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There is a Silver Lining.

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There Is A Silver Lining

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by
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ABSTRACT

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I investigated two unique processes developed throughout this body of work. The first technique is the cracking and lifting of an electroformed layer from a core vessel form. The second process, that I named “crunch-raising”, is used to form vessels.

General data were gathered through research of traditional metalsmithing processes. Using an individualized approach, new data were gathered through extensive experimentation to develop a knowledge base because specific reference information does not currently exist.

I find that an electroformed layer can be lifted from a core form with extreme torch heat to reveal the underlining vessel. I also find that the “crunch- raising” technique leaves a rippled texture in the surface of a vessel as it is being formed.

I conclude that the project is successful. It is quite significant in that it has given me a personal vocabulary to define my current work.

DEDICATION

In loving memory of and celebration for the lives of my parents:

John Murdoch Crowell

December 7, 1922 – February 24, 2003

and

Naomi Jernigan Crowell

July 8, 1928 – April 15, 2001

and

for my uncle

James R. Jernigan

January 27, 1936 – May 28, 2002.

Words cannot express my gratitude for their influences in shaping my life.

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I am deeply grateful for the unwavering emotional support of my brother, Tolbert C. Crowell II as we faced the aging and deaths of both of our parents. He stepped in to help handle family matters, allowing me to concentrate on my program of study.

Finally, my dear friend Margaret J. Cortez, in Denton, Texas walked me through the formatting of this manuscript. She answered every frustrating phone call and e-mail. I have grown to respect and treasure her knowledge and expertise in this area. I thank her from the bottom of my heart, as the typed manuscript was accomplished in a timely manner only because of her help.

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CHAPTER 1

INTRODUCTION

Three areas of inquiry will be addressed in this thesis: (1) the technical processes and mechanical techniques, (2) the conceptual and aesthetic concerns, and (3) the conclusions drawn from the execution of this body of work.

Chapter 2 is a short personal history of the recent experiences that led to my decision to pursue a second master of fine arts degree in metalsmithing through the Department of Art and Design at East Tennessee State University. In the past five years those experiences have dealt with the trauma and death of my mother, the death of my uncle a year later, and, as I write this, the aging and death of my father in February of this year. It describes how I extended my emotional responses to these experiences through the creative process, using as a starting point, the chile pepper.

Because I have chosen to use chile pepper imagery to define the people in my life, I felt it necessary to explain the origins, history, and influences of this fruit-vegetable-spice. Chapter 3 provides that information. As I read about the chile pepper, I became fascinated with the language used to describe its characteristics, as it is much the same language used to describe the physical and temperamental attributes of human beings. For example, chile peppers range in appearance from lean to plump, tall to short, dark to light, and from black to white. Similarly, the culinary attributes of chile peppers, (mild/spicy, sweet/sour, weak/bold) parallel the range of human temperament as well.

Chapters 4 through 7 describe the techniques and equipment used to execute this body of work. Each chapter includes explanations of traditional metalsmithing processes along with their limitations and/or advantages.

Chapter 8 follows with a general analysis of each piece in this body of work. Included in this chapter are images of the work, which will be on exhibition at The Carroll Reece Museum on campus from July 24th through August 13th, 2003.

Chapter 9 concludes with a summary of this thesis project and an overall examination of the work. Here I address the specific challenges I faced and the solutions I found to meet those challenges. The successes of this body of work, along with an explanation for my position, are also examined in this chapter. Finally, I theorize on the probable direction that my metalsmithing work may take in the future.

CHAPTER 2

PERSONAL HISTORY

Comparing and contrasting the metal art I produced eight years ago to my present work reveals a shift in my approach to studio processes and handling of materials. The work itself is still about personal relationships, but focus now is on maturation and life experiences. Death, dying, and aging have predominated my thoughts throughout the past few years and are reflected in my present approach to metalsmithing.

My previous work was highly polished. The finishing was as flawless as polishing compounds would allow. It lacked surface texture, probably a reflection of my unblemished world. I added color to the pieces by using exotic and dyed wood in the designs but never used color as part of the actual metal.

At that time, I viewed life through rose-colored glasses. I wanted to make my world as close to perfect as possible. I believed that I was in control of every aspect of my life. I had a naïve view of people and of the world in general. Age, ugliness, trauma, and death had not touched my world. I was fortunate in that regard. I did not understand at the time that my world view was reflected in the imagery that I chose to use, the surface treatments I preferred, and in the overall handling of the materials. My pieces were predominately geometric, hard-edged, clean, crisp, and bold. The jewelry and small-scale sculptural pieces I made were beautifully designed and skillfully crafted. While I was deeply engaged in that work, it appears insensitive and cold to me now, possibly a reflection of the limits of a younger sensitivity.

Since then I have learned that I do not control most aspects of my life; that I cannot change what happens in my world; that one phone call can change a person's entire world view,

and that it is inevitable that the phone will ring. But I've also learned that I can change my reactions to what happens in my life

My present work reflects the imperfection of people, of life, and the lack of control we have over both. In the past several years my family has fallen apart through the protracted illness and death of my mother and the aging and death of my father. Mother was the matriarch who held our family together. The word artists use to describe a composition with this dynamic is *synergism,* where the total effect is greater than the sum of the individual effects. There is little left to the old composition of my nuclear family. It remains a distant memory almost as if it were a composition on someone else's wall. I approached my present work with all of these thoughts and memories fresh on my mind.

The vessel forms, surface treatments, and pepper imagery in this body of work reflect maturation and life experiences. A vessel is defined as a container that holds something. That something can be a thought, a feeling, or a memory of a human being. The physical wrinkling of skin as we grow old, and the imperfect world in which we live, can be seen in surface treatments. The discoloration and ugliness of the human condition as one nears death and the emotional responses as loved ones witness that deterioration are all evident in this body of work. And yet, there is something unique and beautiful in the raw and honest reality of life and death. The wrinkling of skin shows age, but with that age comes wisdom. Emotional layers that we have spent a life time building in the belief that they would keep us strong and secure are shed, one by one, to expose the vulnerability of life's experiences hidden beneath the shell.

Some family members avoided Mother to a large degree during her illness. They could not stand to look at her; nor could they endure the broken conversations. With each of three major strokes, and numerous neurological insults, her condition diminished along with her

inhibitions. Her honesty could cut one to the quick. While she never lost her sense of humor, she was unconcerned with pleasing others or with being politically correct. For me, there was the initial shock, anger, and disbelief about her condition and the utter chaos that it wrought in my life and the lives of my siblings and father. That emotional overload settled into a calm resolve relatively early in her illness. I found her worsening condition to be honest, raw, and real and, because of that, absolutely beautiful. I grew to cherish her crooked smile. Her steel blue eyes sparkled like no other time in her life. Because her mind wandered in and out of reality, and her body defied even her strongest will to move it, or perhaps because it took her longer to process information or to get her point across, her eyes became her voice. We had always been good friends and were extremely close. Yet I learned more about Mother and about myself as we approached her slow but inevitable death. She left me a precious and simple gift, one that I think is the hardest to learn.

