FORM COLOUR TEXTURE
PREFACE

This report is in conjunction with my 1988 postgraduate exhibition which forms part of my postgraduate assessment in silversmithing at the Canberra School of Art (C.S.A.). The twelve month programme involved the exploration and experimentation of form, colour and texture.

Prior to undertaking this programme I had completed, in 1985, a four year Bachelor of Arts degree in Gold and Silversmithing, at the Canberra School of Art. The knowledge and expertise I gained in those four years allowed me to take full advantage of the Graduate Diploma Course. By the end of 1986 I had reached a stage in my development where I needed to do the Graduate Diploma Course to investigate my ideas. I felt that C.S.A. Gold and Silversmithing Workshops had suitable facilities for the work I wished to undertake. The Workshop has a positive creative environment which is a stimulating atmosphere for interrelating concepts with the staff and students.
ACKNOWLEDGEMENTS

Anyone who thinks that writing a report is easy hasn't tried it. There is a lot more involved than just writing about the work you did in the twelve month programme. Fortunately there were many generous, supportive and knowledgeable people around to assist and advise me with this programme.

I am most grateful to the Gold and Silversmithing staff and students for their unfailing interest and support during the twelve months. A special note of thanks to Ragnar Hansen, whose knowledge, experience and supervision proved most valuable during the programme.

To Dr Derek Butterfield, as Safety Officer and chemist, I owe many thanks for the advise and information he gave me on the various chemicals used and their dangerous properties.

My pocket would also like to thank Dr Butterfield and the Department of Chemistry in the Faculty of Science, Australian National University for their generous contributions of chemicals necessary for my experimentation with patina.

I am also very much indebted to Ellen and Lee Shipley for their assistance in putting this report into the computer and help round off the rough bits.

I am most grateful to my brother, Alastair Paton without whose technical knowledge of computers and untiring energy this report would never have been written.

Finally to my parents who were always totally supportive throughout the duration of the project. Last but never least, thankyou David....
INTRODUCTION

Both form and colour contribute to the aesthetic appearance of a piece. The surface (whether textured, coloured or highly polished) integrates with form to make a unified piece of art. I chose established forms for their relatively uncomplicated interpretation when colour and texture is applied.

My conceptual ideas are based on geometric forms especially the established forms, for example the sphere, cube, cylinder, cone and pyramid. The sphere is the purest form, it has total movement yet there are no edges or lines to suggest it. The circular movement is within the form. The sphere has no top or bottom, no start or end. The movement is eternal. It also has no flat planes edges or corners which complicate a form. The circle can be evenly geometrically divided to form a square and triangle.

The cube which is another building block for the geometric forms also has no side that is definitely top or bottom, regardless of its position, it is always balanced, the cube also has an angular movement contained within the form.

The triangular pyramid has the same character as the cube, except no sides are parallel or opposite. These three previous forms can all be symmetrically contained within the sphere. I call them primary shapes or forms.

The following asymmetrical geometric forms are what I consider secondary geometric forms, since they have a profile of a primary shape but not form. e.g. the profile of a cone is a triangle, the triangle is also the profile of a pyramid! So the triangle can be the profile for a cone, pyramid and square pyramid. Three totally different forms. The profile of a cylinder is square but it is not a cube. These geometric forms are combined with each other to create different geometric forms. As these forms are explored, the concepts change and progress into other forms. I chose these geometric forms for their simplified appearance so as when colour and texture is applied it is not confusing.

Colour is part of a form, patination is the process of chemically colouring metal. The patina (colour) remains in the metal, it is not just a colour applied like paint or enamel. The colour and texture is the result of a chemical reaction on the metal surface. I feel the patina is part of the metal, consequently part of the form. I did extensive research and experimentation to control and understand patination.
To get the full understanding of my ideas I felt it was necessary to make three or more pieces on the same theme. My work therefore is in progressing series. The size of my work is very important, it must be able to be handled.
OBJECT FORMS

The first series of work is based on how a patinated surface affects that particular form. I intended that the objects have no top or bottom, but still maintain movement. The tops and bottom act intrinsically as form, the forms can be placed on any surface (plane) or even left to roll around.

When I combined the geometric forms I wanted the final form to be evenly balanced. This was achieved by halving both forms, applying them side by side or having the two volumes the same depending on the individual shapes.

