The Saga of Indian Cannons. R. Balasubramaniam. Aryan Books International, Pooja Apartments, 4B Ansari Road, New Delhi 110 002. 2008. 350 pp. Price: Rs 4500.

Throughout military history, artillery has played a significant role in deciding the outcome of battles, the best example being the stunning victory of Babur at Panipat in 1526 due to the skillful use of cannons. This is why the book under review is of crucial importance.

The aim of this well-documented study is to inform readers about the wonders of Indian metallurgical skills and bring to the fore the enormous range of cannons available all across the Indian subcontinent. The text is divided into twelve chapters. In the introduction the author presents the metallurgical heritage of India, and touches upon the invention of gunpowder and the origin of cannon technology.

He devotes the first three chapters to general points regarding gunpowder weapons. After mentioning ancient references to the use of artillery and considering the diffusion of cannon technology across India, Egypt, Turkey, China, he analyses the earliest cannons used in the subcontinent, the techniques of cast bronze cannons learned from the Turks, of wrought iron cannons borrowed from Europe and finally of cast iron cannons, adopted as late as the 18th century. He ends his presentation with technical details on the various parts of a cannon: barrel, rear, handling rings and trunnions.

In the next two chapters, the author gets to the heart of the matter by analysing bronze cannons and forge-welded iron cannons. First, he shows the different types of cannon developments in cast bronze cannon technology, beginning with the description of the three types of

Being from Denmark, Scandinavia, the home of the sagas, the book entitled *The Saga of Indian Cannons* must, of course, please me. I derive from a family of pyrotechnists, who learned the art as soldiers in the Austrian Empire artillery 200 years ago. My background therefore mostly involves actual gunpowder use in rockets. I have also been extremely interested in history throughout my life and have read about rockets and artillery, in general. I met Balasubramaniam in 2006 as part of a group from Denmark and England, who came to India to study the history of saltpetre production. India was the main source of saltpetre, using which most of the gunpowder was manufactured in Europe in pre-modern period. This field of research needs attention, because it is increasingly clear that India could produce such large amounts of saltpetre, and in such a good quality. It is also necessary to study the origin of saltpetre, because I would not be surprised, given India's glorious heritage in chemical sciences that saltpetre production started in India before China, and certainly, much before it was known in Europe. If India made saltpetre so early, and had both sulphur and charcoal, would Indians not also be the inventors of what we would call gunpowder? But, if they were, it is certainly commendable that they did not use it for conquest, like the Mongols and later the Europeans, which, in my opinion, is to their credit.

Balasubramaniam's book is a revelation of beauty and information that, for me at least, will take a long time to digest. I will keep returning to this good source of reference quite frequently. Balasubramaniam's speciality is metallurgy, and he has gone to great lengths to bring out the skill of the Indian metal smiths (bronze casters and blacksmiths) as explained in the numerous cannons described in the book, some for the first time. I thoroughly enjoy the works of the master-smiths of old India, where a weapon was a work of art, and not like modern day's ugly murderous instruments. Some of the weapons described in the book are humorous, shaped like a sitting tiger, a fish or a dragon emitting cannon balls. So is Balasubramaniam's use of almost poetic English in many of his descriptions. Though a scientist, he etymologizes all the words and expressions used in the text, which I find important, as you can almost speak 'archaeology' through explaining the origin and meaning of words.

The chapter, dealing with rockets, was of particular interest to me, when India was so advanced that England learned from it. Similar stories have been unfolded in the other chapters that the reader is left with a feeling of the relatively advanced state of warfare in the Indian subcontinent in pre-modern India.

There are some mistakes which need to be corrected in future editions. In chapter one, it is said that Chinese alchemists had found out that saltpetre deflagrated vigourously when thrown in fire. The fact is that saltpetre cannot burn, unless you add fuels to it (like sulphur and charcoal).

It is also amazing that the Indians mastered the art of making gunpowder when artillery had reached India proper. The improvement of gunpowder was not so much due to the right proportions, but also depended on use of pure chemicals and an understanding of the importance of the size of grains, which can vary from a little less than a millimetre up to a little more than half a centimetre. The longer the tube, the grains need to be bigger in order to allow for longer time burning. It does not matter if big grains are used in a pistol, but it will not shoot as long as the grains will still burn when the bullet has left the tube. On the other hand, there will be an accident if one uses a fine-grained pistol-powder in a long cannon, because when this big surface from all the small grains burns at once, it will cause the cannon to explode. Therefore, the mastery of the Indians in the art of artillery is wonderfully explained in this illustrated book with examples showing the metal-workers skill.

The book is of excellent quality, especially regarding the illustrations and colour photographs. The Mughal miniature paintings are particularly riveting and provide an eye-witness account of the state of affairs during Mughal times, when artillery was a major factor in the establishment of Mughal power.

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guns used by Babur, of the mortars and light cannons fabricated by Akbar and their material of construction, before taking a close look at the manufacturing methodology of these engines, pattern and mould preparation, ornamentation, machining and gun foundries. Then, to explain the development of forge-welding cannon technology, which is truly Indian, he gives a catalogue of the marvellous specimens of Indian blacksmithing skills on display in various places of India, from Murshidabad to Thanjavur, and dwells on the general design characteristics of these cannons.