She gave me the gift of inner strength and outward courage. Through Mother's weakening condition and hard-felt vulnerabilities, I found a silver lining in the cloud of her death. She believed strongly in education, as did my father. Because of their beliefs, and the gifts of strength and courage they gave me, I decided to pursue a second master of fine arts degree in metalsmithing. Though I had flirted with the idea of returning to school for a decade, I had resisted the idea, fearful about how it would affect my life.

CHAPTER 3

THE CHILE PEPPER, A SHORT HISTORY

I have become fascinated with the chile pepper over the last several years as I have watched them grow in our garden. Each year my husband scouts local nurseries for a new breed. Early last summer he brought in a basket of peppers from the garden and set them on my workbench. I was surprised and delighted at the different shapes, sizes, colors, and varieties that came out of our backyard and intrigued enough to start researching the chile pepper.

Chile peppers remind me of people because each pepper has a distinct personality and different appearance. In The Chile Chronicles, Tales of a New Mexico Harvest by Carmella Padilla, chiles are actually referred to as land races (7). My research led me to a website, www.chiliplants.com which sells over five hundred varieties of chile peppers from around the world. Cross Country Nursery has a wonderful image of each mature breed and describes the physical and culinary characteristics as well as the country of origin and region where each is grown. I was curious enough to start reading other recommended books on the chile pepper and its history.

Carmella Padilla writes extensively about the art and culture of her homeland New Mexico. She explains that the Chiltepin or chile is indigenous to South America but made its way to Central and North America with the help of birds and humans (1). Padilla observes that the Chiltepin's berry is red, small, and in its ripened stage resembles, in taste and appearance, Piper Nigrum, the source of black pepper. She confirms that botanically chile is a berry; however, when the chile is green it is considered a vegetable, and when it is red and dry it becomes a spice (9). She notes that the Chiltepin was domesticated in what is known as present day Mexico and eventually evolved into the species Capsicum Annuum (16). Common breeds

are the poblanos, jalapenos, and serranos. These peppers became essential ingredients in the lives of the Spanish and Indian cultures of colonial New Mexico. Padilla follows the introduction of these species to other parts of the United States by following the expansion of the rail system, starting with the Santa Fe Trail in 1821, and the Chili Line between Denver and Mexico that opened in 1881 (3).

According to Padilla, sixty percent of all chile cultivated in the United States, where the name of this plant has been anglicized to "chili", is grown in New Mexico (3). The chile pepper is not just a food staple. It is a three hundred million dollar a year industry (xii) that reaches into other economic sectors as well. The colorful dye is extracted and sold to cosmetic manufacturers; the single chile pod which contains six times the vitamin C of an orange has medicinal value (xii.). The chile pepper is used extensively as an advertising element in cuisine promotions, home decorations, and posters and prints of the Southwest.

Jean Andrews is a Texas artist and writer. She was enticed by the chile pepper and its elements of design: line, shape, form, value, and color (xi). She is known as "the first lady of chili peppers" and "The Pepper Lady" because she has traveled extensively abroad to research and verify chile facts. She compiled this history in several books including PEPPERS, The Domesticated Capsicums, which she illustrated, and The Pepper Trail, History & Recipes from Around the World. According to Andrews, the Chiltepin was not known to regions outside South America before 1492. She verifies that Christopher Columbus made a journal entry on New Years day in 1493 that he had discovered a small berry used by the local Indians as a spice; he mistakenly called it "pepper" because it was sharper and stronger than the familiar black pepper (Pepper Trail 9).

Columbus first carried the dried fruit to Iberia as a spice commodity and by following the trade routes of the next one hundred years, Jean Andrews has shown that the Spanish and Portuguese explorers took the seed to Africa, India, China, and Tibet (Peppers xiii). The Chiltepin was incorporated into the cuisines of India and Indonesia to such an extent that early botanist thought the plant originated there (Padilla 2).

CHAPTER 4

CASTING

Edward Lucie-Smith in The Story of Craft, The Craftsman's Role in Society states that the smelting of copper is probably connected with the introduction of glazes for pottery (37). Malachite, a compound of copper, was used for coloring clay pots (37). The casting process can be dated to the fourth millennium B.C. (38). Copper is relatively soft and somewhere along the way tin was added, creating a hard and durable bronze alloy. Prehistoric molds with a bronze ax intact have been found that date between 4000-3000 B.C. (38).

Because metal can be heated to a fluid state, it can be poured into a mold taking on the shape of its cavity and then cooled into a solid state. Molds can range from a simple depression in sand to the more sophisticated methods used in industry to replicate designs for mass production.

My discussion is limited to "lost wax" casting because this is the process I use to produce the pepper forms. I explain two different methods of lost wax casting: centrifugal and poured vacuum assist. I also address various alloys used in casting, including Shibuichi.

The name "lost wax" comes from the French term cire (wax) and perdue (lost) (Oppi Untracht 490). Wax blocks, sheets, extruded wires, and pellets for melting are available with characteristics from hard to soft and brittle to malleable, and with melting temperatures ranging from high to low. It is possible to construct just about any model form from the variety of commercially produced waxes. Most can be fused or melted together to accommodate the personal needs of the artist. Blocks can be carved, sheets can be fabricated, and melted pellets can be poured. The surface can be smoothed with heat or textured with small rotary tools. For

these reasons, the use of wax for casting has been widely adopted by metalsmiths, jewelers, and manufacturers.

After the wax model is finished, it is attached to a sprue, a wax wire that is available in a variety of gauges to accommodate various size models. The sprue becomes the channel through which molten metal flows to reach the model. The sprue with model attached is set on a convex base. A flask, which is an open ended tube, is then placed on the base. While thicker gauge stainless steel flasks are generally used, a coffee can opened at both ends can be used as a substitute. The model is then "invested."

Investment is a dry mixture containing plaster and silica. When mixed with water, it produces a thick mixture known as slurry that is poured around the model to be cast and left to harden. This compound is used for casting because it expands when heated to compensate for the shrinkage that occurs when fluid metal solidifies (Oppi Untracht 490). Investment is mixed and placed in an enclosed vacuum environment for a few minutes to remove air from the mixture. The removal of air is necessary to eliminate bubbles in the slurry that can adversely affect the final casting. Bubbles can make the investment too porous to set properly, creating air pockets or cavities that could fill with metal. Once the vacuum cycle is complete, the slurry is poured into the flask covering the model. The invested flask with wax model will set up very quickly but is usually left overnight to cure before continuing with the burnout cycle.

A kiln is used for the burnout process. This eliminates the wax contained within the investment leaving a hollow space or cavity. The completed burnout cycle depends on the size of the flask, taking as little as three hours for smaller work or up to twelve hours for a larger flask. While the length of each phase will vary depending on size, three requirements must be met in burnout. First, the kiln is heated to three hundred degrees. The flask, with the sprue side down, is

placed in the chamber. The temperature is brought up slowly to approximately eleven hundred degrees in order to completely burn out the wax model from inside the investment. During the second phase, the flask is turned sprue side up and remains until the temperature reaches twelve hundred fifty degrees. The purpose of this is twofold: it allows gasses within the mold cavity to escape, and it properly cures the investment for casting. At this stage, the investment appears white or slightly gray in color. The last and third requirement is to slowly cool the kiln to the casting temperature of eight hundred fifty to nine hundred degrees. It is held at this temperature for thirty minutes to insure that the investment has cooled. This completes the burnout cycle. The mold is ready for casting.

