Uranium Glass

By Barrie Skelcher

To the general public the word uranium is synonymous with nuclear weapons, nuclear power stations and radioactivity. But the term uranium glass, to the collector, will always be associated with that oily, yellow-green, transparent medium known colloquially as Vaseline glass. However, this is only part of the story.

The chemistry textbooks tell us that uranium was discovered by the German chemist, Martin Heinrich Klaproth, in 1789, which is perhaps a simplification of the truth. The element was named after the planet Uranus and what Klaproth reported to the Royal Prussian Academy of Science in that year was uranium oxide, which he had separated from the heavy, black mineral known as pitchblende. The element itself was not isolated until 1841, but this did not stop it from being used in glassmaking.

The chemistry of uranium is somewhat complex as it has several valency states. It is also amphoteric, being able to act as either a base or an acid. Hence we can have such compounds as uranium nitrate or sodium diuranate. This must have made life somewhat bewildering for the early 19th century glassmakers, especially as the chemists of those years had only a very crude understanding of molecular compositions.

Plate 1:
Selection of late 19th and early 20th century wineglasses, all coloured by uranium.

Perhaps this is why in the surviving batch books of those days we find such loose terminology. For example in a Whitefriars batch book of 1832, on the same page we see the terms "Saltpetre" and "Nitre" used in adjacent recipes when they were in fact the same compound, i.e. potassium nitrate. In other books we see recipes using the term "lead", "litharge", "red lead" and even "lead or litharge". We now understand that these are not the same compounds; while litharge contains about 93% lead, red lead may only have as little as 90% of the element. Much the same applies in the early recipes to uranium. Sometimes the word is "uranium"; at other times it is "uranium oxide". Will they be referring to U_3O_8, which predominates in pitchblende, UO_3 that occurs in becquerelite, "uranium yellow" which is an intermediate stage in the processing of pitchblende and is sodium diuranate, or even orange uranium, which is potassium diuranate? The percentage of the element uranium in these will vary from as much as

85% to 64%. All this adds to the areas of uncertainty as we unravel the use of uranium in glassmaking over the past 150 years.

But who first thought of using uranium to colour glass? Some authors give the honour to Josef Riedel at his glassworks in Bohemia in the 1830s. It may be that he was the first to produce uranium coloured glass in quantity with his Annagrun and Annagelb - green and yellow glasses named after his wife - but it is unlikely that he was the first to add Klaproth's discovery to sand and alkali. We know from records held by the Museum of London that Whitefriars used uranium colouring in 1836. There is good reason to believe that the British scientist, William Vernon Harcourt, started experimenting with glass compositions in 1834. He did not publish his work but it would appear that by 1861 his work had included uranium. There are reports of a uranium glass beaker cut with a portrait of the famous German poet and dramatist Friedrich Schiller. He died in 1805 and it is thought this beaker commemorates the 20th anniversary of his death, as it is inscribed with the date 1825. Between 1800 and 1809, Thomas Cock, brother-in-law of P.N. Johnson of Johnson Matthey, working at the laboratory of William Allen at Plough Court in Lombard Street, studied the extraction of uranium oxide and its application to the colouring of glass. An early English reference to uranium in glass also comes from C. S. Gilbert's Historical Survey of Cornwall (1817). He devotes sixty pages to Mineralogy and Mining and mentions a number of elements used in glass manufacture. With regard to uranium he states: "Its oxides impart bright colours to glass, which are, according to the proportions, brown, apple green, or emerald green". From all this we conclude that the colouring properties of uranium were known early in the 19th century, but it was not until the second quarter of the century that it was marketed.

Notwithstanding the foregoing there are suggestions that uranium was used by the Romans. The story revolves around a find near Naples in 1912. A sample of a green Roman mosaic was brought back to England and analysed at Oxford University. It was reported to contain uranium. For a more detailed account, the reader is referred to Caley's Analysis of Ancient Glasses, 1790-1957, A Comprehensive and Critical Survey, Corning Museum of Glass, Corning, New York 1962. There are good reasons for suspecting the findings of the Oxford scientists to be fallacious. For example, if uranium oxide had been deliberately used by the Romans, from where would they have obtained it? It is hardly likely that a budding Roman geologist, after globe trotting round the world, clutching a bag of strange earth, would have rushed up to the glassmaker as he was about to make the melt for his tesserae and say "hey, try putting this in your mix". If that did happen, why was it not repeated and how come the discovery was lost for the next two millennia? Until the measurement is repeated, I remain sceptical about this claim.

