Neutron studies of 15th – 17th century roundshot

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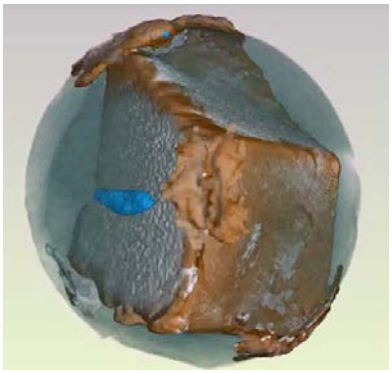
Gunpowder weapons were introduced to the battlefield towards the end of the 14th century. By the second half of the 15th century, highly mobile and effective guns were being used regularly apparently due to major changes in gun, gunpowder and projectile manufacture. The archaeological evidence (principally from the fired lead projectiles) is beginning to provide a detailed picture of the scale and chronology of the use of guns in the field, including information on their bore, type and how they were used, and is complemented by knowledge obtained from surviving guns; from documentary sources; from unfired projectiles and obturators from wrecks, but we still do not fully understand the key changes that were made and where and why they first took place to enable these guns to become battle-winning weapons.

As part of a much larger project to understand the changes in projectile manufacture, how they contributed to warfare and what they can tell us about this key transition in the history of warfare we have carried out an investigation into composition and structure of early 15th, 16thand 17th century round shot using neutron diffraction and neutron tomography.

This paper presents the results of neutron experiments on roundshot from the Mary Rose (1545), and the battles of Towton (1461), Bosworth (1485), Pinkie (1547) and Basing House (1643-5). Neutron radiographs and tomographs were collected on NEUTRA at PSI to determine the structural features. The experiments showed that projectiles are generally spheres of lead, and that some contain metallic cores, stone pebbles or flint shards. Neutron diffraction patterns were collected from a selection of roundshot at ambient temperatures using D2B at ILL. The diffraction patterns confirmed that all the round shot studied were essentially pure lead or pure iron and that the metallic cores were iron.

As an example of our results we have included an image of one Bosworth roundshot (below) which shows a lead ball containing an irregular iron dice (rather than a perfect cube) possibly having been crudely chopped from a bar of wrought iron. It has been located off-centre and it is not clear if this is deliberate or accidental. The purpose of such inclusions is strongly debated and will be discussed in detail in this paper. Suggestions range from careful control of ballistic properties – by making a lead ball fly as if it was of iron or to introduce a more random trajectory on firing; weight reduction to reduce internal pressures in early gun barrels, which were prone to exploding; or simply to save lead, which was expensive.



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