ship came to rest, which slopes gently down to about 60 metres before dropping off again to deeper water. Ikonomu and Kontos had agreed a plan of action. Light objects from the sunken cargo were to be attached to ropes and raised using winches attached to the divers' own boats, and heavier ones were to be lifted with the sturdier hoist of the *Mykale*. But in that first run, the sea was still pretty rough. Swells from the north punched against the cliffs and it became clear that the *Mykale* was too large to get safely close to the rocks. Kontos, eager to prove the truth of the find and not one to be deterred by a little inclement weather, sent his men down anyway. In the three hours before the worsening storm forced them to stop they brought up a bronze head of a bearded man, the bronze arm of a boxer, a bronze sword, two small marble statues (both missing their heads), a beautifully crafted marble foot and several fragments of bronze and marble statues, as well as bronze bowls, clay dishes and other pottery.

Returning to Athens to be replaced by a smaller craft, the *Mykale* took these rewards home in triumph. Staïs must have breathed a huge sigh of relief when he realised that his investment had been a wise one after all. The divers really had stumbled upon the biggest hoard of ancient Greek bronzes ever found. The story became front-page news and, as the Government had hoped, all of Greece (but especially Athens) was set alight by a collective and patriotic excitement. After centuries of having their treasures looted by everyone from the Romans to the British, some antiquities were finally making it back home.

The navy assigned a more manoeuvrable ship, the steam schooner *Syros*, to the Antikythera mission and she arrived at the wreck site in time for the divers to start work again on 4 December 1900.

The conditions they faced were treacherous. Top of the list of difficulties was the unwieldy suit, which was not designed for the hard physical work of digging and lifting statues. To make matters worse the waters around Antikythera are cold and prone to sudden currents, as well as frequent gales and storms. The salvage expedition lasted ten months, until September 1901, yet the weather prevented the divers from working even a quarter of those days. For the rest, they had to sit out the storms on their tiny boats.

But the biggest challenge of all was the depth of the wreck, which was to push the divers to their limit. At about 60 metres down the site was well out of reach of any navy in the world at that time. Even by 1925, for example, just 20 US navy divers were qualified to dive to 30 metres. For Kontos’s men to reach the wreck at all with the equipment they had, let alone do heavy work down there, was an incredible achievement. It’s likely that no one but the Mediterranean’s most daring sponge divers – who practically grew up in the water and depended for their

livelihoods on going deeper than anyone else – could have managed it.

Although the divers at Antikythera had no comprehension of the diving tables or decompression stops used for safe diving today, or of what the depth was doing to their bodies, they at least realised that limiting the time they spent on the bottom reduced their chances of dying. They limited their submersions to five minutes on the bottom, twice a day, coming up reasonably slowly (meaning that between them, the six men could only work a total of an hour on the bottom each day). But even with the best intentions their diving suits were hard to control, especially when ascending. A diver had to carefully monitor the amount of air in his suit by balancing the air he vented with the intake from the valve in his helmet. If he miscalculated and allowed in too much air it would expand within the suit as he rose, carrying him helplessly ever faster towards the surface, and a sure case of the bends.

There was also a second depth-related danger to contend with – nitrogen narcosis. Well known to most scuba divers, it is a mysterious alteration of consciousness thought to be caused by the effect of high nitrogen pressure on nerve transmission. The French diver-explorer Jacques Cousteau famously described it as ‘the rapture of the deep’, because it feels as if you are giddily drunk. It gets worse the deeper you go, kicking in at around 30 metres and getting progressively more serious – budding scuba enthusiasts are taught to remember that it’s like having one martini for every 10 metres below 20 metres. The effects reverse as soon as you ascend, but the impaired judgement they cause means that some divers never surface. The rapture makes them feel invulnerable and affected divers have been known to throw away their masks or swim far down to their deaths.

Cousteau’s diving colleague Frédéric Dumas described the effects of nitrogen narcosis at 70 metres, just a little

deeper than the divers at Antikythera had to reach, in Cousteau's 1953 book *The Silent World*:

> My body doesn't feel weak but I keep panting. The damned rope doesn't hang straight. It slants off into the yellow soup. I am anxious about that line, but I feel really wonderful. I am drunk and carefree. My ears buzz and my mouth tastes bitter. I have forgotten Jacques and the people in the boats. My eyes are tired. I lower on down, trying to think about the bottom but I can't. I am going to sleep, but I can't fall asleep in such dizziness.

That was in 1943, when scuba-diving gear had just been invented by Cousteau, together with Émile Gagnan, an expert in industrial gas equipment in Paris. Gagnan had been working on a demand valve to feed cooking gas into car engines. The Second World War had caused petrol shortages and everyone was trying to work out how to run cars on the fumes of burning charcoal and natural gas. Feeding compressed air into a diver's mouthpiece on demand turned out to be a similar problem.