My opinion is that it is unlikely that any one person invented uranium glass. The most likely explanation is that various scientists and glassmakers explored the use of uranium in the early part of the 19th century, and that during the second quarter of the century some items made from coloured uranium glass were being produced for sale.

It is difficult to know just how rapidly the interest in uranium glass developed. From the samples I have studied, most of which are subject to my own dating, I am of the opinion that it did not gain popularity until the last quarter of the nineteenth century and was then used by most glasshouses until the start of the Second World War. However there is an interesting note in the Pottery Gazette and Glass Trade Review (September 1891) which states that "fifty years ago it (uranium) was first used in glass and we think then it was new, or at all events a scarce mineral, and our older readers will remember the rage 'canary yellow' had at that period in hock glasses, toilet bottles, etc. Amongst the early makers of this colour in glass were Hawkes and Bacchus & Green, who priced it at 3s. 6d. per lb. It was then only made in transparent glass; now we find it in semi-opaque and ivory body, but like everything in fancy glass it has had its day and is seen no more". This latter comment is a little hard to accept as Davidson's were at that very time producing their popular Primrose Pearline. Perhaps the writer was ignoring the cheaper press moulded products made for the masses! Nevertheless, deducting the fifty years brings us back to 1841, which is only a few years different from what the other sources indicated.

As I will describe later, there are many examples of uranium being used in both pressed and blown glass, in green, amber, yellow and other colours right up to the start of the Second World War. These were from large glasshouses such as Walsh-Walsh, Thomas Webb, and Bagley.

It seems likely that during the war there was a moratorium on the use of uranium. Anyhow, the glass producers were on war work rather than producing fancy goods. There is considerable evidence that uranium was used in the UK after the war but probably nothing like to the extent of its pre-war deployment. I have seen a number of examples of Bagley's design registration 849118, which was not registered until 1945, and these have all contained uranium, albeit at relatively low levels. I also know that Plowden and Thompson in conjunction with Thomas Webb were using uranium to produce borosilicate tubing for

Plate 2:
Group of late 19th and 20th century glass, all containing uranium
except for the sailing boat on the right.

French neon light tubes as late as the 1970s. Nazeing produced an ashtray in the 1950s or early 60s, which contained about 0.28% uranium by weight. Uranium was also being used abroad, and I have found lampshades made in France in the 1980s and pieces of Fenton Burmese (USA) as re-cent as 1994.

One advantage of collecting uranium glass is that it is easy to detect. Without recourse to sophisticated analysis techniques, there are two ways the collector can confirm the presence of uranium, although neither is absolutely foolproof. Used together they must provide a level of certainty, which would be highly acceptable in any antique assessment.

Uranium responds strongly to ultra-violet light. This is especially so for the wavelengths close to those of visible light (near region), and lamps producing UV in this range are easy and cheap to buy. It some-times goes under the name of "black light" and is not uncommonly used for stage effects. A 150-watt bulb used for this purpose will cost about £35.

Plate 3:
The same group of glass as seen in plate 2, but shown under UV light. This illustration shows how different metals respond to UV light. The sailing boat on the right, which responds strongly, is the only item which contains no uranium! The dark amber wine on the left hand side has twice to three times the uranium of any of the other items, yet hardly responds at all! The small Burmese hand vase, which is from Fenton, responds more strongly than the piece of Webb's Burmese even though it contains only about half the uranium.

It is also used for checking "invisible marking" and the small torches used for this purpose are readily avail-able for around £15 - £20. When exposed to such light the uranium glows with a very characteristic ghostly green colour, which, once seen, is easily recognised again (Plate 3). There are three problems with using UV light. The first is that it cannot be used in bright "visible" light as this swamps the fluorescence. Secondly, in some glasses, especially those with a high lead content, the fluorescence is so weak that there is an element of uncertainty. Thirdly, I have found examples of modern glass with yellow fluorescing agents, which glow much the same as uranium. The other method is by the use of a Geiger counter or other suitable radiation-detecting instrument. This again is not foolproof for there are other sources of radiation, which might confuse an instrument. However, the likelihood of this happening can be greatly reduced by careful selection of the instrument. I have found an end-window, beta-sensitive Geiger counter suitable for this work. Its sensitivity is such that when presented to a packet of sulphate of pot-ash fertiliser, it reads

one count per second on a scale of one to five. A combination of both methods gives a very high degree of confidence.

