

Behind the Scenes at the Goldsmiths' Company Assay Office

There's more to the Assay Office than meets the eye. When it comes to precious metals, there's a great deal that goes on behind the scenes - not just the business of hallmarking.

We spoke to laboratory manager **CHRIS WALNE** to find out more

We provide a unique range of services to the trade, using the most sophisticated techniques and state-of-the-art equipment. We can be asked to test anything from a common wedding ring to samples removed from valuable pieces of art, or historical artefacts, which makes the job different every day.

The term 'assaying' refers to the analysis of a metal article's composition. Gold analysis by Fire Assay is the most common test that we carry out in the lab as gold is the metal that is most commonly re-cycled within the jewellery trade. We use a variety of techniques, some ancient and some modern:

GOLD CUPELLATION

This is a 2,000-year-old small refining process where the pure gold portion of an alloy is separated from the base metals in order to calculate the percentage of gold content overall. The process involves the collection of precious metals in lead, removal of the base metals by oxidation and then separation of the silver by dissolution in nitric acid to leave the gold at the end.

SILVER TITRATION

This is the analysis of the pure silver portion within a silver alloy by means of an acid/base titration.

This involves dissolution of the silver alloy in nitric acid, addition of sodium chloride to precipitate silver chloride and subsequent calculation of the pure silver content based on the volumes used.

INDUCTIVELY COUPLED PLASMA OPTICAL EMISSION SPECTROSCOPY

Platinum and palladium are analysed using a technique called Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). This involves dissolution of the sample in a strong acid reagent, Aqua Regia, in order to form an analyte that contains all the elements of interest. The solution is then introduced into a high energy plasma source which is able to excite the atoms of each element such that they give off UV and visible light radiation at certain wavelengths. With this information we can identify the particular element and quantify it by its intensity.

THE LAB ALSO CARRIES OUT A RANGE OF SPECIAL TESTS AND SERVICES:

Nickel Testing

Nickel is a well-known allergen and as such is subject to the laws set down in the EU Nickel Directive and The Dangerous Substances and Preparations (Nickel) (Safety) Regulations 2005. There are

no restrictions on the Nickel content that may be in a metal alloy, but suppliers of products that are found not to comply with the Regulations regarding Nickel Release are deemed to be committing an offence under the Consumer Protection Act.

The EU Nickel Directive states that any manufacturer, retailer or importer will commit an offence if they sell or supply post assemblies to be inserted into a pierced part of the human body unless the rate of Nickel release is less than 0.35ug/cm²/week. Similarly, if they sell or supply jewellery items, precious or base metal that come into prolonged contact with the skin unless the rate of Nickel release is less than 0.88ug/cm²/week.

There cannot be any certainty that a product conforms to the EU Nickel Directive without it undergoing full testing. We are able to provide reference tests according to the British Standard method EN181 to ascertain the release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin.

LEAD AND CADMIUM TESTING

The ability to detect Lead and Cadmium in jewellery items is

The Dangerous Substances and Preparations (Nickel) (Safety) Regulations 2005

These regulations specify the upper limit for nickel release in articles which have direct and prolonged contact with the skin - such as jewellery, fashion accessories, and metal adornments for apparel. It also specifies the upper limit for nickel contact in specific articles. Anyone wishing to place items on the market for sale must recognise that they have a legal obligation to ensure that items meet the requirements of the legislation. The proof of this is known as showing 'due diligence'.

becoming more important due to the harmful effects that these toxic elements can have on the wearer. We provide a Lead and Cadmium testing service for precious metal and costume jewellery in line with REACH regulations, using the ICP-OES technique.

Cadmium and Cadmium Oxide are very toxic and known carcinogens. The fact that Cadmium is used in the jewellery industry as an alloying constituent and in solders means it poses a significant health risk.

The EU REACH Directive 494/2011 came into effect in December 2011, restricting Cadmium content in jewellery to 0.01% by weight of metal. This applies to all component parts of precious metal jewellery, fashion jewellery and non-metallic materials. The exceptions are jewellery items that are proven to be more than 50 years old or placed on the market before January 2012.

Lead and its compounds are also toxic at low levels of exposure, so Lead was added to the EU REACH Directive 836/2012 in October 2013. Lead and its compounds must not be present in jewellery articles in quantities of more than 0.05% by weight. Non-metallic component parts are also included, but crystal glass, precious and semi-precious stones are not unless they have been treated with Lead compounds.

SMELTING

Smelting is a comprehensive service for precious metal scrap that involves the melting of materials in an induction furnace to produce a homogenous bar or ingot. The idea is to evenly mix the metals so that an accurate assay can be carried out on the resultant bar in order to render it for sale to a bullion dealer.