Either the centrifugal or vacuum assisted process can be used to cast the object. Each process has its advantages and disadvantages, but both are equally valuable. Smaller objects or multiple small objects on a common sprue are usually cast by centrifugal force. Larger objects are often cast using the poured vacuum assist method.

The centrifugal casting machine has two arms that pivot around a common stand. They work as one unit though a stationary arm holds adjustable weights and a movable arm holds the melting crucible and flask. The unit is wound which puts pressure on the spring contained within the stand. It is held under tension with a pin. The metal is then melted in the crucible with an oxygen/acetylene torch and, once the metal or alloy is molten, the pin is released and the spring tension throws the loose arm around the base with the rigid arm following. During the first few tenths of a second, the molten metal is thrown from the crucible opening into the receiving end or opening channel of the mold. The cavity in the investment is now filled with metal. Once the arms have stopped moving, the flask is removed, cooled slightly, and submerged into water. The investment dissolves quickly and separates from the flask to expose the cast object.

The force and speed of the centrifugal process ensures that the molten metal will flow into all areas of the cavity created during the burnout phase, including undercuts and very fine detail work. The centrifugal process is therefore a good way to cast silver because it produces a dense metal with a close grain structure (Oppi Untracht 491). One disadvantage of this technique has to do with size. Even the larger centrifugal casting machines will accommodate a flask only four inches in diameter and six inches long.

Vacuum assisted castings are filled by pouring rather than by force. Many machines for this purpose have two parts that satisfy two needs. The vacuum table is used during the investment process to remove air bubbles from the slurry and is required regardless of the actual filling technique. The other part of this equipment is a casting table to hold the flask during fills. Under pressure, the vacuum helps or assists in pulling the metal into the mold. The melting crucible is held in a long tool used by the artist to make the pour. After the metal is heated in a crucible to the molten state, the vacuum is started and continues while the metal is poured from the crucible and into the open end or channel of the mold. The cast object is retrieved as previously discussed.

Because the negative mold fills more slowly using poured vacuum assist compared to the centrifugal process, the resulting metal is slightly more porous (Oppi Untracht 491). Brass and bronze alloys, which have a longer liquidus range than silver alloys, are conducive to the poured vacuum casting. But the greatest advantage of poured vacuum assist over centrifugal casting is one of size. Vacuum chambers will accommodate perforated flasks up to five or six inches in diameter and seven or eight inches in height. With the use of an adapter plate, an even larger solid flask can be used.

Alloys

An alloy is at least two metals mixed together to produce a stronger metal or one with another desired quality. For example, sterling silver is an alloy of fine silver and pure copper. When these two metals are mixed together in a ratio of 92.5% fine silver, which is .999 pure and extremely soft, and 7.5% copper, which is relatively soft, the resulting metal is a binary metal known as sterling silver. It is quite strong and is used extensively for casting, fabrication, and raising.

Brass and bronze, which consist mostly of copper, can be alloyed to produce a variety of metals with varying properties and color tones. Usually containing at least three metals, they are a ternary alloy (Oppi Untracht 31). They are inexpensive for the metalsmith to produce because scraps can be melted down in just about any ratio. This knowledge led me to start experimenting with different alloys including shibuichi.

Shibuichi is another alloy of fine silver and copper, but in this alloy copper is the predominant metal. Shibuichi was first used in China during the Han Dynasty as cast sculpture and was later adopted by the Japanese for making art swords (Reactive Metals Website).

Traditionally, shibuichi is 60-70% copper, 30-40% silver with small amounts of tin, lead, or zinc. The word means “four parts” referring to its four original metals (Oppi Untracht 668). Depending on the silver content, shibuichi ranges in color from silvery pink to grayish orange. Because of its high copper content, it is fairly inexpensive to alloy and has a long liquidus range making it ideal for pouring ingots or vacuum assisted castings. While it takes a chemical patina well, shibuichi develops a natural patina from the oils in one’s skin. I have combined different percentages to compare color and have set up tables to alloy shibuichi from either scrap or grain

for casting (Page 45-47). Because each casting requires different percentages of metals, the tables provide a quick and easy reference for converting content and weight ratios.

CHAPTER 5

ETCHING AND ELECTROFORMING

Etching and electroforming are processes that change the surface dimension of metal. Etching is a subtractive process that uses chemicals to cut into or remove metal; electroforming is an electrical process that deposits metal onto another surface. Both processes use solution baths to promote the reaction, but the similarities stop there. I wanted to add texture to my work and started experimenting in-depth with these processes. I address both studies in this chapter.

Oppi Untracht states in JEWELRY Concepts and Technology that "the word etch is derived from Dutch and German words meaning 'to eat or corrode'" (320). A piece of unprotected metal left in an etching bath would eventually dissolve. For this reason, resist materials are used on all areas of the metal not intended for etching. For example, a design might be desirable only on the front of a metal disc and thus the back and edges of the disc would need to be resisted before submerging the work into the bath. While some solutions require heat, most are used at room temperature. The solutions can be strong or weak, but leaving the piece in the solution too long or removing it too early can ruin an intended design. After performing in-depth, solution-controlled and time-controlled experiments, I concluded that the most important factor in etching is time.

Numerous materials can be used as a resist for etching. The traditional resist most often used is asphaltum, a petroleum-based material similar to roofing tar. It is messy and requires turpentine to cleanup. Other common resists are enamel paint or paint pens, wax, rubber cement, or a good sturdy tape.

Through experimentation, I have found some other items that work well for etching and add flexibility to the process. Sharpie fine-point markers and Liquid Paper all-purpose correction

pens are excellent for drawing designs on metal. Both of these are limited in that they start breaking down in the solution after forty minutes; but, if a fresh solution is used, these pens will give a good etch. Another product that works well is the Blue Resist sold by Rio Grande as a screen-printing resist. I found that it could be thinned with mineral spirits and brushed onto the surface or put in a small squeeze bottle with a tip and used for drawing. It is durable and will hold up in an acid solution for approximately one and one half hours before breaking down.

Copper based metals are usually etched in a solution known as etchant. It is a salt solution rather than an acid bath and is safer to use than acid. A fresh solution will give a very satisfactory etch in forty-five minutes. The metal is placed design side down and suspended in the solution. The bath must be agitated; an aquarium aerator works well for this purpose. Etchant does not work on silver and the process for etching silver is slightly different.

Silver is etched in nitric acid, which is available in small quantities to the studio artist through print making suppliers. Many recipes call for a ratio of three parts water to one part nitric. I found this solution to be a little slow and decreased the amount of water for a stronger bath. Two parts water to one part nitric worked faster and resulted in a good etch in thirty to forty- five minutes without breaking down the resist. In this etching process, the metal is placed on the bottom of the dish with the design facing up. As the metal begins to etch, small bubbles will form on the surface. These can interfere with the design if not removed promptly and gently brushed away periodically. Unlike using etchant, this process needs to be supervised constantly.

