

The Fröslunda shields: Cymbals or symbols?

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Shields of Herzsprung type excavated at Fröslunda were too thin for practical armour, and examination of their microstructure showed tin contents too low for cymbals. Copper sulphide inclusions were consistent with the Late Bronze Age date, and their dimensions suggested that the shields had first been cast as 15 cm blanks before being forged to shape.

A hoard of ceremonial Bronze Age shields was discovered in 1985 by Bert Ivarsson while plowing the fenland of his farm, Fröslunda, located on the shores of Lake Vänern in western Sweden. The shields were excavated in 1986 by Ulf Erik Hagberg, Director of the Museum of National Antiquities in Stockholm, and are now in the *Skaraborgs länsmuseum* after conservation by Margaretha Klockhoff in the Archaeological Research Laboratory, Stockholm University.

There were 16 shields in this hoard. They were identified as belonging to an uncommon Late Bronze Age type called Herzsprung shields, after a site in Germany (Hagberg & Jacobzon 1986), and were manufactured

most probably in central Europe. They are Celtic, belong to the Hallstatt period and date to 700–600 BC. Prior to the finds at Fröslunda only 20 of these shields or fragments of them had been discovered. These included two in Ireland, nine in Denmark and only one in Sweden, at Nackhälle, on the West Coast. Scholars on the Continent tend to be of the opinion that shields of this type represent part of a suit of armour that would also include helmet and greaves.

The Fröslunda shields are of very thin bronze sheet, about 0.3 to 0.5 mm thick and 60 cm in diameter, heavily embossed. There is an occasional textile structure found imprinted in the surface that suggests forming on a tex-

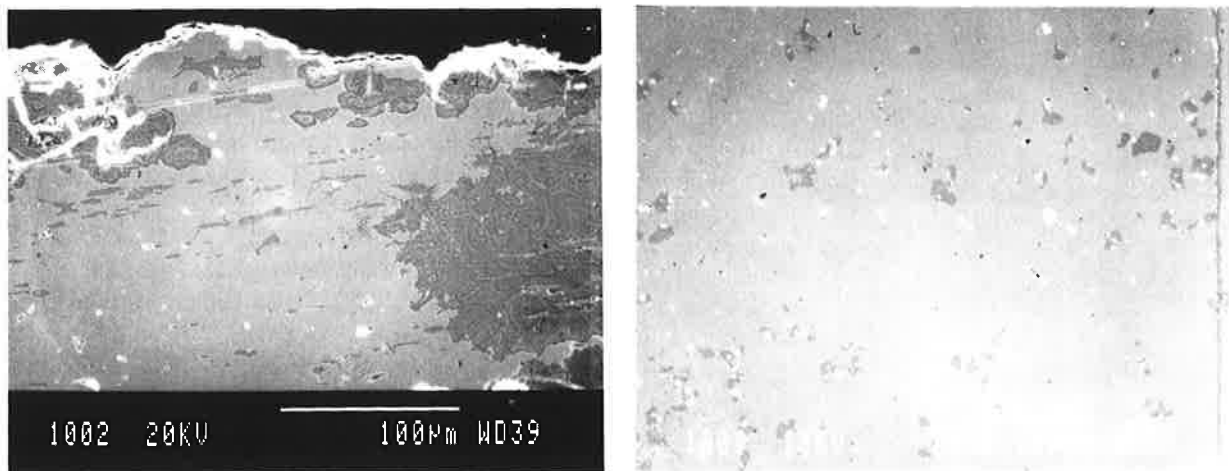


Figure 1. Scanning electron micrographs of polished but unetched longitudinal (left) and transverse (right) sections from shield no. 10, showing the elongated shape of the copper sulphide inclusions.