There are a number of methods available for estimating the uranium content of glass. Probably the most accurate is by chemistry, but this requires a small sample to be destroyed and is not available to the ordinary collector. Another is by gamma spectrometry. Although the measurement itself is simple and non-destructive, the equipment is very expensive and technically specialised. In the 1970s some work with gamma spectrometry was reported by Murray & Haggith (Journal of Glass Studies, Corning Museum of Glass, Vol. XV, 1973), but the technique is not generally available to the collector. As an alternative, I have used a beta-sensitive Geiger counter. It enables an estimate to be made of the uranium content of glass, which, although lacking the precision of the other methods, is probably within the variation of the mixes in the earlier days. It is non-destructive and can be used almost anywhere at any time.

The measurement is based on the "infinite depth" method and assumes that the sample under consideration is so thick that any increase in the thickness would not increase the reading on the counter. (Beta radiation is not very penetrating and is easily absorbed by matter. Consequently if we take a material which has a beta radioactive element evenly dispersed with in it and we measure the radiation at its surface, as the thickness increases, the radiation will at first increase but then tail off to a constant level. This is because the radiation originating in that part of the material, which is furthest from the surface, will all be absorbed before it reaches the surface.) In the case of glass this is probably only a millimeter or less, a thickness which is exceeded on most glass objects. However, caution has to be observed when the uranium layer is cased and very thin, as the "infinite depth" may not have been reached and any measurement will lead to an under-estimate of the uranium concentration.

The Geiger counter is calibrated against a source of known strength, which is also at infinite depth, and from there on it is a matter of simple proportion. Ideally the calibration source should resemble the nature of the test sample as closely as possible. Hence it is better to calibrate against a glass whose composition is known. These are not easy to find, although the Thomas Webb Sunshine Amber formula is published, as is the formula for their Eau de Nil and Bristol Green (see S.R. Eveson Reflections - Sixty years with the crystal glass industry, Glass technology Vol. 31, 1990). Both these glasses were made in the 1930s when chemical control was reliable and they can therefore be used for calibration. Nevertheless, it is best to take an average of several samples that are unlikely to have come from the same batch. For example, if the average of a number of readings from pieces of Sunshine Amber were "20" on the Geiger counter, then a reading of "1" on the Geiger would

indicate a uranium concentration of 1.1% divided by 20, i.e. 0.055% “U” by wt.

An alternative method of calibration is to use naturally occurring potassium, which is readily available in the form of potassium chloride or potassium sulphate. The specific radioactivity of these is 14.4 Bq/g and 12.4 Bq/g respectively, but this would then measure the uranium content in terms of its radioactivity rather than its weight. The percentage weight could then be obtained from the specific radioactivity of natural uranium. A problem with using potassium is that the energy of its beta ray is significantly different to the average from uranium and such a calibration could have a built in error. For this reason I have relied on calibration by known glass concentrations but used potassium as a standard against which to check the consistency of the instrument. In my use of the Geiger counter I consider the uranium estimates are within the range of +/- 15%.

I am often asked “is uranium glass safe?” The short answer is “probably yes” but it needs qualification. First of all nothing is absolutely safe in this life; there is always an element of risk in whatever we do. So long as we are alive we are vulnerable; it is a fact of nature. Only if by the term safe we mean as safe as all the other risks we willingly accept in every day life, such as driving a car, flying in an aeroplane, travelling on a train, eating an orange etc., is the answer “yes”. In terms of absolute safety there may be some very small risk. It is not possible to be sure because scientists are not unanimous about the effects of radiation at very low levels. Some, and it is the official view, say that with all radiation there is a risk of biological damage, which could lead to a cancer. A minority take a different view and point to a substantial amount of evidence, which suggests that a very low dose of radiation may have net beneficial health effects. The only thing we can be sure about is that, if there is a risk, it is a very small one. At the levels of uranium that I have found, with possibly one exception, the risk is probably so small as to be undetectable. The exception is with items where the uranium con-tent is several % by weight and the item, perhaps a piece of jewellery, is likely to be in contact with the skin for (say) 20 hours per week, throughout the year. In this case the radiation dose to the skin could exceed the current control levels, but not by a lot!

