

Scientific repercussions of the first circumnavigation

Nowadays, when intercontinental trips take place every day from airports and ports around the world, it is hard to imagine the difficulties faced during the expedition led by Magellan and Elcano 500 years ago, resulting in the world's first circumnavigation. The years at sea gave rise to scientific discoveries and technical applications that are still relevant today.
By Álvaro de la Cruz-Dombriz

State secrets

First, the expedition served to dismiss the old portulan charts that for centuries were useful for a closed sea, such as the Mediterranean, but useless for the vast oceans. Astronomical observation and the study of ocean currents had by then made more distant navigations possible, so 24 nautical charts were used in this historic voyage, containing all the knowledge that both the Spanish and Portuguese had accumulated about the Eastern and Western Indies.

The information gathered by the expedition allowed Nuño García de Torenó to show the location of the Moluccan and Philippines Islands in his chart, dated 1522,



NASA

The Strait of Magellan near the tip of South America was named after Ferdinand Magellan after he proved the existence of this passage between the Atlantic and Pacific Oceans.

Information gathered during the circumnavigation was used in the *Padrón Real*, the Spanish master map completed in 1527 and used as a template for the maps carried by all Spanish ships during the 16th century.

of Spanish territory in southern Asia. The same year, Pedro Reinel released a southern polar (or azimuthal) projection chart depicting the coast of South America. In 1527 Diego Ribero finished the *Padrón Real*, the official and secret Spanish master map used as a template for the maps carried by all Spanish ships during the 16th century. Its layout was strongly influenced by the information obtained during the Magellan-Elcano circumnavigation, and is considered the first scientific world map.

Cartography thus became an essential tool at the service of the Hispanic Monarchy. The King was able to furnish his powerful network of diplomats with the authority conferred by discoveries represented on the maps.

Instruments

The use of all the available technology at the time, including quadrants, astrolabes, magnetic compasses, sandglasses (hourglasses) and pairs of compasses (drawing tools), eased the enormous task of the expedition. For instance, compasses could be used to measure distances based on angles marked on the maps, while astrolabes were used to measure the height of stars above the horizon so that latitude could be determined. It seems that Elcano noticed how magnetic compasses lost precision once the North Star could no longer be seen as the ships approached the southern hemisphere.

Three oceans and the American continent

On 1 November 1520, the expedition entered a 565-km long labyrinth of islands and channels at the tip of South America. By finding the way through and emerging on the other side of the continent, the existence of a southernmost passage, subsequently named the Strait of Magellan, was confirmed. It took Magellan and his crew three months to cross the ocean beyond, which they named the Pacific Ocean for its calm waters and bright skies. It thus became obvious that Asia and America were different continents, a fact that



ESO/Y. Beletsky

The Magellanic Clouds can be seen with the naked eye, but high-ISO, long-exposure photography allows them to be captured here as two bright areas between telescopes at the Paranal Observatory in Chile, South America, while the Milky Way arches overhead.

Visible only from the southern hemisphere, the Magellanic Clouds were known by indigenous people of Africa, South America and Australasia long before they were documented during the Magellan circumnavigation.

They are the subject of ongoing research, both in South Africa and abroad, to be discussed at a dedicated scientific workshop hosted by the European Southern Observatory (ESO) in Germany in September 2019.

These two dwarf galaxies – the Large Magellanic Cloud (LMC) approximately 163 000 light years away, and the Small Magellanic Cloud (SMC) some 200 000 light years away – may eventually merge with our own galaxy, the Milky Way, but not for another two billion years at least!

had remained unclear since 1492, when Christopher Columbus claimed to have arrived in the East Indies. The expedition also marked the first crossing of the southern Indian Ocean. Consequently, Europeans abandoned the idea that the Atlantic Ocean was the sole ocean, and America achieved the status of being another continent.

The southern skies

Once through the Strait of Magellan, the voyage chronicler, Antonio de Pigafetta, reported two features of the southern skies. First, he remarked on the presence of 'clouds' in the heavens – these two dwarf galaxies, neighbouring the Milky Way and visible without a telescope, were duly named the Magellanic Clouds. Second, Pigafetta described the Southern Cross, probably making him the first to record this set of five stars.

Around the world

Although both Aristharcus and Eratosthenes theorised about the roundness of the Earth in the 2nd century BC, it was Elcano's team who proved it because the expedition returned to the same point from which it had started, just by navigating west. In fact, they also realised that their logbooks were one day behind, although they had kept meticulous records, marking each day as the sun rose. Since the Earth rotates eastwards, by navigating west and returning to the same point they had spent one less day under the sun than those who had stayed at that point. Now, a realistic world map was indeed feasible.

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