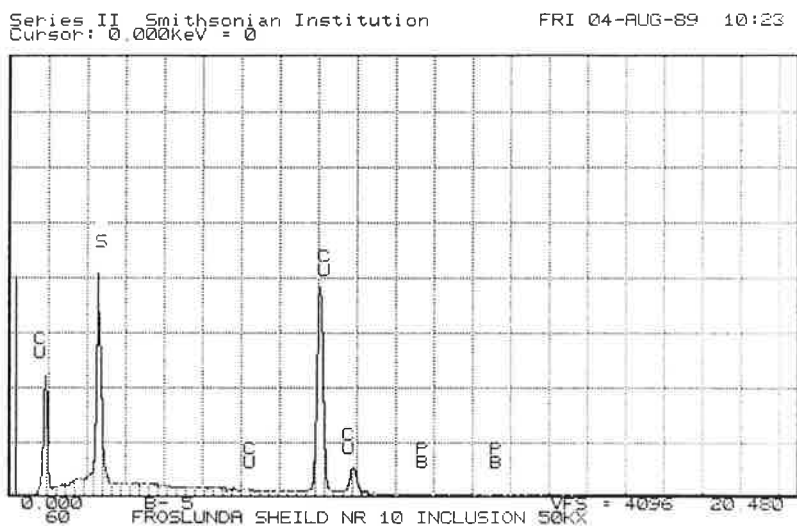


Figure 2. X-ray emission spectrum of a single copper sulphide inclusion in shield no. 10.

tile-covered surface. No wood, textile or leather remains were found attached or associated with the shields, nor were they found with any other parts of armour. The shields have handles of sheet bronze filled with lead rivetted to the back and a lead-tin rod around the rim (pers. comm. Ulf Erik Hagberg).

The shields appear to some to be too thin for practical armour. A ceremonial or symbolic use has been suggested, as in the cult practices depicted in contemporary rock carvings, especially numerous at Tanum in Bohuslän, on the Swedish West Coast. Dr Hagberg, however, noted that according to Tacitus the Romans sang into their shields, and also that Herzsprung shields are often found in pairs. Since an even number of shields were unearthed at Fröslanda (16), Dr Hagberg hypothesized that they might have been some sort of musical instrument used in pairs as, for example, are cymbals (pers. comm. Ulf Erik Hagberg). With that hypothesis in

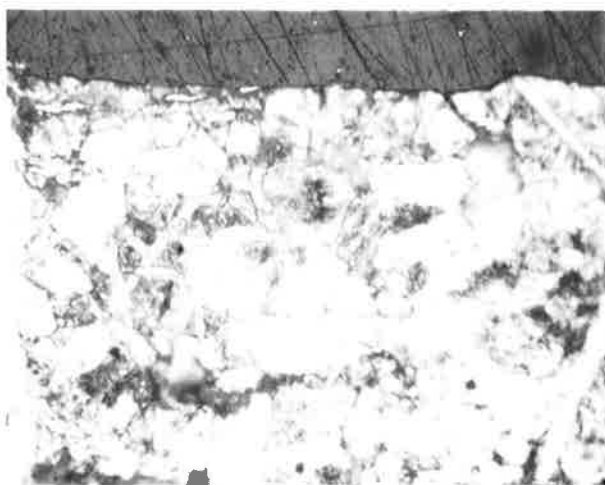


Figure 3. Micrograph of the sample of shield no. 16, polished and etched, showing heavily worked structure and elongated copper sulphide inclusions in longitudinal section, 350 \times .

mind, samples from shields nos. 8, 9, 10, 11, 15, 16, and 17 were compared in composition and microstructure with those of typical gongs and cymbals.

The samples were heavily corroded. They were first mechanically probed for the presence of sound metal within the corrosion products. Yellow metal could be found in all samples except that of no. 10, which was a reddish metal. Initially a small fragment of metal from each sample was analysed by X-ray emission in the scanning electron microscope for identification of the principal elements present. These were consistently copper, tin, and sulphur. As anticipated from its reddish colour, the sample of no. 10 had relatively less tin than the others.

