The Reconstruction of Historical Jewellery and its Relevance as Contemporary Artefact

An ADR submitted in fulfillment of the requirements for the degree of Doctor of Philosophy

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To RMIT Higher Degrees

For Appropriate Durable Record & Exegesis

Declaration

I hereby declare that the Appropriate Durable Record and Exegesis for the work entitled The Reconstruction of Historical Jewellery and its Relevance as Contemporary Artefact, as submitted on seventeenth of November for the qualification of PhD, represents the work of myself, except where due acknowledgement has been made in the documentation.

The work entitled The Reconstruction of Historical Jewellery and its Relevance as Contemporary Artefact, has not been submitted, either in whole or in part, for any other academic award. The Appropriate Durable Record represents the work undertaken during the period of candidature from 01/01/1999 – 17/11/2005 being part-time by research.

Some material included here represents a revision and extension of previous conclusions.

Yours sincerely

Robert Baines
Melbourne, November 2005
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## Glossary

### Abbreviations - Journals, Institutions, Catalogues and Books

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<tbody>
<tr>
<td>AJA</td>
<td>American Journal of Archaeology.</td>
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<tr>
<td>BM</td>
<td>British Museum.</td>
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<tr>
<td>BMOP</td>
<td>British Museum Occasional Paper.</td>
</tr>
<tr>
<td>CBA</td>
<td>Council for British Archaeology.</td>
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<tr>
<td>GB</td>
<td>Gold Bulletin.</td>
</tr>
<tr>
<td>GR</td>
<td>Greek and Roman (BM)</td>
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<tr>
<td>JAS</td>
<td>Journal of Archaeological Science.</td>
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<tr>
<td>JHMS</td>
<td>Journal of the Historical Metallurgical Society.</td>
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<tr>
<td>JHS</td>
<td>Journal of Hellenic Studies.</td>
</tr>
<tr>
<td>JAS</td>
<td>J. Paul Getty Museum, Malibu</td>
</tr>
<tr>
<td>MASCA</td>
<td>Museum Applied Science Centre for Archaeology, The University of Pennsylvania.</td>
</tr>
<tr>
<td>MCA</td>
<td>Museum of Contemporary Art, Sydney.</td>
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<tr>
<td>MMA</td>
<td>The Metropolitan Museum of Art, New York.</td>
</tr>
<tr>
<td>MNAA</td>
<td>Nacional Museu de Arte Antiga, Lisboa</td>
</tr>
<tr>
<td>NGA</td>
<td>National Gallery of Australia, Canberra.</td>
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<tr>
<td>NGV</td>
<td>National Gallery of Victoria, Melbourne.</td>
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<tr>
<td>NYHS</td>
<td>New York Historical Society.</td>
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<td>SAM</td>
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<tr>
<td>SJH</td>
<td>Society of Jewellery Historians.</td>
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<tr>
<td>St. Etr.</td>
<td>Studi Etruschi.</td>
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<tr>
<td>St. Va</td>
<td>Studia Varia.</td>
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<tr>
<td>TWMA</td>
<td>TarraWarra Museum of Art, Healesville.</td>
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<tr>
<td>V&amp;A</td>
<td>Victoria and Albert Museum, South Kensington.</td>
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<tr>
<td>W.C.G.</td>
<td>Worshipful Company of Goldsmiths.</td>
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## Technical Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>EDAX:</td>
<td>Energy Dispersive Spectrometer</td>
</tr>
<tr>
<td>EMP:</td>
<td>Electron Microprobe</td>
</tr>
<tr>
<td>PGE:</td>
<td>Platinum Groups</td>
</tr>
<tr>
<td>SEM:</td>
<td>Scanning Electron Microscope</td>
</tr>
<tr>
<td>SEMEDS:</td>
<td>Scanning Electron Microscope Energy Dispersive Spectrometer</td>
</tr>
<tr>
<td>XRF:</td>
<td>X Ray Fluorescence</td>
</tr>
<tr>
<td>Au:</td>
<td>Gold</td>
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<tr>
<td>Ag:</td>
<td>Silver</td>
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<tr>
<td>Cl:</td>
<td>Chloride</td>
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<tr>
<td>Co:</td>
<td>Carbonate</td>
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<tr>
<td>Cu:</td>
<td>Copper</td>
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<tr>
<td>Na:</td>
<td>Sodium</td>
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Summary of Research

The dating of ancient jewellery is given by the archaeological context. Technology applied by the ancient goldsmith is traceable through archaeometallurgy. The aim of this research is to analyse historical jewellery and to construct copies based on the known technology of the era. Resultant laboratory constructions with their historical correctness and the new knowledge of jewellery structures will then be available for reworking to convey a contemporary visual relevance and a statement of history. The results of these analyses and reconstructions will form the basis of metalwork objects in which contemporary aesthetics are informed by historical practice.
1. Introduction/Summary of Exegesis

1.1. Two Major Antecedents

Streams of archaeometallurgy and studio art practice as a goldsmith come together in this body of research though there have been on going periods of mutual exclusivity of both endeavors. I was introduced to the jewellery technique of granulation by my lecturer Wolf Wennrich in the Gold and Silversmithing Diploma Course at Royal Melbourne Institute of Technology. Following graduation in 1970 I pursued a studio investigation of the granulation technique using combinations of silver and gold alloys and applications of this acquired skill became an important aesthetic component in my studio artwork.

**Archaeometallurgy**

In 1979 I was awarded a Winston Churchill Fellowship Study to examine the fine jewellery of Greek and Etruscan goldsmiths.1 The objective of the study tour was to gather information on the varied structural contexts of granulation joining and their possible application in a contemporary goldsmith practice. The Churchill Fellowship Study facilitated my first visit overseas to examine ancient jewellery in public and private collections and initiate what became an ongoing dialogue with curators, researchers and material scientists in the major museums of Europe and the USA. Ongoing visits to examine goldworks predominantly in public collections ensued and resulted in writing research papers2 and presentations at major conferences and workshops on the subject.3 In 1989 at Royal Melbourne Institute of Technology I supervised a multi disciplinary research project into the analysis and evaluation of a gold jewellery piece from the Antiquities collection in the National Gallery of Victoria.4

In 1997 I conducted a Senior Fulbright research project at the Metropolitan Museum of Art in New York in the Sherman Fairchild Center for Objects Conservation. The research was primarily centred on Etruscan and some Greek gold jewellery. This was a critical point for personal discovery due to the very supportive staff at the museum and availability of primary research material.

**Studio Art and the Practice Based Research**

I have been a practicing artist goldsmith continuing to exhibit internationally since "Tendenzen 1982", Schmuckmuseum, Pforzheim Germany.

Subject based jewellery and larger works have been commissioned and shown extensively in Europe, USA and New Zealand and I have been awarded major art prizes including the Colin and Cecily Rigg Award 1997 (NGV, Melbourne) and the Seppelt Contemporary Art Awards 1998 (MCA, Sydney). Larger works acquired for public collections include The Spray Brooch (Powerhouse Museum, Sydney), The Entropy of Red, Trumpet (Victoria and Albert Museum, London), and Tea Sets (NGV, NGA,

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3 In correspondence to the Fulbright Review committee on this subject Dr. Barbara Deppert-Lippitz wrote, “His (Baines) articles on the gold cylinders from Praeneste, published in 1992 and 1993, have set a completely new standard in the scientific as well as in the art historical analysis of ancient jewellery. For about 30 years most of the research on ancient goldsmithing techniques has been quite repetitive. Mr. Baines’ work was the only remarkable exception. His approach lead to the discovery that in ancient goldwork stylistic features are often the result of technical necessities” (05-09-1995). Dr. Joan Mertens, curator of the Greek and Roman Department of the Metropolitan Museum in New York, wrote “To my knowledge, Mr. Baines is the only person who is focussing specifically on the process of construction of ancient jewellery and the degree to which technical factors determine the appearance of the finished object.”

Powerhouse Museum). Major pieces such as The Entropy of Red, Table were acquired for private collections. A significant turning point was the award of an Australia Council Arts Fellowship Grant in 1992. The study period provided investigative research in the building of linear structures using wire. Formats of wire configurations and systems of solder and fusion joining were experimented with and from this synthesis of knowledge and ideas came a technical dexterity in construction and rudimentary basis for future studio work.

1.2. A Personal Fine Art Statement
The subject directed studio based work in a broad way is the furthering of a Christological statement. This is an expression of personal belief and the intention is to build jewellery as a personal form of worship; it is not intended to be didactic or evangelical. The colour red can be a vehicle to carry reference to Judaic-Christian practice of a sin offering where there is a [cultural] belief of the requirement of the shedding of blood for the remission of sin. This is part of my own spiritual enquiry and questioning. I do not regard theological discussion as relevant to this research.

**REDEVENT**
The conveying of love and sacrifice through the vehicle of red has antecedents since time immemorial. Within all the substances to convey red is the enjoyment of entropy and in its ultimate state of degeneration the symbol becomes quiescent. The fullness of red remains untold. A,AAA,AAA….REDEVENT is a jewellery group comprising the following series: The Intervention of Red, commencing 1994; The Entropy of Red 1995; REDLINE, commencing 1996; A Vesseled History 1997; Bloodier than Black, commencing 1998, Meaner than Yellow, commencing 2001, and Whiter than Red commencing 2004.

1.3. Laboratory Analysis, Reconstruction and Authentication
Laboratory reconstruction of ancient goldworks and the making of copies of particular jewellery types have a number of attributes. Prior to the Victoria and Albert a baule5 laboratory reconstruction important test pieces investigating the Palestrina cylinders6 were constructed in my studio in Melbourne and later published (Fig.1.1). Much of the goldsmithing of the test pieces and this PhD research into ancient goldsmithing is centred around the technical joining process commonly called granulation.

![SEM image](image)

Figure 1.1. Test piece by Robert Baines: granulation on convex substrate, showing the fusion of the granules to each other and to their base. The substrate has not been part of the melting process, and the surface abrasion and scribing are unaffected. (x 72) SEM image by Barry Smith and Robert Baines courtesy of RMIT.

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6 See note 3 and fig.1.1.
Granulation is a decorative jewellery technique by the goldsmith describing the joining of small round balls or granules to a substrate. This is the most common application. It can also be the joining of granules (balls) to granules or wire to granules and wires to a substrate. The joining is by fusion and so the term granulation is used to describe the fusion process when objects of gold and silver are placed in contact to be joined and are heated to a molten state and surfaces become liquid and join at the contact points. Fusion identifies that surfaces are joined in a molten state and implies an intermolecular penetration making a join that is very fine, stable and does not remelt.