By lowering themselves down a rope and signing their names on boards attached at various measured depths, Cousteau and Dumas wanted to see just how deep it was possible to go. Subsequent dives down to 100 metres set what is still sometimes called the 'theoretical limit' for diving with compressed air. It's more than a theoretical barrier, though. When the fearless experimenters tried to extend the limit with a 130-metre rope, their close friend Maurice Fargues was first to descend. At first all seemed to be going well, but after a few minutes his signals to the surface stopped. Cousteau and Dumas dragged him up by his lifeline; when he appeared beneath them they were horrified to see his body limp and his mouthpiece hanging from his chest. Twelve hours of desperate and exhausting

resuscitation proved unsuccessful. When they later pulled up the marker rope, they found Fargues's illegible signature on the very lowest board.

For Kontos and his men in 1900 the exertion of hauling statues and artefacts, and attaching them to the winch line of the boat above, caused them to breathe heavily, making the effects of nitrogen narcosis even worse than normal for the depth they were at. Their helmets trapped the carbon dioxide they breathed out (unlike scuba gear, which releases the air you exhale into the water), befuddling them even more. Visibility was a problem, too, as the mud and sand floated up from the bottom in clouds as soon as the divers moved anything.

Yet throughout the winter the sponge fishers dived again and again and brought up find after find, while the archaeologists on board, dressed smartly as always in dapper suits, looked on. And despite the vile conditions the divers worked carefully – often taking several days to dig and clean around an object before easing it from the slippery mud. The supervising archaeologist George Byzandinos (who had taken over from Ikonomu) concluded that the fragments being brought up had broken thousands of years earlier, not in the salvage process. He even praised the divers for showing as great an interest in the preservation of the antiquities as any 'inspired fan of ancient art'.

By Christmas their haul included plenty of marble statues, mostly of men or horses, another bronze sword, a bronze lyre, a colossal marble bull and various fragments of bronze furniture, including a throne. And there was the most exciting find so far: a beautifully worked bronze statue, perhaps of Hermes or Apollo. Although broken into several pieces it was quite well preserved and was hailed as one of the finest bronze statues to survive from antiquity. Perhaps it was even the work of one of the great fourth-century classical sculptors, Lysippus or Praxiteles, the

archaeologists speculated excitedly. There was one statue that got away, though. The body of a large horse tore itself loose from its chains just as it reached the surface and crashed back into the sea, falling down the cliff into the deeper water beyond the divers' reach.

The statues piled up on deck and although the bronzes had survived pretty well, most of the marbles were terribly eroded. Emmanuel Lykudis, one of the archaeologists present, described the scene in his diary entry for 7–10 February 1901:

> *The sea has affected them in a terrible way. Most of them are now transformed into shapeless sea-rocks, and they have the appearance of tremendous sea shells … But under the transformation and destruction that the sea has carried out, one suspects the old glory, believes one can still recognise the beautiful lines*.

The statues that had been recovered so far were transported back to Athens and put on public display at the National Archaeological Museum. Eroded or not, crowds flocked from far and wide to see such treasures from their nation's past, while the newspapers reported on every detail of the unfolding adventure.

Back at Antikythera, however, the storms, the punishing depth and gruelling regime of work were taking their toll, and the divers were beginning to suffer from exhaustion. By February, according to an account of the finds published in 1903 by John Svoronos, one of the country's most senior archaeologists, the men were often emerging from the water 'half-dead'.

The mood soured as the pace of discoveries slowed. Then the divers announced a further problem: part of the wreck, they said, was obscured by enormous boulders. After some discussion the archaeologists worked out that

these must be rocks from the cliff above, dislodged at some time by an earthquake, and soon devised a strategy for shifting them.

They instructed the divers to dig tunnels underneath the boulders, then twine strong ropes around them several times, an arduous task that took more than 20 dives for each boulder. The other end of the rope was attached to the sturdy *Mykale* (brought out again from Athens for the task), which then steamed at full power towards the open sea. Once dislodged from the wreck, the boulders were to be released from the ropes, rolled down the slope and into the depths below.

It was a risky strategy, described by a jumpy Lykudis as ‘one instant of large and probably justified fear!’ If the rope snapped, the sudden shock might be enough to capsize the *Mykale*. Or worse, if the boulder remained entangled in the rope, its weight might drag the ship down with it. To avert the latter fate, several of the crew gathered around the rope where it was tied to the ship, ready with hatchets. Fortunately, their services weren’t required and several boulders were successfully dispatched over the underwater cliff.

But then the minister Staïs, who was visiting, had a startling thought. What if the ‘boulders’ were actually colossal statues, so overgrown and corroded that the befuddled divers, working in the dim light of the wreck site, had failed to recognise them? He ordered the next boulder to be brought to the surface – at considerable further risk to the ship. After some tense moments there was cheering from the decks as it heaved into view through the clear water. It was a huge, muscular Hercules, complete with club and lionskin – eroded but still recognisable as similar in style to the world-famous Farnese Hercules, kept in the Naples Museum. Presumably, they preferred not to dwell on the statues that had already been rolled forever out of reach.