Etching has numerous possibilities. Designs, patterns, and even photo images can be etched into metal. It is a controlled process with the end result anticipated beforehand. I wanted a surface texture that was less controlled, more spontaneous; a texture that would better represent what I had come to learn about the frailty of life. Electroforming spoke to these concerns and

seemed a possible avenue to explore. Adding layers of metal instead of taking them away intrigued me. I started experimenting with this process and discovered some exciting surprises along the way.

Philip Morton explains electroforming in Contemporary Jewelry. In this process, a thick layer of metal is deposited onto another surface by electrolytic action known as electrodeposition (230). Electrolytic action was discovered in 1807 by Humphry Davy (230). He found that molecules of certain salts, when dissolved in water, separated into positive and negative ions (230). This theory was later expounded upon by Michael Faraday in the 1830s (Caswell Plating 1). When small amounts of electrical currents are passed through these, a positive ion will separate from an anode, travel through the electrolyte solution and deposit itself onto the negative cathode (2). Thus metal is literally taken from one source and deposited onto another source. The relationship is direct; as the negative cathode or work becomes thicker, the positive anode or metal source becomes thinner and will eventually dissolve completely.

The recipe for a copper electroforming bath reads as follows: two pounds of copper sulfate, four ounces of reagent grade sulfuric acid, and one gallon of distilled water. Copper sulfate is readily available through farm equipment suppliers. It is used in livestock water tanks to cut down on algae. After calling many sources and realizing that an individual could not purchase reagent grade or 98% sulfuric acid, I called Mike Caswell in New York. He is the author of CASWELL electroplating in miniature, The Complete Plating Manual, Version 4. His book is the most comprehensive guide on electroforming I have seen to date. Mr. Caswell was very informative and explained that battery acid was 33% concentrate and could be purchased at Napa Auto Parts stores. He also converted the recipe for me as the electroforming bath calls for 98% reagent sulfuric acid. Instead of four ounces of reagent grade sulfuric acid, twelve ounces of

battery acid is used. The most interesting fact that he mentioned was that the recipes did not have to be exact because electroforming baths had a rather wide window of error and would give good results as long as the three ingredients were close to the correct ratio.

CHAPTER 6

RAISING AND FORGING

Raising is an ancient metalsmithing technique that has not changed through modern times. A flat piece of metal, usually a round disc, is hammered around a stationary form to change the shape and create a three dimensional object. Examples of traditional raised objects are chalices, bowls, and other vessels. Through a series of repeated steps, sheet metal can be transformed into seamless, hollow, volumetric forms capable of holding liquid.

While each metalsmith might approach raising differently, the basic technique of raising remains the same. The diameter of a flat disc should equal two times the height of the finished piece plus the width of the base. For example, to raise a four-inch bowl that has a four-inch base, a twelve-inch disc is needed. Four inches of metal is needed for each of two sides and four inches of metal is needed for the base.

The disc must first be annealed to a malleable state. Tim McCreight in THE COMPLETE METALSMITH defines annealing as "the process of using heat to relieve stresses within a metal" (190). He explains that "at a heat usually near two thirds of the metal's melting point, recrystallization occurs, creating a more flexible alignment among the crystals" (190).

Annealing can be accomplished by placing the metal in a kiln. This is the optimum way to anneal because the kiln insures that the metal will be evenly annealed. Most metalsmiths use a torch to anneal metal. If the entire surface cannot be annealed at the same time, care must be taken to evenly heat large areas, one at a time. If the piece or an area of the piece is not properly annealed, the metal may crack under the force of the hammer blows.

With the metal somewhat soft, the disc is placed on a stake or anvil at an angle, leaving air between the metal disk and the stake or anvil just above the contact point. The hammer blow

is made just above that contact point forcing the metal sheet down toward the stake. It is a metal (the hammer head) to metal (the disc) to air (the gap above the metal stake) contact blow. If the hammer blow is made on the metal contact point of the stake it will compress the metal rather than move it. Holding the disc with one hand against the stake stabilizes the placement of the metal and ensures that the hammer blows strike the intended point. The metal is worked in concentric circles from the center of the disc. It is rotated slightly between hammer blows. The disc is then repositioned on the stake about an inch above that round of hammer blows and the process is repeated. Each round is called a "course", and each course is positioned above the other and repositioned on the stake until the outside edge is reached. Once the outside edge is reached, the work must be annealed again and the process repeated until the desired form is achieved.

Once the form is reached, the piece is planished. Planishing is similar to raising with three major distinctions. First, the number of metal contact points used for planishing is three as opposed to the two required to raise an object. There is a metal (the hammer head) to metal (the object) to metal (the stake) contact. Planishing compresses the metal by realigning the crystals and eliminating the hammer marks and dents created during the raising process. The second major distinction between raising and planishing is the attitude with which the metal is struck. Planishing requires a softer, quicker tapping of the object than raising where hammer blows are designed to change the shape of a piece of metal. Planishing taps are also closer together and done in small concentric circles around the piece. The final distinction between raising and planishing is the natural polish that occurs as the surface is cleared of hammer marks and other blemishes.

Forging is a hammering process that is similar to raising. The metal is moved by the force of a hammer. It is different in that metal stock or rod is used as opposed to sheet metal. Steps to forge a piece are similar. The metal must be annealed, worked, annealed again, and repeated until the desired shape or form is produced by the hammer blows. A wedged shaped hammer is used and struck perpendicular to the rod to increase its length and parallel to the rod to increase its width. Thus, the direction of the metal can change by changing the position of the hammer blows and the dimension of the metal can vary within the same piece.

I have included a brief description of forging here because the stems on my peppers now appear to be forged. They are actually drawn down through a draw plate that has decreasing incremental holes which creates the initial taper. Because there is a small ridge left around the metal with each decreasing hole, I tried sanding the stems to finish them. I was not satisfied with the results. I now use a hammer to remove the ridges and finish the stems by planishing. Small, close hammer marks are left in the metal which gives the appearance of a forged stem.

CHAPTER 7

PATINAS, SOLVENT DYES, AND WAXES

Webster defines patina as "a surface appearance of something grown beautiful, especially with age" (Webster's 852). Patinas have been used on surfaces, metals and organics, for years, but they are particularly relevant to this body of work because they speak directly to the maturation process referred to in the chapter on personal history – the conceptual foundation for this work. That chapter is, in essence, the genesis for A Silver Lining. For this reason, I have chosen to include the process of patination and other surface transformation treatments in this paper.

Patination refers to colors on a metal surface brought about naturally, through oxidation, or applied chemically using acids. It is accelerated with moisture and the impurities in air. Immediate coloring can be achieved through application of a wide range of chemicals. Many traditional recipes are not only dangerous to use but require chemicals that are difficult to find. Many have been replaced with contemporary premixed, cold chemical solutions. Supply companies often carry only a few commonly used possibilities: green, blue, and brown. However, Ron Young of Sculpt Nouveau offers a wide range of patinas, oxides, dyes, and waxes for both ferrous and non ferrous metals. All of these are premixed and most can be used cold.

Ron Young gives a very comprehensive look into the surface coloring of metal in Contemporary Patination, 5th edition. He classifies chemical patinas in six categories according to application (29). However, he breaks this down to two groups, acid patina and non acid patina, in his Instruction Book For Patinas & Finishing Products (11). For best results, Young suggests warming the metal slightly before application of a non acid patina (11). This can be achieved by using a blow dryer, setting the piece in a pre-heated oven, or simply setting the object in the sun.