Information gleaned from laboratory recording and analysis identifies and broadens and increases knowledge of museum collections. Laboratory reconstruction principally tests assumptions and theoretical strategies of working by the ancient goldsmith. Using goldsmithing skills based on known technology of the same era, theories of manufacture can be tested. This can also establish a vantage point of knowledge to authenticate and identify fakes.

A further objective is to identify worked surfaces and structures and place them in a technological and chronological context. Such evidence can also develop the source and location of theories of manufacture (Figs.1.2-5).

Figures 1.2,3. Wire working characterising ‘loop in loop’ chain type with marks caused by use of tools in a modern copy of an ancient chain. SEM image by Robert Baines and Mark Wypiski courtesy of the Metropolitan Museum of Art in NY.

Figures 1.4,5. Wire working in a loop and loop chain of a fake that has the same stylistic mistakes as figures 5,6. Clearly the chain is not made by the same goldsmith. Photo by Gail Spring and SEM image by Robert Baines and Barry Smith courtesy of RMIT.

It has to be stressed that all surface and subsurface alloy analysis conducted on the jewellery items in Section 3 are not published in this exegesis. Weights and measurements in tables and on drawings have also been removed from the publication of this research at the request of the Greek and Roman

Department of the Metropolitan Museum of Art in New York. This leaves the methodology of research still identifiable but without my making available material which could be employed for fraudulent replication. Measurements of alloys, dimensions and weights are enclosed in research reports at the Metropolitan Museum.

The same investigative scrutiny is made of the later laboratory samples for comparative analysis. This provides a vantage point to consider the broad manufacturing aspects of sheet, wire and granules in ancient gold jewellery artifact and my personal methods of fine gold construction work. Series of drawings are made of selected artefacts depicting possible sequence of assemblage based on the copper salt diffusion joining system. The drawings are used as maps for the scanning microscopy. The Energy Dispersive Spectrometer (EDS) elemental analyses of artefacts and samples identify surface and subsurface alloys and this is integral to the research and discussions. Using the SEM, markings and structures indicating manufacture of the decorative components are observed and photographed. This visual information on surfaces reveals sequences of assemblage and identifies goldworking methods.


From a goldsmith’s point of view I am considering how formulated heritage is available for reference, questioning and modification. The option to copy, to replicate, or to modify the historic document jewellery is a possibility and new inputs can both verify or be used to engender falsehood. Laboratory samples are made replicating jewellery by means of goldsmithing skills based on typical technology of the same era.

The laboratory constructed samples become available for reinterpretation as artistic expression. The pieces can be reworked and physically changed in response to the inclusion of contemporary materials and thinking. Found object and modern materials placed into the “historically correct” jewellery will interfere with and confront the previous orthodoxy of the jewellery object. What was once “historically correct” will thereby become stylistically distorted. Such “interfered with” jewellery objects offer a new experience of jewellery as a historical and contemporary document.

I have had a shared concern particularly with Dr. Joan Mertens at the Metropolitan Museum of Art in New York for the past ten years concerning my laboratory constructed copies and their eventual destination. The possibility existed of these investigative pieces later being sold as fakes if I was to continue to show them (with some modification) in exhibitions in commercial fine art galleries. It was resolved that if they were to be shown it would be on a ‘scientific research basis’ and not in a commercial context. The work would remain in my collection and eventually be donated to either the National Gallery of Victoria or the Metropolitan Museum of Art in New York.

Investigations of the fake and the genuine are not alien to archaeology and the study of our cultural history. Objects of suspicious provenance or actual fakes are exhibited in museums or galleries, and published or presented to the world as authentic artefacts. They then become components of our intellectual culture and capital. Inclusion of the bogus into that which is accepted as the standard or primary reference subverts knowledge of the genuine. Can this be prevented? Is it being nurtured by the publication of research findings? Is it possible to safeguard our cultural history from sabotage? These are personal confronting questions. Is it valid for a goldsmith like myself to ‘play’ with these issues? Working as a goldsmith, it comes very easy to build fictitious “historical” jewellery.

Is it a sin if it is just an artist at ‘play’?

The questions I posed for research

In what ancient jewellery types is style or placement of iconographic forms as much a consequence of technology as the stylistic genre of the day?

What new knowledge of technology and modification of current theories can be gleaned from laboratory reconstruction of historical goldworks?

Is it possible to construct artefacts that are stylistically, chemically and methodologically conformable to ancient examples?

How can my work express aspects of the knowledge gained from analysis and reconstruction in contemporary jewellery and object using both historic and current forms and materials?

2. Historical Background
2.1. Development of Analysis Techniques

A main theme of this PhD research is the idea that the application of technology, together with experience with the properties of gold and silver is part of human history alongside other cultural statements of politics, society, ideas and art. Jewellery encapsulates and becomes a document that holds such historical meanings.

It is not possible to take readings of fingerprints from the gold works considered in this research but there are identifying outward marks which mirror the inner thinking of the jewellery makers. Mental planning and “jotting” is evident in some jewellery. Quite often it is found they are purposefully applied with the expectancy that in a later sequence the process will erase or cover over any such indication. On other occasions such preliminary markings in a later sequence provide a facility for the addition of further construction, for example a scribed line becomes a location for a row of granules.

Figures 2.1, 2. Etruscan gold a baule ear ornament MMA 95.15.139, fourth century BC. The grooved folded strip has lifted to reveal preliminary marking out on the substrate by the goldsmith. SEM image courtesy of the Metropolitan Museum of Art in NY.

Visible Signs of Inner Thinking

Almost nothing has been written of these expressions of preliminary design thinking. They have been generally overlooked or disregarded, but signage of planning and designing can identify them as the visible working out of an idea. This offers a window into the design thinking or strategies of the maker identifying methodologies that are principally invisible in the finished object. Obscure markings on artefacts belonging to a peripheral time for the contemporary goldsmith identify strategies of working and these are available for consideration and evaluation (Figs.2.1,2).

In particular ancient gold jewellery the decorative configurations that accumulatively mark their style can also be regarded as a consequence of technologies. Their placement and relationship to each other is in part a testimony to the joining technology carried out by the goldsmith. Jewellery artefacts selected for this research appear to confirm this argument, and by observing them through the microscope working drawings were constructed. Series of drawings of the selected artefacts develop the method and strategies of analysis and can also depict possible sequences of assemblage of the gold jewellery. Detailed drawings of surfaces and structures describe the geography of the jewellery and these are used as maps while in the chamber of the SEM. The drawn maps facilitate an orienteering through the complex jewellery landscape. The drawings highlight locations and areas of interest for observation and analysis.

Historical Location of Technology

11 While there are some gems and silverware with marks of the maker, there is an absence of signed pieces in the domain of gold jewellery. Together with the absence of any written or illustrative script attribution is quite rare in the discussion of Etruscan and Greek goldworks. There is no figure like the Greek painter Amasis, one of many potters and painters who signed their works in the sixth century B.C.
12 It is with an understanding of the technology of the manufacture I have ‘played’ with. The knowledge becomes a vantage point for interpretation. This is explained in section 4. Development of Original Work. p. 106
The SEM provides detailed examination imaging and high quality photography with clear depth of field resolution. This facilitates identifying and recording characteristics of manufacture; the sequential mode of assembly of the various components. Identification of beaded, spool and flat sided wires can be attained and observations of granulation with its diverse configurations and possibilities of joining are accurately recorded. The first objective in such methodology is to articulate metal analysis and define its contextual meaning with regard to the period of gold technology in the historic sequence. The second objective is to identify worked surfaces and structures and place them in a technological and chronological context. Such evidence can also develop theories of the source and location of manufacture.

Generally the mode of joining by the goldsmith can be identified first by visual inspection, for observation of contact points reveals the characteristics of particular heat systems of fusion. However visual perception can quite often be misleading. Metal surfaces can vary considerably according to diverse combinations of heat, atmosphere and chemical contexts (Figs.2.3-6). More comprehensively, comparing the joined core can make identification by qualitative analysis with the substance of the joining material using EDS. Finally, scanning electron micrographs of cross sections can be compared with the surface and the core material of heat joined regions. This qualitative analysis and comparison of regions using the EDS clearly shows the application of copper in the diffusion bonding system. Further to this can now be added, in some instances, the observation of stylistic configurations of gold works.

![Figure 2.3. Test piece by Robert Baines: Copper salt diffusion joining of granules to the substrate by the goldsmith can be identified first by visual inspection. SEM image Nigel Meeks by Nigel Meeks, Scientific Research Department courtesy of the British Museum.](image)

![Figure 2.4. Test piece by Robert Baines. SEM clearly identifies the stability of copper salt diffusion joining system. SEM image by Barry Smith and Robert Baines courtesy of RMIT.](image)

A Personal Research Methodology

A premise to my research has been that the design configuration of some goldworks in antiquity is a consequence of technical factors. In particular, marking out, the placement of structures, the varying types of structures and the repairing of connections can identify the copper salt diffusion joining system. This can be tested by laboratory reconstruction of selected gold works, and making of samples and replicating museum artefacts using goldsmithing skills based on known technology of the same era.

In particular ancient jewellery, the decorative configurations that accumulatively mark their style can also be regarded as a consequence of technology. Their placement and relationship to each other is in part a testimony to the joining technology carried out by the goldsmith.\textsuperscript{14} The method of this laboratory research is to identify the mode of joining first by visual inspection, as observation of contact points reveal the characteristics of particular heat systems of joining. Further identification can be made by comparing the joined core by qualitative analysis with the substance of the joining material using an energy-dispersive x-ray fluorescence spectrometer. An objective in such methodology is to articulate metal analysis and define its contextual meaning with regard to the period of gold technology of the Classical Era. Laboratory reconstructions follow, with the manufacture based on the known technology of the period.

This research methodology was a new direction of investigation in the research of ancient gold technology. It is based on a theory, which can be tested through materials research and construction.\textsuperscript{15} This tested current theories and raised further questions.

