Rocketing from the Galaxy Bazaar

Indian rockets were once the best in the world, and gave the Duke of Wellington a shock he never forgot. But India's social system prevented such technology from fuelling the kind of scientific revolution seen in the West.

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Rockets helped the Mysore army to achieve a famous victory over the British in 1780. The army was led by Hyder Ali, a bold officer who had become the effective ruler of the state, and his son Tipu. The battle is celebrated in a mural at the summer palace in Tipu's capital, Sri-ranga-pattana. "The fortunes of the English in India had fallen to their lowest water-mark," said the British historian Sir Alfred Lyall, writing in 1914 about this battle in the second Anglo–Mysore War.

A celebrated victim of such a rocket attack was Colonel Arthur Wellesley (later Duke of Wellington and the hero of Waterloo). In the fourth Anglo–Mysore War of 1799, Wellesley suffered a nasty encounter in a mango grove just outside Sri-ranga-pattana. He lost his way, several of his men were killed and the rest retreated in disorder. This incident had an indelible effect on Wellington, for even late in life he would revert to it with his own "explanations", presumably to counter what his detractors hinted was a blot on his career.

The Rocket Corps in the Mysore army was 5,000 strong in Tipu's time. His rocketmen were skilled in adjusting the elevation of the rocket depending on its size and the distance to the target, and they launched rockets rapidly using a wheeled cart with ramps. Tipu was a 'technology buff', and promoted the manufacture of rockets and other novel devices in areas of his towns often called *Tara-mandal-pet* (which translates loosely as Galaxy Bazaar, probably named after the spectacular firework known as a star cluster). The rockets' range was typically 2.4 kilometres, an outstanding performance for the time, attributable chiefly to the iron employed for the casing. Indian iron and steel had long been about the best in the world, and permitted increased bursting pressures and hence higher propellant packing density. (European rockets still used some kind of pasteboard.)

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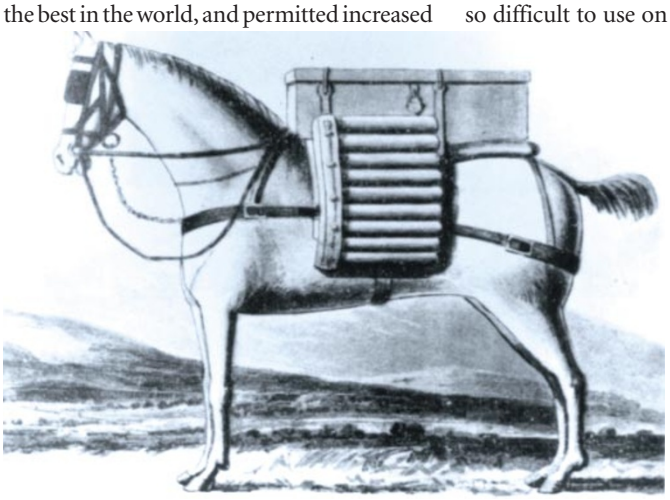
Technology buff: Tipu, painted in about 1800.

The British were so impressed by these rockets that they soon began a vigorous technology programme led by Colonel William Congreve. Several Indian rocket cases were sent to Britain for analysis. In 1801–02, Congreve confirmed with tests that the biggest sky-rockets then available in London had a range less than half that of the Mysore rockets. At the Royal Laboratory at Woolwich Arsenal, he tested various combinations for propellant, and developed a series of rockets with a stout iron case, and iron hoops on one side making it easier to fix the stabilizing stick.

In 1804 he published *A Concise Account of the Origin and Progress of the Rocket System*. Reasoning on the basis of Newton's third law of motion, he recognized that the rocket did not suffer from the recoil that made cannons so difficult to use on ships. In 1806 a rocket attack on Boulogne, where Napoleon had assembled forces to take war to British soil, set the town on fire, and ended French plans for a cross-Channel expedition. This success was followed by the use of rockets in various other wars in Europe, and in the United States in the War of 1812, when rockets were responsible for the fall of the city of Washington.



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Rocket horse: Congreve's six-pound 'service rockets', pictured on a pack horse in 1813, were said to be more effective at frightening the enemy with their noise than at inflicting harm.

One major reason for interest in this episode is that it occurred during a time of global transition in geopolitics, economics and technology. Clearly, even in the late eighteenth century there were several Indian products technologically superior to Western equivalents, and this was recognized by both sides. But the British effort that followed had the sophistication of research and development today. Scientific principles were applied, designs made, products developed and tested, and all of this was carefully documented — a process alien to Indians of that time. The Indian rockets were well-made but not standardized, being the creation of traditional artisans.

Interestingly, the Indian literature on such technological subjects is rather scarce — even in metallurgy, where the tradition extends over more than three millennia in India. Some of the available texts were written with great authority. A thirteenth-century author said: "I describe for the benefit of the world what I have done myself or observed with my own eyes, not something recorded only from hearsay or from a teacher's instruction." But another exhorted the reader to "guard [this knowledge] with determination, as you would the privacy of your mother": knowledge was handed down only to selected pupils and family members.

Although a certain kind of practical information has always been closely protected around the world, the prevailing social system in India seems to have encouraged great secrecy. The interdependence among the castes, a strong feature of the system that contributed to its remarkable stability, was sustained in part by an 'allocation' of different knowledge subsystems to different castes. So, the craftsmen making the best rockets in the world had no contact with scholars.

Apart from the various causes that have been widely discussed to explain why the scientific and industrial revolutions took place in Europe and not in, say, India, I suggest two others. First, India, being already wealthier, did not need these revolutions. And, second, Indian intellectual property resided in distinct communities that guarded it more jealously and for longer than elsewhere. □

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