The patina is applied to a finished piece of metal art. It can enhance the beauty or change the mood of a piece. It can be applied in a variety of ways that include spraying, brushing, and/or rubbing the chemical on the metal. A patina will continue to slowly react with elements in the environment unless it is sealed.

A dye can be applied directly to the metal or over a patina. Solvent dyes for either ferrous or non ferrous metals are available through Sculpt Nouveau. They contain "UV inhibitors, corrosive inhibitors and binders that will help maintain the color integrity in an outside environment" (19). They are transparent and can be blended and mixed on the metal surface to create subtle or intense color changes. While they can be applied to any metal surface, the adhesion is strongest when there is a slight bite on the metal. They will not adhere well to a highly polished surface.

After completing the surface coloring of metal art, it is preserved with a sealant or wax. Lacquer sealants tend to yellow or chip with time. For this reason, I choose to wax the piece at this stage. A good quality wax will not yellow with time, it will preserve the patina and dye coloring, and it can be periodically buffed with a soft cloth.

CHAPTER 8

DISCUSSION OF THE WORK

The first vessel form I produced for this project was "A Disconnected Family." (Figure 1) It is a bowl, raised from twenty-gauge copper and set off center. It is approximately seven inches high and six inches in diameter. Resisted first and then etched, it was cut out with a jeweler's hand saw between pepper shapes.

Figure 1.
A Disconnected Family.

This is quite a significant piece for me in that it was the first completely non-functional metal art that I had produced. This was not originally intended. Raising is a difficult process to learn and takes practice and patience. This bowl represents an accomplishment in the technique of raising. It is crafted well and professionally finished. The outside plane is void of all planishing marks, it is filed and sanded and the rim is evenly trimmed. Upon completion, however, I realized that the bowl lacked conviction. What I had grown to believe about life was not represented in this piece. I could not, at the time, determine how to resolve the form.

When I am unable to immediately solve a problem like this, I put it aside in order that another piece can be started. The emotional creative process will continue and often when performing a completely unrelated task, cleaning for instance, ideas will develop. It is probably because at somewhat mundane times, my mind is relatively relaxed and wanders; ideas are free to formulate.

At this time, I was simultaneously researching peppers and performing time and solution controlled etching experiments in various metals. I had hoped to find ways to incorporate this imagery and knowledge in my work.

To reduce the risk of breathing fumes, my etching station was set up outside under the carport. On a hot Texas afternoon while etching a piece of gold clad in aqua regia, I went inside to make a glass of iced tea but was side tracked answering the telephone. When I realized with disappointment what had happened, I ran out to retrieve a lacy metal sheet from the acid solution. My disappointment slowly turned to a welcomed surprise. The acid had etched completely through the metal between the resisted areas. The metal pattern is juxtaposed with negative space. The effect is quite attractive and it was at this moment that I determined how the raised bowl should be finished and proceeded to do so.

Various pepper shapes etched into the outside form signify different family members and are repeated to represent different stages in our lives. The cut out area in between pepper shapes suggest two ideas. The negative space literally defines a void or what is no longer there or real. On the other hand, negative space figuratively represents the negative feelings surrounding my family unit as each member dealt with death on death's terms. Instead of expressing compassion for or toward each other because we experienced the same loss, most of my family isolated themselves to deal with the lingering emptiness alone. The container is full of holes. It contains only memories. The disconnected family portrait was finished.

Figure 2. Sisters-in-law.

The next work produced is titled "Sisters-in-law." (Figure 2) These three simple containers are made of copper and electroformed. Each has an attached cast pepper with a long stem encircling the vase. The length of each tube was cut from copper plumbing pipe of various diameters. One end was capped

by soldering a plate of copper sheet for the base; it was trimmed, filed, and sanded. These were placed in the electroforming solution for four days. The rectifier was set at approximately one and one half amps.

Figure 3. Texture.

As I was soldering the pepper to the side of the first container, the electroformed layer was upset from the intense heat of the torch and started cracking and lifting from the pipe. The development was exciting and fascinating. The layer of electroformed copper now created a surface texture unlike any I had seen and immediately spoke to my sensibility of raw layers being peeled or separated from its core. When I tried to solder the next pepper on the second vessel, I could not get the same effect. After unsuccessfully trying to pull up this layer on the third, I realized the layers were not thick enough to separate as the first one had. I put these two containers back into the electroforming bath for two days and tried again. This time, the layer popped, split, and separated with the heat of the torch.

The tall vase and its pepper are proportioned to each other in size and form. The other two are slightly awkward. These pieces represent the interaction of my three sisters-in-law with my brothers. The tall vessel represents my youngest brother who stands figuratively taller than the other two. The pepper represents his wife who also stands above the others and its stem gracefully lifts from the top edge and returns to encircle the vessel. They are a team, each independent and yet interdependent but in harmony with one another. The other two pepper stems create a bit of tension by wrapping around their containers in a clinging way and appear to squeeze the container as opposed to encircling them. The pepper and vase components are not in harmony but more at odds with each other. This depicts the tension that appears to dominate those relationships.

I feel it is important to note a comment on the copper layer here. The electroformed shell is relatively thin. Because it is fragile and brittle, it can easily break. While this technical disadvantage can complicate packing and shipping, I feel the esthetic quality far outweighs this challenge. Life is also very fragile and therefore this new-found texture represents and defines that concept.

The pepper pipe vases were technical and conceptual precursors that made way for the next two vessels titled "There Is a Silver Lining." (Figure 4) My parents believed so strongly in education and the ongoing process of learning. Before Mother died, she gave me the gift of courage to return to school. I did so just shortly after her death. My Father became a strong advocate, continuing the gift through encouragement over the next year and a half. He died just five months before I finished my second master's degree.

Figure 4. There is a Silver Lining.

The pieces, representative of the gifts given by my parents, are very formal and sophisticated in comparison to the copper pipe vessels. They are small at the base but have a large rim opening. They have a vertical linear opening that gracefully reveals the silver lining. This idea is revisited later again in "The Silver Lining Series."

Figure 5. Sterling Silver Vessel.

These two pieces were fabricated of silver with the outside electroformed in copper. Sterling silver of twenty-four gauge sheet was used for the shorter vessel while the taller one was fabricated from twenty-four gauge fine silver sheet. Because fine silver melts at a higher temperature than sterling, the tall vessel gave me some technical problems. I was heating the form to pull up the copper layer. Instead, it actually fused to and mixed with

the copper layer in areas. This is called an eutectic event in which two metals combine to form a lower temperature alloy. Separation of the copper from the fine silver was not as pronounced as I had hoped and this was a bit disappointing.

Figure 6. Fine Silver Vessel.

Because fine silver does not easily tarnish, it would have been the optimum metal for the base forms. But after completing these two pieces, I determined that twenty-two gauge sterling silver was needed to create structures of this type. The thicker gauge gives a bit more strength to the vessel. Sterling holds up better than fine silver under the extreme heat of the torch during the crackling process that I had developed to lift the copper layer from the form.