Metallographic sections of the metal samples were then prepared. Microscopical examination of the polished surfaces revealed extensive internal corrosion, not unexpected in excavated metal, and also non-metallic inclusions in the metal that were original to the smelting and alloying process (fig. 1). Inclusions in nos. 8, 10, 15, and 17 were separately analysed and were identified as copper sulphides (fig. 2). Such inclusions indicate that the copper was smelted from a sulphide ore rather than an oxide produced by weathering and so presumably was mined from the deeper deposits that were characteristically later to be exploited. This conclusion is consistent with the date of the shields.

Copper sulphide inclusions can be used as markers for the amount of extension the metal has undergone during forging (Hencken 1950; Coles 1962; Gräslund 1967; Bukowski 1972; Goodway 1989). Such an estimate assumes that the copper sulphide, which is insoluble in bronze, is roughly globular in the original ingot or blank, and the location of the sample in relation to the rest of the object is known. Since in these samples this was not known, only a rough estimate of the extension of the metal could be made. The longest inclusions visible in fig. 3 of the sample from shield no. 16 measure approx-

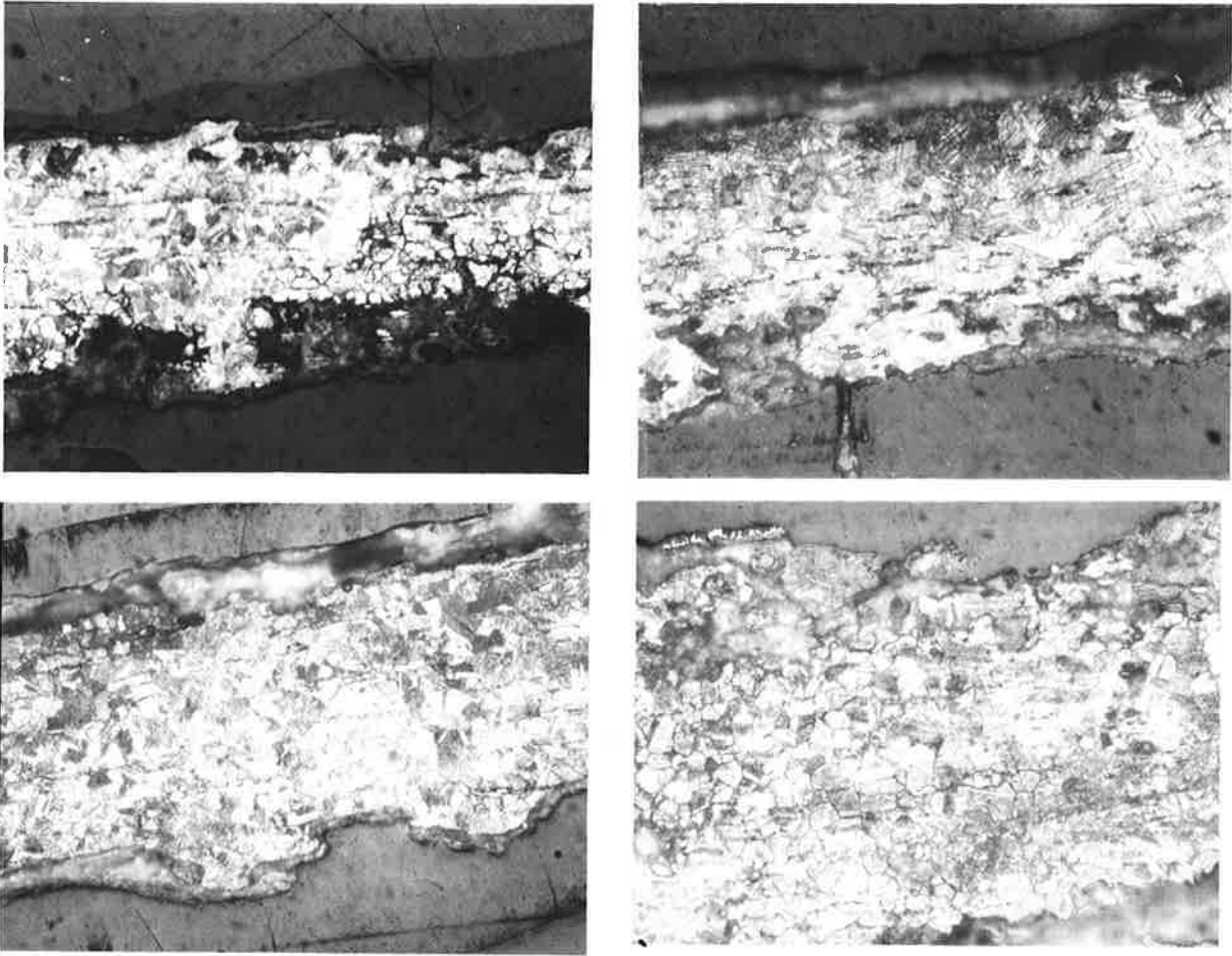


Figure 4. Longitudinal sections from shields nos. 8 (top, left), 10 (top, right), 15 (above, left), and 17 (above, right) at 350 \times , showing the thinness of the shields and the fine grain size of the metal.

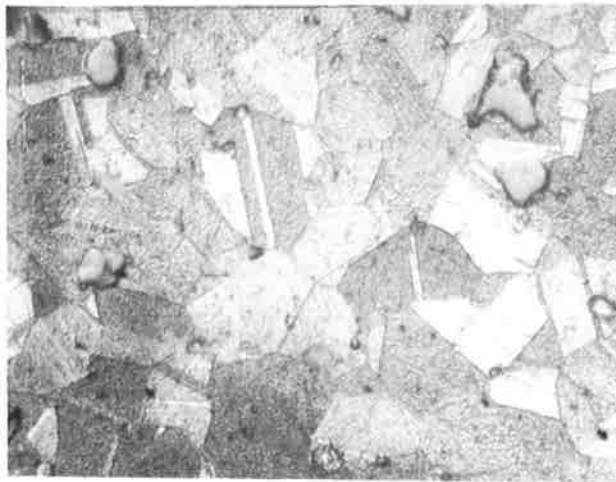


Figure 5. (Above). Sample from shield no. 10 sectioned transversely (parallel to the surfaces of the shield) at 700 \times , etched, showing copper sulphide inclusions and fine, nearly equiaxed twinned grains of alpha-phase bronze typical of repeated working and annealing.



