Further Notes on an Anvil and a Palstave found at Flax Bourton, Somerset

By R. M. Organ

These two finds were reported in the *Proceedings* of the Spelæological Society, Bristol University, of May, 1931, by Mr. S. J. Jones. Photographs may be seen in that report. They have now been technically examined in the Research Laboratory of the British Museum at the instance of Mr. L. V. Grinsell of the Bristol City Museum, with the primary object of determining whether the distortion of the face of the anvil was due to use in ancient times.

The surface of neither object exhibited the green patina commonly found on corroded bronze. The palstave had been cleaned on discovery with a wire brush and metal polish and such "patina" as now remains consists of black plumbago-like material. Microscopic examination of the anvil at a magnification of 200× showed the presence of minute crystals of cuprite, azurite, and cassiterite, indicating that recent surface corrosion had taken place.

On the anvil, fragments of copper were found in a number of places: on what is assumed to be its face, on the large point, and on both convex and concave sides. A fragment of brass also was found on the convex side near the anvil face. The copper fragments were brittle through having been hammered flat. They were on the surface of the patina and were therefore of recent origin.

The face of the anvil, lower on one side than on the other and bulging sideways at the lower level, suggests that the face had been beaten down in use although no hammer marks were visible on the face. In order to discover whether the metal had been worked in this way a section was polished at the place shown in the sketch (*Fig.* 29), and the metal examined metallographically. This was done using silicon carbide, diamantine, and diamond dust as successively finer abrasives resulting in a well-polished surface which did, however, exhibit fine scratches under the microscope. Owing to the awkward shape and considerable weight (695 g.) of the object, no attempt was made to remove these by further polishing.

The polished surface was of a colour suggesting a 20 per cent tin bronze and this was confirmed by colorimetric analysis of a sample taken from the metal adjacent to the polished section which showed: copper 78 per cent, tin 20 per cent. Spectrographic analysis indicated the presence of a little lead, iron, manganese and nickel and traces of zinc and arsenic. No

phosphorus was detected. There is nothing characteristically modern about this alloy but it is of a type used for making bells and gongs and for moving parts which are subject to poor lubrication.

The section was etched in a solution containing ammonia, distilled water and 30 per cent hydrogen peroxide in the proportions 5 : 5 : 2 by volume with the result shown in *Plate* 9, *B* at a magnification of 80 diameters. The section showed no distortion of the crystal structure such as would have occurred if the observed depression of the face of the anvil were due to hammering. Measurement (*Fig.* 29) indicated that the metal has been compressed by at least 20 per cent, bearing in mind that the energy of a hammer blow is dissipated principally in the surface on which the blow falls.

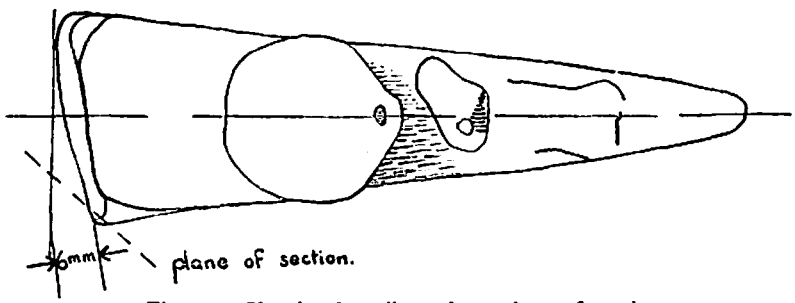

Fig. 29.—Sketch of anvil to show plane of section.

In order to verify the view that hammering to this extent would in fact distort the dendrites, a small bar of nominally 20 per cent tin bronze, in the as-cast condition, was cut into two pieces. The piece from one side of the cut was subjected to 250 light hammer blows which compressed the metal just sufficiently to cause a crack nearby. The two sides of the cut were then mounted side by side in a plastic disk for easy comparison and were polished using the technique employed on the anvil. Corresponding thicknesses of the hammered and unhammered section were measured and it was found that a localized reduction of thickness from 2·88 mm. to 2·43 mm., i.e. a compression, which was almost uniform along its length, of 15 per cent, was sufficient to cause cracks in the metal. The cracked specimen was etched and showed very much distorted dendrites (*Plate* 9, *C*).

Since distortion of the metal structure does not appear in the section of the anvil which was polished and since no cracks are anywhere evident, even in the metal of the " bulge " where they were most likely to appear, it may reasonably be considered that the distortion of this anvil is not due to use.

Samples from the palstave found with the anvil were taken in four places : the combined material was analysed colorimetrically and found to

contain: tin 13 per cent, copper 87 per cent. The casting has been made in a two-piece mould and at the junction of the mould a flash of metal has formed. On the cutting edge of the very thick blade this flash is scarcely disturbed despite marks of use on the sides of the blade. Evidently the object has never been used as a cutting tool but it may be a poor copy of a palstave which has been used. The appearance of the surface of the casting also suggests excessive use of a proprietary mould-protective dressing.

In summary: the anvil is made of a 20 per cent tin bronze alloy containing lead. It has had slight use recently but certainly not to the extent suggested by the deformation of the face. After allowing for the probability of its having been cleaned on discovery there are no signs of prolonged exposure to corrosive influences. It may be a copy of an earlier much-used anvil of softer metal or a casting from a whittled wooden pattern. The metal of the palstave is a 13 per cent tin bronze which, like the anvil, has not been subject to corrosive influences for a prolonged period. It also may be a copy of a used palstave. It is noteworthy that whilst the surface of the anvil has been cleaned up after casting, the palstave has been left in a partly finished state.

The analyses of the metals were carried out by Miss M. Bimson of this Laboratory.