

AXE MONEY

COMPOSITION: Copper-arsenic alloy, containing 2.4% As.

MICROSTRUCTURE

SECTION A: Transverse section through one end of the blade

Photomicrographs

- A1 -This polished section shows a portion of the blade at a location where one surface of the blade (left) is marked by long striations or grooves. The opposite surface (right) is flat. The metal contains tiny inclusions of cuprous oxide (Cu_2O) which are strung out along the length of the section. This directionality of the inclusions reveals that the metal has flowed through plastic deformation (working), carrying the inclusions along with it [x50; Etchant: none-polished condition].
- A2 -The same section shown in A1 has been etched to reveal the severely worked structure of the metal. Grains are visible in only a few areas. The alternating and roughly parallel white and grey bands in the structure correspond to zones of metal that are higher (white) or lower (grey) in arsenic. The thinness and closeness of these bands indicate how severely the metal was worked in shaping this object. The metal has undergone extreme deformation and plastic flow. The black regions that lie immediately below the surface grooves represent regions of metal that have been severely attacked by the etchant. They are localized zones where the metal has been heavily worked [x50; Etchant: FeCl_3 in alcohol].
- A3 -A highly magnified detail of metal located immediately below one of the surface grooves. In photomicrograph A2, this zone appears black. Here, however, at a magnification of 500, one can distinguish individual grains, extremely thin and elongated in shape, which contain criss-crossing strain lines. The density of these strain markings, together with the overall deformation of the grains, is an indication of the severe plastic deformation the metal has experienced in these localized zones [x500; Etchant: FeCl_3 in alcohol].

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INTERPRETATION OF MICROSTRUCTURE

The axe money was fashioned entirely by working (hammering). In shaping the object, the original metal blank was hammered and annealed many times to thin the metal, to spread the broad blade, and to form the raised flange that runs along the edges of the shank. The metal was worked severely in the final stage of manufacture and was left in this worked condition, presumably to harden it.

After the object was shaped, a series of grooves was made on one surface, both in the shank and in the blade. The photomicrographs reveal that these grooves were not cut into the metal. Rather, they were formed by a hard tool that was pressed into and dragged along the surface of the object. This tool compressed the metal immediately beneath it, forming the groove. The compressed, highly worked and deformed metal is characterized by elongated grains full of strain lines produced by the force exerted by the tool.