Why was uranium used to colour glass? If it had not been discovered until 1998 the probability is that it would not have been used at all. With possibly one exception, all the uranium colours that I have come across I have also seen in non-uranium glass. The chemistry of uranium is complex. It is has several valency states and can be either basic or acidic when forming salts. It is these properties, which enable it to give different colours according to the chemistry of its host glass. Green may be due to the four-valency state and yellow to the six-valent complex uranyl ion. (It

is reported that trivalent uranium in aqueous solution gives a claret colour but I have not discovered this in glass). Literature tells of red and black glass produced with uranium but I have not yet found any examples.

Back in the early 1800s uranium provided the glass-maker with new possibilities. The golden transparent yellows with their slightly oily look were then new and exciting. The greens of uranium often had that extra bit of life and sparkle, more so than the greens produced by iron. These were the new Annagelb and Annagrun of Bohemia and the Topaz of England. No doubt having discovered a new colouring agent, glassmakers started experimenting with other possibilities leading to the ivories, ambers, turquoise and Burmese. But why do we find uranium in the very pale, almost white, opaque glasses? Why do we find it in some of the lifeless greens of the depression years that are indeed difficult to tell apart from their non-radioactive alternatives? The answer was suggested by the late Dr Sheilagh Murray. It lies with the response of uranium glass to ultraviolet light. Before the days of cheap and readily available electricity for the modern lighting of today, folk would sit in their rooms with curtains open extracting the last from the twilight. Under such conditions the ultra violet part of the spectrum increases with regard to the visible light component. The result is that uranium glass gains a ghostly glow of its own. This is easy to ob-serve in an unlit modern living room, but perhaps more dramatic is the effect as darkness starts to fall over the traders' tables at Newark and other antique fairs. In the last few minutes before the plastic sheets cover the outside displays, stop and survey the scene. Each item of uranium glass will stand out significantly from its non-uranium containing neighbours.

But we also find uranium in colours where there appears to be no rational explanation. For example, it has been used in the reproduction dark green "Georgian" glass, made in the 1920s and 30s. Why was uranium used by Webb, Walsh, Stevens & Williams and others as the inner casing of items where its attraction, if any, cannot be seen? Uranium was an expensive component, so why use it where it appears to add nothing to the product? The relative cost of uranium can be judged from a recipe book from the Coalbournhill Glassworks, Stourbridge, dating between about 1860 and 1877. It indicates that in a formula for opaque yellow the uranium would have been nearly 60% of the total material cost! I have no answer but can only guess that perhaps, over the years, it had gained a personality of its own and that glass-makers, in their conservatism, were reluctant to relinquish its use.

To the collector, perhaps the most popular form of uranium glass is the Primrose Pearline produced by Davidson at the end of the nineteenth century (Plate 4). For a time it became a major prop in their business.

Plate 4:
Primrose Pearline cream jugs by Greener (left) and Davidson (right), late 19th century. The Greener jug has the design registry no. 262018 for 16th September 1895. The glass is nearly identical
in both density and uranium content.

The melt not only contains uranium but also arsenic. The latter caused the glass to turn milky/opaque when re-heated at the furnace. Although they held a patent, there is evidence that other manufacturers copied the process. I have examined sixty examples of Davidson's Pearline glass; the average density is 2.53 g/cc with a range of 2.49 to 2.57 g/cc. This represents a variation of only 3%. It is interesting to compare this with their clear glass of about the same period, which is lower by about 0.06g/cc with much the same range. I can only speculate that the presence of the uranium has caused this small difference. Unusually I find a wide variation of uranium concentration, varying from 0.22% to 1.36% by wt. This is far more than would occur by random or even poor batch control. Moreover, in terms of colour intensity, items range from a pale to a deep primrose. I observe that the palest items have a uranium content of between 0.22% - 0.28% by wt. There then follows a jump to 0.5%, which ranges up to 1.36% uranium by wt. I can only speculate on the reason for this. Perhaps both pale and deep colour products were sold over the same period, but with the uranium content of the deep primrose being reduced to give a cheaper alternative.

