



Iron Pillars of India

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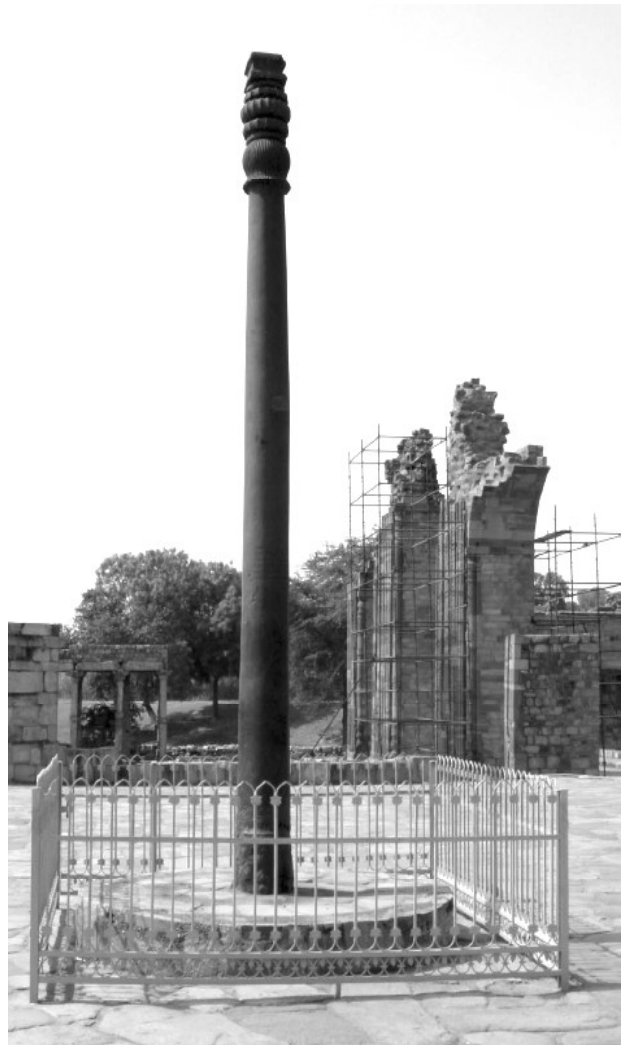
Metallurgy was developed in ancient India. Many bronze figurines or humans and animals have been discovered from Indus Valley Civilization sites. There are many Buddha statues of copper and bronze made between first century AD and sixth century AD spread over north India. In first millennium BCE, iron was used in North India. The iron making skill was improved tremendously and iron was exported to the Middle East. The first 'wootz steel' was produced in South India and it was iron mixed with carbon in controlled conditions. From Indian steel, the famous 'Damascus Sword' was manufactured in Syria. The swords were famous for their sharpness and toughness.

The craftsmanship of Indian ironsmiths is well demonstrated in some iron pillars. Three such pillars have been described here.

Iron Pillar of Delhi

The Iron Pillar of Delhi stands in the Qutb complex of Delhi and it is one of the most curious metal objects in the world. The height of the pillar, from the top to the bottom of its base, is 7.67 m, 1.12 m of which is below ground. It weighs more than 6 tons.

According to a six-line Sanskrit inscription in Brahmi script on the surface of the



Delhi Iron Pillar



pillar, it was erected by “*Chandra as a standard of Vishnu at Vishnupadagiri*”. Vishnupadagiri has been identified with modern day Udayagiri near Sanchi in Madhya Pradesh and Chandra with the Gupta Emperor Chandragupta II Vikramaditya (r.375 – 414 CE). The pillar was brought to its current location in New Delhi’s Qutb Complex in 1233. It is believed that it was made to honour one of the most important Hindu gods – Vishnu.

The pillar has avoided corrosion from the rains, winds and temperature fluctuations over the last 1600 years. Made up of with ninety eight percent of pure wrought iron, the pillar is an absolute testament to the high level of skill achieved by ancient Indian ironsmiths. Its non-resistant properties are mainly due to the presence of phosphorus in the iron. Phosphorus together with iron and oxygen from the air, contributes to the formation of a thin protective passive coating on the surface. It was made using a coal heated furnace to create a heat hot enough to achieve forge welding, where two or more pieces of metal were hammered together. It goes to the credit of Indian blacksmiths that through patient trial and error they were able to select the right type of iron ore and process it in the right way for such wonderful and monumental pillar which now attracts thousands of tourists.

Dhar Iron Pillar

The Dhar iron pillar is located in the Dhar town of Madhya Pradesh. Dhar is a small

town near Indore and was the capital of the Malwa region, which comprised what is west-central Madhya Pradesh and south-eastern Rajasthan today. The city is believed to have been founded by Raja Bhoja, the most prominent ruler of the Paramara Dynasty who ruled over the Malwa

Metallurgy – Dhar pillar

14 meters in height and 7 tones in weight (3 pieces together), built by Bhoja in (1000-1055AD) and “is a tallest non corrosive Iron Pillar in the world”



Historian Vincent Smith writes

“While we marveled at the skill shown by ancient artificers in forging the great mass of Delhi pillar, we must give a still greater measure of admiration to the forgotten craftsmen, who dealt so successfully in producing the still more ponderous iron mass of the Dhar pillar monument”.

Dhar Iron Pillar

region in the first half of the 11th century CE. The Iron Pillar of Dhar, originally almost twice as tall as its counterpart in Delhi, is preserved in the compound of the Lat Masjid (‘lat’ means ‘pillar’).

