by James Piercey





Top: AIA Triptych, 1988, overall 8' 10" x 5' 7", fabricated mostly from various shades of travertine and marble with granites and some stone from Texas

Lower: Detail of above. — Part of the interest in this piece is the overall graphic form that reads well from a distance. It draws the viewers in closer, where they can then discover fish and trilobite fossils. Another interesting detail is the varying heights of the stones, which provides a good deal of visual relief and texture. Note that the stones are cut to fit fairly tightly, as no grout is applied in the interstices in this style of mosaic. In 1980, prior to attending a Ludwig Schaffrath workshop, I bought his book (*Ludwig Schaffrath: Stained Glass* + *Mosaic*), obviously being interested in the body of work that he had done in stained glass. At that time, I was attempting to get my head around how someone could design stained glass windows for a church in which the window designs had no figures or traditional symbols. To me, most of his purely rectilinear designs seemed quite out of place in an American church.

Wow, was I educated or what? It took only to the end of the first day of class and his first lecture to decide that that was the artistic style and design philosophy that I would like to pursue. Since then, I have tried to integrate this kind of influence into my body of work just as Ken von Roenn, Guy Kemper, Gordon Huther, Dennis Harmon, Andy Young, and others have. Then, in 1983, after my first trip to Germany and actually seeing his work *in situ*, I was convinced that I should never design another window with a figure, dove, or any other type of traditional symbol.

But the reality of providing stained glass designs for most American churches finally hit — as much as you try to educate the clients, most of them still are hesitant to go purely abstract/architectural for their church's windows.

However, in studying Herr Schaffrath's book, I was equally captivated by his mosaic work. I was familiar with the typical Italian Byzantine style of mosaic, as it has been around for a couple of millennia, and there are numerous examples of it in the United States.

One of the major distinguishing characteristics of this style of mosaic is that the surface is generally in one flat plane. This is due to the materials used, the method with which the mosaics are



Studio signage, 1989, 8' 1" x 2' 1", fabricated with polished and split- faced Carrara, black slate, and Rose Aurora (polished and split). The logo is black emaille glass that provides a good contrast to the black slate. The lettering was deeply sandblasted into the stone. Intended for exterior signage, we opted to keep it inside our studio. Notice the overhead fixtures that provide oblique lighting that enhances the texture and relief characteristic of German-style mosaics.

fabricated, and the way in which they are installed. Also, since the small pieces are irregularly shaped, there are always gaps, called the interstices (sometimes small, sometimes not so small) between the tesserae. These gaps are not undesirable but rather a normal visual characteristic of this style of mosaic. In addition (and very importantly), the space allows cement to come up between the tesserae during installation. This provides for a cement bond not only on the bottom of the piece but between the sides (in the interstices) as well, basically locking the piece in place. The cement becomes the grout and adds a great deal of strength to the mosaic. A properly installed Byzantine-style mosaic is just about bomb proof!

A quick note about mosaics: the correct term for this style of mosaic is "Byzantine style Venetian Glass mosaic." Mosaics can be made of most any material; I once saw a really interesting one made of jelly beans!

A piece that is used in a mosaic is called a tessera (pl. tesserae). Usually these tesserae are types of enameled glass called smalti (smalto is the singular). Smalti are all hand cut, and there are only a very few companies that produce them – the best are from Italy.

Another type of tesserae is called marmi (marmo is singular) which are pieces of stone, usually marble. All marmi that I know of are made in Italy. Just as with antique glass for stained glass windows, there are between 2,000 and 3,000 various shades of smalti available. And because of the variations in color and shading of marble, the range of marmi is pretty much incalculable. In addition, smalti are available in 23.5 kt. gold leaf, heat-laminated between a thin and thick layer of glass. Depending on the color of the glass used, the gold smalti can vary in shades.

Typically, tesserae (smalti and marmi) average about $\frac{1}{2}$ "x $\frac{3}{4}$ " and about $\frac{3}{6}$ " thick, and they are all hand cut. In Italy, this means they are actually split or fractured from a larger piece of glass, and, knowing the characteristics of fractured glass, you can easily see that all of these pieces are fairly irregular in size. This adds to their interest. The fractures also provide a reflective surface area for light to bounce from. Most all of the glass used in the making of smalti is enameled.