FOUR OBJECTS

Approx 10 x 15 cm Copper, Brass
These are two primary forms combined to make another geometric form. The junction of the cube and hemisphere describes the efficient union of the two forms. This particular object appears architectural as the hemisphere was often used as domes on towers, especially in religious buildings (mosques and churches).

I feel this form is established and hence very familiar. There is no contrast within the form; it is very harmonious. The effect of these concave sides made the form appear much softer as the cube was no longer sharp and angular but with gently curving planes. I used a traditional ammonia patina which gave the piece a very strong architectural feel. This patina is similar to a patina found on copper domes on cathedrals. In Italy where there are many pigeons a natural patina forms on the copper domes. The high ammonia content in pigeon droppings causes this ancient natural patina.
With the use of the square pyramid the piece appears very sharp. I feel the pyramid dominates the sphere. There is no flow from the sphere to the pyramid. Also due to the side of the pyramid being dramatically sucked in, the pyramid has many conflicting and contrasting curves. I feel this form would work better if the sides were more convex than concave. The patina on this form is totally uncontrolled, yet I found it quite appealing, a deep etching with blue veins running haphazardly around the form!

I feel as a piece it is unsatisfactory, but in an experimental nature it has potential and could be promising if it could be controlled and reproduced.
The combination of these two pointed forms gives a contrast of movement in opposite directions. I feel that the form is attempting to pull itself apart. The cone and pyramid have the same height so they are in proportion. I made the base of the triangular pyramid slightly uneven (asymmetrical) hence two of the arches are the same and the other is slightly larger and deeper. I feel this gives the form an unbalanced appearance in certain perspectives, which isn't obvious at first glance. I rather like this form for its contrasting and ambiguous feel. The patina also supports the contrast as it appears a soft blue but has a stone-like feel to it. Its appearance is also misleading as to its weight. I feel it appears very heavy, similar to a solid piece of rock, yet it is very light.
Even though the pyramid is a harsh angular form, the slightly convex curved surfaces have made it compatible with the sphere. This piece works particularly well for its harmonious appearance with form, texture and colour. The texture is not too strong to destroy the hard edges of the pyramid and the join of the pyramid and sphere. The small, mottled, greeny-blackish-yellow spots give the piece depth and warmth. The forms are in proportion with each other and the pyramid holds the only direction. This is a very successful piece.
CONE / SPHERE

This form appears very simple as it has only one point which gives it only one direction of movement outwards. Initially I made this form as 1/2 hemisphere to cone, but I felt that the proportion was all wrong. I then made the proportions 2/3 sphere to cone, hence the nickel silver container form with blue tip and band which is in more detail in the Geometric Container forms.

When I had made these four object forms, they were in their natural unfinished state of filed or sand-blasted metal. I could not apply a patina until I undertook some experimentation with patina.

With these four forms I realised how important it was to visualise the form as a finished object, not as an object that has an unfinished metal surface with later on a patina being applied. I was able to gain a stronger understanding of the relationship between form, texture and colour after I experimented with patinas and then applied them to the forms.
COLOUR AND TEXTURE

After I completed the four object forms I started to experiment with patina. Colour and texture were an important part of my work and so I needed to experiment and explore the patination of metal. Initially my methodology for testing was fairly complex. This became simpler as I discovered the relationships between surface treatments, metals, chemicals and methods of patination. My first task was to gain control over the amount of irregularities, colour and texture. Once this was achieved, I was able to progress with more combinations of chemicals to develop better colour combinations.

Aesthetically, it was very important for these works not to have any visible joins. In my research (2,3,4) I could find no previous work had been done on the use of solders with patinas and metals. Therefore I had to undertake some fairly rigorous testing of the solders and material combinations I wanted to use.

Initially, I used silver solder. After using copper phosphorous solder which patinas well, it was no longer necessary to use silver solder. The copper phosphorous is also know as "Phos Copper" made by Comweld CIG (f) for flux free brazing of copper. (Refer to Appendix One for more information)

There was a substantial break between completing these four object forms and finishing the forms with patinas. Only after experimenting with patination did I choose which patina suited a particular form. I discovered many interesting aspects about form with colour and texture after I applied the patinas. Coarse, deeply etched patinas tend to work with smooth subtle forms, but when a 'gutsy' patina is combined with sharp edges and angles they tend to be lost.. The more matt, smooth patinas tend to complement sharp, angular complete forms. I think when a 'gutsy' deep patina is applied to an angular complex form, there is too much contrast and confusion within the piece. The piece doesn't hold together (like wine that has turned).

