Feature Archaeotechnology

The Decorative Bell Capital of the Delhi Iron Pillar

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The design and construction of the decorative bell capital of the 1,600 year old Delhi iron pillar attests to the high degree of skill of the ancient Indian blacksmiths in working iron. Detailed visual observations clearly establish that the decorative bell capital is not a single piece of metal, but is composed of separate pieces that have been individually constructed by forge welding. A critical analysis of the fitting methodology of the Delhi iron pillar’s decorative top indicates that the individual pieces were fit around a cylindrical hollow iron shaft, which was connected to the main body of the pillar by means of an insert.

Figure 1. The Delhi iron pillar located at the Qutub Minar complex in New Delhi.

Over the last 30 years, there has been a discernible increase in the number of scholars who have focused their research on early industrial organizations, a field of study that has come to be known as Archaeotechnology. Archaeologists have conducted fieldwork geared to the study of ancient technologies in a cultural context and have drawn on the laboratory analyses developed by materials scientists as one portion of their interpretive program. Papers for this bimonthly department are solicited and reviewed by Robert M. Ehrenreich of the National Materials Advisory Board of the National Research Council.
INTRODUCTION

The iron pillar currently situated in the Qutb Minar at New Delhi, India, has attracted the attention of metallurgists and archaeologists for its excellent corrosion resistance. Several theories have been proposed to explain its superior corrosion resistance and can be broadly classified into two categories: environmental and material. The proponents of the environment theory state that the mild climate of Delhi is responsible for the corrosion resistance of the Delhi iron pillar, since the relative humidity does not exceed 70 percent for significant periods of time in the year, resulting in very mild corrosion of the pillar. On the other hand, several investigators have stressed the importance of the construction material as the primary cause for the pillar’s corrosion resistance. The factors proposed in this regard are the relatively pure composition of the iron used, the presence of phosphorus and the absence of S/Mn in the iron, its slag-enveloped metal grain structure, and passivity enhancement in the presence of slag particles. Other theories to explain the corrosion resistance are also found in the literature, such as the mass metal effect, initial exposure to an alkaline and ammonical environment, and surface coatings both after manufacture (treating the surface with steam and slag coating) and during use (clarified butter coating). The importance of the construction material as a factor in determining the corrosion resistance of ancient Indian iron is attested by the presence of ancient massive iron objects located in areas where the relative humidity is high for significant periods of the year (for example, the iron pillar at Dhar in Madhya Pradesh, the iron beams in the Konarak temple in coastal Orissa, and the iron pillar at the Mookambika Temple at Kollur situated in the Kodachadri Hills on the western coast).

There are several studies reported in the literature on the Delhi iron pillar’s corrosion resistance; however, the construction and manufacturing methods of the decorative top capital of the pillar have not yet been addressed, most probably because of the inaccessible nature of the pillar top. This article, which is based on an investigation conducted with the assistance of the Archaeological Survey of India, elucidates the construction details of the Delhi iron pillar’s decorative capital and provides insights into its fabrication method.

The skill of the ancient Indian blacksmiths in the art of working iron is also highlighted. The construction of such a large mass (weighing about six tons) is an engineering marvel considering the time period (around 400) in which it was constructed. The construction of the pillar’s top indicates a high degree of sophistication achieved by the ancient metallurgists in planning, executing, and constructing large iron objects.

THE PILLAR CAPITAL

Dimensions

The total length of the pillar is 23 ft 6 in., including the decorated capital (3 ft. 5 in. tall). Moreover, the distance from the bottom of the pillar to ground level is 1 ft. 7 in., and the height from the yard level to the raised platform is 1 ft. 6 in. The stone platform currently surrounding the pillar was erected by Beglar in the 1860s when he investigated the underground regions of the courtyard in great detail. The pillar rises about 17 feet above the platform level and is crowned with the decorative capital.

The capital was also analyzed in detail for its dimensions (Figure 2). The decorative capital is symmetrical in nature, and its dimensions are relatively uniform. It must be appreciated that the designers of the pillar had originally planned the dimensions very carefully before construction, and the fabricators ensured accurate reproduction of the design.

The overall dimensions of the pillar were also analyzed (Figure 3). The rough portion seen currently at the bottom of the pillar (Figure 4) was originally buried underground in its original location in a Hindu temple; when the pillar was later placed in the mosque, a part of the rough section was exposed. The total length of the pillar, including the top decorative portion adds up to 23 ft. 4 in. The top of the pillar was adorned originally with an idol of garuda (eagle), which was removed when the pillar fell into the hands of the Muslims. The pillar should have measured 25 ft. with the idol on the top of the decorative capital. One fourth (5 ft.) of the main body of the pillar (20 ft.) was placed underground and the rest (15 ft.) ap-