Davidson also produced this yellow in transparent colour. I have examined examples that probably date between 1910-1920. Their uranium content is about 0.74% by wt and they have an average density of 2.49 g/cc. Unlike other glasshouses, Davidson appears not to have used uranium in other colours. A large number of greens, including all those on display at the Davidson's Glass Exhibition at Shipley Art Gallery in 1993, have been examined. Only two items were found which contained significant amounts of uranium, i.e. 0.03% by wt & 0.11% by wt. They are a grapefruit dish and a piano insulator. Neither of these was marked but they were identified from catalogues dating between 1928 and 1940. It is difficult to see why, having not used uranium in the bulk of their greens, they should use it for just a few items. Perhaps these were not produced by Davidson but by some other glasshouse from Davidson moulds. We do know that the Nazeing Glassworks did acquire some Davidson moulds and that Nazeing also used uranium after the Second World War. Again, it is a matter for speculation.

The other major glasshouses on Tyneside also used uranium extensively. Greener appears to have made an equivalent of Davidson's Pearline, despite the patent. Examples are few and far between, but I have examined one item with the Design Registration Number 262018 (Plate 4). This identifies it as being from Henry Greener & Co., 1895. With a density of 2.53 g/cc and a uranium content of 0.62% by wt. it is indistinguishable from Davidson's Primrose Pearline.

Plate 5:
Glass by Jobling of Sunderland from the 1930s: jade green bowl
(left) and green fir cone plate (right).

Greener, and later their successor Jobling, used uranium for other colours. Two of the original Greener notebooks are in the possession of Sunderland Museum and Art Gallery. These suggest that up to the 1880s uranium may only have been used for the production of green glass but this is by no means certain. The colours Topaz, Canary, Gold Yellow and Primrose, made by using uranium, are mentioned after 1885. However I have found three Greener items in yellow, with Design Registrations between 1867 and 1870. Their densities range from 2.56 g/cc to 2.64 g/cc and the uranium content from 0.19% to 0.26% by wt. It is quite possible that these items were made after 1885 from earlier moulds. Unfortunately I have not yet come across a uranium green of the 1860/80 period.

Plate 6:
Pressed glass by Sowerby of Gateshead, late 19th century: dolphin bowl in
giallo vitro-porcelain (left)
and Queen's Ivory bowl (right).

By the 1930s, now trading as Jobling, the company used uranium in their green and jade non-Pyrex glass (Plate 5), but I have not found any yellow examples. Baker & Crowe in A Collectors Guide to Jobling 1930s Decorative Glass give a formula for the Jade which I would expect to lead to a glass of about 2.60 g/cc density and 0.28% uranium by wt. This is consistent with the few measurements that I have made on their Jade. However the Jobling clear and frosted green appears to have a lower density of about 2.47 g/cc and a uranium content of 0.13% by wt.

Sowerby, like their Tyneside competitors, also used uranium. During the latter part of the 19th century they appear to have used it in both green and yellow glass, but the only examples from the 1930s I have found are green. With regard to their 1880's wares, the yellows have a uranium content of between 0.25% and 0.5% by wt. I have examined only two

green items and, although one was much deeper than the other, they had a uranium content of about 0.37% and 0.43% by wt. respectively. Perhaps the most interesting is their "Queens Ivory" range (Plate 6). Sowerby patented their mix, which had 24 lbs of "uranium" in 14 cwt of batch. Allowing for uncertainty about what is meant by "uranium", this is consistent with the measurements I have made. Nine samples lie between 0.93% and 1.24% uranium by wt., but two other pieces have only about 0.65% uranium by wt. It is difficult to explain these variations unless Sowerby found they could reduce the uranium without prejudice to the colour, which in any case appears to vary in shade. I have also examined one item, which is much more yellow that of the usual Queens Ivory, which I take to be their "giallo" (Plate 6). Strangely, its uranium content is 1.1% by wt., which is in the middle of the range I find in Queens Ivory. It would seem that the deeper colour is not obtained by higher uranium levels. Unusually for Sowerby glass, the density of this glass is 3.20 g/cc (compare 2.52 g/cc for Queens Ivory), which suggests it is loaded with lead or, more likely, barium.

