Luigi Marsili's collections of war machines and models of city walls harnessed learning for power.

MILITARY SCIENCE

Empires of reason

Alison Abbott delves into the legacy of a remarkable Italian scientist–spy and avid collector.

Knowledge is power. Luigi Ferdinando Marsili (1658–1730) — scientist, diplomat, soldier, spy — might have coined that phrase. Marsili was perhaps the only polymath of the European Enlightenment who knew from experience how science can serve the ambitions of ruling powers.

He was an acknowledged pioneer of oceanography and geology, but Marsili also served for more than 20 years in the army of the Holy Roman Empire, where he rose to general. He collected obsessively during his decades of expeditions throughout Europe and the Ottoman Empire, the main rival to the Habsburg monarchs. He mainly gathered knowledge — but he also gleaned objects from the military and the natural world, as well as artefacts and manuscripts from ancient civilizations.

Parts of these collections are presented in a series of exhibitions in Bologna, Italy, celebrating 300 years since Marsili created a magnificent legacy for the city, his birthplace. In 1711, Marsili founded the Institute of Sciences and Arts to bring together everything from astronomy to zoology in a place where scientists could do experiments and any interested student could learn. Marsili donated his collections to the institute and accepted or bought contributions from others.

The collections are now housed in the sixteenth-century Poggi Palace, which also hosts the celebration's main exhibition: *The Science of Arms*, a selection of intriguing

models of defence walls, arms and warships. Other exhibitions include ancient manuscripts at the Bologna University Library, and Turkish weapons and standards at the city's Medieval Civic Museum.

Marsili was born into the aristocracy but had no interest in a comfortable life or romance: he remained unmarried, and dedicated his life to science and to imposing his views on others. A tall, commanding figure with a booming voice, he had a notorious lack of patience that drove him to constant travel.

His career began when, aged 21, he joined a diplomatic mission of the Republic of Venice to Constantinople (now Istanbul), centre of the Ottoman Empire. He would ultimately visit the city a dozen times, mostly as ambassador for the Habsburgs — whose army he joined at 24 — and once as a prisoner.

Marsili had great respect for the Ottomans, noting that their cartography was far more advanced than that of the West. He sucked up their knowledge like a sponge, studying the empire's culture, fortifications and language, and the fabric of its landscape. He measured, surveyed and collected.

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The Science of Arms

Poggi Palace Museum,
Bologna, Italy.
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He called it science; the Habsburgs called it spying, and it helped them enormously in

assessing Ottoman vulnerabilities. Marsili's understanding of cartography and the potential geographical pitfalls of the landscape helped him to map and delineate the borders defined in the 1699 Treaty of Karlowitz, in which the Ottomans ceded control of much of Central Europe to the Habsburgs.

That activity was the pinnacle of his military career, which ended in disgrace in 1703 when his troops, besieged in the fortress of Breisach on the border between the Holy Roman Empire and France, capitulated. Marsili's sword was symbolically broken in two and he was dismissed from the army. Humiliated, he returned to Bologna; his first action there was to build a wooden model of the Breisach fortress, which he used to demonstrate that he never had a chance of withstanding a siege there, given that he didn't have the necessary reinforcements.

His honour was restored, at least locally. But from then on, he focused exclusively on science, and success heaped on success. He published many influential books, among them *Histoire physique de la mer* (1725), the first treatise on oceanography. It described geological and biological aspects of the seas, which were at the time believed to be bottomless and home to monsters. He was made a member of several scientific societies, including the French Academy of Sciences in 1715, and the UK Royal Society, to which he was personally introduced by Isaac Newton.

The Institute of Sciences and Arts was his great pride. Visitors will certainly enjoy exhibits added after Marsili's death, including, from the eighteenth century, wax anatomical models of breathtaking beauty and the equipment that physician and physicist Luigi Galvani used in his experiments on electrical activity in frog muscles. But *The Science of Arms* adds a special dimension.

Marsili imbued the institute with a teaching-through-seeing approach to military science. The advent of gunpowder had changed warfare; technological advances in weaponry needed to be matched by technological advances in defences. The high walls that had circled medieval towns and protected them from slings and arrows collapsed under artillery attack. Modern intellectuals were applying new knowledge — including rediscovered Euclidean geometry and Newtonian physics — to work out the theoretically most stable arrangement of city defences. A lower-rising pentagonal shape was agreed to be best.

The Science of Arms includes many wooden models of defence walls, none of which were actually built; it also includes Marsili's collections of exquisite models of weaponry and war ships. These demonstrate science's role in the service of war — the conversion of knowledge into power. ■

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