There was a time gap between the completion of these forms and applying their patina. I feel the piece is more successful when I decide on the total image of a piece. The colour, form and texture are together, not a separate mix and match.

See Appendix Two for the results of patination.
CYLINDRICAL CONTAINERS

I started the next series with the intention of creating the piece as a whole, by deciding on the patina with the form before I made the piece. These pieces are a series of cylindrical containers, they all have the qualities of having no predetermined base or top, they can be replaced in any particular position that the handler chooses to put them in. The pieces are a suitable size to be turned around in the hand, I wanted the pieces to be viewed, touched and opened to be heard (each piece has its own vocal statement). When the piece is opened there is a popping sound, the piece can also be used as a whistle. Each piece has a subtle change in tone due to the slight variation in the cylindrical forms.

CYLINDRICAL CONTAINERS

Approx 3 x 3 x 23 cm

Copper
I feel the intricate, complex colour and texture improve this very simple form. A complex form with a complex patina would be too confusing and contradictory. The ends are round so the movement is within the form. The band is very unobtrusive, it suggests that there is a join, it also acts as a flange. A flange is traditionally on the inside of a container which is purely practical. By placing the flange on the outside I have made it a decorative feature as well as functional. The rounded surfaces fuse with the "gutsy" patina to create an almost "stone-like" sensation. The build-up of copper salt (hence the blue) makes the piece appear very heavy and old. I found it quite fascinating to handle this piece which was fresh out of the patina and only a few days old, yet it felt like it had been buried for hundreds of years.
This piece is very fluid with no hard corners. The ends are round and the ring is round. I feel this patina worked particularly well on this form because it is very soft and warm. The angle of the ring gives the form a slight contrast and movement.
The ball is relatively large in this piece to accentuate the join. I feel this piece has a slight anatomical feel to it (similar to a knee socket), as opposed to a bulbous formation. The piece is very harmonious in form, texture and colour.
I feel this is an organic form with sexual connotation. I found this accidental form quite humorous. Even though it is obviously a softly curved form it has also complex curves and movement, so to keep with the form I patinated it matt black which suits the form perfectly! I think that the combination of flowing curves with a matt smooth texture makes the piece very satisfying to touch and handle.
This form is harsh and angular with a strong definite disc to add contrast and movement. I also highly polished the rim to emphasise the contrast line in the form. The matt black patina complements this sharp hard angular form. This piece has a slick industrial design feel to it!
I intended the Square to be a strong sharp line cutting through the form. This has been achieved, but the piece does not work aesthetically. The thinness of the square plate (sheet) does not relate to the solid, cylindrical form. This piece had a sand blasted black surface which gave it a 'high-tech' appearance. Unfortunately, it also magnified any imperfections or slight curves in the metal. A deep textured patina with a blue tinge suited this form best. It made the form stronger.
This is the most successful of the large containers. My aim was to create excitement in the change of angles in the form. By making the disk round with a curved rim, it held the form together as a whole. The piece is quite successful. The gutsy dark olive green patina blends perfectly with the form.
This piece is very successful as it works as a whole. I placed the triangle at the same angle as the ends to mirror the movement of the cylinder. The triangle is a contrasting form. To emphasise this I patinated the rim in a different texture and colour. Because the piece is large, a coarse, deeply etched patina was needed. The black rim also gives the appearance of a gem stone sliced and polished in its natural state, leaving a coarse grained shell with a flat highly polished face.

This series of work was very cohesive. It explores variations of a theme. The pieces combine their colours and textures to resolve the exploration. The qualities of each piece invite the observer to pick up and touch the piece. It is important for a person to appreciate a piece texturally as well as visually. I wish my art to appeal to the sense of touch as well as sight and occasionally sound (with the popping sound from the containers as they are opened - they also make good whistles!).
GEOMETRIC CONTAINERS

I found the next series of work very stimulating and enjoyable. I wanted each piece to have no predetermined stationary position, to have total freedom in itself, to be left just to roll around. These pieces were also made to be comfortable to hold and turn in the hands. I strove to make pieces that suggest they could be opened, by accentuating the junction of the two forms. My intention was that once the form was opened, and the two sections separated, each section had a strong identity in it's own right.

GEOMETRIC CONTAINERS

Approx 11 x 10 x 14 cm Copper, Nickel silver
This piece is exciting and well-resolved. It has all the qualities for which I have been striving.

