



Deutsche Botschaft
New Delhi



The Non-Rusting Iron Pillar of Delhi

By: K. Rößler*

The non-rusting Delhi Iron Pillar has intrigued scholars and laymen alike for centuries. It was first described by British and Indian archaeologists of the 18th century, however extensive investigations were only done in 1963.

A few factual details about the pillar could be interesting here. It is 7.3 metres long, of which 1 metre is below ground. Its diameter is 48 centimetres at the foot and it tapers to 29 cm at the beginning of the wonderfully styled capital. The underground portion has a shape of a bulb with a maximum diameter of 72.5 cm. It weighs approximately 6.5 tons and was manufactured by forge welding of numerous steel blooms of 10-15 kg each. The steel is a low carbon mild steel without alloying elements, but with a high P-content of 0.11-0.48 %. The S-content is very low (0,003-0,008 %), because of the use of the charcoal hearth process to produce wrought iron. The "miracle" of its non-rusting was explained by the dry and low pollutant climate of Delhi, the heating of the big iron mass during daytime and the low cooling down rate at night, and the presence of oxides and slag inclusions, which prevent surface corrosion attacks.

The inscription, chiselled into the body of the pillar, indicates that it is a victory pillar of King Chandra (maybe Chandra Gupta I, or II). On the hill Vishnupada he erected the pillar for god Vishnu. From the reign of the kings it can be deduced that the pillar was manufactured during the 4th century AD. A second inscription says that King Bilan Dev or Anangapada, the founder of the Tomar dynasty, had arranged for the pillar to be taken to Delhi in 1050. Today, the pillar is situated in the yard of the Mosque Quwwatul-Islam in the compound of the Qutb Minar in Mehrauli, Delhi. According to this dating, the pillar could now be about 1600 years old.

The pillar surface is covered with a dark-blue oxide layer, enriched with phosphorus. Such a layer of rust hindered continuous atmospheric corrosion. Near the foot, there are deep corrosion scars which could mean that the pillar was placed deeper in the earth at its former location. Below the surface of the earth the pillar has a rust layer of 1-1.5 cm thickness. The bulb-shaped foot has a foundation of square steel bars and is anchored into the stone beneath it by lead joints. At a height of 1.10 to 1.50 meters, the pillar is metallically bright. This part of the pillar is embraced daily by hundred of visitors who believe that this brings luck to them. At the time when the pillar was manufactured, drop hammers, driven by water wheels were unknown in India. It is incredible that the pillar with a weight of 6.5 tons could be forge welded from 400 to 600 steel blooms of 10 to 15 kg only by the manpower of the blacksmiths, as described by K.N.P. Rao.

GERMAN NEWS : N



The newly-built fence at photograph taken Janua



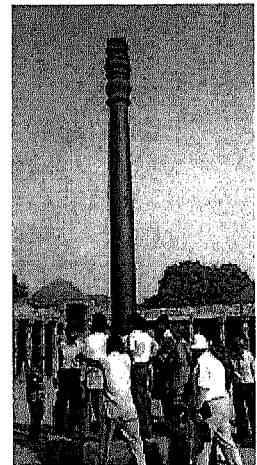
Damage by corrosion ne

A more acceptable theory of the author is that the impact energy was increased and provided by the use of heavy rams (hammer machines) and so the forge welding process of bloom to bloom was possible. Perhaps one ram worked in a longitudinal direction to increase the length of the pillar and the second one in a perpendicular direction to make the pillar round. The 1.07 m long capital has been made from single parts which were attached to the pillar's body. The body at this height is a cone of 22 cm at the top and 29 cm at the beginning of the capital. In the top plate there is a cavity with a depth of 41 cm. The cavity, in the form of a sword, might have been used to affix a figure like the legendary bird Garuda, the vehicle of Vishnu. Since 1998 the pillar has been enclosed by a steel fence to protect visitors from touching it. This resulted in corrosion starting to take place. The difference in this corrosion process can be seen in the two juxtaposed pictures, one taken in 1996 and the other taken in January 2000. The secret of the non-rusting of the iron pillar was because of the daily polishing of the pillar by hundreds of visitors. The picture shows the difference in nuances of colours between the "young rust" and the "old rust". It is well possible that on the former polished part of the pillar such a colour of the rust layer might develop in the next few years. This means that the rust layer could become a protection against further atmospheric corrosion. For metallurgists and welding engineers the Delhi pillar remains a miracle, because it demonstrates the high standard of steel production, joining technique and art of forging 1600 years ago in India.

To support this view we may quote here an authority on the iron and steel technology of ancient India, Sayed Jafar Mahmud: "The nature of the dense iron of the pillar, the good forge welding employed and the less cold-worked condition also contributed to corrosion-resistance. Moreover, a thin film of iron oxide has been observed on the surface, which protected the metal from the onslaught of the elements."

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The difference in juxtaposed pictures, polished by touch) a fence prohibiting the t left: 1996; right 2000.