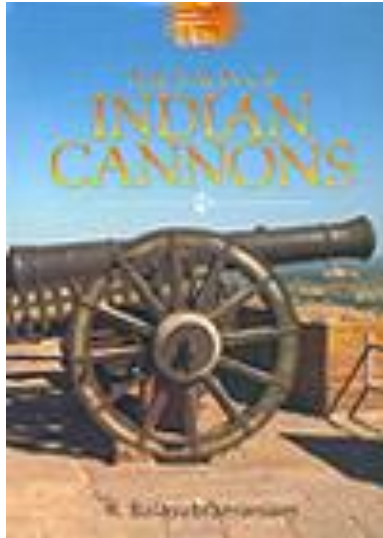


Chronicle November 2008 issue

The Saga of Indian Cannons-Book

Introduction by Prof. R. Balasubramaniam (Metallurgy 1984)



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An introduction to the book by the author-Prof. R. Balasubramaniam



**(Prof. R. Balasubramaniam)**

**1) Why I got interested and my interest in cannons and allied matters.**

I devote a part of my research activities to highlight the metallurgical tradition of India. It is very clear that Indians were masters of metal like the Chinese were considered as masters of ceramics, from a historical perspective. My attention was first drawn to the Delhi Iron Pillar and I began exploring various facets concerning the Pillar. The Pillar was not made by casting but rather by the process of forge welding, a process that essentially used impact force to weld together pieces of

iron. This was the traditional method by which the Indians manufactured their iron objects. It is easy to say that the Indians mastered the art of making large iron objects from smaller iron lumps by forge welding, but it is not at all known how the process actually took place. For example, the Iron Pillar weights 6511 kg. It is really difficult to predict what would have been the method to join smaller lumps of iron (weighing about 20 to 20 kg) to make this large an object. However, we do have clues and indirect evidences that point out the fact that the iron lumps were added to the main body of the Pillar, with the Pillar placed in a horizontal position. This implies that the force to join the lump to the main body was applied in the radial direction. This resulted in the lump elongating along the axial direction of the Pillar. We have indirect evidences from the surface and direct evidences in the form of elongated slag particles in the iron lumps being elongated along the axial direction of the Pillar that confirms this methodology. However, when one really goes about re-constructing the process, it is difficult to imagine how the surface of the Pillar could be maintained in a relatively quite hot condition before the next lump was forge-welded on to it. It is also quite possible that the iron lump was directly reduced on the growing Pillar such that forge welding was facilitated. These are ideas that actually need to be tested out. In fact one of my wishes is to forge weld another pillar like the Delhi Iron Pillar and am looking for sponsors for this project which I have titled "FORGING THE PRIDE OF INDIA."

Anyway, this brings us to the basic question of what motivated me to study cannons. When I was wondering about the manufacturing method of such a massive piece like the Delhi Iron Pillar, I began looking at other monumental large iron objects to gain insights on the manufacturing methodology used to fabricate large iron objects. I carefully studied the Dhar Iron Pillar, which is now lying in three broken pieces, at Dhar (close to Indore) in Madhya Pradesh. The original length of this Pillar was almost twice that of the Delhi Iron Pillar. Some vital clues to how the Pillar may have been manufactured was obtained from study of the surface of the Dhar iron pillar. I was also aware of the presence of large forge welded cannons in the Indian subcontinent and have seen pictures of some them in the book by Neogi that was published in 1914. This book is called *Iron in India*. I noticed that one of the largest forge welded cannons in the Indian subcontinent was located very close to my hometown at a place called Thanjavur. Around 1999, when I visited Salem, my hometown, I decided to visit Thanjavur along with my parents. I remember the day when we all landed on the mound in which the majestic and massive *Rajagopala* forge welded cannon was situated. This was the first massive cannon that I set my eyes on. That was the first day I embarked on a detailed study of cannon. I spent almost 3 hours that day measuring each and every feature of the massive *Rajagopala* cannon. Since this was in the afternoon, I still remember my parents taking a nap in the tree shade near the cannon while I completed the study. I fondly recall this significant moment in my life. My father is no longer with us but the encouragement and support he showed for my work is

truly incredible. He was a very silent person but now I understand the true meaning of his silence.

Slowly, I began exploring other massive forge welded cannons. I started visiting other massive forge welded cannons located across India, first hand and began collecting dimensions and photographs. In this way, my "love affair" with the historical cannons of India was initiated. I also began collecting literature and understanding technical as well as historical details of cannons of the Indian sub-continent.