The ensuing chapters concern specific aspects of Indian gunpowder weapons. The author concentrates on the use of artillery by the mighty Mughals, from Akbar to Aurangzeb, and also by the regional powers: Rajputs, Marathas, Sikhs and Mysore rulers. He then considers the unique Indian innovations in cannon technology. Some are well-known, such as the swivel cannons mounted on camels and elephants, but other innovative features, such as the multibarrel or multipiece screwable cannons and the extraordinary 'yarghu', which could clean 16 gun barrels at the same time, are described here in full detail for the first time; to this should be added the strengthening of wrought iron cannon barrels by casting them over with bronze, a technique resulting in what are called composite cannons.

The last chapters are devoted to the use of cannons in fortifications, on stone platforms, with the swivel fixed in a circular socket, and on cannon accessories such as gun carriages, the saltpetre industry, cannonballs and rockets.

This large-format book, which is the outcome of sustained research extending over several years, is a scholarly edition with full notes and references at the end of each chapter and a detailed index. Printed on art paper, it is sumptuously illustrated with hundreds of photographs and drawings of cannons, mostly in colour, and with fascinating reproductions of Mughal miniatures taken from the famous 'Akbar, Babur and Padshah Namas'.

On all the pages are found photographs of most of the significant cannons located at military or archaeological museums and in fortifications in India. Many pictures are accompanied by engineer's drawings showing the characteristic features of the cannon; often, for the same engine there are several pictures of its different portions. Particularly interesting are the images of the Malik-i-Maidan, located near the Sherza Burj at Bijapur, one of the heaviest cannons in India (55 tonnes), bearing inscriptions on its surface and the design of a lion devouring an elephant on its front. Readers will enjoy admiring the pictures depicting the rear portion of a bronze cannon shaped like a ram or a crocodile, the handling clamp designed like a dolphin, a lion, an elephant, a crocodile, a fish, or the tiger inscribed on the muzzle head, trunnions and cascable of Tipu's cannons.

The miniature paintings reproduced in the book are not only works of art but also tools of investigation, since all the details of the weapons are clearly to be seen in them. They show the different types of cannon used in siege wars against forts and on the battlefield during the Mughal period: light cannons resting on forks, heavy mortars. The details of the engines are so clear that, in one of them, two light cannons are seen, one with a straight barrel and the other with a bulge in the breech.

As has been rightly remarked in the preface by R. D. Smith, 'This is the first book to tackle the subject of cannon for the whole of the Indian subcontinent [...] it will remain a classic for many years to come'.

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Human Development Report 2007/2008: Fighting Climate Change: Human Solidarity in a Divided World. UNDP, Palgrave Macmillan, New York. 2007. Price: £16.99.

While the habitual assimilator of newspaper/magazine exclusives on climate change would consider the Human Development Report 2007/2008 (HDR 2007/2008) to be timely in its appearance and consequence, any eager observer would look askance at the title of this year's HDR: why is the fight against climate, when it should really be against humans? Moreover, by fortifying its stance in the sub-title through the use of the words 'divided world', the report has pre-empted the inconvenience of arriving at a uniform solution for 'dangerous' climate change.

Adopting the ceremonial Confucius-based methodology of digging the past to 'divine the future', HDR 2007/2008 underlines climate change as a 'crisis that links today and tomorrow'. One cannot be obliterated from the deluge of foreboding and haunting prophecies that are conveyed by any work on climate change, especially in terms of water levels rising gulp down land masses or the recurrently advertized implications of rise in temperature. This report too follows suit, but with a difference. There is enough space for deliberation on how such potential outcomes could be averted. Further, the human development dimension and its relation to climate change are also examined.

Two features retain their redolence during discussions apropos climate change. One is the certainty of an impending large-scale disaster and its suffusing character, highly evocative of an inescapably fated future. For instance, the HDR 2007/2008 statement that, 'The supreme reality of our time is the spectre of dangerous climate change' (p. 21), places the debate on climate change on an unfriendly footing. The other is the unequivocal acceptance of climate affecting the poor nations more than the rich nations. Such a demarcation, geographically or income-wise, makes the understanding of the climate change implications one-sided and parochial.

The preponderance over the poor nations getting affected more than the rich nations is bolstered by the very economic and social structure of income-deficient nations. In such nations, agriculture dominates and urban poverty is ubiquitous. Risks from climate change shape agricultural productivity and hence livelihoods (as in cases of excess/deficient rainfall) and the urban slum-dwellers bear the brunt of losing their possessions and life due to heavy floods. The imminent and immediate consequences of 'climate shocks' on human welfare can be understood from what the HDR 2007/2008 specifies: 'threats to health and nutrition, the loss of savings and assets, damage to property, or the destruction of crops' (p. 74). Ultimately, uncalled for changes in climate will wear away 'human freedoms and limit choice', and eventually hold back 'the efforts of the world's poor to build a better life for themselves and their children'