2.2. Laboratory Research at the Metropolitan Museum of Art in New York

During this PhD research period there have been visits to the Getty Center in Los Angeles and the Antikensummlung in München to conduct basic inspection work of specific jewellery works. A more substantial visit at the Scientific Research Department of the British Museum was directed to the use of stereo-microscope imaging of the recrystallisation of gold on the gold Etruscan disc \textit{BMCJ 1419}.\textsuperscript{16}

\textsuperscript{14} The stylistic configuration of the most complex goldworks can be characteristic of the diffusion bonding system. This theory was first presented by the author at the international conference \textit{The Art of the Greek Goldsmith} held at the British Museum in October 1994.
\textsuperscript{15} See Note 3. Introduction Summary.
\textsuperscript{16} This was made through the generosity of Dr. Dyfri Williams keeper of the Greek and Roman Department and Nigel Meeks of the Scientific Research Department at the British Museum.
In 1997 during long service leave from RMIT I carried out a four-month Senior Fulbright research project in The Sherman Fairchild Center for Objects Conservation at the Metropolitan Museum of Art in New York. This was primarily on Etruscan and some Greek gold jewellery. Two Andrew Mellon research fellowships followed, first in 2000, with the investigation of selected gold jewellery from the Egyptian Department of the Hellenistic period. In 2003, examination of a substantial portion of the Etruscan collection of one hundred and five Etruscan jewellery items was carried out and basic notes on each work were recorded. Suggestions were made of some conservation needs and follow up treatment occurred. The Etruscan jewellery group from Vulci was a focus of research activity throughout that Fellowship term. Stereomicroscope photography recording descriptions of manufacture was carried out on the necklace, MMA 40.11.7 and the two quartz inset discs, MMA 40.11.8,9. Hollow ball construction was a major enquiry relating to this group.

The research methodology involved the taking of detailed measurements. Some samples were made of some components in the pieces such as wire types and the hollow balls. Making comparisons of size and quality of manufacture between the hollow balls on each of the pieces was then compared with another pair of Etruscan discs MMA 30.225.30A,B. (Figs.2.7-9).

Figure 2.7. Gold Etruscan disc MMA 30.225.30A. Hollow ball construction. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 2.8,9. Test piece by Robert Baines. Hollow ball construction using copper salt diffusion joining. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

The important note about these previous laboratory reconstructions was that they were all built using a secondary heat source- that is, either a jeweller’s ‘French’ gas torch or blow pipe for focusing heat on the jewellery object. A major part of the 2003 Fellowship was to investigate a single heat source for the manufacture of ancient gold artifacts. This activity was carried out in the Installer’s workshop in the Sherman Fairchild Center for Objects Conservation initially using a charcoal fire with a primary and secondary pottery shard canopy and the use of a blowpipe to create a broad heat. Silver granulation

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17 Etruscan Jewellery Group from Vulci MMA 40.11.7, 8-9.
18 Commonly called a ‘French’ torch, they require the jeweler to supply the air into the fire by blowing in a tube leading to the flame.
samples using copper salt diffusion followed by fusion were successful. The size of the fire was inadequate for gold fusion and hence appeared insufficient for manufacture of larger jewellery pieces of the classical era. (Appendix B)

A larger heat source was established using a constructed muffle beneath a more substantial charcoal fire and the required heat was achieved for gold manufacture. Many issues had finally been resolved and further improvements appear quite feasible. A number of conservators and curators from the Greek and Roman Department and Medieval Department attended a demonstration firing. (Appendix C)

**Research Plan, Methods and Techniques.**

A laboratory workstation was established at The Sherman Fairchild Center for Object Conservation at the museum for the construction of sample/reproductions and test pieces (Figs.2.10-12). Examination, photographing and drawing of work was made at Objects Conservation and the chemistry laboratory, as the major place for the manufacture and preparation of gold samples wire making, granules and the fire joining of gold samples. The Installers workshop was a second facility for larger fire work such as the alloying and melting of gold. It was also the most suitable place for hammering out sheet and wire. The investigation of the two charcoal fire types were built and tested in the Installers workshop. (Appendix B,C.)

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19 Rudi Coban from the Sherman Fairchild Center for objects Conservation photographed the seminars.

20 My thanks go to Tony Frantz and the people within “Objects Conservation” for providing such a practical working environment. I would like to express my appreciation of Richard Stone for his knowledge and the opportunity to share and exchange opinions. Other special thanks are to Carlos Picon and the Greek and Roman Department and particularly to Dr. Joan Mertens for her continuing support and encouragement and of course for making the jewellery available.
Figures 2.10-12. A laboratory workstation in the chemistry laboratory was established at The Sherman Fairchild Center for Object Conservation at the Metropolitan Museum of Art in New York. Preparation of gold samples, wire making with chisel and wood block, granules and the fire joining of gold samples. photo courtesy of the Metropolitan Museum of Art in NY.

Following observation by microscope of selected goldworks from the Museum’s Egyptian, Greek and Roman collection, samples were made replicating artefacts by means of goldsmithing skills based on typical technology of the same era. Sets of drawings of selected artefacts depicting possible sequence of assemblage were also used as maps for the SEM imaging and analyses. The sequence of assemblage is critically affected by the process of joining using copper salt diffusion. Photomicrographs of constructed samples investigate the migration of copper in the diffusion process and methods leading to surface enrichment.

The research plan gleaned a great amount of information. SEM further identified manufacturing idiosyncrasies and surface and sub surface analyses of alloys. The same scrutiny was made of laboratory samples for comparative analysis. This provided a vantage point to consider the broad aspects of manufacture-sheet, wire and granules. Surface depletion as a sequence of manufacture and grain growth indicating manufacture has been topics of ongoing discussion and these questions remain at the forefront of research.

Constructing goldworks by diffusion bonding with a copper salt causes a copper enriched surface. Compositional changes to surface alloys as a result of the application of copper during the heat joining process became major issues for reconsideration. The relevance of flux as a reduction agent of copper oxide on heat joined gold alloy was also a major consideration as the interference of copper oxide on surfaces proved quite problematic during ongoing joining campaigns. An accumulation of copper on some samples suggests there could have been a conscious depleting of surfaces as the final sequence of manufacture. The absence of fluorate or borate material in the Etruscan and Greek era initially determined the non-use of a flux in the constructing of replicas and test pieces and this caused some difficulties with multiple joining. A typical natron material was used in later samples as a flux agent for heat joining, and also for the making of button ingots. Surface treatment with the natron material for the reduction of copper oxide proved quite effective. Microscopy identified surfaces as not being ‘typically ancient’ in appearance though, and so questions remain unanswered.

It was during this research period I observed extensive grain growth on some gold artefacts and this can, in addition to being an indicator of sequence of manufacture, offer insight into the duration of firing time to construct goldworks.

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21 See 3. Examples of Analysis and Reconstruction, 3. A Greek Disc and Pendant Ear Ornament. p.77
22 Natron, Na2 Co3, Na Cl, Na2 So4. There appears to be no references to firing natron as a flux for soldering or casting. Natron is a naturally occurring compound and found in three localities in Egypt, See A. Lucas, (1912) 2. Lucas states the Egyptian usage of natron varied from purification purposes, for making incense, for the manufacture of glass, glaze, for cooking, in medicine, for bleaching linen and mummification (1989) 267.
23 This will be mentioned further in 2. Historical Background, 4. Recrystallisation and Grain Growth. p.30
These broad issues are all relevant to goldworks of the Etruscan, Classical Greek and Ptolemaic Egyptian period. There has been very little technical investigation of the Hellenistic Egyptian goldworks and the research Fellowship facilitated in depth inquiry into works from the Egyptian collection at the Metropolitan Museum of Art. Increased knowledge of these respective eras enhances a greater understanding of the museum collection and broadens the knowledge base of the museum curator to authenticate goldworks in public collections and potential acquisitions. The identifying of fakes leads to the furthering of knowledge of individual fakers or workshops.

**Laboratory Reconstruction of Baule Ornaments**

Goldsmiths’ fingers hold the blowpipe at the mouth and physically interact with the gold alloy in the fire. This can no more be neglected than the emotions and thoughts of spatial arrangement or the placement of symbolic meaning with gold sheet, wire and granules. The investigation of possible fire sources is first referenced by the artifact and what texts are available. Signs of fire applications on works help in the identification of fakes.

Figure 2.13. After Davies, *The Tomb of Rekh-Mi-Re at Thebes*, 1943, pl.55. An Egyptian goldsmith at a charcoal fire. The fire bed is housed in a pottery receptacle and muffle hood and a supply of charcoal at the ready. The Jewellery object held by tongs is moved in and out of the fire for the controlling of appropriate temperatures. Additional broad heat is achieved with the reed blow pipe with the metal tipped tuyère. The goldsmith seated at the fire identifies complex and extended duration for the firing of gold works.

See Appendix B.

Figure 2.14. After *The Pirotechnica of Vannoccio Biringuccio, The Classic Sixteenth Century Treatise on Metals and Metallurgy*. Translated and edited by Cyril Stanley Smith and Martha Teach Genudi. Fig.13 p.140 Book 3
Alloys

The researcher Jack Ogden has indicated that purity of gold in the Bronze Age and Early Iron Age varies from 75% to 90%. Higher purities than this quite often indicates gold refining which is believed not to predate 600-500 BC. The presence of some iron is in keeping with ancient gold alloys and percentages of copper within the 2-3% range suggests the material is native gold. Alloying of copper to gold for stabilising structure and for harder wearing and the making of solder cannot be excluded. The addition of copper to gold certainly dates back to the early Bronze Age.

Reported metal analysis of Etruscan granulated jewellery has shown similar purity ranges. The composition of 65% Au, 32% Ag, and a copper variation between 1.25 and 3.2% was analysed in a serpentine fibula from Marsiliana d’Albegna. In another piece, a comb fibula found in the fossa tomb XLI, Banditella di Marsiliana d’Albegna identified an average alloy composition of 68% Au, 30% Ag and 1.3% Cu as identified.

2.3. The Identification of Ancient Gold Artifacts with the Electron Microprobe

The SEM with X ray analysis facilities offers a window into the study of ancient gold artefacts and the characterising of manufacture by the goldsmith. Combining the acquired knowledge of the fabric and methodologies of manufacture offers a vantage point for the conservator to identify and authenticate ancient gold artefacts. The investigation of the conservator/researcher to understand antique goldwork increases knowledge of joining processes, manufacture of wire, working of sheet surfaces and the diverse surface methodologies.