The Dhar pillar is in three pieces, placed horizontally on a platform in the mosque compound. When standing vertically, the pillar would have soared 14 meters high. It would have tapered from top to bottom, changing shape at different points. While the bottom fragment has a square cross-section, the middle fragment has square and octagonal cross-sections, and the top fragment has an octagonal cross-section with a small circular portion at the top. It is believed that



this circular part was the base of a fourth, missing piece, which was probably a *trishul* (trident) or a *garuda* (a mythical bird) that crowned the pillar. Today the 3 existing fragments of the pillar are approximately 24, 11 and 7 ft in length respectively. The pillar has small, irregular holes at intervals on all sides. These holes range from 1.75 inches to 3 inches in depth, and 1.25 inches in diameter, and they may have been created by welders to help them manipulate and manoeuvre it.

Very little is known about the pillar, including who built it. The pillar has no inscription or other markings to suggest its purpose or who its donor was. According to local lore, it was a victory pillar erected to commemorate a conquest by Raja Bhoja (r. 1010 - 1055 CE). Vincent Smith, an Irish Indologist and art historian of the late 19th and early 20th century believes the pillar dates to the Gupta period (mid-3rd to 6th CE), like the Iron Pillar of Delhi.

On the other hand, Henry Cousens, an archaeologist with the Archaeological Survey of India in the early 20th century and who studied the pillar in 1902-03, says the pillar was erected in 1210 CE by Paramara ruler Raja Arjunavarma Deva (r. 1210 - 1218), with the molten implements of war left by his enemies during his attack on Gujarat. Even as experts differ on who built it, no one really knows where the pillar originally stood.

Astonishingly, the Pillar, just like the one in Delhi, is rust-resistant, which means the craftsmen had used advanced metallurgical techniques. Dr R. Balasubramaniam, Professor of Metallurgy in Indian Institute of Technology, Kanpur who studied the composition of the pillar in great detail in 2002, believes it was made by 'forge welding', a technique in which pieces of metal are joined by heating them to very high

temperatures and hammering them together. If this was indeed true, the Iron Pillar of Dhar would have been the largest ancient forge-welded pillar in the world. He also states that the pillar shows superior resistance to corrosion due to its chemical composition. Analysis has revealed the chemical composition as carbon 0.013%, silicon 0.06%, phosphorus 0.072%, sulfur 0.003%, copper 0.057%, nickel 0.268% and the rest as iron. Significantly, there is no manganese in it.

In 1598 CE, Emperor Akbar engraved an inscription on the pillar. He was camped in Dhar while directing his Deccan campaign, and left an inscription on the pillar, in which he had recorded his presence in Dhar for 7 days. The position of the inscription suggests that the pillar was no longer upright at this time. Later, in his autobiography, Mughal Emperor Jahangir (r. 1605 - 1627 CE) says he had ordered that the larger pillar be taken to Agra, to be erected in his father Emperor Akbar's tomb complex, as a lamppost. However, this too never happened.

Historian Vincent Smith writes,

"While we marveled at the skill shown by ancient artificers in forging the great mass of Delhi pillar, we must give a still greater measure of admiration to the forgotten craftsmen who dealt so successively in producing the still more ponderous iron mass of the Dhar pillar monument."

Kodachadri Iron Pillar

The 8.7-metre-tall Kodachadri iron pillar popularly known as the *Dwajasthamba* (flag staff) and weighing 500 kg, is located at the Adi-Mookambika temple at Kodachadri in Karnataka. It is one of the oldest examples of ancient Indian metallurgy, which culminated in key achievements between the second and sixth



century AD. The iron pillar has not rusted in over 2000 years. When the Indira Gandhi Centre for Atomic Research (IGCAR) team carried out several non-destructive tests on the pillar and observed a small sample under a scanning tunneling microscope, they found the pillar was starkly different from the Delhi iron pillar in one key aspect, it had less phosphorus than the one on the Qutb Minar complex. Moreover, it contained less carbon. The presence of iron oxide particles in the pillar and other scientific analysis demonstrated the iron pillar at Kodachadri was produced using solid-state reduction process.

Conclusion

Undoubtedly, ancient Indians were masters in iron metallurgy. There are many other

evidences. The same technology as was used for the iron pillars was also used to manufacture huge iron beams, such as at Puri Jagannath temple (12th century). The iron beams at Konark's famous Sun temple are even larger dimensions. Chemical analysis done in one of the beams shows that it is wrought iron mixed with phosphorus (99.64% iron, 0.15% phosphorus, traces of carbon and sulfur and no manganese).

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Trading Dreams

Dr. Sonali Mohapatra

I try so hard to tell in words
but all i seem to do is cry
i try so hard to write in prose
but all i write comes mixed up.

I am standing here, my wares on offer
my blessings for your story
a penny for your laughter
i want to trade dreams.

Your past for my future
and a coal for my matchstick
i am cold this night,
maybe the sparkle in your eyes
will warm my night.

I try so hard to find a path
but all i do is get lost in the trees
i try so hard to sing my fears
but all i do is silently scream.

I am standing here
with my empty eyes
my soul for your heartbeat
a smile for your sorrow
i want to trade dreams.

Your past for my future
and a charcoal for your white
i am cold this night,
maybe the sparkle in your eyes
will warm my night.

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