The bar is stamped with a unique identification code traceable to the



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The Goldsmiths' Company Assay Office Laboratory is fully independent and has been accredited for more than 15 years by UKAS (United Kingdom Accreditation Service, which oversees laboratory practices, methods and procedures within a test house). It has also been selected by the Trading Standards Authorities to examine and witness the authenticity of metals.



MOLTEN METAL AT 1100 CENTIGRADE

certificate of analysis. The results of this analysis are recorded, along with the weight of the bar and the customer's details. This enables the sale of the bar without the need for further testing and also means that the seller can realise the true value of the precious metal content. Smelted bars, teeth and coins of the Realm are the only items that don't require hallmarking.

Scrap gold and/or silver can be submitted for smelting, assaying and certification up to 10kg per bar. Platinum and/or palladium are limited to 2kg per bar.

SILVER DATING

This service is unique to our laboratory. It involves measuring the impurities of a sample taken from a silver article of unknown date, using the technique of ICP-OES. The impurities are compared with those in our unique database of impurities of silver of known dates and to the reference samples in the Goldsmiths' Company Collection, thus allowing the most probable date range to be calculated.

THE ANTIQUE PLATE COMMITTEE

The Antique Plate Committee (APC) was established in 1939 and is the internationally renowned body for adjudicating spurious silver articles. It is the only body in the world to do so. It advises on the authenticity of an article's provenance - decisions on which are usually based on three vital elements:

- The hallmark
- Connoisseurship of the experts
- Analytical testing process

The APC also advises on whether there has been an illegal alteration or an addition to the piece, whether it could be an electrotyping, or if the hallmarks have been cast.

Since 1478, the hallmark has included a distinctive date letter indicating the year of hallmarking. The temptation to make an article appear older than it is by using counterfeit punches, or by transferring a genuine hallmark from an antique into a more modern article has proved too great for some.

This offence, known





SCRAP POURED INTO THE SMELTER

as transposing of a hallmark, is an offence under the Hallmarking Act (1973).

The APC comprises of a dozen expert members, including dealers, restorers, academics and collectors who serve for a fixed term. The Committee is supported by an extended panel of volunteers who report and

inspect potential problems in the trade.

APC PROCEDURE

Articles can be submitted to the APC free of charge. However, if the articles require application of a modern hallmark to make them legal, a charge is made. All submissions are date tested, which requires removal of a

minuscule sample of material.

The majority of antiques submitted are in the form of tableware, most often dating to the Georgian period. Most are submitted by private individuals, although many have been advised by Auctioneers to check out a piece because they believe it to be suspect in some way. **10**

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MOLTEN METAL
POURED INTO THE
CRUCIBLE

Q&A WITH CHRIS WALNE, LABORATORY MANAGER



CHRIS WALNE

Chris Walne has been a chemist in the Assay Office laboratory for 26 years. Before he came to work here, he spent five years as a chemist in the laboratories of Inspectorate International at Witham in Essex, where he was primarily in charge of the analysis of precious metals in base metal concentrate mineral ores.

DESCRIBE A TYPICAL WORKING DAY

As we have little idea of what samples may turn up on any given day, my normal working day can be pretty varied, involving anything from answering customers' technical questions to working out methods of analysing samples using the many different techniques which we employ in the laboratory.

As I also sit on the ISO technical committee for European test methods, I try to keep up with what's going on in other fields of analysis so that our lab can progress accordingly on technical matters.

WHAT'S YOUR FAVOURITE PART OF THE WORKING DAY?

The first two hours in the morning are the best time of day for me as I get to organise the day's work in relative calm before the phone starts going mad.

WHAT'S THE BEST THING ABOUT WORKING AT THE LAO?

The best thing about working in the LAO labs for me is the diversity of the things we get asked to test - from newly minted coinage to ancient artefacts.

TELL US SOMETHING THAT MOST PEOPLE WON'T KNOW ABOUT THE LABORATORY

Our lab is the only test facility in the world responsible for the testing of the coins minted by the Royal Mint each year. Also, I analyse all the antique silver items submitted to the Antique Plate Committee for authenticity by the various experts.

WHAT HAS BEEN YOUR MOST MEMORABLE MOMENT HERE?

Becoming a Freeman of the Goldsmiths' Company and the City of London was pretty memorable for me as it is quite an unusual and proud moment, and something that you would not achieve at most companies.

IF YOU WEREN'T DOING THIS JOB, WHAT JOB WOULD YOU BE DOING?

If I wasn't doing this job, there are plenty of other things I could be doing such as marine biologist (my initial thought when I was younger), wine connoisseur (I have qualifications with the WSET), or something to do with horse racing, not necessarily in that order!

SO DID YOU WANT TO BE A JOCKEY?

Unfortunately, my days as a jockey never actually started after I hit 6 feet 5!



CHRIS IN THE LAB