The principle heat joining method distinguishing ancient jewellery is the use of a copper salt diffusion bonding system. Chrysocolla, malachite combined with an organic glue is painted over the surfaces to be joined. When heat is applied the copper salt converts to a metallic copper, which subsequently diffuses into the gold alloy, thus reducing the melting temperature of the surface, and joining of parts in contact occurs. Identifying this method is difficult as the copper enrichment is low and the diffusion zone is low. Metallographic analysis of sliced cross sections can identify copper migration to the joined contact points. A secondary system of joining called fusion welding is a surface joining without any additional alloying. There are some gold, silver copper alloys where the crystal boundaries become fluid while the major mass of the object remains solid.

The third method of heat joining is soldering where a lower melting alloy is applied in the contact areas. The solder is enriched with copper and silver. SEM micrographs, X Ray distribution map of selected elements on very small areas identify the various joining processes in the classical era or iron-age artefacts. SEM micrographs, EDAX and electron microprobe EMP with X Ray distribution map attachment using small samples offer non destructive identification in the field of archaeological research. The detailed observation of artefacts identify ancient or modern manufacturing characteristics. The knowledge offers a position to identify forgeries and the possible linking of forgery to makers or workshops.

Authenticating procedures had been carried out with specific pieces in the National Gallery of Victoria at the Department of Metallurgy and Mining at RMIT University. In addition to micrographic observations:

24 Ibid 20.
26 P. Parrini et al. (1982) 118-121.
27 Ibid 119.
28 Chrysocolla. See references note 7, p.12
quantitative analysis of surfaces of sheet, granules, wires and solder zones detected significant quantities of gold, copper and iron.

XRF analysis is utilised to determine the amounts of the major components of gold alloys i.e. silver and copper. Minor and trace elements are determined with EDAX. Readings of 8% and 10% iron identified the alloy not to be an ancient alloy. Micrograph observation of wire manufacture and decorative processes identified the piece to be a forgery. A jewellery group in the Metropolitan Museum of Art in New York having the same stylistic mistakes was examined using the same SEM investigation methodologies. The qualitative analysis of surfaces, and observation of manufacture affirmed its status as a forgery. By comparing the SEM documentation it was clearly identified that the mode of manufacture and alloy quality of the two groups proves them to be made by different forgers/workshops.

2.4. Recrystallisation and Grain Growth

Extensive grain growth has been observed over broad surfaces of some ancient gold jewellery (Figs.2.15,16).

Figures 2.15,16. Pair of gold Greek disc and pendant ear ornament. The Metropolitan Museum of Art New York. Roger’s Fund, 1906, 1217.11-12. Photo courtesy of the Metropolitan Museum of Art. A swaged hair ring has fused to the wall of the disc indicating high temperatures immediately before the liquid zone and within a reducing atmosphere. Other areas on the object have commenced melting. photo courtesy of the Metropolitan Museum of Art.

Figures 2.17,18. Close up of reverse of ear ornament. MMA 1217.11-12. Even growth of equiaxed grains over a broad area of the sheet. No indication of localised working during the heat joining process. SEM photo courtesy of the Metropolitan Museum of Art.
In specific locations on goldworks recrystallisation is recognised in a clearly tessellated formation (Figs.2.19-21). 

Figure 2.19. Detail. Gold Etruscan *a baule* ear ornament. The Metropolitan Museum of Art New York. Roger’s Fund, 95.15.141, 142. SEM photograph of grain growth on concave bowls and substrate of the pediment. SEM photo courtesy of the Metropolitan Museum of Art in NY.

Figures 2.20,21. Detail. Gold Etruscan *a baule* ear ornament., The Metropolitan Museum of Art New York. Roger’s Fund, 95.15.141,142. SEM photograph of grain growth on concave bowls and substrate of the pediment. The orientations of the crystal axes in the different grains are grouped closely about a common mean value. There is a macroscopic segregation of equiaxed solidification. SEM photo courtesy of the Metropolitan Museum of Art NY.

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31 A. Cottrell, (1982) 173. This is described as a preferred orientation.
On other jewellery recrystallising has resulted in the dislocating of individual grains from the gold sheet of the artefact (Figs. 2.22, 23).  

Figure 2.22. Close up of reverse of Etruscan disc ornament. Tessellated crystal region around outer edge of disc, London, British Museum GR 1881. 5-28.2. An intercrystalline fracture along the grain boundaries shows sharp ridges and valleys. Photo by Nigel Meeks courtesy Trustees of the British Museum

Figure 2.23. Gold Etruscan disc ornament. Munch, Antikensammlung. Inv.2477-78. The centre insert has been overfired and floriettes have melted. On the reverse of Inv.2478 around the outer edge are twelve clearly defined areas of grain growth and macroscopic segregation. The crystallised areas correspond with the contact points of the fluted bowls on the obverse.

Dislocation of grains following segregation is specific on the reverse side of contact points that are possibly copper salt joined (Fig.2.23).  

Similar characteristics have also been an outcome on some laboratory reconstruction copies of ancient goldworks using the known manufacturing technology of the same era (Fig.2.24).

Figure 2.24. Laboratory copy of a baule ear ornament V&A 1856-3347. Grain growth occurring on the substrate. SEM by Nigel Meeks courtesy of the British Museum.

Test pieces with wire joined on the substrate using a copper salt of three different gold alloys were soaked in heat in a non-reducing atmosphere for various durations. This exposure caused a heavy copper oxide layer over the entire surface of the sample and options that would be available for pickling within

32 Gold Etruscan (ear?) disc BMCJ 1419.
33 Ibid, Munich Antikensammlung Inv.2477-78.
34 A baule ear ornament V&A 1856-3347.
35 Copper carbonate. The alloys were representative of Etruscan a baule ear ornament analysed at the MMA.
the ancient era were considered. Natron, a material known to have been available to ancient workers was applied to surfaces of the heated samples. Viewed under the microscope, these pieces revealed negligible grain growth.

Metallic structure in jewellery differs according to particular manufacture. Cast objects have groups of distinctly different crystal configurations compared to wrought rod, wire, and sheet gold. Identifying the relative proportion of crystal phases differs in location on cast objects. These phases exist as crystals intermingled in a matrix and in the context of silver dendrite formations can be clearly observed. The rate of cooling of molten metal determines the size of the crystal.

Heavily worked sheet gold is characterised by a different type of crystal and following a number of annealings alloyed gold sheet this results in uniformity in the size of the grains compared to cast metal objects.

Annealing and heat joining occurs with the increasing of temperature and cold worked microstructure becomes more and more unstable. In this first stage of recovery the dislocations introduced during cold working undergo structural rearrangement into more energetically favorable configurations without any significant change in their concentration. This reduces the crystal lattice strain without causing any observable change in the metals microstructure. The second and most important stage of annealing and consequently heat joining is recrystallisation. This stage involves the replacement of the cold worked structure by a new set of strain free grains. These grains are not elongated or deformed as are the cold worked grains, but are approximately equiaxed (i.e. have the same diameter no matter what direction they are measured in).

Recrystallisation is a process which may occur over a range of temperatures. The term’ recrystallisation temperature’ should not be regarded as a specific temperature, below which recrystallisation cannot occur. Rather the recrystallisation temperature is a temperature for a given metal at which a highly cold worked structure completely recrystallises over a particular duration. Using the phenomena of recrystallisation in MMA 1217.11-12, as a reference experiments were conducted to determine the conditions required to achieve recrystallisation of gold manufactured jewellery.

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36 Organic acid such as vinegar combined with salt in a boiling solution would be suitable.
37 D. Scott, (1991)
Figures 2.27,28. Test piece no.1, 82% gold, 12% silver, 6% copper. Square shaped test piece with creased wire joined to the substrate areas. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art NY.

Figure 2.29,30. Test piece no.1. Square shape of the test piece with wire form is severely deformed but discernable. The sample has been heated above its solubility limit, and the grain boundaries released together cause a uniform grain growth. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art NY.

Figure 2.31. Test piece no.2. Square test piece deformed. 96% gold, 3% silver, 1% copper. Bright flat facets, variously orientated are produced when the fracture follows crystallographic cleavage planes through the grains. The measured activation energies for grain growth in impure metals are often anomalously large because, as the temperature is raised, increased solubility and coarsening of inclusions releases the boundaries for faster movement. The gold sample showing abnormal grain growth was initially fine grained has been heated almost to the solubility temperature. Normal grain growth was followed by the impure particles dissolving and coarsening. Some boundaries are released and flow through the metal making a very coarse grain size. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

38 *Ibid.* 342
The amount of cold work determines the amount of energy stored as elastic strain in the material. Because heavily cold worked materials have a greater amount of extra strain energy than lightly cold worked materials, recrystallisation may start at a lower temperature (i.e. requires less energy) and may result in a finer grain size.

Grain growth is the third stage of annealing and heat joining. This involves the growth of recrystallised grains at the expense of surrounding recrystallised grains. The action for grain growth is simply the lowering of energy by decreasing the grain boundary area (i.e. the same as decreasing surface energy). On a gold Etruscan a baule⁹⁹ ear ornament grain growth is evident on the surface of ‘dapped or pressed’ forms that have been placed on the pediment (Fig.2.19). This suggests gold sheet used as the substrate of the a baule had an excess perimeter surrounding it during manufacture. During construction of the a baule on a flat surface multiple parts are applied and joined. The perimeter sheet will be treated to high temperature close to solubility. This excess sheet would be removed prior to curving up the a baule. The remnant sheet extracted with a chisel then becomes available as substrate and source of components for the pediment (Figs.2.19-21).

Usually there is no sharp distinction between recrystallisation and grain growth as grain growth may occur in the parts of the material, which recrystallised first, while other regions are still recrystallising. During the process of heat joining grain growth can occur. Repeated campaigns of heat joining will further extend this growth. This can be identified on the reverse of large Etruscan discs and clearly is a consequence of manufacture. The substrate is the contact point for the multiple joining of a series of concentric rows of iconic forms. The configuration requires successive heat joined contact points extending from the centre to the outer rim of the disc. On the reverse of the disc, the substrate at the outer edge has distinct grain growth, in some locations to the point of separation of individual crystals from the tessellated sheet (Figs.2.22,23).

