cf Report 3286

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Discussion of the qualitative analyses of objects from Sheepen, Colchester.

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The analyses showed that a variety of copper alloys were used to make the objects found, so one then needs to try and answer the questions that immediately come to mind: Why use different alloys? and,On what basis, if any, were alloys selected?

The first question is easily answered. Different alloys have different appearances and properties. Some are easily and conveniently worked in one way, some in other ways. The second question - and answer - follow from the first. It could be that the alloys were chosen soley for their physical properties but other possible factors should also be considered. Was some of the raw metal coming from military and some from civilian sources? Is there a chronological variation in the availability, and hence use, of one or more alloys? Did changes in fashion dictate the use of one alloy rather than another because of its colour?

Although the finds come from different periods there are relatively few from each one and a variety of alloys is always present. The overall time-span is not great so any major chronological variation is not to be expected.

The civil/military divide is another possible split. However most of the definitely military fittings are made of sheet metal (cuirass hinges, sheild bindings etc) so the alloy choice may be governed by this factor rather than by reason of their military nature.

Examples of alloy properties suiting manufacturing method are numerous; none of the analysed objects were made from a totally unsuitable alloy.

The three pieces of sheet (nos 6, 11 and 67) are all unalloyed copper which is very malleable and therefore easily hammered into thin sheet. It is not very hard or strong but these are not necassary properties of eg box claddings.

The strap buckles and hinges, cuirass hinges and shield bindings are all made from sheet metal together with thin rods and rivets. All those analysed were of brass (copper + zinc) which is malleable and therefore easily worked into the basic sheet or rod but stronger and tougher than pure copper. It also has a pleasing golden appearance.

Adding lead to copper alloys has several effects on the properties of the metal. It lowers the melting point and gives higher fluidity to the molten metal and so is easier to cast, especially where complex shapes are

involved. The lead does not dissolve in the copper alloy but is dispersed throughout the metal as tiny droplets. This makes the metal difficult to forge as it tends to split, the lead making weak points in its structure. For the same reason heavily leaded alloys are not suitable for objects where mechanical strength is important as they are liable to fracture in use. Lead was a relatively cheap metal so heavily leaded alloys may have been used where practicable as an economy measure. Examples of leaded alloys among the Sheepen finds include the dice-box and dice (nos 73 and 74) and the weight (no 13) which are all of leaded bronze (copper + tin + lead). The two possible cart fittings (nos 57 and 77) and the ?leather punch (no 64) are of leaded gunmetal (copper + tin + zinc + lead). The two highly decorated, S-shaped pieces (nos 23 and 54) are both of leaded alloys which suggests that their function was decorative rather than structural.

The number of objects of different alloys is shown in the table below. It should be stressed however that the objects analysed were not a random selection and so the overall balence is probably somewhat different. One thing though is perfectly clear - a significant proportion of the objects are not bronzes but brasses.

To sum up: Alloy choice can be explained on purely practical metallurgical grounds but other factors cannot be completely discounted. The numbers and types of objects analysed from the different periods did not permit definite conclussions one way or another.

Table : Distribution of alloy types by period

Period	copper	leaded copper	bronze	leaded bronze	brass	leaded brass	gunmetal	leaded gunmetal	Total analysed
III	1			1	3	1	1		7
III-IV	1		1	1			4		7
IV			2	3	16		1	3	25
V	2	1	1	3	2			3	12
later					1				1
U/S				3	6		1	1	11
	4	1	4	11	28	1	7	7	63