Gizeh iron revisited
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Abstract

Further examination of the iron plate from the Great Pyramid at Gizeh failed to detect any gold as previously reported. The authors of this paper confirm the metallographic structure but suggest this can be better explained in terms of known post-medieval iron fining technology rather than invoking unknown techniques from the remote past.

In 1989 an article by El Sayed El Gayar and M P Jones on the iron plate from the Great Pyramid at Gizeh, Egypt, appeared in this journal suggesting on the basis of metallurgical examination that it was of great antiquity. The present authors published a letter in the same issue expressing reservations over some of the principal conclusions of the article. We promised, somewhat optimistically as it turned out, to provide more information in the following issue of the Journal. For various reasons our work was delayed, but now that we have been able to examine the original section studied by El Gayar and Jones we can conclude our observations on the probable history of this artifact.

First, we will adumbrate the known facts; a plate of iron was found near an air passage high up on the side of the Great Pyramid in 1837. The original finders of the piece were at some pains to stress that it was apparently found deep within the masonry of the structure after blasting had removed the two outer tiers of stone, and thus it was likely to be contemporary with the construction of the pyramid in about 2750 BC. No less an authority than Petrie seemed to have accepted this, making it the earliest substantial piece of iron known. Shortly after its discovery the piece entered the collections of the British Museum (Registration no EA 39 1-13 1). There it has remained ever since with no scientific examination beyond an analysis which showed that it was not of meteoritic origin, until El Gayar and Jones requested a section to be cut from a corner for metallographic examination.

Their analysis of the section revealed gold on the surface of both the corrosion and of the metal beneath. The iron itself was of high chemical purity, but contained many inclusions, although these were not of slag as might have been expected for early iron. On the basis of this examination they pronounced that the iron was likely to be of great antiquity.

We were sceptical about this, but were unable to obtain access to the section for a long time, and thus confined our attention to the remainder of the piece. The reported presence of gold would clearly suggest that this piece was of some importance and not just a piece of recent iron. However our analyses of surface of the plate, and of a new section cut adjacent to the original section, failed to detect gold at all either in the metal or in the corrosion. The examination began with micro-analysis in the scanning electron microscope with a detection limit of about 0.3%, both at the British Museum and also independently at the Ancient Monuments Laboratory, English Heritage by Dr G McDonnell. In addition analysis was carried out by X-ray fluorescence in the British Museum; this method has a detection limit of 0.05% for gold and once again no gold was detected anywhere. It was, and remains, highly suspicious that no gold could actually be seen in the microscope either by El Gayar and Jones or by us. In our experience surface gold is almost always visible, either as a thin sheet or as particles.

Since the last report the original section has been returned to the Museum and we have been able to carry out a thorough investigation. Once again we must report that despite extensive searches no trace of gold could be detected, and it is our firm opinion that the original report of gold is incorrect.

The structure of the iron in both of the sections is very similar and we are in broad agreement with El Gayar and Jones on its identification, if not interpretation. The structure of the iron is banded, mainly consisting of wrought iron (low carbon) with some areas containing more carbon. The unusual features are the absence of slag stringers and the very large numbers of other inclusions. These are unusual in that they contain large quantities of calcium (up to 60%), phosphorus (up to 15%), and some sodium, silicon and potassium. A number of chlorine-rich areas were also found. However, we do not agree with the view of El Gayar and Jones, that these inclusions indicate ancient