Plate 7:
The pressed candlesticks closely resemble items in the Molineaux Webb pattern book and almost certainly come from that glasshouse.
The knife rests are probably also Molineaux Webb as their density is very similar to other Molineaux Webb items.

The Lancashire glasshouses were probably using uranium before the large Tyneside producers. A surviving pattern book from the Manchester firm Molineaux Webb & Co suggests that that the company was producing pressed glass at least by 1851. I have examined six pressed candlesticks, which are illustrated therein (Plate 7). They are all yellow bordering on amber and their uranium content lies between 0.43% and 0.56% by wt. Their densities are 3.3-3.4 g/cc, which probably means a lead content (or possibly barium) of 35% or greater. Other, non-uranium glass from this company, which I have examined, suggests that in the 1860-1880 period the density of their glass was about 2.8-2.9 g/cc. I think it likely that lead content was reduced over the years to keep production costs competitive, in which case the higher leads represent the earlier glass. Almost certainly these candlesticks are not typical of the bulk of Molineaux Webb glass. I have only been able to examine a few items of uranium glass, which I consider, probably originated from this glasshouse in the 1860-1900 period. One is a pale yellow candlestick with a density of 2.68 g/cc and uranium of 0.26% by wt. The others are four green knife rests, all of the same pattern (Plate 7); their densities range from 2.73-2.96 g/cc and uranium from 0.25% to 0.37% by wt.

Several catalogues from Percival Vickers & Co. have also survived and these, together with design registrations, have enabled me to identify some of their products. As with Molineaux Webb, I think it is likely that the early Percival Vickers glass had a high lead content giving densities greater than 3g/cc, but between the mid 1860s and 1900 the density was about 2.80 g/cc with a range of 2.65 - 2.90 g/cc.

Plate 8:
Centre: pressed tumbler by Percival Vickers, Manchester, illustrated in an 1881 catalogue, but probably earlier in date because of its high density.
Right: piano foot registered by Percival Yates and Vickers for Thomas Dawkins 1859. Left: piano foot in same design but unmarked.

Two items I am confident come from this earlier period are a piano insulator and a tumbler (Plate 8). The former (Plate 8, right) is green, has a density of 3.00 g/cc and a uranium content of 0.22% by wt. It bears a diamond registry mark equating to registration 120613, 8th July 1859.

The deposition states: "Made and Registered by Percival, Yates, & Vickers for Thomas Dawkins, Little Warner Street, Clerkenwell, London". From this it would seem that the original article was made by Percival Yates & Vickers but raises doubts as to who owned the moulds. The matter is significant, as I have examined several other examples of this design. These do not have the diamond registry mark on the underside but a pattern of either concentric rings or small squares (Plate 8, left). The density of these was 2.52 g/cc and they had a uranium content of 0.25%-0.28% by wt. I have also seen this pattern portrayed as made by the Crown Crystal Glass Company in Australia! There must surely be some doubt as to whether these un-marked piano insulators were made by Percival Yates & Vickers. If they were, then it was probably from resurrected moulds in the 1890s, which may then have been sold to the Australian firm. The tumbler is illustrated in an 1881 catalogue. It is in yellow and has a density of 3.16 g/cc. This, together with the quality of the moulding, leads me to consider it is older than the catalogue and probably dates from about 1860 or even earlier.

Plate 9:
Left: opalescent swan posy holder by Burtles Tate, Manchester, design registry no. 20086 for 8th January 1885.
Right: lion paperweight by John Derbyshire, Salford, Manchester, design registered July 3rd 1874.

