In 2004, Greenwich workmen found a sealed jug about 1.5m below ground. It was a barmann or bellarmine—a salt-glazed jar made in the Netherlands or Germany, stamped with the face of Cardinal Roberto Bellarmino (1542–1621). When the jug was shaken it splashed and rattled, and the Greenwich Maritime Trust asked retired chemist Alan Massey to study it. Massey has told British Archaeology what he and colleagues discovered: a unique insight into 17th century witchcraft beliefs.

Immediate X-ray revealed pins and nails stuck in the neck, consistent with the jug having been buried upside-down (see cover photo). Computed tomography scans at Liverpool University showed it to be half-filled with liquid. It was clear that this was a witch bottle. Burial of vessels holding personal items, typically from someone suffering an illness and believing themselves persecuted by a witch, was a common practice. Until now, however, the best example, a glass bottle buried after 1720 in Reigate, Surrey, had been opened years before it could be examined (also by Massey).

Liquid was drawn through the cork of the Greenwich bottle with a long-needled syringe. Complex chemical studies that included recording a proton nuclear magnetic resonance spectrum, and then gas chromatography/mass spectrometry analysis of organic acids by Richard Cole (Leicester Royal Infirmary) and inorganic analysis by Helen Taylor (British Geological Survey), allow Massey to say that the liquid “is unequivocally human urine”. Past claims for urine in witch bottles have rested solely on inorganic material.

Cole identified cotinine, a metabolite of nicotine: the urine had been passed by a smoker (probably of a clay pipe). Acting on a hunch, Massey tested a black solid in the urine, and showed it to be iron sulphide. “It is virtually certain”, he says, that sulphur in the jar had reacted with the iron nails. In other words, the bottle contained brimstone, recalling the passage in Revelations when “the beast” and “the false prophet” were “cast alive into a lake of fire burning with brimstone”.

Scientists then removed the cork, which disintegrated, and the rest of the contents: 12 iron nails, eight brass pins (one very severely corroded), quantities of hair, a piece of leather pierced by a bent nail, which “might just be described as heart-like” (paralleling cloth hearts found in other witch bottles), 10 fingernail parings (not from a manual worker, but a person “of some social standing”) and what could be navel fluff.

At the Old Bailey in 1682 a plaintiff, believing his wife afflicted by witchcraft, told how a Spitalfields apothecary had advised him “take a quart of your Wife’s urine, the paring of her Nails, some of her Hair, and such like, and boil them well in a Pipkin”. He might instead have buried a bottle upside-down in a select place such as under a fireplace or doorway. Urine, fingernails and hair of the “victim” were believed to draw the spells, tormenting or even killing the witch.

Massey and co-authors Brian Hoggard and Graham Morgan are now seeking an archaeological journal for publication of their full report.