- The object (container) has no top or bottom. It may pivot around a point or roll in a large circle on its rim.
- When the form is separated, the sphere and cone are strong identities on their own.
- The patinas work with the form.
- The change in material and shape acts as a contrast and indicates the separation between the two forms, yet the piece still appears to be one form.

On the form is an etched patina, on the copper wire and tip the patina is built up which acts as a textural contrast, the square wire and tip are the two points where the piece contacts the surface. I think the blue patina works exceptionally well to emphasis the areas of "stress" or weight. This piece is very strong both assembled and separate, I found the spherical shape was very satisfying to handle and move in the hand.
The black patina on this form is very deep and soft, giving this angular form a soft appearance. This piece works best when it is resting on the rim and cone. Note the end of the cone is slightly raised off the surface, giving the piece the appearance of “take-off”, defying gravity, and hovering just above the surface. The light coloured rim acts as a contrasting dividing line on the form. Initially, the rim was highly polished, but in most situations it picked up the surrounding colours (from jumpers) confusing the appearance of the piece. I dulled the rim so it was still a contrast to the black so it didn't pick up the surrounding colours.

I enjoyed making these pieces. The enjoyment is obvious in the humorous impressions of the pieces. The pieces are conceptually similar, yet they are all individually different. The use of a contrasting lines on the forms works perfectly. I also enjoyed viewing the inside of these pieces. Once they were opened, I saw lines and curves on the inside, that were different but related to the outside appearance. I pursued the concept of viewing the inside and outside of the form in the next series of open forms.
This piece has a lot more contrast than the previous piece. I find this piece quite humorous from the bottom-up position or pointing to the sky effect. The round disc on the square pyramid acts as a very strong contrast. The patina works with the "amusing" appeal of the piece, with its pink background and tiny little blue spots! The transition from the sphere into the square pyramid creates very pleasing semi-circular lines. The big bottom side (backside) is very comfortable for the hand, it encourages the holder to view the piece differently and experience its textural qualities.
OPEN FORMS

I felt that to fully appreciate the inside and outside of a form at the same time it needed to be larger than the previous forms. I strove to make an open form that was harmonious and balanced using spheres, pyramids, and cones.

OPEN FORM

The open form is the combination of a sphere & triangular pyramid. The piece can be placed in any position. I feel the best position is on its round sphere and long edge of the pyramid. This piece has movement round and up, but it has controlled movement as it stops at the junction of the three planes of the pyramid.

The initial patina was a blueish tinge that was varied and irregular. I did not feel that the consistency of the patina suited the form. I removed the patina with sulphuric acid which left a slightly etched surface where the patina was and had a brass appearance. This surface remained on the piece until I felt that a warmer darker patina would be more suitable. The reddish hue on the form suits this harmonious form: this form is resolved and complete.
UNFINISHED FORMS AT TIME OF WRITING

Unfortunately, at the time of writing, two forms were still in progress, and will be completed for the exhibition in March. They can be viewed at the exhibition and commented upon at that time, independent of this paper.

These forms consist of two large open forms, one of copper, one of guilding metal. Both have similar conceptual ideas and aims to the open form series. The open forms can be viewed from any angle, they have no predetermined front or back. I felt the forms are resolved and complete, yet still retain some excitement and spontaneity in their design.
CONCLUSION

In conclusion, I feel this programme has helped me to fully understand the relationship between form, colour and texture. I achieved this through the exploration of form and the experimentation of patination. My concepts were based on geometric forms. I chose these forms for their relatively uncomplicated interpretation when colour and texture was applied.

With the object forms, I discovered it was necessary to visualise the piece as a whole, not as a form (with an unfinished surface) with colour and texture applied later on.

It was important for my work to be held, so as the viewer/holder could fully experience and appreciate the pieces form and textural qualities, not just its visual appearance.

I wanted the geometric containers to have no predetermined stationary position, to have total freedom in movement, to be left to just roll around. The pieces can be opened and each section is strong enough to remain separate and stand on its own.

The open form series is most exciting, not because it is the end of the proposal, but has given me a starting point to go on with and progress with new ideas.

I feel confident to continue my work outside the environment of an institution and I believe it is necessary to keep in contact with the workshop and to continue the rapport I have established with staff and students.