Enamel types of glass reflect light. This is important, as mosaics are mounted on a very solid surface with cement, so they are opaque. Light does not pass



Detail of a 23'6" x 15'2" reredos — Our Lady of Fatima Catholic Church, Ludlow, MA, 1999. For comparison to the German style, this is a typical traditional Byzantine style mosaic executed in the indirect method, using smalti. There are approximately 325,000 smalti in this mosaic, although we did not count each one! If you consider that at least four decisions and manipulations have to be made for each smalto (selecting exact color, fitting, shaping, etc.), you can assume that this mosaic involved more than 1,000,000 separate decisions.

through smalti as it would with the transparent or translucent glass used in stained glass windows. Therefore, all traditional mosaics are viewed with reflected light, not transmitted light, as stained glass windows are.

All of the materials described above are typical in Byzantine-style mosaics. Magnificent examples of these types of mosaics can be seen at the Basilica of the National Shrine of the Immaculate Conception in Washington, D.C., in the Cathedral Basilica of St. Louis in St. Louis, MO, as well as in many small parish churches throughout the world.

I have given the above general description of Byzantine mosaics so you can make comparisons and contrasts between them and the German style of mosaic.

I most often use the term "Schaffrath mosaic" because that is whose work I

was first exposed to in this style. These types of mosaics are relatively new. Actually there are many German artists as well as other nationalities who design them and several studios that do their fabrications.

The major characteristics of these mosaics are again due to the way that they are designed as well as the types of materials used and the way they are fabricated and installed. Generally, the tesserae (although this is not a term used in this style of mosaic, probably "pieces" is as good a term to use as any) are larger. Typically they are saw-cut so their size and shape is much more precise.

Most of these mosaics are executed in various species of stone. These mosaics are assembled in the "direct" method — that means that the pieces are set onto the substrate as they will actually appear when finished. In contrast, in Byzantine mosaics, the "indirect" or "reverse" method is used, in which the cartoon is produced in reverse; the tesserae are glued to the actual reversed cartoon with a water-soluble glue. At installation, cement is applied to the "back" (or glass) side of the sections so they can be applied to the wall or substrate surface. The exposed paper cartoon is then removed, thus revealing the "right-reading" version of the design. This is a complicated installation technique but is a tried-and-true method that has lasted thousands of years.

Quite a few things excited me about Schaffrath's mosaic work. There is great rhythm and harmony in his designs and in his sensitivity of the selection of stone for execution. Because most stones can be cut very precisely, the pieces can be fitted very tightly together, resulting in very tiny or non-existent interstices. If the stones are all cut from the same stock, they will all be the same height. Or, you can cut stones into strips and then handsplit them to achieve different heights.

In my studio, we use the hammer and anvil that we used for faceted glass. Splitting stones provides a relief and texture that is another distinguishing characteristic of the German style of mosaic.

After admiring Ludwig's mosaics for several years, I decided in 1986 to see if I could figure out how to make one of my own. There were no books available on this style of mosaic, so I had to start from scratch. I had a faceted-glass window design that was a reject and felt that with some modifications, it might work just as well in mosaic because it was sort of rectilinear, had concentric types of curves, was not too organic, etc.

As our studio was heavily into faceted glass at that time and we saw-cut a lot of our pieces, we had two of those big, orange "Clipper" saws with the 14" diamond blades. Well, we found that they also cut marble pretty well! I went to a local marble supplier who let me wade through his trash pile. Since he and I kind Ascension, St. Mary Catholic Church, Johnson City, TN, 2001, 14' 6" x 20' 9". Originally the entire arched wall was to be stone. But in order to reduce the cost in the final mosaic, much of the background was eliminated, leaving only the "Celtic" cross-shaped portion. The figure is composed of sandstone for the flesh, slate for the hair, with Carrara and a red travertine in the garment. The cross shape is split-faced travertino classico; the smaller cross and halo is gold leafed, textured glass; and the halo is composed of many shades of granites and onyx.

of hit it off, he let me have anything that I wanted, for free! So I ended up with a lot of scrap tile (^{*}/_{*}" to ^{*}/_{*}" thick) as well as a lot of slab scrap, mostly cutouts from his cutting holes in countertops for lavatories! Scraps and cut-offs are great for mosaics because you are going to end up cutting them into small pieces anyway *and they were free*!