At this point the ill and exhausted divers demanded a month's break, at least until Easter. At first, Staïs encouraged them to continue for a few days more by promising to increase their reward, but eventually they were beyond persuasion and went on strike.

They donned their suits again in April, with ten divers instead of the previous six, but the easily recoverable objects had already been brought up, so in the first week the returns were meagre. Then tragedy struck. One of the divers, Giorgios Kritikos, surfaced too fast and died of the bends, leaving his family without a pension. Accounts from the time pass over this inconvenience with few details about what happened or even any detectable regret at his passing beyond its effect on the work at hand. Indeed, Staïs's response seems to have been to threaten to hire Italian divers who he thought would be more efficient.

He never acted on these words though, and the long-suffering Symiotes worked on into summer. As the months passed, the team was increasingly troubled by a seasonal wind that affects the area, called the *melteme*. Coming in from the north-east, it can whip up a harsh storm in minutes. The wreck site was completely exposed and it became harder and harder to work there. Every loose object had been removed from the wreck and the divers had begun to dig into the layers of sea growth underneath, but with little success. Then two more divers were seriously paralysed by the bends and work was finally suspended at the end of September 1901.

Those involved were reluctant to stop, believing that many more statues remained embedded there, especially as the bodies of many of the salvaged heads, feet and hands had not yet been found. From time to time the Government tried to hire foreign crews to continue the work, but these efforts failed because the divers wanted to keep some of the salvaged artefacts, which was forbidden by Greek law.

According to the official report of the Archaeological Society, the Greek government paid the ‘conscientious citizens of Symi’ – those who survived at least – a small fortune of 150,000 drachmas (equivalent to nearly half a million pounds today) as their reward, while the society paid them a bonus of another 500 drachmas each. The report proudly noted that the quality of the salvaged artefacts had exceeded all expectations.

It was a great success. The first ever archaeological survey of a wreck had yielded treasures far beyond what anyone had imagined. But the project was very different from anything that archaeologists might recognise today. There was no attempt to study the items from the wreck in context or to learn anything about the ship itself or the way of life on board. It was purely a salvage operation. None of the archaeologists would have dreamed of getting into the water themselves and they treated the divers as nothing more than hired labour. At no point, for example, did they ask them how the wreck and its contents were arranged.

Similarly, the finds were treated very differently from how they might be today. They were taken to the National Museum in Athens, under the supervision of the museum’s director Valerios Staïs (Spyridon’s nephew). But there was no effort to definitively catalogue the fragments and artefacts. Some were placed on public display, but most were put straight into a rather jumbled storage. Inside the museum, a pretty open courtyard became the eerie resting place for heaps of marble statues, horribly disfigured by the action over the centuries of hungry sea creatures – everything from date mussels to marine bacteria. Men, women and horses were missing faces, heads or limbs, and their smooth, sculpted surfaces had been grossly eaten away, leaving sad, pitted shadows of the artist’s original intent. Indeed, the crew members of the *Mykale* were so moved by one statue that was raised, of a beautiful but

eroded young man, that they called it ‘the ghost of Praxitelean Hermes’.

Every so often part of a statue was saved where it had been buried in the sand. One legless horse had a well-preserved body, and around a hole where the head would have fitted was a carved strip showing an eagle, helmet, Galatian shield and axe. Elsewhere a crouching boy, perfect on his right side with neatly cropped hair and eyes gazing upward, had suffered his left arm and leg being munched away to stumps.

The most valuable finds, though, were the bronzes. They were mostly in pieces, but the fragments, despite the metal on the surface having been corroded by electrochemical reactions with the seawater, had generally retained their original shape. Even so, most of the smaller pieces were thrown into crates and left in the courtyard, where museum workers would occasionally sift through them to look for bits that might fit the larger statues as they were reconstructed.

The big prize of the haul was a bronze of a naked young man, the beautiful Hermes or Apollo already mentioned. Nicknamed the ‘Antikythera Youth’, he stands calmly, nearly two metres tall, his right arm stretched out as if holding something. Although found in more than 20 pieces the statue was reconstructed in the early 1900s (then taken apart and reassembled again in the 1950s, with a slightly different posture) and its languid grace now presides over a central hall in the Athens museum.

Another colourful find was the portrait head of an elderly man, perhaps a philosopher, with piercing features, bushy beard and tousled hair. Plenty of other smaller bronzes were also found, in various poses, often decorated with eyes, nipples and genitals made of stone. One statuette of a naked young man was attached to a rotating base, presumably so that his slender form might be viewed from different angles.