I greatly benefitted from the amount of space that was made available to me. My only frustration was the inadequate colouring facilities at the time of the programme. To achieve certain colours, different techniques were necessary which required fume cupboards for boiling chemical solutions. The cupboards were completed by the end of '87, unfortunately this was too late any extensive experimentation in patina. It was disappointing that no experimentation in patina of this nature could be included in this report.

The programme has given me a strong foundation to continue pursuing my concepts with form, colour and texture.
"PHOS COPPER" is an excellent solder to use when the process of patination is applied, as it reacts similar to the base metal, so joins are scarcely visible. The natural colour of the solder is black. A black line can be seen depending upon what patina technique and base metal are used.

The false copper alloy is not very ductile. It will crack or split with rolling or hammering. Therefore, prior thought had to be given to what patina, metal and position of the join, in order to select an appropriate solder.

The alloy tends to run all over the surface. I controlled this by chalking the areas that needed protection. The chalk acts as a resist, e.g.

Some areas were inaccessible for cleaning, yet were visible. By using the chalk, many joins became neat and controlled. Information appears below from the Comweld C.I.G. Catalogue of Gas Welding Consumables (1).
COMWELD Phos Copper

*For flux free brazing of copper*

**Characteristics:** COMWELD Phos Copper is an excellent substitute for low silver content brazing alloys. It is a thin flowing alloy with good corrosion resistance and electrical conductivity. The outstanding characteristic of this alloy is that no flux is required on copper to copper joints.

- Typical Tensile Strength: 370 MPa.
- Typical Melting Point: 715°C.
- Complies with: AS.1167-B1; BS.1845, Type CP3; AWS.A5.8-B Cu P2; ASME. SFA 5.8-B Cu P2.

**Applications:** Because COMWELD Phos Copper has an extremely good capillary action, parts to be joined should be a close fit, i.e. from 0.05-0.08 mm. COMWELD Phos Copper was designed to meet the need for a reasonable priced alloy for use on copper to copper without the need of flux. This alloy is used extensively by the Refrigeration and Electrical Industries on copper tubing, etc. It is not recommended to join steel or other ferrous base metals.

**Procedure:**

1. Ensure areas to be joined are as clean as possible.
2. If this alloy is to be used on copper alloys, COMWELD Copper and Brass Flux (321822) should be used.
3. Heat parts to be joined and, when correct temperature is reached, a small amount of COMWELD Phos Copper should be melted off and the flame drawn away approximately 50-80 mm. Keep moving along until the joint is completed.
4. Avoid overheating and remelting.
5. The copper colour of the braze areas can be restored by immersing in 10-20% sulphuric acid and water solution. Rinse in hot water.

**Colour Tip:** Crimson.

**Packaging:** Sealed packets.

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<th>Standard Diameters</th>
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**Easyweld Packs:**

| 3.2 mm | 15 rod pack | 322042 |

**Standard Length:** 750 mm
APPENDIX TWO

RESULTS OF PATINATION

I found test strips the best form of recording and storing the results. Each metal strip was stamped to indicate the type of metal, patina, surface treatment and method used. See next page for Layout and Table of Codes used on test strips.

Preparation of Test Strips:

**Solder:** Initially I soldered the test strips together using silver solder to see how the solder would patina. After using the Phos Copper solder (refer to Appendix One) it was no longer necessary to solder test strips together.

**Cleaning Solution:** All surfaces needed to be free of dust, grease, etc. I made my own cleaning solution of 70% washing-up detergent, 20% concentrate ammonia and 10% water. The test strip would be rinsed in hot water, washing with cleaning solution, rinsed again and finally wiped over with acetone.

Waxes for Finishing and Sealing:

**Durosil Silicone** is a wax paste for floors, which is suitable for patinas that are delicate or can be rubbed off.

**Matisse Matt Varnish:** A thin coat of varnish is suitable for patinas that can be easily rubbed off or are built up.

**Silicone Car Wax:** This wax is very hard and requires vigorous polishing. Only patinas that are gloss, matt, strong and stable are suitable for this wax.
Patina Test Strips.

4.5mm Hole for Holding Test Piece

Type of Metal → Cu → Method Used → Sm → Type of Patina

Surface Treatment

Codes for Test Strips.

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<td>Gilding Gi</td>
<td>Emery B</td>
<td>&quot; - Med. Sm</td>
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<tr>
<td>Brass Br</td>
<td>File - Coarse C</td>
<td>&quot; - Fine Sf</td>
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<td>Sand Blast D</td>
<td>&quot; - V. Fine Svf</td>
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Method:

**Wood Chip:** The hard wood chip is sifted into four different grades using sifting pans. The wood chip was then dried in the open air. When saturating the sawdust with chemicals, the consistency should be such that the sawdust glistens. It does not drip when a handful is held, but when it is squeezed the solution starts to drip out.