Since a strong German trait is that everything is *"in ordnung"* (in order, or the proper way), their style of mosaic depends on using pieces that are pretty much precisely cut from tile or slab. So we started cutting pieces with our *dalle* saw. The Clipper saws cut well enough, but, as they were essentially saws for cutting concrete block, bricks, etc., they were a bit of overkill. Precision was difficult to obtain because of the massiveness of the saw, the lack of precision of the table, etc.

I must interject here — I had no idea how to build a mosaic of this type, but it



was pretty intuitive, especially since we already had a saw — the major tool requirement. But pretty much all the techniques in our first prototypes were dreamed up by us. There was no book available at that time (and still isn't as far as I know) about how to make these mosaics.

We cut up a bunch of pieces of various marbles and granites. We had piles of stones all over the place. We next laid a sheet of plastic over the cartoon to protect



Untitled private residence fireplace surround, 72" x 96", executed in polished and split-faced Carrara, Italian rose, a gray and pink marble, and slate. Gold smalti provide the reflective surfaces. The mantle is split because this piece was designed during a Schaffrath class on mosaics at Pilchuck in 1988. Any time I am on the West coast, I am thinking about plate tectonics!

it and began placing our stones on it, making angled and curved cuts where necessary.

Then we had to figure out what adhesives would work and which substrates for mounting the stones to were appropriate. Three-quarter-inch plywood worked well. We just transferred the cartoon design to the plywood. But what should we use for an adhesive? Since this was an experimental piece, and, since we had a gallon of Elmer's sitting in the shop, I figured, why not?

For a first piece, it turned out well. Of course the entire mosaic was not composed of same-size squares — certainly there are times when you need a different shape or size. You can use a fine marker to draw off the shape of cut you need to make and then gradually cut it away with the saw. But you have to be careful with the marker you select because the spray of water that comes off the blade will erase just about any kind of mark you can put on the stone. We found that scoring the polished stone with an old glass cutter gave us a pretty indelible mark. Some of us mark dalles the same way before we cut or chip them; it is the same kind of technique.

We also were lucky in that Elmer's glue worked great. In fact, the next day, we wanted to change out some stones and found that the Elmer's bond between the stone and plywood was so strong that, when we tried to remove a stone, sometimes it either split or the plywood delaminated. To this day, we still occasionally use this type of glue, but, now, we use the yellow instead of the white.

We also determined that it is a good idea to use marine plywood when doing anything other than an experimental piece, as it is probably more dimensionally stable.

In 1987, the AIA had their national convention here in Orlando, so we decided to take an exhibit space. Part of the exhibit was one of our stone mosaics. By then, we had done several other experimental pieces, so this one was our first "real" one. We decided to purchase an M-K tile saw with an 8" non-segmented diamond blade. The table was much smoother in operation, the adjustable miter gauges worked well for making angled cuts, and the size of the saw enabled us to make smaller cuts more comfortably (and safely). On this piece, I decided to use some fossils that I had



Untitled installation at Heart of Florida Hospital, Haines City, FL, 1996, 11' x 8'. This piece fits into a 12' x 9' niche. It "floats" off the surface of the mounting wall. It is executed mostly in black slate, quite a few shades of various colors of marble, granite, and onyx. There are a lot of gold smalti used as "hi-lites," along with some fossils and coral. This particular piece was executed in three separate planes with about 1" elevation separating them, thus giving the piece quite a bit of mass for such a delicate and intricate design.

found in a lapidary store (also a Schaffrath technique). We also included some brass rods of various lengths. The edges of the plywood sections on any mosaic are always a problem, but we framed this mosaic with brass.

The mosaic for AIA was a triptych, with the center panel weighing about 200 lbs. We rigged a slip-joint hanging system for it and the two side panels. After the conference, it was placed in our studio, where it still hangs. Every time a visitor comes to the studio, they are visually drawn to the piece.

