SALTY COMMENTS #7

(Observations and opinions on open salt dish collecting)

At first we thought it would be simple. If you want to make colored glass, it would be like making frosting for a birthday cake - you use red coloring to make red, mix it with blue to get amethyst, and so on. As we should have suspected, it is far from being that easy. Making desireable colors in glass turns out to be an art, and those that know how to do it well are highly regarded in the glass business. The actual formulas they use are trade secrets; the only ones we could find were from old glass companies long since out of business.

Our rude awakening came in the Corning Museum Library. We asked for books on how colored glass is made. They had only one that really addressed the subject. It went into considerable technical detail, which used all of our limited knowledge of chemistry and physics. We will try to pass on the gist of what they said, keeping away from the spectral diagrams and details about valence states. For those of you who might like to explore further, the book is listed in the references below.

To begin with, defining a color is a problem. The word "red" is adequate when talking about the stop light at the corner, but it is not at all sufficient to distinguish between varieties of roses. The experts say that the human eye can distinguish about 10,000 different colors. There is certainly no vocabulary which can handle that large a grouping. Instruments can do the job, but they are well beyond the financial and technical reach of collectors. We have to be content with published color pictures to communicate, or with widely recognized terms like cobalt blue or cranberry.

We found a simplified list of glass colorants for lead crystal glass in the Rockwell Museum at Corning. This is a good starting point for understanding colored glass, but remember that red is not always red is not always red:

COLOR	COLORANT
White	Tin oxide
Blue	Copper oxide, Cobalt oxide
Green	Copper oxide, Iron oxide
Purple	Manganese dioxide
Yellow	Antimony, Cadmium sulfide
Brown	Iron Oxide
Red	Cadmium sulfide or selenide
Ruby	Cadmium & zinc sulfide or selenide.
Ruby	Gold

These turn out to be only a few of the materials that are used or have been used in the past. Green, for example, can be made with chromium oxide (emerald green), copper oxide and magnesium dioxide (stop light green), black copper oxide and uranium oxide (apple green), as well as red iron oxide (Coke bottle green) and black copper oxide (blue-green) which the list shows. In addition, little details in making a batch of glass, such as temperatures, barometric pressure, heating rates or excess air in the furnace can change some colors and make it hard to get exactly the color you are aiming for.

One of the most interesting materials for coloring glass is gold. Although it is expensive, it only takes a little to make a lot of color. The most expensive formula we saw called for about $5 worth of gold (at today's prices) per pound of glass. This would make a deep red color - probably not much different from that made with cheaper materials. When used in thin layers, however, it makes the cranberry glass we know so well. We had a chance to see some of this being made in Corning at a local glass shop. A

small disk of the gold glass, about the size of a quarter, was picked up by the glassblower on the end of his pipe. He softened it and picked up a large glob of clear glass on top. He then made the dish, in this case a vase, and it came out as cranberry glass. If the design of a dish is right, it is very hard to tell that it is "cased" and not solid pink. We now are looking very hard at all of the cranberry glass we see, and find that at least 90% of it is made this way. One of our salts that we would have sworn was solid cranberry turned out to be mostly clear with a cranberry liner when we set it in a white bowl filled with water. If you have any cranberry salts, you might want to make the same test. Remember, however, that being "cased" does not diminish the value of a piece, since this is the only way things like this can be made.

One interesting property of gold in glass is that it requires reheating to develop the red color. This was used in the early "Burmese" and "Peachblow" colors that are so valuable today. Burmese was made with feldspar and fluorspar (to make it opaque), uranium (to give a yellow color) and gold (about 1/10 ounce per 184 pound batch), and came out with only the opaque yellowish color showing. Reheating the upper part of the dish developed the red color there, giving the shading from one color into another that is characteristic of this glass. Peachblow was made the same way, except that uranium was replaced with another colorant. The uranium, incidentally, is used even today to make the "vaseline glass" that shines so vividly in the sunlight. It looks even more striking at night under a "black light" bulb. It is the same chemical element that goes into nuclear power plants and atom bombs, but the amount needed in glass is so small that it is harmless. Besides vaseline glass, uranium has been used as a colorant in some of the "apple green" dishes - again the black light will pick these out quickly.