If the sawdust isn’t wet enough then patination only occurs where there is direct contact with the metal. Etching occurs to the same texture as the sawdust.

If the sawdust is over saturated pooling occurs at the base of the container and the section of the piece submerged tends to be patinated/etched differently. Consequently, localised patination occurs.

**GENERAL NOTES:**

Solutions with Nitrate in them tend to etch the surface as well as patinating them.

- Copper sulphide
- Potassium sulphide
- Sodium sulphide
- Barium sulphide
- Calcium sulphide
- Cuprous oxide
- Cupric Oxide
- Ammonium Chloride
- Ammonium Carbonate
- Acetates
- Chlorides

Sulphur compounds all tend to give a black colour

Oxygen compounds produce brown - red tones

Basic chlorides and carbonates produce brown - green tones

Yellow - green tones

Rich solutions act rapidly and darken after a while.
TYPES OF PATINA

The combination and quantities of chemicals in the solutions are from the book "the Colouring, Bronzing and Patination of Metals" by Richard Hughes and Michael Rowe (2).

1 Blue / green.          Sawdust (20-60 hr)

Ammonium Carbonate 120 gm
Ammonium Chloride 40 gm
Sodium Chloride 40 gm
Water 1 lt

The first batch was in for 38 hours and was very speckled. This was due to the sawdust not being moist enough, so the patina only occurred where the sawdust particles had direct contact with the metal.

The second batch was for 20 hours with evenly saturated medium sawdust. The patina tended to be most consistent on a sandblasted surface. If a more bluish patina is desired leave the piece in the sawdust for approximately three days or until the necessary colour is reached.

This solution can used with cotton wool and cloth, giving a textured cloth effect or a mottled surface with the cotton-wool.

2 Orange / red / brown    Sawdust (two days)

Copper nitrate 200 gm
Water 1 lt

I used very fine woodchip (wood dust) when the solution was added the consistency was very similar to mud.

Once the pieces were removed it was obvious that the purple blue steely grey colour was only successful on the sand blasted or coarsely filed surfaces or when the sawdust was very moist.
3 Red / green / yellow

Copper nitrate 280 gm with
Water 850 ml
Silver nitrate 15 gm with
Water 150 ml

Dissolve the copper nitrate and silver nitrate in separate portions of water.

The fine sawdust gave a fine even texture and colour, the sawdust must be evenly packed around the piece otherwise unevenness occurs. The results with various metals are listed below:

Cu: Even Orange / red on sand-blasted surface
Br: Black / yellow on sand-blasted surface (med. wet sawdust)
Gi: Orange / red occasionally on polished surface
Ns: Yellow / green / black etch on highly polished surface

4 Blue residue with brown base

Ammonium carbonate 24 gm
Pottasium hydrogen tartrate 6 gm (cream of tartar)
Sodium chloride 6 gm (salt)
Copper sulphate 6gm
Acetic acid 6% to form paste

The paste is applied then left to dry for about two days then more paste is applied. A thick buildup of copper salt forms resulting in a think blue layer which can be chipped off leaving a dark brown metal base.

Not very successful.
5 **Blue / green** (old patina)  
Liquid (several days)

Ammonium chloride 35 gm  
Copper acetate 20 gm  
Water 1 lt

More liberal applications of the solution tends to result in a bluer patina. Apply be dabbing and wiping sparingly, leaving an evenly moist surface, let dry and repeat once a day.

This patina develops into a blueish hue, similar to the green on architectural copper domes. It is very effective on surfaces that have pits. for example a chased, punched or filed surface giving a dark brown bases and light blue in the crevices. It should be noted that NS sandblasted had the appearance of sandblasted glass.

6 **Black**  
Liquid (several min)

Potassium Sulphide 125 gm (Liver of sulphur)  
Ammonia (.880 solution) 100ml  
Water 1 lt

Patina reacts very quickly on a sand blasted surface and there is an instant reaction with copper. To patina Br, Gi and Ns the metal needs to be dipped in pickle (sulphuric acid) after being dipped in the patina solution.