In addition to being an indicator of sequence of manufacture and strategy of working by the goldsmith as in the a baule, it could also offer insight into the duration of firing time to construct goldworks. The extensive growth of crystals resulting in separation and dislodgment from the body of the gold sheet has been observed around the outer edges on the reverse of Etruscan discs of the sixth century B.C.⁴⁰ Acute grain growth has been found on three discs that have a small cut out in the centre. Segregated crystals also occur in regions that correspond with contact points on the obverse (Fig.2.23). These pieces do not have an absent centre and consequently receive extreme heat around their perimeter during joining campaigns.

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⁹⁹ See Fig.2.19
⁴⁰ British Museum GR 1881. 5-28.2.
Quenching the hot object following joining campaigns is quite useful in the testing of joins and will impose a second condition on the gold structure. Increased grain structure will be frozen at this point. Subsequently firing will further increase grain growth.

Discs with larger cutouts in the centre would facilitate the heat source being directed to inner and outer perimeters. This would result in a broader and more even distribution of heat alleviating the occurrence of extreme disparities of temperature during heat joining and the eventual grain growth around the outer perimeter.  

**Conclusion**
Areas of clearly defined grain growth and macroscopic segregation on the Etruscan discs identify crystallised areas corresponding with the contact points of the fluted bowls on the obverse. This clear similarity of technical signs on the same jewellery type can suggest working by the same maker. The British Museum disc ornament has other significant links with the Munich disc and also the New York disc with its quartz insert. 
There are still questions remaining. What is the rate of grain growth in ratio to the alloy (gold copper silver)? What impact does a reducing atmosphere during the firing of the work or inverted sheet facing the charcoal block have on a gold piece? What impact does the inclusion of copper on the surface as a result copper salt diffusion joining affect grain growth? What impact does the quenching following each joining campaign have on grain growth?

**2.5. Wire Manufacture**

The extensive research into ancient and historical wire has informed me in the authentication of collected jewellery and equipped me to build fine art jewellery. Use of wire to build form in my art making has direct historic derivations, though at times this may appear quite obscure. The knowledge of ancient and historic wire particularly through ‘laboratory reconstruction’ has been a profound vantage point to apply in a contemporary context. The exploration of primary references in public and private collections has been the basis for interpretation, reinterpretation and further invention for the various contemporary contexts.

I have employed principally two philosophies of wire application for the making of my art works. A major characteristic of the fine art studio based work within this research period is the multiple combinations of the use of wire to build form and surface. Most of the diverse wire construction is simply the combination of one flat and one crimped wire and this was usually in sterling silver for the making of large works. Fine ribbon twisted and block twisted wire applications, whether open or attached to a substrate of the

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[45] New York, MMA 40. 11 9, diam. 61 mm. From Vulci.. The large centre cutout would facilitate an even firing and reduce the likelihood of extreme heat around the outer perimeter.
[46] The outer border of the Munich pair consists of a folded grooved strip followed by a circular row of hollow balls between fluted bowls, each with a granulated sphere. This sequence of components also occurs as the outer border in other discs from the Metropolitan Museum (MMA 1913. 225. 30 a-b. diam. 43mm) and the British Museum (London, BMCJ 1416. diam. 61mm). The fluted bowl occurs with its fourteen groove surface on each of the three groups. The recurring of this design element suggests usage of the same tool. The inner rows of the Munich discs have three pressed shapes separated by hollow balls. A vertical bow spiral ornament surfaced with granulation separates a siren and a frog pressed in gold sheet. Both the frog and smiling siren face toward the centre of the disc. The positioning and repetitive sequence of these forms has a similar geometry to the Metropolitan and the British Museum disc in particular. The pressed forms are consistently flat on the top with sides that are almost vertical.
Etruscan and Greek of the High Classical era has been a significant influence on the development of my original studio work and the invention of new wire systems.

Figure 2.34. Etruscan filigree gold bracelets, Firenze Museo Archeologico inv. 11151, 11152 seventh century B.C. Marsiliana d’Albegna dia.5.5 cm. (after M. Cristofani and M. Martelli, 1985).

Figure 2.35. Etruscan silver winding fibula. Roma, Museo Nazionale di Villa Giulia inv.53614. Cerveteri, Beginning of the seventh century B.C. (after I. Caruso, 1988). length 5.5 cm

The Cellini treatise clearly describes the principles of filigree making with powder solder.\(^{47}\) The finest work he describes ‘will make a man’s mouth water’.\(^{48}\) The main primary references in developing my personal technique was looking at the Castellani and Giuliano jewellery\(^ {49}\) and eighteenth and nineteenth century jewellery and the fakes of the nineteenth and early twentieth century. Inspections and investigations leading to accumulated knowledge in the making and joining wire structures gave an informed vantage point in looking at historic jewellery where filigree and Canatille were prominent.

\(^{48}\) Ibid 10
\(^{49}\) Victoria and Albert Museum, also Jewellery at the B.M. Hull Grundy collection, Brooklyn Museum, Philadelphia Art Museum.
Canatille Work
In the first half of the nineteenth century in Europe a popular filigree system was Canatille. Possibly it was most popular due to its resembling embroidered brocades on military uniforms. The various types of techniques are characterized in the contemporary publication, P. Broué, *Traité d'Orfèvrerie, Bijouterie et Joaillerie* (Paris, 1832)

For many years methodologies of wire production have been considered in archaeological literature and the twelfth century treatise by Theophilus has been continually referred to as indicating the mode of manufacture in the Classical era.  

There is no evidence that the implements detailed by Theophilus existed within the Greek and Etruscan manufacture in antiquity. There is no archaeological evidence of iron tools (or bronze for that matter) of this type in the Classical era though their non appearance could be attributed to being melted down on becoming redundant due to wear. In the case of iron they possibly disintegrated due to a rust process.

A basis for authenticating ancient goldworks and major criterion in determining mode of manufacture is the observing and counting of creases on wire. There were two systems for making wire in antiquity and the option to block twisting, is the twisting of strip or ribbon cut from sheet, followed by cross rolling and this method is described in Exodus 39.3.

The twisting described will again identify helical creases and this technique known as strip twisting involves the twisting of a thin strip to form a regular tube and creating a single helix. Following a sequence of annealing, pulling and further gentle twisting, the helical creasing becomes tighter. A cross rolling of the wire between two blocks in the same direction of the creasing to minimise metal fatigue will swage the wire into a smooth surface and so diminish the helix. Creasing of wire can be further removed during the fusion heat joining process with molten surfaces flooding fine surface details.

The Making of Beaded Wire
The Organarium
The first of the two instruments described by Theophilus for the making of beaded wire is in Book 3, ch.9.

A copy of the instrument described has been in use by me for some years with one major variation being the absence of the two spikes for the anchoring into a wooden base. It was decided rather to locate the *organarium* in the jaws of a bench vice for more secure working. It quite successfully produces beaded and spool wire from 0.5 mm.D.

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50 J. Hawthorne & C. Smith, (1979), Book 3.
51 For a comprehensive study on ancient wire manufacture see J. Ogden (1991) 95 – 105, N. Whitfield (1998) 82,83
52 W. Oddy, (1977) 83
53 “The gold was beaten into thin plates, cut and twisted into braid to be worked by a seamster with violet, purple and scarlet yarn and fine linen.”
54 The first publication on the making of ancient wire by twisting was in the catalogue by C.R. Williams, (1924) 43, 140; also pls. 19-20, of an ancient gold jewellery collection of the New York Historical Society.
56 For spool wire see Hoffman, Davidson (1965) Introduction.
57 Ibid 90. “The Implement Called the *Organarium* [for Swaging Beaded Wire]:

“There is also an implement called the *organarium* which consists of two pieces of iron, a lower and an upper one. The lower one has the width and length of the middle finger and is slightly thin, with two spikes which fit into a piece of wood below it. On the upper side above these spikes there project two thick pins which hold the upper piece. The latter is the same width and length as the lower one and has two holes, one at each end, through which the upper parts of the two pins should pass so that the two pieces will fit together. They must be fitted exactly to each other with a file, and [a series of] small grooves should be cut out in both pieces in such a way that holes appear right through the middle.

Then, a long [rod] of gold or silver, hammered evenly round, is pushed into the larger hole and the upper part of the tool is struck hard with a horn hammer while the piece of silver or gold is turned with the other hand. Round beads like beans will then be made; in the second hole they become like peas; in the third, like lentils; and so on smaller.”
The Beading File
The second iron beading instrument described by Theophilus is in Book 3, ch.10.  
The grooved file or beading file is trapezoid in cross section, and the wire is placed across its furrowed section. The tool is then rolled over the wire, which is supported underneath by a hardwood block base.

The beading file based on the Theophilus description produced successful bead or spool wire. Round wire having been placed on a flat wooden base, the beading tool with its grooved edge was placed across

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58 “Files Grooved on the Bottom”:
“...there are also tools, as thin as a straw, a finger long, and nearly square, but wider on one side. Their tangs, on which handles are put, curve upwards. On the underside a longitudinal strip is dug out and filed like a furrow, and the faces on both sides of this are filed sharp. With these tools both thick and thin wires of gold and silver are filed so that beads appear on them.”
the wire. With a gentle rolling generally in one direction the metal between the grooves is displaced and slowly contracts into a bead form. By moving the tool and locating it in another groove the beginning of another bead begins to appear. This is continued along the wire. The piece needs to be annealed for a second series of rolling to ultimately achieve a “full” beading sequence. It was found that rolling the wire in a single direction alleviated metal fatigue and consequently reduced the number of annealings. The size and shape of the bead and spool varies according to the diameter of the wire and the pressure applied.

**Grooved Twisted Wire**

Much wire appeared to be twisted but the twist appearance is achieved by the cross rolling of the beading file (fig.2.39).

![Figure 2.39. Gold a baule ear ornament MMA. 95. 15.139](image)

The round wire appears to be twisted but the twist is achieved by the beading file grooved up and down the wire. SEM photo courtesy of the Metropolitan Museum of Art in NY.