Another interesting characteristic of this type of mosaic, if properly designed and executed, is that, from a distance, the viewer becomes interested by the bold graphic forms. Then the viewer will be drawn in closer where they begin to notice the details — the inclusions, fossils, etc.; the varying textures and reliefs; the selection of stone (using the veining in marble can be a great design element); and the interesting cuts in the stone.

A side note: one visitor to my studio was observing a fossil in the mosaic and I, just in casual conversation, said something like, "Isn't it interesting that that fossil fish lived in the ocean about 300,000,000 years ago?" The man looked at me as seriously as he could and said, "That's what they would have you believe." Needless to say, we had an interesting conversation about evolution afterwards! In 1988, Pilchuck had Herr Schaffrath teach a class on German-style mosaics. I figured it would be a good idea to take the class just to see if the techniques I had developed in the studio were close to being right. As it turned out, they were right on, and we were quite proud of ourselves for being so clever! Also, by then, we had started getting commissions for stone mosaics. And, we had begun using mastics for our adhesives as well — just the basic tile mastic found at Home Depot, (AcrylPro Ceramic Tile Mastic, et. al.).

If you have ever taken a course at Pilchuck, you know that each class has a Teaching Assistant. If you have not taken a course, you should try to do so;



Detail of Heart of Florida piece; the nominal size of the pieces is $\frac{3}{4}$ " x $\frac{3}{4}$ ". One of the 1" elevation changes can be seen as the travertine diagonal from left to right.

Pilchuck is a great experience. The school had assigned a lady to assist Ludwig, but she became ill after about half way through the first day. Since Ludwig knew me from the two glass-design seminars I had had with him, and

since he knew I was already doing mosaics, he asked me to be his assistant!

The class had about 10 or 12 students from all across the country, including Jean Myers, a SGAA Accredited Artist/Designer. Through the next 10-12 days, we worked on mosaics. I helped each of the students and, at the same time, fabricated one of Ludwig's designs, which he gave to the Pilchuck auction at the end of the class. At the end of the seminar, as we were walking to lunch, Ludwig said, "So Jim, now you can say that you are a Schaffrath assistant." That was one honor that I still cherish!

So, just like stained glass, you want to keep your mosaic panel size at about 10 - 12 sq.ft. because of the weight and to make installations easier.

If your design is larger, say four of these panels, then you try to make a line in your design line up with the way you cut your stone and make it line up with a plywood joint. Place your plywood panels close together; then cut your stone so that when placed on the plywood, the joint fits precisely along the seam between the plywood sheets.

Or, if this is not possible, assemble all of your pieces, glue them up (except the stones that overlap the seam). Then, when installing the panels, save these overlapping pieces for last. Install them over the seam, thus hiding it. For me, it is very desirable not to see the seams in a mosaic. They should be concealed, unless, of course, they can become part of the artistic design. Sometimes we will use a less-aggressive adhesive on these overlapping stones.

It is a good idea to mark the stones that overlap the seams and mounting hardware, so that, if you have to ever remove the mosaic, you will know under which stones the screws are located. We use a Sharpie to put a small dot in the lower right corner of these stones, It goes without saying to make sure these marks are also on your design/cartoon, otherwise you could find yourself removing a lot of stones to find the ones that are over your screws.

Mosaic panels that have a plywood substrate can be mounted in several ways. For mounting into wood studs under drywall, wood screws work well. Use sheet metal screws if going into metal studs and TapconsTM if mounting on a block wall, etc. Of course, because of the weight, you need to use plenty of fasteners. We normally fit the stones precisely when we are "gluing up" the mosaic in the studio but do not glue the ones over the fasteners or joints. We number them, put them in a box, and then, at installation, we can determine which stone goes where. Install all of the panels; then put in those stones.

Every installation has different requirements. If the piece is an interior one and will never be subjected to water, then Elmer's or a mastic on plywood is a perfectly adequate technique. However, if the piece is an exterior one, then you need to use actual cement (a real Portland cement product) on a substrate such as Durock[™] cement board or a concrete block wall. Sometimes a block wall has to be prepped with a layer of cement about ³/₈" thick. We did a fountain at the University of Florida in which the mosaic is always under water, so we used cement on Durock[™], and it has held up very well for the past 15 or so years.