7 **Brown / bronze**  
Torch (several min)

Ferric Nitrate 10 gm  
Water 1 lt

This has the appearance of mouldy metal.
8  Orange / brown  Liquid (5 days)

Copper Nitrate 15 gm
Zinc Nitrate 15 gm
Ferric Chloride 5 gm
Hydrogen Peroxide (100 vol) to form paste

I applied liquid twice a day for five days. The patina gradually became stable, deeper and duller. All sand blasted surfaces went dark brown with blue hue. The results below are on a highly polished surface after 20 hours.

Cu: Yellow / orange appears like yellow gold and rubs off
Br: Uneven, mottled red / orange / yellow / brown and rubs off
Ns: Yellow, very unstable and rubs off. Three days later, where the initial yellow patina rubbed off, a red patina slowly appeared with a blue fringe.

9  Dark / mottled brown (like firescale)  Torch

Ferric Chloride 10 gm
Water 1 lt

The brass and gilding take the appearance of copper once the patina is added. Nothing happens to the Nickel silver. This patina looks like blotchy firescale. It is unsuccessful.

10  Red / brown  Paste (30 min)

Antimony Trisulphide 30 gm (poison)
Ferric Oxide 10 gm (rouge)
Ammonium Sulphide (to form paste) garden fertilizer

A beautiful deep red brown forms on the highly polished surface of the brass and nickel silver, going darker on sand blasted and emeried surfaces. The Gi and Cu went black which could be rubbed off and was very unstable. The Silver solder was patina-ed black. When these pieces were waxed, the recesses went a pale green colour which was a good contrast against the black base metal.
11 Brown / bronze Paste (30 min)

Antimony Trisulphide 20 gm
Ferric Oxide 20 gm (rouge)
Potassium Poly-sulphide 2 gm (liver of sulphur)
Ammonia (.880 sol) 2ml.
Water 4 ml to form paste

This patina is a very messy process!

Cu: some patina was removed on the highly polished surface. When the excess powder was removed during waxing the remainder of the patina rubbed off in patches and the sandblasted surface no longer remained a shiny red black but a blotch bronze.

Gi,Br & Ns all tarnished on the highly polished surface. On the sand blasted surface, a shiny red black formed which was removed during waxing.

12 Bronzing Cold application (30 min)

Potassium Sulphide 1 gm (liver of sulphur)
Ammonia Chloride 4 gm
Water 1 lt

A bronzing darkening of metal with cold scratch brushing.

13 Black mottled Liquid (several min)

Potassium Sulphide 10 gm (liver of sulphur)
Ammonia (.880 sol) 1-2 ml

Gives a varied mottled effect. Patina number six had better results. Same chemicals but different proportions
14 Dark brown bronzing

Liquid (several min)

Potassium Sulphide 20 gm
Ammonium Chloride 30 gm
Water 1 lt

Cold scratch brushing, same results as number 12 and same chemicals but in different proportions.

15 Blue black bronzing
cold scratch brushing (few min)

Potassium Sulphide 2 gm
Ammonium Sulphate 5 gm (garden fertilizer)
water 1 lt

This is a cheap easy bronzing patina.

16 Black (on Cu , Gi)

Liquid (several hr)

Barium Sulphide 10 gm
Water 1 lt

After two hours the pieces were removed and rinsed in water. No reaction with brass, Ns went a bronze yellow. The Cu and Gi went a deep blue black gloss on the highly polished surface and only an even strong black patina formed on the sandblasted surfaces.

After being submerged for 20 hr a very deep patina develops.

17 Black

Liquid (several hr)

Copper Nitrate 200 gm
Zinc Chloride 200 gm
Water 1 lt

Cold application twice a day. It was not necessary to test solution 17 as I had found a suitable black with solutions 6 and 16.
18 Black Liquid (few min.)

Copper Nitrate 20 gm
Zinc Sulphate 30 gm
Mercuric Chloride 30 gm

It was not necessary to test solution 18 as I had found a suitable black with solutions 6 and 16.