Simultaneously, I began research on gun powder and its use in the Indian subcontinent. I was quite amazed to find out the entire supply of world's saltpeter (potassium nitrate), the most important ingredient what went into the making of gunpowder, was sourced out of India in the hey-days of artillery-centric warfare. When one reads history, it can be quite enlightening. In fact, as a country we made a mistake in trading saltpeter with the European powers when they had just entered the Indian scene as traders. Finally, it was using our own gunpowder, that these powers established themselves firmly in the subcontinent and elsewhere in the world. Did you know that all the saltpetre for the American Civil War originated from India? All these stories are really fascinating and it was a great pleasure to research them.

Once we had collected significant information concerning historical cannons and gunpowder in India, I was keen to share the knowledge with general public. As a first step, I proposed to the Editorial Board of the Indian Journal of History of Science (published by the Indian National Science Academy, New Delhi), of which I am also a member, that we bring out two special issues of the journal on the subject of cannons of the Indian subcontinent. This was agreed and soon I began collecting and writing articles for these two special issues. These issues were published in September and December issues of 2005. Incidentally, this was the first time that the journal published thematic issues. (In 2007, we again brought out two thematic issues on the celebrated wootz steel of the Indian subcontinent, and I was closely associated with this also). The issues were well received by learned scholars around the world. During the course of planning and execution of these two special issues, along with the Chief Editor of the journal, I came into contact with several well known scholars on artillery around the world and then I realized that here we have a great tradition that has not been properly highlighted at all to the public at large. It was then that I decided to collect all the information that I had collected and add more interesting details and bring them all out in the form of a book.

There were no books that dealt with cannons of the Indian subcontinent although some information was scattered in the literature. The subject of gunpowder in the Indian subcontinent and the historical use of gunpowder have been researched by the learned scholar I.A. Khan and his book on the subject "*Gunpowder and Firearms: Warfare in Medieval India*" (published in 2004) is a significant

contribution. There are several historical facts given in the book. However, I realized that the book did not deal with the engineering aspects of historical cannons of India. There were hardly any pictures of the real cannon pieces and as it was more a book on history, there were facts collected from historical sources and analyzed by the learned scholar. I felt that there was need to bring facts to light because one of the biggest problems with the historical records has been the identification of the type of cannon – bronze, forged iron, cast iron or composite (forged iron+ bronze). It was very important to collect and analyze the information first hand. I was already doing this work and therefore it was not a problem at all for me. Plus, I realized at that point itself that was quite an involved task since there are so many historical pieces that had to be studied and catalogued.

I would not say that my studies are complete, but nevertheless my publisher Mr. Vikas Arya of Aryan Books International proposed in December 2005 that I put together all the knowledge in the form of a book. He proposed to bring out a coffee table book. This is the manner in which the book was planned and then I started writing and collecting information for the book. It took me a long time to write the material for the book and it took me much more effort to collect the images that appear in the book. I had to spend a significant amount of my personal funds to visit locations and collect images of historical cannons. Moreover, I also had to pay for several images that I obtained from other sources, for example the images of the Mughal miniature paintings that appear in the book. I also sent some of my students on trips to collect photographs and information.

In the end, I can truly state that it has been a satisfying experience. However, at the bottom of my heart, I know that the task has only begun because since there is still a large amount of vintage cannon pieces lying across the length and breadth of the Indian subcontinent which have not been studied. Some of these really wonderful pieces are lying in a pathetic condition. It is my wish that at least these cannons are brought to the notice of the concerned authorities and the public so that they may take interest in their care and preservation. This will hopefully instill a sense of pride in our country also, which is sorely lacking now.

We have started cataloguing the cannons that exist in India at remote locations, paying special attention to cannons of indigenous make and design, in contrast to cannons of European origin. The range and engineering of the Indian pieces are really wonderful and in no way inferior to the European cannons. We must all realize that it was made possible by the good metallurgical engineering tradition of the subcontinent. This is one of the facts that we want to highlight in our studies. Some of the pieces that we have earthed are so massive that it makes one wonder how they were fabricated. The technological prowess of the Indian people in the pre-colonial days was substantial. We seem to have lost our scientific spirit now thanks to the subjugation by the British, especially their policies from the middle of the nineteenth century. If one studies history, then one will realize the great harm imparted by British policies to the scientific temper of the country. In

my opinion, we are still in the “colonial stage” as far as our scientific work is being conducted. We still tend to ape the west in all scientific matters and are not willing to research on original ideas that are more suited to our environment and surroundings. This is due the flawed scientific policies of the country and the people who have directed science in India since our Independence. This has to change if India has to move steps higher in the development chain. This is not the forum to talk about this issue, but some day I will get back to you on this as my mind is actively grappling with these issues at the present moment.