Figure 7. Small Treasures

The next piece that I produced is a raised bowl titled "Small Treasures." (Figure 7) This piece is technically significant in that it led the way to a process that I call "crunch-raising." This form was made from twenty-eight gauge copper. This gauge is thin enough to manipulate by hand. After folding the disc in a form that resembled a cup cake liner, I proceeded with the traditional raising process. As the sides were hammered into a cup form, ripples folded on themselves to reveal an intriguing texture. I then electroformed the bowl just enough to thicken the outer edge and finished it with a pepper stand.

I feel this piece represents a nice interdependence between components. The bowl is oval shaped and can be separated from the encircled stem of the pepper base. While the two parts do not work alone, they interact to make a completed piece when put together.

I was enticed with the possibility of crunch-raising thin gauge metal and immediately cut a twelve by eighteen inch disc. I established the form and offset the base so that one side is higher than the other side. Through experimentation, I discovered that more texture could be achieved by moving the metal in opposite directions before establishing a finished form. Stressing the thin metal back and forth increased the folding of metal on itself and thus increased the texture.

There is a disadvantage in this process that I had not anticipated. Cracks can form from the stress of the metal folding back on itself. If the metal is folded again over itself, the crack can often be hidden. I have since started to remedy this challenge by annealing the work more often. I also have learned to identify problem areas before the cracks occur and can usually keep them to a minimum. The piece is titled "An Unfair Advantage." (Figure 8)

Figure 8. An Unfair Advantage.

After raising this form, I decided to work larger. Out of curiosity, I wanted to know if I could physically handle a larger disc. I also wanted to know if the textured rippling effect could be achieved on a larger plane. The widest copper sheet available through a metalsmithing supplier is twelve inches. Copper roofing sheets are available in three foot widths. It is approximately twenty-four gauge. This is a bit thicker than the metal previously used and I learned rather quickly that this gauge had to be approached differently.

Starting with an eighteen inch disc, I hammered a dozen crimps into the metal from the center out in a radial pattern by using a rounded groove in a wooden block. I realized that a metal crimping stake would be advantageous for this technique. I will eventually need to make my own

stakes as the metal stakes at this scale are unavailable. My small maple wooden block has cracked during the crimping stage and it is only five inches in length.

Figure 9. Blue Mood.

To my disappointment, the metal cracked on this piece. When I tried to fold the metal back over itself to hide the crack, I could not do so. The rounded ripples do not compress like the delicate rippling that occurs in the thinner gauge copper and it is therefore difficult to fold the metal back on itself. It is finished with an antique patina and colored with blue undertones from dyes. It is titled "Blue Mood." (Figure 9)

The next piece titled "From the Outside, Looking In" (Figure 10) is made from a twelve inch disc of twenty-eight gauge copper. After working with the roofing copper, this seemed relatively easy to manipulate. The metal was hammered over a stake to bring it up in a narrow cylindrical shape and then flattened out. This was done several times to add the ripples before determining the final form. Again, the metal is worked back and forth in a convex and concave fashion in order to exaggerate the rippled texture. After this has occurred, I can establish a final form.

Figure 10. From the Outside Looking In.

The sides of this piece roll inward toward the center focal point, moving the eye from the outside of the piece to the inside center area. The title is also a commentary on various perspectives regarding the same issue.

Figure 11. Flair.

I continued to experiment with this process and produced several other crunched raised vessels. The twenty-eight gauge had produced a small delicate texture and the roofing copper yielded a large rippling effect that was difficult to compress. Because of this I decided to work with twenty-six gauge copper

and produced “Flair” (Figure 11) and “Tilted” (Figure 12) respectively. This gauge both compresses very nicely as well as left enough of the rippling effect to be interesting.

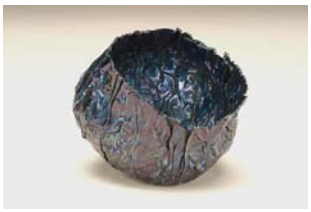

Figure 12. Tilted.

Figure 13. Green Fields.

Again, desiring to work larger, I produced two pieces from roofing copper. “Green Fields” (Figure 13) is approximately twenty eight and one-half inches in diameter and five and one-half inches in height. Instead of trying to compress the ripples, I left them full and exaggerated. This can be seen again in “Orange Bowl” (Figure 14) which is approximately 17 inches in width and 7 inches in height.

Figure 14. Orange Bowl.

It was not until I had worked with all three gauges that I understood the direct relationship between the gauge of metal and the rippling texture.

At the end of January, I received a call from Dr. Dugan. Dad had brain cancer; it would quickly take his life. I just felt lost. I started rummaging through my scrap box and pulled out a few pieces of heavy plumbing pipe that had been deemed too thick for use. After annealing the pipe, I took a hammer to them; somewhat out of frustration, disappointment, and fear. I damaged the cylindrical forms with a hammer and disfigured them with an oxygen/acetylene torch. I melted slits into the metal and distorted the outer edge of the vessel. The molten metal dripped and created small puddles. They were then fabricated into vessels. During this time I cried a lot: for my Dad, for my Mom, and for my family. Because it appeared as if the vessels were crying, I titled them “The Burden is Heavy and I Weep.” (Figure 15)

The weeping vessels are very expressive. Because they are odd shapes, I would not consider them the better forms aesthetically. However, they depicted the feeling of sadness that had lingered in my world over the last few years. I will pursue this idea again in sterling silver.

Figure 15. The Burden is Heavy and I Weep.

The vessels were then electroformed and subjected to intense torch heat in order to bring up the new layer of copper. But, they would not crackle and the copper layer would not separate, regardless of the amount of heat they endured. This presented a major challenge that could not be explained.

I had mixed a new electroforming solution and wondered if this could be the problem. Could the old solution have weakened with age or chemically changed over time? After running both flat and curved test samples and not being able to get the layer to crack, I felt it might be a combination of factors. I then fabricated a few vessels to run as samples because at this point I could not determine whether the size of the piece, dimensional quality of the form, or the new bath could be affecting the electroformed layer.

Using twenty-two gauge copper, I fabricated a few forms similar in size and shape to those that had previously been successful. I also knew from research and experimentation that the amperage of the rectifier and submersion time or duration in the bath (or run) could affect the layer. There were three possibilities: 1) high amperage and short run, 2) medium amperage and medium run, or 3) low amperage and long run. The sample strips had been run with medium to high amps and had not worked; therefore, I decided to try the sample vessels on low amperage for a longer run. There was also another possibility.

After filing the base cap flush with the structure, I sanded the entire form in a linear direction on the vertical axis of the plane. It was at this point that I realized the sample work had been sanded in a circular pattern. While minute, the circular sanding would have produced undercuts in the metal and the linear sanding would not have done so. It was possible that the electroformed layer adhered more readily to this circular pattern.

After extensive experimentation with a combination of factors, the layer of electroformed copper did not react with torch heat and the new layer has not crackled and/or separated. The sample vessels are titled "Time Out" (Figure 16) simply because I had taken the necessary time out to try and remedy the challenge at hand.

Figure 16. Time Out.

