

Magnetic susceptibility of ancient and modern potsherds using a fast, cheap and portable probe

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It has been estimated that there exist over 100 million ancient potsherds in various collections worldwide, many of which have never been studied and for which the provenance is ambiguous or unknown. Indeed, many collections are extremely badly catalogued or completely mixed-up. We have been using a novel portable probe to measure the magnetic susceptibility and electrical conductivity of potsherds in the hope that this fast, cheap and portable measurement can provide data that will help to sort similar looking potsherds into sets in a manner which may help to define their provenance.

The probe, which resembles a firearm, uses the Hall effect to make a non-destructive measurement on the potsherd. The probe is attached to an Dell Axim X51 PDA, which runs software that allows the measurement to be carried out and logged. Each measurement, which is made by pressing a button on the gun, takes only a few seconds. We have made measurements on three suites of ancient potsherds as well as a suite of modern potsherds that were created by using a garden centre and a hammer!

In each case a set of 5 stacked measurements were taken on the inside and outside faces of the potsherd in two perpendicular directions. Potsherds which were either (i) so flat that the inside and outside could not be distinguished, (ii) so curved (radius of curvature less than 5 cm) that the probe tip could not approach the surface sufficiently closely, or (iii) smaller than the probe tip, were excluded from the suite of measurements. Each suite contained over 50 measureable potsherds. All measurements were completed within one day. In this pilot study we found that (1) each suite was represented by a normal distribution of magnetic susceptibility values, (2) the four different suites could be distinguished statistically on the basis of their magnetic susceptibility measurements, but (3) the distinction was not sufficiently powerful to separate all potsherds (i.e., there was a significant overlap of the susceptibility distributions). This seems to confirm that the method may be used to give additional information that can be used to help to provenance a potsherd, but the susceptibility measurement is not sufficient on its own.

In addition, we found that (4) the electrical conductivity measurements depended upon the local conditions (mainly humidity) and was of no use in distinguishing between suites of potsherds. However, most interestingly, we found that (5) there is a statistically significant difference between the magnetic susceptibility measured on the inside face and that measured on the outside face for all three ancient suites of potsherd, but not for the modern potsherds. The reason for this is not currently known. One hypothesis is that the difference is due to the manufacturing style. Further studies are being planned to extend our database.