![Figure 2.40. Gold neckpiece. Melbourne, National Gallery of Victoria. A forgery, said to be second to third century AD, Romano-Egyptian indicating the simulation of beaded wire by the fusion of a row of single granules (after R. Baines et. al., 1989).](image)

**The Grooved Block**

A long grooved tool not unlike the Theophilus beading file is most effective in the displacement of round wire for the making of beaded and spool wire. This *grooved block* was also used in the folding or swaging of wire (Fig.2.41). There are a number of interpretations of decorative wire in Etruscan and Greek goldworks that could possibly have come from the same source tool. A number of wires appear to have an open corrugation from a corrugated tool without further folding. This is then applied directly to a jewellery work. Wire corrugated in the *grooved block* and then folded between the fingers has the accuracy and similarities of Etruscan and Greek wire (Figs.10,11).
The jewellery works (Figs. 2.42, 43) show possible exceptions to the use of the grooved tool. The decorative wires were possibly made by the folding of wire around two rows of pegs from a tool which is as yet unrecognized in historical text. The second simpler wire in figure 2.45 shows open corrugated wire with some sections showing the tendency of folding into the closed formation similar to the common folded strip.

Figure 2.44. Etruscan filigree gold spirals, Roma, Museo Nazionale di Villa Giulia inv. 53578, 53583 mid seventh century B.C. Cerveteri dia.2.5 cm (after M. Cristofani and M.Martelli, 1985).
The Grooved Strip

A strip reinforced with grooves makes a very stable reinforcement plate for ancient gold of the Classical era with its extremely fine joining and thin sheet gold. Grooved strips are used to reinforce wire joins to a substrate on early third century B.C. Greek disc and pendant ear ornaments. Frequently folded grooved strips serve as a curved border in Etruscan ear disc ornaments of the late seventh and early sixth century B.C. On the Etruscan a baule ear ornaments it is also frequently found as a border or a decorative element. When used as a border it is vertical from the substrate and accommodates (and protects) a construction of wires or fluted bowls with granulation.\textsuperscript{59}

Wire crimped in a coarse grooved block can leave a straight sided corrugated or crimped wire as in my powder coated studio work, \textit{Neckpiece, REDLINE 2003}. (Fig.2.47).

\textsuperscript{59} \textit{Ibid.}, Fig.2.39.
The same wire folded in the fingers achieves quite a different identity in *Bracelet ‘Java-la-Grande’, 2004, 5* (Fig. 2.48)

Figure 2.47,48. Folded wire/strip. Wire pressed into a deep grooved block producing corrugated wire as in *Neckpiece, REDLINE 2003*. This wire can then be followed by folding in the fingers as in *Bracelet ‘Java-la-Grande’, 2004, 5*. Photos by Garry Sommerfield.
3. Examples of Analysis and Reconstruction

3.1. Preliminary: ‘Fakes’ and Reproduction

‘The fake is recognised as “historical”, and is thus garbed in authenticity’...60

Fakery has been present since ancient antiquity. It can quite often be historically positioned by its mode of manufacture and quality of alloy. Nineteenth century forgeries are flawed in that technology current to that era is the mode of manufacture and this can be identified using visual observation and chemical analysis. SEM assists with greater detail. More recently forgers have benefited from new knowledge provided from the SEM. An example of this has been the emergence of forgeries with PGE inclusions in the body alloy of gold artefacts following new research publications of the incidence of platinum in the alloy of ancient gold jewellery.61

Uncovering the Cover Up

There has been a recent period of arguing the negation of authorial authenticity to the point that authorship was regarded as unimportant. Despite this implied rejection of the relevance of attribution by Derrida and other contemporary theorists62, scholars and collectors of historical artefact have continued to pursue the scholarship of establishing historical and material culture authenticity.63 The altering of attribution of an artwork still implies demotion from a “great” to a “secondary” or even “unknown” artist with consequent devaluation not necessarily aesthetically but certainly financially.

Investigations of the fake and the genuine are not alien to archaeology and the study of our cultural history. Objects of suspicious provenance or actual fakes are exhibited in museums or galleries, and published or presented to the world as authentic artefacts. They then become components of our intellectual cultural capital. Inclusion of the bogus into that which is accepted as the standard or primary reference is subversive. Can this be prevented? Is it being nurtured by the publication of research findings? Is it possible to safeguard our cultural history from sabotage? These are personal confronting questions and at the fore particularly in my research at the Metropolitan Museum of Art in New York. Increasingly some curators prefer that I do not publish by written text most of my findings for this reason.

There may be a scrupulous scholarship of attribution and current technology applied to the conservation of artefacts, curators’ grouping and placing of artworks and the detailing of reconstructed historical contexts. All these endeavors can be carried out and yet the absence of a guarantee of authenticity can remain. Attribution in the traditional sense is entirely within the province of the art historian using tools of stylistic analysis and historical documentation. Richard Stone wrote, “Conservators provide evidence of entirely independent origins that lends arguments previously based on stylistic insights alone a new

60 U. Eco (1995) 30
61 W. Young, (1972) 5-13 hypothesised that the Pactolus valley was a major source of gold for manufacture in the Near East. He reported a rare platiniridium alloy inclusion in some objects from the Near East such as Early Dynastic dated objects from the Royal Cemetery at Ur, Lydian coins and an Achaemenid earring. It was proposed that the Lydian gold coins made from gold of the Pactolus Valley showed by electron microprobe analysis that the composition of the inclusion was approximately 60% platinum, 40% iridium. Whitmore and Young postulated that due to the apparent frequency of this type of inclusion of Near Eastern gold artefacts, the Pactolus Valley was an important source of gold in antiquity and it was used extensively as early as 2500. B.C.F. Whitmore and W. Young, (1973) 88-95. Maxwell Hyslop, doubting the theory, suggested gold sources in Western Asia would be closer to Sumer than the Pactolus Valley. K. Maxwell-Hyslop, (1977) 83-86. N. Meeks and M. Tite carried out analyses of platinum group element inclusions in a range of jewellery and coins from Egyptian, Eastern Mediterranean and the Near East spanning the period from 3200 B.C. to A.D. 300. N. Meeks and M. Tite, (1980) 267-275. Using the energy-dispersive X-ray fluorescent spectrometer attached to the Scanning Electron Microscope they found that “the Iridium-Osmium-Ruthenium alloy inclusion found even within a single object frequently exhibit a wide range of compositions. Although this probably reflects the compositional variations of the PGE inclusions from a single placer deposit rather than implying the use of gold from several placer deposits, it does not mean that the compositions of this type of inclusion do not necessarily provide a basis for characterising the gold source.” Ibid 273.
62 R.Barthes, (1977)
Connoisseur is derived from the French word connaître, “to know” and the Latin word cognoscere is “to learn.” “Connoisseurship involves discrimination and taste; its practitioners make judgments about specific things like authenticity and authorship and about subjective things like beauty and quality.”

Professor Julius Held of Columbia University taught a course in connoisseurship in the 1950’s and 1960’s. Carol Janis writes “Professor Held maintained that the most intriguing part of connoisseurship is that the decision is actually made in an instant. One looks, and to the experienced eye-a determination comes in an intuitive moment.”

R. Rosenblum described a particular connoisseur’s meeting. “The ambience was often like a spiritual séance in which the ghost of Giotto or Giulio Romano might be conjured up to claim authorship or denounce an imposter.”

‘Art historical analysis’ or ‘stylistic analysis’ is I have found a more preferred museological context than connoisseurship. A more informed connoisseurship at its highest investigative point is a rigorous enquiry using analytical skills in the identifying artifact, its material substance, when it was made and who was the author. This investigation then extends the quality and the status of its context.

Often the historical object is so much “restored” that its historical status diminishes to the point of it becoming a pastiche. Other works such as jewellery are enhanced or added to, making the piece part authentic but with components of different eras. There is also the reconstruction into a complete object of units scattered in burials in contrived configurations.

Technological factors identify many jewellery fakes as rather obvious, but there is a small but dangerous group of fraudulent jewellery so carefully executed as to prove deceptive to even the most critical eyes. As discussed above, while it is not possible to take readings of fingerprints from ancient gold works, it is possible to see and identify literal marks as indications of the thinking of their makers. Mental processes and planning is evident in some works.

Almost nothing has been written of these expressions of preliminary design thinking, repairs and ‘cover ups.’ This window into the design thinking or strategies of the maker identify methodologies that are principally invisible in the finished object. Scientific research brings its own evidence, though the data is not always reliable and quite often misread. Some accompanying evidence supporting authenticity or the attribution of authorship only appears to be ‘scientific’ and a planned tactic of ‘shifty’ dealers or owners of art works. Curators and art historians are usually ill equipped to make accurate evaluations of technical data and generally operate independently of relevant scientific and technological knowledge.

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64 R. Stone (2002) 4
65 Editors note, SOURCE Notes in the History of Art Vol.XXIV No.2, 2005 1
66 C. Janis, (2005) 78
Quasi technical evidence is found in shadowy X-rays and infrared reflectography when investigating the authorship of some paintings but surface and subsurface analyses of some gold works can be just as misleading. SEM using EDAX providing qualitative analysis of surface and sub surface alloy of gold works is reliable only if the geometry of object and the EMP are in the correct settings. XRF analysis is also utilised to determine the amounts of the major components of gold alloys i.e. silver and copper. Minor and trace elements are determined with EDAX.

**Material not Just Manufacture**

The development of technical instruments to detect not only synthetic but treated gemstones continues to follow technological advances in the treatment of stones. The most recent is the fracture filling of low quality rubies with a new lead-glass which not only hides the cracks (as it has a refractive index similar to corundum) but also improves the colour of the stone. “Detection at this stage is somewhat difficult for a dealer…Experts in the ruby trade who were deceived by these new glass-filled stones, became suspicious when they were offered stones at relatively cheap prices.”69

The significant researcher and publisher on ancient jewellery Jack Ogden,70 commenting on his rather sparse description of the ‘wrong’ aspects of a Georgian fake necklet wrote, ‘Too detailed an explanation of where forgers get it wrong simply ensures that the next generation of fakes get it better’.71 Ogden was writing on the ‘wake of fake goldwork in Greek and Scythian style’ and its appearance at a similar time as the first Russian language description of ancient Greek jewellery technology—“the Russian translation of the exhibition catalogue Greek Gold: Jewellery of the Classical World (D. Williams and J. Ogden, London 1994).”72

**Idea, not Material, not Manufacture**

Michelangelo’s forgery of a work by his master Domenico Ghirlandaio was a student prank, but the reason for his forgery of Cupid Asleep, which was sold in 1496 as a classical sculpture, may not have been so innocent.73

From the vantage point of a goldsmith/researcher I consider how the formulated heritage is available for reference, questioning and modification. The option to copy, to replicate, or to modify the historic document jewellery is a possibility and new input can verify or engender falsehood.