Figure 6. (Right). Typical cymbal microstructure at 600 \times , showing grains of alpha-phase bronze surrounded by a needle-like matrix of quenched beta-phase bronze (Goodway & Conklin 1987).

imately 56 and 80 μm long and about 2.4 and 3.6 μm across. Their initial diameters were estimated to be about 13 and 18 μm , indicating an extension of the metal in this area of about four times. Such an extension presupposes the casting of a bronze blank perhaps 15 cm diameter from which the shield shape was then forged.

After analysis the prepared sections were etched using standard solutions of potassium dichromate followed by ferric chloride, and the microstructures of longitudinal sections of shields nos. 10, 15, and 17 are shown in fig. 4 at 350 \times , and a transverse section of shield no. 10 in fig. 5 at 700 \times . The structures are typical of alpha-phase tin bronze which was heavily worked and repeatedly annealed. This procedure produced considerable grain refinement; the grains seldom measure as much as 20 μm across.

The microstructures of the metal samples and their relatively low tin content are not those typical of cymbals or gongs (Goodway & Conklin 1987; Goodway 1988). The tin content of the shields was estimated to be at least 10% below the 22–24% required to produce the very low-damping microstructure characteristic of cymbals (fig. 6) and in fact the structure of the shields was conspicuously different. A typical cymbal microstructure would contain grains of alpha-phase bronze surrounded by a martensitic quenched-beta phase, and no copper sulphide.

If indeed the shields were meant to be sound-producers, the sound must have been of a nature entirely different from that of cymbals. It seems more likely that the shields are symbolic rather than functional objects.

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