I called Mike Caswell in New York, explained this phenomenon to him, and asked for his help in solving this challenge. After a short discussion, he suggested that I mix a new electroforming solution with reduced sulfuric acid in the bath. He also suggested that I contact Ted Mooney by submitting a letter of inquiry to www.finishing.com. Mr. Mooney posted my letter, replied, and suggested that I put an organic copper brightener in the solution. He explained that the brightener was co-deposited and would cause brittleness and be adversely affected by heat. I experimented with the recipe, but it did not solve the challenge. At this point, I am convinced that the solution changes with time; I can therefore only let the bath sit for a year and try again to get the intended results.

During Dad's final month, we were very fortunate to have Hospice Care. Their goal was two fold; first, to keep Dad out of pain and second, to prepare him and our family for his death. We were encouraged to read their literature as Hospice underscored the importance of understanding the separation process in death and dying. Whether interpreted from a religious or

a secular point of view, the message was the same. “The physical, emotional and spiritual separation occurs at different times. When family members are cognizant of and sensitive to this, separation can occur in a peaceful manner.” (section 10, page 1.)

Figure 17. The Silver Lining Series.

My father did indeed have a very respectful, peaceful, and dignified passing. It was at this time that I decided to pursue the silver lining vessels again. He was a formal and dignified man. The vessels needed to reflect this. I revisited the original silver lining form and proceeded to fabricate four vessels. Each piece started from the previous pattern and lines were changed to vary the forms. The separation became exaggerated in the final piece to signify that separation is complete.

Figure 18. Vessel 1.

Figure 19. Vessel 2.

The vessels collectively titled “The Silver Lining Series” (Figure 17) were fabricated from twenty-two gauge sterling silver and copper electroformed on the outside. They were put under extreme torch heat but the copper layer remained intact without cracking or separating. This was disappointing but was also anticipated at this point.

“Vessel 1” depicts the whole person. It has a narrow vertical slit revealing the silver lining and appears very much in tact. “Vessel 2” represents the emotional separation; the gap or vertical slit opens further to reveal the inside. “Vessel 3” extends or lifts on one side to figuratively show the spiritual aspect. “Vessel 4” signifies the physical and final stage of separation; the vertical openings are wide and exaggerated, the left extension is tall and distorted, and the overall physical appearance is quite removed in form from the initial vessel.

Figure 20. Vessel 3.

Figure 21. Vessel 4.

CHAPTER 9

CONCLUSION

The areas of inquiry outlined in the Introduction to this paper will be summarized here. Two concerns were originally proposed: the technical and mechanical aspects involved in the production of this body of work and the conceptual artistic expression of the individualized pieces.

The technical and mechanical aspects were successful in the beginning and fueled my enthusiasm for further study. Later in the experimentation process, challenges emerged that have yet to be resolved, especially in the process of electroforming. I believe that the nature of the problems I encountered have to do with fine tuning the recipe for the electroform solution. After testing every known factor and mixing numerous recipes that altered the ratio of one chemical at a time, I concluded that the electroform bath probably changes with time. I can only let the solution sit for a year and try the process again.

Another mechanical aspect of this work yielded some particularly exciting results and gave rise to a new raising technique I call "crunch-raising." In this process, the texture folds back onto itself many times creating ripples in the metal. This adds both aesthetic and physical characteristics. The ripples juxtaposed against the folded material gives the appearance of flexibility to a sheet of hard metal.

The ripples add structural stability to the relatively thin gage copper used in "crunch-raising." The gage of metal has a direct relationship to the size of the rippling texture. For example, small forms made from twenty-eight gage copper yield a delicate, compact, rippling texture. Larger forms, made of roofing copper, have a voluminous ripple suitable to the size of the form being produced.

I will continue to refine the "crunch-raising" process, the development of which was limited by the equipment available. The available stakes were positioned horizontally to a bench, inhibiting the rotation required to produce a cylindrical form of any significant depth or size. The larger pieces, produced for the exhibition, are shallow in form for this reason. I believe special stakes oriented in a vertical position would be desirable to achieve the shape, depth, and size of larger "crunch-raised" forms.

The creation of the body of work for A Silver Lining proved to be successful in conceptual artistic expression. Lifting an electroformed layer by torch heat added depth, interest, and texture to the vessel forms. When formed over silver, the heat physically defined the silver lining vessel concept. The electroformed layer takes a patina well. It is brittle and fragile and care must be taken when handling this work. These transformation processes address and enhance the original concept for this work

As they were developed, these techniques presented many questions and challenges which were resolved through repeated and practical experimentation. Fortunately, I have always been a strong advocate of sample work because frequently the mistakes that happen in the sample-making process lead to exciting new innovations and discoveries. Because reference works for these techniques do not yet exist, this thesis has become a seminal work. The unique processes developed will be inherent qualities in my contemporary metalsmithing vocabulary.

Table 1

FIFTEEN PERCENT SHIBUICHI FROM STERLING OR FINE SILVER

Grams	Sterling	Fine Silver Content	Copper Content	Add Fine Silver	Add Copper	15% Fine Silver	85% Copper
25g	3.75	3.469	.281	.281	20.969	3.75	21.250
50g	7.5	6.938	.562	.562	41.938	7.5	42.5
75g	11.25	10.406	.844	.844	62.906	11.25	63.75
100g	15	13.875	1.125	1.125	83.875	15	85
125g	18.75	17.344	1.406	1.406	104.844	18.75	106.25
150g	22.5	20.813	1.688	1.688	125.812	22.5	127.5
175g	26.25	24.281	13.125	13.125	135.625	26.25	148.75
200g	30	27.75	2.25	2.25	167.75	30	170
225g	33.75	31.219	2.531	2.531	188.719	33.75	191.25
250g	37.5	34.688	2.812	2.812	209.688	37.5	212.5
275g	41.25	38.156	3.094	3.094	230.656	41.25	233.75
300g	45	41.625	3.375	3.375	251.625	45	255
325g	48.75	45.094	3.656	3.656	272.594	48.75	276.25
350g	52.5	48.563	3.937	3.937	293.563	52.5	297.50
375g	56.25	52.031	4.219	4.219	314.531	56.25	318.75
400g	60	55.50	4.5	4.5	335.5	60	340
425g	63.75	58.969	4.781	4.781	356.469	63.75	361.25
450g	67.5	62.438	5.062	5.062	377.438	67.5	382.5

Table 2

TWENTY PERCENT SHIBUICHI FROM STERLING OR FINE SILVER

Grams	Sterling	Fine Silver Content	Copper Content	Add Fine Silver	Add Copper	20% Fine Silver	80% Copper
25g	5	4.625	.375	.375	19.625	5	20
50g	10	9.25	.75	.75	39.25	10	40
75g	15	13.875	1.125	1.125	58.875	15	60
100g	20	18.5	1.5	1.5	78.5	20	80
125g	25	23.125	1.875	1.875	98.125	25	100
150g	30	27.75	2.25	2.25	117.75	30	120
175g	35	32.375	2.625	2.625	137.375	35	140
200g	40	37	3	3	157	40	160
225g	45	41.625	3.375	3.375	176.625	45	180
250g	50	46.25	3.75	3.75	196.25	50	200
275g	55	50.875	4.125	4.125	215.875	55	220
300g	60	55.5	4.5	4.5	235.5	60	240
325g	65	60.125	4.875	4.875	255.125	65	260
350g	70	64.75	5.25	5.25	274.75	70	280
375g	75	69.375	5.625	5.625	294.375	75	300
400g	80	74	6	6	314	80	320
425g	85	78.625	6.375	6.375	333.625	85	340
450g	90	83.25	6.75	6.75	353.25	90	360