19 Blue / green on brown Applied liquid (five days)

Copper Nitrate 110 gm
Water 110 ml
Ammonia (.880 sol.) 440 ml
Acetic Acid (6% sol) 440 ml
Ammonium Chloride 110 gm

20 Lustre Cold immersion (one hr)

Antimony Trisulphide 50 gm
Ammonia Sulphide 100 ml
Water 1 lt
21 Lustre

Cold immersion (30 min)

Sodium Theosulphate 240 gm  
Copper Acetate 25 gm  
Water 1 lt  
Citric acid crystals 20 gm

A dark brown black formed on the sandblasted surfaces of Cu, Gi and Br. The Ns had a blue streak which I could not repeat. The lustre only occurs on the highly polished surface. After five minutes the Cu, Gi and Br went a reddish dark colour which progressed into a dark brown perpetual blue lustre for Cu, a pink-brown with a pink-blue lustre for Gi and a orange brown base with blue petrol lustre for Br. Ns developed a very interesting lustre series:
+ 5 min bright pink lustre
+ 10 min blue black lustre
+ 15 min blue with yellow base
+ 20 min back to a dull pink yellow patina

The lustre appears to get duller with each time series.

22 Dull pink lustre

Applied paste (5 min)

Antimony Trichloride 50 gm
Olive oil to form paste

23 Purple / black with red

Fine sawdust (20 hr)

Butric Acid 20 ml
Sodium Chloride 17 gm
Sodium Hydroxide 7 gm (Caustic Soda)
Sodium Sulphide 5 gm
Water 1 lt

To mix solution first add sodium sulphide to water then add sodium hydroxide to solution (to neutralize) then add remaining ingredients. Do not add sodium sulphide with butric acid otherwise a toxic hydrogen gas will be released.

On the Cu and Gi, a rich deep purple red mottle appeared. There was no colour on the Br or Ns, just an etched mottle.
24 Blue spots with pink  

\begin{itemize}
  \item Ammonium Carbonate 20 gm
  \item Oxalic Acid (Crystals) 10 gm
  \item Acetic Acid (6% solution) 1 lt
\end{itemize}

Cu: On both highly polished and sandblasted surfaces, a blue-green patina formed. The surface has a glittering quality due to the small copper acetate crystals.

Gi: On the highly polished surface small copper crystals formed, causing a blue-green spotty effect on an orange/green base. On the sandblasted surface a more even matt green patina formed, with glittering copper crystals.

Br: On the highly polished surface, a deep orange base formed, with small spots of copper crystals. On the sandblasted surface an orange smoky brown patina formed with no copper crystals.

Ns: On the highly polished surface, a pink-y red base patina formed with little blue glittering spots of copper salts. On a sand blasted surface a dull orange brown patina formed.
I feel the technical aspect of my program is only relevant where the technique has had a direct effect on the conceptual appearance of the piece. I have pointed out particular aspects of the development of certain pieces and how through the physical process of "making" new forms and concepts develop.

My drawings are a basic personal record of my concepts. Through my drawings I can work out technical difficulties with pieces. My quick initial sketches tend to be small and as the concepts develop I draw the pieces to scale, sometimes freehand, sometimes technical drafting, emphasising certain angles or technical difficulties in the piece. Throughout my programme, certain forms and technique reappear. For pieces that were fabricated, I made mock-ups of thick cardboard. This assisted me in understanding the form in 3-D and the scale. The final mock-up was often used as an accurate pattern before cutting out the metal. I found it difficult to calculate on paper the curve of joining two geometric forms. By using cardboard mock-ups as a guideline, a lot of time and metal was saved. Not all the pieces had mock-ups as I felt it was not always necessary. Also not all the mock-ups proceeded to be made in metal.

The spheres were all raised by calculating the length of the curve required. It was possible to raise out the hemisphere. The cones were also raised as I did not want a visible join. All the square pyramids, triangular pyramids and cubes were fabricated. A pyramid is calculated by drawing a circle, the radius being the desired length of the pyramid edges, e.g.

If the bottom edge of the pyramid varies from the side edges, then the distance around the circle varies accordingly.
Shape cut out to fabricate a triangular pyramid:

Shape cut out to fabricate square pyramid.

For most calculations basic secondary school geometry was used. For the curves that were used, normally a mock-up was made and the curves applied to the metal, e.g.:

Pyramid / sphere:

Cube / sphere.

Once the pattern is cut out, I scored all the edges to be folded, then the surfaces are planished so they are slightly convex. By putting a subtle curve in the metal it gains extra strength and tends not to suck in or bow when soldered. The first few forms sucked in during soldering. For example, the sphere cube and the square pyramid sphere. Once the piece has sufficient curve and correct angles and fits the other section, then the piece may be soldered. I used silver solder on the joins that were not to be patinated. Otherwise I used false copper. Refer to Appendix 1.
BIBLIOGRAPHY