A shroud of ‘history’ can encompass the object to the satisfaction of the naive connoisseur who wants to believe in its antiquity.74 The cultivated instincts of connoisseurs and the subsequent attributions devoid of scientific research or conclusive facts have to be challenged. Where all available technical aspects have been considered without a clear outcome, the final resort is quite often conclusions based on connoisseurship grounds.

Research data identified from the jewellery corpus becomes the basis of knowledge for authentication for curators/conservators/jewellery historians and for diagnostic purposes there is the expectation of an archaeological correctness within the fabric and manufacture of the jewellery document. From the vantage point of a contemporary goldsmith, this has provided me with an arena for artistic interpretation— for ‘play’. Historical jewellery becomes contemporary jewellery forms and the ‘play’ becomes a stumbling block and an upheaval within orthodox classification.

**The Castellani Influence.**

During the 1980’s I was fortunate to have a number of in-depth study visits to view the Castellani Collection of gold jewellery at the Museo di Villa Giulia Museum in Roma.75 The duration of the visits

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70 J. Ogden, (1992)
71 J. Ogden, (2005) 31
72 Ibid
73 Comments by D. M. Wilson (1990)
74 U. Eco (1995) 30
75 The Collection of Greek, Italiot and Etruscan vases, bronzes, ivories, coins, and ancient and modern Jewellery was donated by Alfredo Castellani to the Italian State in 1919.
when I was able to conduct examination work of the jewellery varied from a couple of days to a week. Ordinarily there was very restricted access to the work so this was a fortunate productive period of examining, drawing, measuring and note taking.

The Castellani family who were antiquarians and goldsmiths in Rome and Naples in the second half of the nineteenth century was very successful in both selling gold antiques and making modern copies simultaneously.

Fortunato Pio Castellani opened his shop in 1815 but from the 1830’s his workshop produced ‘Etruscan Style’ jewellery. This was very much influenced by the designs of Michelangelo Caetani an amateur artist from a princely Roman family. Jewellery designs developed by the 1850’s continued to be produced relatively unchanged until closure of the business in 1927. Using detailed steel dies ensured a consistent output of detailed jewellery to the extent of variations of beaded wire and animal motifs. Copying of ancient examples decorative techniques of filigree and granulation and a style called millefiori was highly developed. Building faithful antique jewellery like the ‘Cumae’ diadem from the Campana Collection became a renowned development of a ‘nineteenth century style’ later known as ‘Italian archaeological jewellery’.

There was great pride in the declaration that Castellani had rediscovered the challenging ancient art of granulation. The two sons Alessandro and Augusto published papers on Etruscan goldsmithing techniques combined with very close copies of Etruscan a baule bulla, diadem and fibulae. The Castellani success in making copies of ancient jewellery influenced a ‘Historical Revival’ in the nineteenth century and a fashion for Egyptian to medieval to Renaissance jewellery copies and composite jewellery styles.

Alessandro sold a number of pieces to the British Museum in 1872 and on the sale of his estate in 1884 a number of important pieces were purchased by the British Museum and the South Kensington Museum. It is since found that many modern pieces were purchased by public institutions who believed them to be ancient.

On first viewing the Castellani goldwork and later in the nineteen eighties I considered the work as mostly interpretative. I viewed them as copies explaining the visual meaning of the ancient pieces, making them understandable by translation. They were elucidating or deciphering ancient visual identity while the manufacture was embedded in nineteenth century technology.

The Italian archaeological jewellery and the work of Castellani in particular appear to have been enveloped in an atmosphere of bogus religiosity with the discussion and presentation of the wondrous gold works as though they were holy relics. The craftsmanship is superb as modern examples and their value depends in part on their rarity. This value is affirmed and gauged by the price it fetches on the market.

Figure 3.1. Drawing by Robert Baines of Castellani inv. 85268, Museo di Villa Giulia, Roma.

76 For a comprehensive list of works see S Weber Soros, S. Walker (eds.), (London, 2004)
3.2. A Baule Ear Ornaments

In 1997 I conducted a Senior Fulbright research project at the Metropolitan Museum of Art in New York in the Sherman Fairchild Center for Objects Conservation. The research was primarily centred on Etruscan and some Greek gold jewellery. This was a critical point for personal discovery due to the very supportive staff at the museum and availability of primary research material.

The availability of a selection of Etruscan jewellery of the same type resulted in a very informed knowledge which overturned a description of manufacture of a baule ear ornament at the colloquium held at the British Museum in 1994 during the special exhibition Greek Gold. The presentation I made was published.77 The paper, I now know, includes two incorrect statements. This Ph.D research has overturned the requirement and description of a secondary heat source for the manufacture of sixth century Etruscan discs.78 Research on the possibilities of heat sources in ancient antiquity for the manufacture of gold jewellery objects was intensely investigated during the Andrew Mellon research study in 2003 at the Metropolitan Museum of Art in New York. The same publication explains with drawings what is now regarded as incorrect the sequential manufacture of a baule Etruscan ear ornament. The most complex example of a baule from the Victoria and Albert Museum in South Kensington79 was built in 1994 using copper salt diffusion and this was my first attempt at laboratory reconstruction of ancient gold jewellery. It was conducted in my studio in Melbourne. The measurements of the jewellery piece were made at the Victoria and Albert Museum in South Kensington in England. The series of SEM images were made of the laboratory copies at the Department of Metallurgy and Mining at Royal Melbourne Institute of Technology. Parallel imaging was not conducted of the Victoria and Albert original for comparative analysis. Naive as it was, the sequence of manufacture and basic strategy of working I now know has no relation with the ancient example. This is a change of thinking due to the findings brought about in this PhD research.

Figure 3.2. Gold Etruscan a baule ear ornament. South Kensington, Victoria and Albert Museum no. 1856-3347. Photo courtesy of Victoria and Albert Museum, South Kensington.

77 R. Baines (1998) 122-126
78 Ibid 122-124
79 Gold Etruscan a baule ear ornament. South Kensington, Victoria and Albert Museum no. 1856-3347.
Figure 3.3. Robert Baines first attempt at laboratory reconstruction of ancient gold jewellery using copper salt diffusion 1994. Copy of Gold Etruscan a baule V&A no. 1856-3347. Photograph by Garry Sommerfield.

**Studio Art and the Practise Based Research**

Regarded by Reynold Higgins as an Etruscan invention, 80 a baule ear ornaments, of the mid sixth century B.C. tend to have configuration of design elements around an absent centre. 81 This is a consequence of the conditions of heat and mass. Copper salt diffusion joining requires strategies of reinforcement and quite often a surface strata-joining system in order to secure or reinforce the minute diverse parts. It shifts heat joined contact points from the not always accessible substrate to the more manageable surface. 82 There is a building from the outer perimeter towards the centre and this calls for a design solution to cover the central vacant area with round, square and rectangular plaques (Fig.3.4).

**Baule Structures**

Generally this ear type consists of a sheet curved around and terminating in a two knuckled hinge attached at each end. A hoop is suspended from the front hinge and caught at the back hinge. 83 Connected on the front hinge is often a pediment. In some types the curved round strips are covered in by the attachment of side plates.

Plates occur on both sides of some types and this then becomes a structurally very strong hollow construction. Placing a plate on one side of the ear ornament designates the object to be worn specifically on the left or right side of the face. The outside plate would be viewed on the wearer and this was a design decision by the goldsmith. While it conveys the appearance of being solid there is an economy of material in the use of only one side plate. The other open side facing the body of the wearer remains unseen.

The ear ornaments of the early fourth century have elements heat-joined on both sides of the disc. 84 The substrate on the side plates has wire and granule configurations with some surface sheet chiseled away creating open spaces. Edges of the cut gold sheet is quite often irregular and the shape of the extracted area does not always conform to what appears to be a predetermined area of the substrate leaving excess goldsheet. This irregularity is inconsistent with the controlled and accurate worked manner within the remainder of the piece where sequences of granulation patterning, multiple rows of wire and their controlled placing suggest a paradoxical philosophy of working by the goldsmith. In addition there is an excess of gold sheet remaining. This is not due to any awkward positioning of the

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80 R. Higgins (1980) 139. The Italian name a baule is due to its similarity to the Italian hand bag or valise.
81 Later a baule of the fifth and the fourth century are less complex. There are less multiple layers and intricate components. On a baule earrings see I. Caruso, (1988) 25, 27, 30, nos. 36-41; M. Scarpignato, (1985) 41-50, nos. 34-45; M Cristofani and M. Martelli, (1983) nos. 123, 136, 142-7, p. 161, 165-9; R.Higgins.139, pl. 32c; Hadaczek.(1903) 56ff. **BMJN** nos. 1286-1306
82 R. Baines, (1988) 122-126
83 It is usual in a baule ornaments to find the hoop absent. Richard E. Stone states that the pins for the hinges may have been wood.
84 D. Williams and J. Ogden, (1994) nos. 49-50, 63, 70, 88-89
chisel on the sheet but appears to be a conscious decision by the goldsmith to retain an irregular edge and excess of surface as integral to the conclusion of the work. This may be due to ensuring all the gold supplied to the goldsmith was used or possibly concluding the manufacture of the piece at a predetermined or mutually agreed weight.85

Figure 3.4. Gold laboratory reproduction by Robert Baines of a baule ear ornament. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

**Wire**
The twisted wire appearance is consistently found on each of the jewellery examined to be either right hand or left hand twisted and this indicates wire manufacture from a single source and by either a right or left handed goldsmith. A combination of left and right twisted wire within one piece does not occur. The only exception is when a double wire occurs where a left and a right twisted braid are placed together usually on the border of pediments and side plates of a baule ear ornaments.86 The placing of single or rows of wire at edges increases mass and stabilises the plate structurally and reduces the possibility of edges melting before joining in areas not immediately near the outer perimeter. In the a baule group examined only MMA.95.15.146 has beaded wire. Beaded wire does not seem to occur before the seventh century BC. When beaded wire does finally appear it is quite prolific throughout the areas of Phoenician influence.87

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85 Discussion with Richard E Stone.
86 Double braided wire has been joined on the top of folded strip in a baule MMA. 95.15.142. Not confined to being reinforcement this defined a geometric lattice.
87 J. Ogden, (1998) 16
Gold a baule ear ornament MMA. 95. 15.138
Figs. 3.4-12.
There is an absent hoop and two missing hinge pins
The ear ornament has a pediment and two side plates. A centre rosette of eight sections of four tapering strips curve toward the substrate and four curved sections join a sphere in each corner occupying the main section. There is a fifth sphere centrally placed in the rosette. The left side of the ear ornament has been slightly crushed and repair work in the reverse of the object. The ornament has been constructed with its various assemblages on a flat substrate. Following assembling of the construction folding/creasing on the inside attests that the object was curved up prior to the addition of the side plates.

