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## AN OCCURRENCE OF IRON IN THE FOURTH DYNASTY

By DOWS DUNHAM *and* WILLIAM J. YOUNG

IN Prof. G. A. Reisner's report on his excavations at the Third Pyramid<sup>1</sup> the diary entry for July 19, 1908, reads in part as follows: 'On the southern side of this room [room 8 in the Valley Temple], about the middle, in debris resting on the dividing wall, about 40 cm. above the floor, was a decayed shallow pan of copper upside down (pl. 61, e, f). On removing this, a deposit (08-7-30) was found of copper and stone vessels, together with a fine flint wand inscribed with the names of Cheops, and a mass of yellow coloring matter. Underneath were traces of decayed wood, and an oxidized red mineral not unlike iron rust; probably red oxide of copper (it was not attracted by a magnet). These had evidently been in the pan which, with its contents, had been thrown out of the room (8) by plunderers and had fallen upside down. The objects included the wand, two model basins of slate, one of haematite, and one of crystal, a model vase of alabaster and one of slate, a model *hes*-vase of copper, two model shoulder jars of copper, and a stack of six model basins of copper (08-7-31 to 08-7-44).'

The flint wand (*pšš-ḳf*) referred to is in the Museum of Fine Arts, Boston (No. 11. 765), and was long disfigured by a reddish-brown scaly deposit which partially obscured the fine incised inscription giving the names of Cheops.<sup>2</sup> This deposit has recently been removed and subjected to chemical and spectrographic analysis by Mr. W. J. Young of the museum staff. He soon obtained evidence that the material in question was iron and, having in mind G. A. Wainwright's studies on the occurrence of this metal in Egypt,<sup>3</sup> I then asked him to try and determine whether or not it was of meteoric origin. The specimen available was minute, and the spectrographic method alone was practicable, but the definitely negative results obtained in the attempt to identify nickel in two spectrograms lead to the conclusion that the metal is non-meteoric.

The association of the substance *bi* (iron) with the ceremony of 'opening the mouth', to which Wainwright calls attention,<sup>4</sup> is interestingly confirmed by this occurrence of iron with a 'magical set' and a *pšš-ḳf* of the Fourth Dynasty. It seems clear that the set found by Reisner originally included an implement, or perhaps a block, of this metal, and that it was not of meteoric origin.

I append Mr. Young's report on his investigations of this sample, together with a photograph (pl. VI, bottom) of the second spectrogram referred to by him.

<sup>1</sup> G. A. Reisner, *Mycerinus*, London, Humphrey Milford, 1931, p. 36.

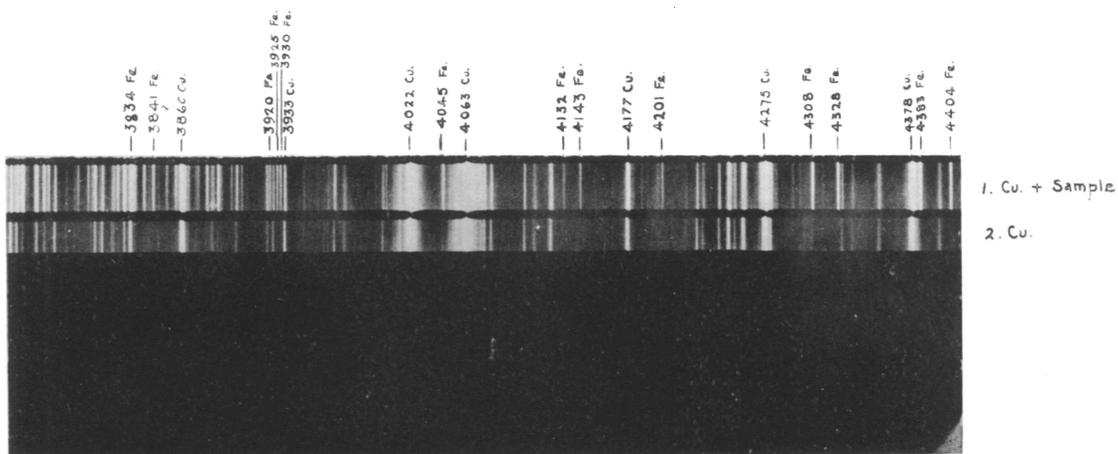
<sup>2</sup> Op. cit., pl. 65, a.

<sup>3</sup> G. A. Wainwright, *Iron in Egypt*, in *JEA* XVIII, 3.

<sup>4</sup> *Ibid.*, 6 ff.



GOLD PLAQUE FROM ALEXANDRIA



SPECTROGRAM OF SAMPLE OF IRON FROM FLINT WAND OF CHEOPS

## REPORT ON IRON DEPOSIT ON FLINT WAND FROM THE MYCERINUS VALLEY TEMPLE

A deposit which was found on a flint wand excavated at the site of the Temple of Mycerinus at Giza was submitted for chemical analysis.

A small fragment of the deposit was taken and a microchemical test for iron made by the ferrocyanide method. This proved to be positive.

The remainder of the deposit was removed from the wand and submitted to a spectrographic analysis in order to ascertain if the element nickel was present. Two spectrographically pure carbons were prepared and used as electrodes. The lower positive (+) electrode was drilled and the deposit embedded in it. This was exposed for 20 seconds in a 220-volt direct current arc. From the spectrogram strong iron lines were noted, and very weak copper lines at wave-lengths of 3247 and 3274 Angstroms. No trace of nickel could be found in the spectrogram. The remains of this deposit were then removed from the lower electrode and were found to be magnetic.

In order to obtain a more simplified spectrum two spectrographically pure copper electrodes were prepared. The positive (+) electrode was drilled and the sample embedded in it and exposed for 64 seconds. Nickel was again sought for, but was found to be absent.

The oxidized red mineral which Dr. Reisner refers to in the passage quoted above by Mr. Dunham must have been the iron in its ferric state, which is not magnetic. When ferric oxide is subjected to very high temperature it is converted into ferrous oxide, which is magnetic. This explains why the sample, after being removed from the bored electrode of the carbon arc in the above spectrographic analysis, was readily attracted by a magnet.

As meteoric iron invariably contains a fairly high percentage of nickel, and as any evidence of nickel was absent in the spectrograms, it must be assumed that the iron was not of meteoric origin.

The weak copper lines observed in the first spectrogram were due, in all probability, to the presence of the oxidized copper pan under which the wand was found. The wooden covering protected (to a degree) the iron deposit on the wand from greater contamination by the copper.