A number of other items, which appear to be from Percival Vickers, have also been examined. Some are press moulded and some blown. They were probably made between the late

1860s and 1880s. Their densities are generally between 2.60 and 2.90 g/cc. and the colours green and yellow. The uranium contents vary considerably from 0.15% to 0.37% by wt. No doubt the other Lancashire glasshouses also used uranium, but I have little information on them. A Burtles Tate & Co. yellow opalescent swan (registry number 20086) has a density of 3.29 g/cc and uranium content of 0.25% by wt. A John Derbyshire green lion paperweight with diamond registry mark for July 3 rd 1874 has a density of 2.73 g/cc and uranium content of 0.26% by wt (Plate 9).

Plate 10:
Group of Burmese glass, Thomas Webb & Sons, Stourbridge, late 1880s.

The Midland firms, better known for their blown lead glassware rather than press moulding, used uranium extensively. Here it was not only used in single coloured items but also in tinted and cased glassware. Thomas Webb & Sons is perhaps the best known and best documented. Eveson, in his Reflections, gives us a number of formulae utilising uranium that were used by this firm in the 19th century and three for the 1930s. The earliest uranium formula that Eveson has found comes from the 1880s, but it is likely that the element was used well before. Uranium is the colouring agent used in Webb's Ivory, and, in several examples that I have examined, the measured uranium content is consistent with the formula quoted by Eveson. Perhaps the best known of Webb's products from the late 19th century is their "Burmese" ware (Plate 10) made under licence from Fredrick Shirley's Mount Washington patent. According to published formulae it should be possible to differentiate between the Webb and Mount Washington products by their densities and uranium con-tents. I would expect the Webb's product to be less dense, about 2.75 g/cc (compare 2.85 g/cc for Mount Washington), and to have less uranium. The formulae quotes "uranium oxide" but I consider it more likely that the uranium was a diuranate, as this would correlate better with my measured results. In this case Webb's Burmese will have about 0.5% uranium by wt. compared with Mount Washington's Burmese of 0.7%.

Plate 11:
The standard colours from

Thomas Webb's Gay Glass range from the 1930s: Sunshine Amber (left), Bristol Green (centre), Eau de Nil (right).

In the 1930s Webb's produced three standard colours using uranium: Sunshine Amber, Bristol Green, and Eau de Nil (Plate 11). These must have been made in considerable quantities, for examples are not difficult to come by at present day fairs. The uranium was in the form of potassium diuranate, and, neglecting the loss of water on fusion of the mix, the published formulae equate to uranium contents of 1.15%, 1.16% and 0.23% uranium by wt. respectively. I consider that the marked items of these colours are sufficiently reproducible for them to be used for Geiger calibration.

Stevens & Williams, now Royal Brierley Crystal, used uranium in both the 19th and 20th centuries. They may have begun using it as early as the late 1840s. I have examined several pink, where it is ivory and where it is even white (Plate 12). By the 1930's they, like Webb, were using uranium in green and amber. I have not examined a sufficient number of greens to draw conclusions about the amount of uranium present, but their ambers are darker than Webb's and have about twice the uranium content, i.e. about 2.80% by wt.items from the 1880's era where the uranium glass is cased with

I have no idea when the Birmingham firm of John Walsh-Walsh first used uranium and have experienced considerable difficulty in identifying their early products. The firm was established in 1851, so it could have been amongst the early users but I have no evidence of this. An advertisement in the Pottery Gazette and Glass Trade Review for November 1883 shows some of their wares in "Crushed Strawberry" and "Electric Blue". On the basis of this I have attributed several items in the "crushed strawberry" (Plate 13) and possibly one in the "electric blue". These items are made of at least two layers of metal and the uranium is not in the prominent strawberry or blue! They are examples of where expensive uranium glass has been used unnecessarily. The density of these items is about 3.2 g/cc or even greater. It is difficult to estimate the uranium content. It is not usually possible to present the full surface of the Geiger tube to the uranium layer; furthermore, this layer is probably not sufficiently thick to be of infinite depth. With these caveats I estimate the uranium content to be about 0.7% by wt.

Plate 12:
Cased vase with applied acanthus leaf decoration, probably Stevens and Williams, Brierley Hill, late 19th century. The uranium is in the white opal outer casing. Unusually for this glasshouse the density is only 2.5 g/cc.