Occasionally, there is the need to use something stronger than the adhesives I have mentioned so far. Epoxies that work quite well are available through marble and stone suppliers; Akemi[™] is one of these. They are good for stone/stone bonding as well as stone/plywood (and other substrates). They come in different viscosities but work mostly like any other epoxy compounds. You mix the resin with a hardener at the recommended ratio and then apply with popsicle sticks, putty knives, etc.

Once mixed, they have a relatively short working life, so you are constantly mixing epoxy. They also are sort of smelly, but if you work in a well-ventilated space or wear a respirator, all will go well. The solvents, resins, and hardeners are not very environmentally friendly or healthy, so white glues and mastics are



Baptismal font, Church of the Nativity, Longwood, FL, 1995, 12' x 12' irregular, 4' tall. The shape of the font was developed in collaboration with the architect and formed by the contractor. Unfortunately the form was ¹/₄" plywood, so, of course, when the weight of the concrete was introduced, the form "blew-out." Our studio spent more than a week grinding in some places, adding concrete in other places, and attempting to get the form somewhat true before the mosaic surfacing could be applied.

The exterior is split-faced travertine. Blue and green glass tile are used to represent water. Some gold is also incorporated. The interior, or wet surfaces, are all glass. Because of the problem with the form, we were installing mosaic at 6:30 p.m. as people were taking their seats for the Easter vigil (as it was, some of the stone was temporarily applied with masking tape, which worked out well because it was the same color as the travertine!). A few years later, the piece was extended to completely surround the laminated arch and to provide a placement for the Paschal candle.

perfectly acceptable, unless the piece calls for especially aggressive adhesives.

Our working stone palette now consists of a lot of species of marble and granite. Limestones, sandstones, etc. also work well. We found a really nice sedimentary rock from Texas that splits very easily to reveal layers of really nice color from tan to brown to violet. Slate also works well, and you can easily find it in tile and in slab thicknesses. Because of its sedimentary nature, it splits easily to give some really nice surface finishes. Note: if you use slate, it can have very sharp edges after you split it. So be careful, as cuts from the edges are nasty.

In addition, slate is relatively soft. It cuts very easily but even a fingernail

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scratch will leave a mark on it, so, right after it is split, it has to be sealed. Let the sealer dry; then make your cuts. It is now protected from water marks, damage, etc.

We also use onyx. There are a lot of onyxes available in some very interesting colors. Onyx is easier to split in one direction than the other, so it is a little tricky to use but worth the effort.

Gold can also be used. Gold smalti and gold tiles are hard to find and pretty expensive, so, often, we make our own. Gold leaf on glass works almost as well as smalti, and you can make the pieces larger than those that you can buy.

Fossils (leaves, trilobites, fish, etc.) all add interest to the piece.

You can also use Emaille glass because of its reflective color; opalescent glasses, iridized glass, etc.; but remember, a German-style mosaic is more about using natural materials like stone, etc. The beauty of creating art from materials straight from the earth is important. A polished marble is okay; a sealer or color enhancer is okay, but never change the color of your stone — it is not truthful. Glass, metals, etc. are used just as details.

Of course, you can also do a mosaic entirely out of glass, using pretty much the same techniques I have described here.

I will not attempt to say much about mosaic design in this article. Remember, every shape has to be cut from stone with a masonry saw, so, in the beginning, keep the shapes and cuts simple. Byzantinestyle mosaics are better suited for representational designs, detailed flowers, faces, etc. German-style mosaics tend to be much more architectonic.

Because you will be using the direct technique of gluing up, the tops of the stones will be of different heights. If you use split-faced stone, you will also have some additional texture. This is one of the most interesting characteristics of these types of mosaics. Schaffrath's mosaics first interested me because his combinations of polished, smooth, and split-faced stone were just as exciting as the forms in the design.

To enable the viewer to better appreciate these combinations of textures, mosaics should be lighted obliquely. Flat light on the surface usually does not do justice to any mosaic, and fluorescent light is a killer. I have yet to see a really good application of LEDs for a mosaic, but I am sure, as this technology develops, this will be the way to light them.