Table 3

TWENTY-FIVE PERCENT SHIBUICHI FROM STERLING OR FINE SILVER

Grams	Sterling	Fine Silver Content	Copper Content	Add Fine Silver	Add Copper	25% Fine Silver	75% Copper
25g	6.25	5.781	.468	.468	18.282	6.25	18.75
50g	12.5	11.562	.938	.938	36.562	12.5	37.5
75g	18.75	17.343	1.407	1.407	54.843	18.75	56.25
100g	25	23.125	1.875	1.875	73.125	25	75
125g	31.25	28.906	2.344	2.344	91.406	31.25	93.76
150g	37.5	34.687	2.813	2.813	109.687	37.5	112.5
175g	43.75	40.468	3.282	3.282	127.968	43.75	131.25
200g	50	46.25	3.75	3.75	146.25	50	150
225g	56.25	52.031	4.219	4.219	164.531	56.25	168.75
250g	62.5	57.812	4.688	4.688	182.812	62.5	187.5
275g	68.75	63.593	5.157	5.157	201.093	68.75	206.25
300g	75	69.375	5.625	5.625	219.375	75	225.00
325g	81.25	75.156	6.094	6.094	237.656	81.25	243.75
350g	87.5	80.937	6.563	6.563	255.937	87.5	262.50
375g	93.750	86.719	7.031	7.031	274.219	93.75	281.25
400g	100	92.5	7.5	7.5	292.5	100	300
425g	106.25	98.281	7.968	7.968	310.782	106.25	318.75
450g	112.50	104.062	8.438	8.438	329.062	112.50	337.50

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Figure 1. A Disconnected Family

Figure 2. Sisters-in-law.

Figure 3. Texture.

Figure 4. There is a Silver Lining.

Figure 5. Sterling Silver Vessel.

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Figure 7. Small Treasures.

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Figure 10. From the Outside Looking In.

Figure 11. Flair.

Figure 12. Tilted.

Figure 13. Green Fields.

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Figure 15. The Burden is Heavy and I Weep.

Figure 16. Time Out.

Figure 17. The Silver Lining Series.

Figure 18. Vessel 1.

Figure 19. Vessel 2.

Figure 20. Vessel 3.

Figure 21. Vessel 4.

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Place of Birth: Chattanooga, Tennessee

EDUCATION:
MFA, Jewelry and Metalsmithing, East Tennessee State University, Johnson City, TN, 2003
MFA, Fibers, University of North Texas; Denton, TX, 1988
BFA, Fibers, East Tennessee State University; Johnson City, Tennessee, 1983
Certification: Machine Tool Technology, Computer Numerical Control, Chattanooga State Technical Community College; Chattanooga, Tennessee, 1991

RELATED STUDIES:
Penland School of Crafts; Penland, North Carolina, metals w/ Marilyn & Jack da Silva, 2001
Haystack Mountain School of Crafts; Deer Isle, Maine, metals w/ Sandra Zilker, 1991
Penland School of Crafts; Penland, North Carolina, fibers concentration w/ Ann Matlock, 1984
Art at the Prado Museum, University of Madrid; Madrid Spain, summer 1981
Arrowmont School of Arts and Crafts; Gatlinburg, Tennessee, fibers w/ Fred Gerber, 1977
Penland School of Crafts; Penland, North Carolina, fibers concentration, 1977
Lily Bohlin School of Weaving; Victoria, British Columbia, Canada, fall concentration, 1976

PROFESSIONAL EXPERIENCE:
2001/2002 Adjunct Faculty in metals and fibers, School of Visual Arts, University of North Texas; Denton, Texas
2000/2001 Visiting Assistant Professor and Coordinator, fibers department, School of Visual Arts, University of North Texas; Denton, Texas
1988-2000 Adjunct Faculty, Periodic Appointments:
University of North Texas; Denton, Texas
Brookhaven Community College; Farmers Branch, Texas
Collin County Community College; Plano, Texas
Chattanooga State Technical Community College; Chattanooga, Tennessee
Artist in Residence, Association for the Visual Arts; Chattanooga, Tennessee

NATIONAL EXHIBITIONS:

American Craft Council Wholesale Market, Eastern States Exposition, West Springfield, Massachusetts, metals 1994

"The Greater Midwest International Exhibition III," Juror Roy Slade Central Missouri State University; Warrensburg, Missouri, fibers, 1988

"ArtQuest '88," One year traveling exhibition: Long Island University, Brookville, New York; Beaver College, Glenside, Pennsylvania; University of California, Irvine, California, 3rd place award, metals, 1988

"Beyond Tradition," University of Houston, Texas, fibers, 1988

Creative Arts Guild 25th Anniversary Fiber Arts Competition," Creative Arts Guild; Dalton, Georgia, 1988

"Fiber Celebrated ," Juror Charlotte Funk, Northern Arizona University; Flagstaff, Arizona, 1987

"Cotton Daze/Summer Haze," Juror Shereen Laplantz, Louisiana State University; Baton Rouge, Louisiana, 1st place award, fibers, 1987

REGIONAL EXHIBITIONS:

"GPS Alumni Invitational," Girl's Preparatory School Gallery; Chattanooga, Tennessee Juror's Commendation Award, metals, 1992

"Lookout for Artist," Lookout Mountain School; Chattanooga, Tennessee, metals, 1991

"Kaki D. Crowell," One person exhibition, Waterhouse Pavilion at Miller Plaza; Chattanooga, Tennessee, metals, 1991

Association for Visual Artists Third Annual Exhibition, Waterhouse Pavilion at Miller Plaza; Chattanooga, Tennessee, metals, 1991

Consignment, BYH Surfaces – Interior Fabrics, Galleria Saguaro; Denton, Texas 1990

"Five UNT Select MFA Graduates," Telephone Pioneer Museum of Texas, Bell Plaza Gallery; Dallas, Texas, metals and fibers, 1990

Faculty Exhibition, Collin county Community College; Plano, Texas, metals, 1989

"Kaki D. Crowell," One person MFA Exhibition, Galleria Saguaro; Denton, Texas, 1988

Honors Convocation Exhibit, University of North Texas; Denton, Texas, metals and fibers, 1988

"Extremes: Lauri Collins / Kaki Crowell," Union Gallery, University of North Texas, Denton Texas, 1988

"Art Salad," Union Gallery, University of North Texas, Denton, Texas, metals and fibers, 1988

Consignment, Omni Art Gallery, Dallas, Texas, fibers, 1987

"DWCA on Exhibit," D'Visual Art Center; Dallas, Texas, fibers, 1987

"Artwear 1987," Apparel Mart; Dallas, Texas, metals, 1987

"Art for All Senses," Union Gallery, University of North Texas; Denton, Texas, metals, 1987

"First Annual Women's Fortnight," Union Gallery, University of North Texas; Denton, Texas, 1987

Contemporary Handweavers of Texas Conference, Trinity Valley Community College; Athens, Texas, First Place Award, 1987