What the cannons make one realize is that India was not a push over like the civilization in Americas. Within a matter of a few decades, the Americas were subjugated by the Europeans thanks to their artillery. However, it took them almost more than 300 years to get their grip on the Indian subcontinent. Remember, it was not easy because we were a first class military power. In fact, not only a great military power but also one that was producing the largest amount of arms in the world. Therefore, let us also realize that India was also very strong in the military sense in the pre-modern period and it was only the policies of divide and rule that kept us subjugated by the Europeans. Had all the powers united together and turned their firepower on the Europeans, they would have all have been beaten back in a matter of months. Alas, what we lacked was proper coherence and unity and this was the source of our subjugation.

I am happy to note that the situation is not the same anymore. We are a united country and ready to face any threat from any quarter. Our nuclear capabilities and missile technologies have given us the military confidence to avoid any kind of misadventure by any alien powers. However, let us learn from history to be united to face any threats in the future, because the threats come from what are apparently soft sources. Consider that the Europeans only wanted to trade with us. Finally, they had the entire country. I notice a similar tendency in the export of trained manpower to the western countries. Using our own “gunpowder” these western countries are sending materials to India and in this way their pockets are filled at our expense. The export of trained manpower that we notice now is similar to the saltpetre that was exported during the past. It is using the same source that the foreign powers gained a firm hold on India. Once we begin to use our human resource purposefully, we should be able to challenge the western dominance in several fields. This is not possible at present given the existing conditions because of lack of highly trained manpower to undertake critical work in India. One example is research work in our universities. It is languishing for want of good and skilled manpower. This is again a topic of a separate discussion, but I am mentioning this here, nevertheless, as this is also an issue regarding the current state of science in India.

Some of my very good friends are involved in this monumental task of collecting information and details of vintage cannons. Dr. S. Jaikishan has catalogued the cannons in Deccan forts and the southern states, Dr. Pranab Chattopadhyaya has

covered Eastern India while Dr. Pravin Deshpande has begun his study of cannons of Western India. There is still the important state of Rajasthan to be covered and several other locations apart from the above places. (I am supposed to write on the guns in Mehrangarh Fort in Jodhpur, but I am not getting the time to write down the research that I have already undertaken.) I am helping all these scholars in collecting information. For these studies, some moderate funding has been received from Indian National Science Academy, New Delhi. We have unearthed some really wonderful pieces and soon hope to bring it to the notice of the public. We are in the process of analyzing the large amount of data collected and then we shall possibly first publish them on the internet and then maybe in publications. However, the time required for this task is enormous and the task is not possible without skilled assistants, which I sorely lack.

## **2) About the Book**

The Saga of Indian Cannons is a fully illustrated book, printed completely on high quality art paper and it contains a significant number of color illustrations. The illustrations give the reader a first-hand picture of the beauty of vintage cannons of India, which were originally designed to kill and maim! The book is based on my personal research spread over more than seven years. In the book, I have tried to put the entire history of use of cannons and the engineering involved, all in one single source of reference. What started out as a coffee table book finally took the form of a proper detailed source book of cannons of the Indian sub-continent. Frankly, I do not want to produce a book with pretty pictures alone. I was more interested in putting down all the wonderful and rare information that I collected regarding Indian cannons in one place and I must thank my publisher for agreeing to go ahead with the publication even if it meant that the book exceeded twice the original planned size. I think that this is the first book of its kind and this view is shared by several other learned scholars involved in the subject of artillery history. In fact, my friends in the armed forces were themselves surprised to learn that Indian possessed such wonderful artillery pieces, which they were not even aware of.

In this way, I am happy that I could contribute something of value. However, it all depends on how the book is received. Since the book is priced a little on the high side (cost price as per the publisher's catalogue Rs 4500), this is a little beyond the budget of individuals in India, but certainly can be purchased by libraries. Maybe, I should start thinking of bringing out a cheaper paper-back book on the subject, but this will have to wait since I have several other academic commitments. One can purchase the book, by emailing to my publisher Mr. Vikas Arya at [aryanbooks@gmail.com](mailto:aryanbooks@gmail.com) or [aryanbooks@vnsi.com](mailto:aryanbooks@vnsi.com).