When cutting stone on a saw or chipping, nipping, grinding, splitting the stone, be sure to wear safety glasses. Use a non-segmented blade when cutting the stone. If, when making a small and delicate cut, your finger should slip off the stone and hit the saw blade, nothing too bad will usually happen. The worst accidents (so far) we have had are slight abrasions from the diamond blade when our fingers hit it. Don't be scared of the blade, just use common sense. Your greatest exposure to injury when cutting stone with a diamond blade is by getting your finger "pinched" between the blade, stone, and the table. This can "pinch" your finger right off, so be smart, keep your fingers out of direct line of the blade, and you will be okay.

You should wear a respirator when using chemicals like sealers and epoxies, especially if you can't work out a good ventilation system for your workspace. Large slabs of stone and mosaics can be heavy, so use good lifting and handling techniques.

Basically, most of the tools and equipment that are needed to make a stone mosaic are found in the typical stained glass studio. The only extra tool that you would need is a good tile saw. These are easily rented, but their cost is not prohibitive (rentals often have very wobbly tables, which will affect your ability to make accurate and precise cuts). In our studio, we now have four tile saws. Eventually, the tables will wear out, so they will become less precise. We also have a small, lightweight saw that we take up on our scaffolding to make slight adjustments to stone, if necessary, at installation. We also have a 48" saw when we have to cut large pieces from slabs.

A lot of materials to get started with are easily available and inexpensive (scrap stone and tile and a bottle of Elmer's). We've even had a couple of ceramic tile reps drop off boxes and boxes of old, outdated samples at our studio. I don't use ceramic tile, as I prefer the beauty of natural, unadorned stone, but I generally don't refuse a gift.

Most stones used in mosaics do not require any kind of sealer. However, unpolished marble and cut marble surfaces usually have a graved-down appearance. If you go to a marble yard, often you will want to carry a spray bottle with you. When you see an unpolished piece, give it a little spritz — when the stone is wet, the colors are more pronounced. Keeping this in mind, and since it is impractical to expect the viewers of your mosaics to have squirt bottles, you might use sealers and clear color enhancers on your stone. We often use clear lacquer on our slate to protect the finish. But we do not apply it too thickly — if you do, you will end up with some unnatural, glossy, plastickylooking thing.

Use all sealers and treatments in moderation. Sometimes, we will actually lacquer slate (it will look unnaturally glossy), let it dry, and then do our cutting and shaping. By doing this, the stone is protected from scratches, etc. Then, when we are gluing up the piece, we lay it in a tray of lacquer thinner for a very short time. The thinner takes off most of the lacquer — the small amount that is left behind serves as a sealer.

If you plan on making exterior installations, you will be using cements and/or epoxies. Get comfortable with all the materials and techniques of interior

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pieces first. Exterior pieces are a magnitude higher in skill level.

From this article, it is apparent that I really like both types of mosaics. Byzantine mosaics suit a particular architecture and artistic style. A *maestro mosaicisti* can cut smalti into shapes the size of fingernail clippings, enabling faces to be incredibly detailed and life-like.

After studying and working with both styles of mosaics for the past 30 years, I appreciate each of them for what they are. Both are beautiful forms of art that have great design applications in today's architectural settings, whether liturgical or secular. Plus, they are fun to make!

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Wheaton Village, NJ: J. Kenneth Leap has 20-plus years of experience as a stained glass instructor. All tools and materials are provided. Small-group classes of no more than six are held at the Wheaton Arts; private classes are also available. Wheaton is one hour from Philadelphia or two hours from New York City. There is an on-site hotel. For additional maps and directions, visit: www.wheatonarts.org.

Corning, NY: The Studio of the Corning Museum of Glass offers 10-week classes in glassblowing, lamp-working, cold working, painting on glass, sandblasting, marble making, and bead making. Fall, Winter, and Summer courses are offered. For class schedules and detailed information, visit www.cmog.org/thestudio.

New York, NY: Creativity Workshop is dedicated to teaching people about their creativity and how to use it in all aspects of life, work, and creative expression. Workshops are available in New York and Europe. For more information, visit *www.roadstocreation.com*.

Staten Island, NY: Robert Lennox, of Stained Glass Imagery, Inc., is offering a variety of glass art classes, including basic and advanced stained glass. Check workshop listings for special classes. For more information, call 718.720-7527, or visit *www.stainedglassimagery.com*.