A similar type of glass without the opaque coloring is amberina, where the dish is basically yellow but shades to ruby wherever the glass is reheated after forming. The original amberina was made with gold, but today's products must be made with another formula, since it is a common color and the dishes are no more expensive than normal.

Mercury glass, also known as "Poor Man's Silver", was popular around the turn of the century. It was made like a glass thermos bottle - the dish has hollow walls. They were hand blown, since there is no way of pressing a hollow-walled dish. After forming, a mixture of lead, bismuth and tin dissolved in mercury was swirled around inside the hollow to coat the walls and give a silver appearance. The excess was removed, and the hole in the bottom sealed to keep the air from deteriorating the coating. This method would not be used today because of the toxicity of mercury. We believe that today's thermos bottles are coated with silver, which is a much less hazardous process.

Early black glass was made by putting large amounts of color into the batch. You can hold the dish up to an intense light, like the sun, and see what basic color was used. We have seem black dishes that were intense amethyst, amber and ruby. Recent products use some different approach - the black is opaque no matter how strong a light you use. We have yet to learn what the colorants are. They are not used very often, however, since cleaning is difficult after black has been made, and the pot or tank often must be replaced.

Manganese is an interesting material. It is used to get the amethyst color that we see in modern dishes. In small amounts, however, it will neutralize the greenish tinge produced by traces of iron in the batch. This was a common way to make a clear crystal before 1900. When this glass is

exposed to the sun over a long period of time, however, it develops an amethyst tinge. If you look carefully at the older dishes in your collection, you will probably find several that have this. It is one indication that the dish may really be old (although it can be faked if someone wants to).

Irridescent and carnival glass are made by applying a coating when the dish comes out of the mold and is still hot. The coating is fused into the surface by the heat. Stretch glass and some art glass are also made by coating the hot piece. Titanium tetrachloride was used as a coating in the old days; this has been replaced by materials which are trade secrets.

Sometimes two pots of glass with different colors are used to get more colorful results. The slag or marbleized glass can be made this way. The gatherer will dip his punty rod into one color and then another before dropping the glass into the mold, so that a mixture of the two shows up in the finished pressed piece. With hand blowing you can use two pots to put one layer of color over another and get cased glass. In any event, you must be sure the two glasses have the same coefficient of expansion. If they don't, one will shrink more than the other when the work is cooled and you will find yourself with a handful of fragments instead of a dish.

Ruby-stained glass has been very popular in the past. This is made by painting the dish after it is formed and re-firing at a temperature which fixes the color into the surface. A yellow stain can also be made with a paint containing silver, but the color does not penetrate the surface as deeply and is not as durable as the red. It is also possible to coat the glass with various colored lacquers without firing, making it look stained. Although the result is pretty, the color is only as durable as the paint, and will not hold up in everyday use.

As you can see, there are almost as many ways of coloring glass as there are glassmakers. The variety of colors is very large - Bernard Boyd of the Crystal Art Glass Co. has produced over 100 in the 5 years he has been in business, and is making new ones on the average of one a month. We think that our collection of salts looks much nicer because of the colored dishes in it. Knowing something about the coloring process has also made it a lot more interesting for us.

Ed Berg
401 Nottingham Rd.
Newark, DE 19711

December 1985

Acknowledgement: We thank John Boyd of the Crystal Art Glass Company for his additions and corrections to this essay.

References:

Nineteenth Century Glass by Albert Christian Revi, Thomas Nelson & Sons, 1967.

Handbook of Glass Manufacture by Fay V. Tooley, Ashlee Publishing Co., NY, 1984

Introduction to Glass Science by Pye, Stevens and LaCourse, Plenum Press, NY 1972