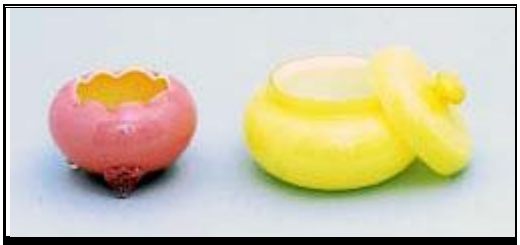

Plate 13:
Glass by John Walsh Walsh of Birmingham. Left: posy bowl in crushed strawberry colour, 1880s,
density 3.2 g/cc; it is not clear whether the uranium is only in the
inner casing or also in the pink. Right: powder bowl in primrose yellow, 1920s, density 3.2 g/cc. The uranium is only in the outer yellow casing.

On the basis of items illustrated in advertisements I have concluded that Walsh also used uranium in the 1920s and 30s. Their "Primrose" glass (Plate 13) is comprised of an inner layer of white and an outer layer of a bright primrose yellow. This contains uranium and, despite being a lead glass, responds moderately to UV light. Not all such uranium bearing items should be attributed to Walsh. I believe that Stevens & Williams also made this type of product. The densities are usually 3.2-3.3 g/cc; the uranium, again difficult to estimate because of the lack of infinite depth, is about 1.1% by wt. From examples which I have attributed as Walsh Pompeian glass, it appears that both the green and amber contain uranium, at concentrations of about 0.3% and 0.6 % by wt respectively. An iridised amber sweet dish, signed "Walsh England", has a density of 3.28 g/cc and uranium level of 1.1% by wt.

No review of uranium glass could be complete without including the London glasshouse, Whitefriars, which was acquired by James Powell and Sons in

1834. As far as I can establish, it was the first in the country to use uranium in commercial manufacture. The Whitefriars archives, held by the Museum of London, record that in 1836 some silver mounted candlesticks with prismatic drops of uranium Topaz glass made by Whitefriars were presented by Lord Howe to Queen Adelaide. The following year Whitefriars made twelve finger bowls and twenty-four hock glass bowls for use at the 1837 Corporation of London Banquet for Queen Victoria (Plate 14). I have had the opportunity to measure the uranium level in three of the bowls. The results are consistent with the formula in an early Whitefriars batch book. It is likely that Whitefriars used uranium to produce other colours and shades, but the only one I have identified is their pale straw opal items where I estimate the uranium content to be about 0.1% by wt.

Plate 14:
Uranium "topaz" finger bowl and ice plate from a set of twelve made for Queen Victoria's banquet at the Guildhall in the City of London on 9th November 1837. The glass and ceramics for this occasion were supplied by the Staffordshire firm, Davenport's, but it is likely that the finger bowls were made by James Powell and Sons.

Unfortunately density and uranium concentrations are not like finger-prints and cannot be the sole method of attribution, but they can provide supporting evidence where a specific regime has been established. A very good example of this is with Burmese. It is not unknown for the unscrupulous to grind off the "Fenton" signature and then try passing it off as Webb's. A density measurement will soon establish the difference. Another example concerns the 1930's reproduction "Georgian" glass. Examples can be found in Hill Ouston catalogue of 1934. The imitations are very good, even to the rough un-ground pontil mark, although in the case of wines the use of the foot-board to form the foot is a give away. I have examined several dark green goblets in this category and found them to contain uranium!

The foregoing represents only a brief synopsis of uranium coloured glass. Many examples can be found but most are un-attributable. To give some idea of the availability of uranium glass I would say that, on average, at the typical small antiques fair with, say, thirty tables, there are likely to be one or two pieces in uranium glass. Typical items include wine-glasses, bowls, vases, salts, piano insulators, paperweights, seals, knife rests, candlesticks, ashtrays, drawer knobs, lamp bases, lampshades, and even label moisteners. If an object has been made in glass, then the likelihood is that somewhere, sometime, someone will have made it in uranium glass. The problem is knowing what to collect.

Article by Barrie Skelcher (1998).

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All photographs are from the author’s collection with the exception of Plates 10 and 14, which have been supplied by courtesy of Broadfield House Glass Museum, Kingswinford.

Further Reading

A more detailed account of Uranium Glass can be found in Barrie Skelcher's book, entitled “The Big Book of Vaseline and other Uranium Glass”.

The book is published by Schiffer, USA (ISBN 0-7643-1474-2).