I have covered historical aspects of gunpowder and cannons and then gone on to place before the readers, visual evidence of the artillery heritage of the subcontinent. I have divided the chapters as follows. I have first introduced the devices that were used in the Indian subcontinent before the arrival of gunpowder

proper and also highlighted the metallurgical heritage of the country that made it possible to manufacture such wonderful cannon pieces. Then I have discussed how gunpowder and cannon technology developed in the subcontinent, from a historical perspective in the second chapter. While some ideas were borrowed from outside, it must be realized that the Indians soon adapted them with wonderful clarity and excelled in what was learned. That was the beauty of the scientific spirit of the Indians, the willingness to adapt and learn anything new that was worth learning, and, in due course of time, excel in it. The operation of cannon and the typical design of cannons have been highlighted in the third chapter. The engineering aspects of cast bronze and forge welded cannons have been described in the next two chapters. These chapters also contain a catalogue of some significant bronze and forge welded iron cannons. The next two chapters detail the cannons of the powers that used cannons to good effect, namely the Mughals, Rajputs, Marathas, Sikhs and southern imperial states. Some unique innovations that were introduced by the Indians are explained in the eighth chapter. Notable among them is the light cannon that was fired from the back of camels (called *shaturnal*). This was a very powerful way to obtain mobility with artillery and therefore critical in battlefield. This was very effectively used by the Indians. Another notable innovation was the manufacture of cannons with a forge welded inner structure that was cast over with bronze - a variety of cannons that I define as "composite cannons." This has been discussed in a separate (ninth) chapter. The use of cannons in fortifications is the subject of the tenth chapter. The accessories that helped artillery-centric warfare like carriages, gunpowder, cannon balls, etc. have been viewed in an interesting perspective in the penultimate chapter. The last chapter deals exclusively with rockets, which is also closely associated with gunpowder-centric warfare. Here again is an idea that the Indians perfected but was borrowed, standardized and perfected by the west.

There are some reviews of the book published and the reviews can be read at the following links.

<http://www.ias.ac.in/currsci/jul252008/261.pdf>

<http://www.hindu.com/br/2008/05/27/stories/2008052750031400.htm>

### **3) From the book flier:**

The fates of nations were decided by the use of cannons. The science of gunpowder and the technology of cannons, from their introduction in the Indian subcontinent in the middle of the fifteenth century up to the pre-modern period, have been illustrated using Mughal miniature paintings and analysis of extant cannon pieces. The massive and wonderful forge welded iron cannons and cast bronze cannons of medieval India have been presented, some for the first time, in this book. The mighty cannons that established Mughal, Maratha, Sikh and Deccan powers have been described. Indian innovations in cannon technology like *shaturnal* (cannons fired from back of camels), composite cannons (of inner

wrought iron bore and outer bronze casting) and *bans* (battlefield rockets) offer sufficient proof of Indian ingenuity in science and technology.

The book draws inspiration and major material from the original publications on the subject by the author. Written simply and profusely illustrated with line drawings and photographs, the book embodies the latest researches on the subject. It will fascinate both serious scholars and lay readers, and provide them rare glimpses into India's rich military and metallurgical heritage.

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Professor R. Balasubramaniam (<http://home.iitk.ac.in/~bala>) has vast experience in teaching corrosion and Indian archaeometallurgy. After graduating in metallurgical engineering from the Banaras Hindu University in 1984 with a gold medal, he completed his PhD in materials engineering from Rensselaer Polytechnic Institute, USA in 1990. He has, since then, been teaching and conducting research at the Indian Institute of Technology, Kanpur in the Department of Materials and Metallurgical Engineering. He is the recipient of several prestigious awards like the BHU University Gold Medal (1984), BHU Ghandhy Gold Medal (1984), Indian Institute of Metals Vishwa Bharathi Award (1984), Indian National Science Academy Young Scientist Award (1993), Humboldt Fellowship from the German Government (1996), Materials Research Society of India Medal (1999) and Metallurgist of the Year (1999) awarded by the Government of India. The widely published author is on the editorial board of several international journals. His significant research work on the famous 1600-year old Gupta period corrosion-resistant Iron Pillar, located in the Qutub, has received national and international acclaim. He is the author of four other books, *Delhi Iron Pillar: New Insights*, *The World Heritage Complex of the Qutub*, *The Story of the Delhi Iron Pillar* and *Marvels of Indian*

*Iron Through the Ages*

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