Granulation
Three different sized granules define the design. The triangular granulation formations are irregular in their placement on the spheres. A group of poorly formed granules are concealed under the lower right curved floriette (Figs.3.10,11). The shape of the poorly formed granules suggests round wire was the initial stock. Some of the granules have retained their primary wire identity and clearly have received very little melting. They have obviously been positioned in the centre of the receptacle during the firing process and have not been fully soaked in the required temperature for the melting into the granule form.

Wire
There are two wire types. Both ‘twisted’ and round wire are consistently right hand twisted (Fig.3.9). Round wire is not prevalent and has been applied in only two places, first as a single large form on the pediment and second as flat open coils on the two side plates. Over the long length of the coil varying thickness in the round wire is visible. Rolling the wire between a block and flat base using irregular pressure has caused this.
Generally there are three different sized ‘twisted’ wires occurring on the pediment with the finest at the top and increasing to the largest diameters on the eight-part centre rosette. The twisted wire rings around the meeting point of the two hemispheres have not been joined prior to positioning on the spheres (Figs.3.9, 12).

Hinge
The hinge being an extension of the substrate is cut with a chisel and rolled up in an anti clockwise direction. The knuckles of the hinge then become the connecting point for the pediment.

Surface Depletion
An enrichment of surface has come about with the reduction of copper and silver. Modern repair work has been carried out and rectangular plates have been applied as patches and powder soldered. Pickling with an acid solution would have followed this addition consequently altering or destroying the ancient surface.

Laboratory Reconstruction
The a baule was constructed based on drawings suggesting a sequence of manufacture using a diffusion joining process (Figs.3.6-8). The gold alloy for the construction is included in the MMA report. The museum piece has burnt out areas on its side spheres and particularly the hemispheres underneath. This indicates a direction of the heat source and the prior firing to join the hemispheres to the substrate. The difficulty in directing the heat is further identified by what appears to be an inaccurately positioned side plate (Fig.3.5). As a final sequence of the heat assemblage the side plates are joined to each side of the object. The connecting edges remain exposed in order to be accessible for heating for the joining process. On the laboratory sample surfaces became oxidised following the heat joining campaigns.

To restore a gold colour to the surface the laboratory samples were brought to the boil in a solution of vinegar and salt which removed any visible copper oxide.

See N. Whitfield, (1998), The 'twisted' wire is described by Whitfield as a spiral-beaded wire, which has oblique (rather than right angled) ‘beads’ separated by spiral grooves running round the wire in the manner of a screw thread (although not as continuous). For Etruscan examples see fig.34, fig.54. For examples of 'twisted' wire on a baule of the second half of the sixth century see Christofani and Martelli nos.143,144 and a baule of the mid fifth century BC., no.145.

See P. Craddock et al, (1988) 112

See Fig. 3.22
On completion the weight of the two laboratory constructed pieces were almost twice the weight of the a baule from the Greek and Roman Department. The size of the samples with their wires and granules match the dimensions of the museum piece but being twice the weight illustrates the delicate quality of the original. The wires, granules and sheet which became the substrate were too thick. Two factors confront the researcher in determining the thickness of sheet. It is difficult to gain an adequate vantage point to actually measure the sheet which forms hemispheres and substrate are not accessible. The second reveals the extremely delicate quality of the work in that the sheet the goldsmith commenced with had been reduced to an acute thinness that renders it quite fragile and susceptible to distortion in the fingers and during joining campaigns in the fire.

The pediment on the ear ornament is connected to the tube/hinge, which has been rolled up from the substrate. Granules reinforce this long contact point to the pediment.

Similar burnout on the substrate of the spheres and floriettes occurred in both the laboratory construction and the museum piece. It was found that particles of copper carbonate not completely dissolved were suspended in the solution of water and tragacanth gum. If painted on to the gold surfaces for joining the ultimate concentration of copper became a burnout point.

Figures 3.4,5. Etruscan gold a baule ear ornament MMA. 95. 15.138 Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.6. Gold laboratory reproduction by Robert Baines of gold a baule ear ornament MMA. 95. 15.138 Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figures 3.7,8. Gold laboratory reproduction by Robert Baines of gold a baule ear ornament MMA. 95. 15.138. Oxide on surface as an outcome of the copper salt joining process. Grooved wire having the appearance of twisted on the pediment. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum in NY.

Figure 3.9. Etruscan gold a baule ear ornament MMA. 95.15138. SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.
Figures 3.10, 11. Etruscan gold a baule ear ornament MMA. 95. 15.138 A group of poorly formed granules are concealed by the goldsmith. The shape of the poorly formed granules suggests round wire was the initial stock. SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figure 3.12. Etruscan gold a baule ear ornament MMA. 95. 15.138 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.
2. Gold a baule ear ornament MMA.95.15.139
Figs. 3.13-19.
The ear ornament has a pediment and two side plates which would have allowed it to be worn on the left or right ear. The main section is occupied by three rows of domes with each having three granules topped with a centre granule.91 Bordering on either side of the domes is a grooved folded strip and the second inner row has lifted from the substrate at the top left. This allowed a vantage point for the SEM to photograph preliminary marking out on the substrate by the goldsmith (Figs.3.15,16). The substrate surface has flowed during heat joining but insufficiently covering the scribed line. This is signage of the maker. The preliminary marking out of spatial intervals for the placing of design components reveals design thinking by the goldsmith and part of this strategy was the scribing would be covered over by the flow of the molten surface due to both the fusion process and the grooved folded strip placement. The SEM image reveals incomplete joins on the base of some domes and this is typical of diffusion bonding. The domes also have crimped edges which are an outcome of the thin gold sheet folding and not being hammered tightly into a dapping form.92
The ear ornament has been constructed on a flat substrate and curved round prior to the side plates being attached as resultant creasing is clearly visible inside the ornament.

Granulation
The granules on the domes are repeated in groups of three and one on the top in the centre. They are consistently the same size.

Wire
All the wires on the artefact have left hand creasing and imply they were wrought by a left handed goldworker (Figs.3.18,19).
Varying in diameter from 0.2 - 0.4 mm. the wire appears to be block twisted and on the right-hand side plate is a wire border the SEM identified as round (Fig.3.18). Clearly the wire has been manufactured initially round in section followed by helical grooves worked up and down the wire using a grooved tool by the goldsmith. The wire has been held in the left hand and the tool is run up and down the wire. The grooved folded strip is typically flat on the underside with consistent flat sides and uniform width (Fig.3.18). The ridge at the underside edge is a result of the folded strip having been hammered lightly on its edge. The strip is strategically placed both as a protective border and as a reinforcement at the joins of the domes to the substrate. This is a particularly important component in the strategy of reinforcement by the goldsmith. The SEM illustrates the incomplete joins to the substrate (Figs.3.15,16).

Hinge
The hinge has been chisel cut from the substrate and rolled up into a tube anti clockwise.

Surface Depletion
No reduction of copper in the surface analysis indicates surface depletion has occurred as the copper salt diffusion joining campaign would have added copper to the surface. The 8 % reduction of silver and corresponding increase of gold endorses the theory that a leaching action has produced surface enrichment.

Laboratory Reconstruction
The copy was constructed using the alloy 92% Au, 6% Ag, 2% Cu. A drawing was made of a suggested sequence of assemblage based on the diffusion bonding joining system. Substrate, domes, grooved folded strip, side plates, pediment, granules and wire are all components illustrated plotting the sequence of their assemblage.

In the construction of the replica a double grooved iron tool was successfully used to create the twisted appearance on the wire.93

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91 see note 9

93 Ibid, note 17
Figure 3.13. Gold laboratory reproduction by Robert Baines left and right gold a baule ear ornament MMA. 95. 15.139. Bordering on either side of the domes is a grooved folded strip and the second inner row has lifted from the substrate at the top left. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.14. Gold laboratory reproduction by Robert Baines of gold a baule ear ornament MMA. 95.15.139 Red comb identifies the fine scale of the work.
Figures 3.15, 16. Gold a baule ear ornament MMA. 95.15.139. The grooved folded strip in the second inner row has lifted to reveal marking out on the substrate. The grooved folded strip is typically flat on the underside with consistent flat sides and uniform width. The ridge at the underside edge is a result of the folded strip having been hammered lightly on its edge. SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figure 3.17. Detail. Gold a baule ear ornament MMA. 95.15.139. SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figure 3.18. Gold a baule ear ornament MMA. 95.15.139. Grooved folded strip. SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.
3. Gold a baule ear ornament MMA.95.15.146  
Figs.3.20-25  
The ear ornament has no pediment or side plates. It has two rows of six domes topped by beaded wire jump rings with a singular solid ball/granule (Figs.3.20,21). The perimeter of the domes and granules configuration is a beaded wire terminating at each end in a swaged sheet hinge. The excess substrate at the sides has been burnished around the beaded wire border.  

Granulation  
The granules are consistently 0.7 mm. diameter and have smooth surface. Granules are located on tops of beaded wire jump rings and adjoining domes. Connecting the components together would increase the structural strength, particularly during the curving up from the flat substrate stage to the annular a baule form.  

Wire  
There are two types of beaded wire made from block twisted wire. The small beaded wire as a ring supports granules on the top and between the domes. This provides an increased contact point. The beads are irregular in size on the small wire.  

Hinge  
The hinge is constructed as a separate swaged tube. A more coarse and angular tool has been used in this instance than that for the beaded wire. The swaged hinge has been constructed independently of the ornament and joined to the extended substrate.  

Surface Depletion  
No analysis  

Laboratory Reconstruction  
The laboratory sample was constructed on a flat substrate and then curved up (Figs.3.22,23). Creases on the reverse are similar to the museum piece. Surface analysis of the laboratory sample found that copper increased from 1.3% to 3.9%.
Figures 3.20,21. Gold a baule ear ornament MMA.95.15.146  Photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.22. Gold laboratory reproduction by Robert Baines of gold a baule ear ornament MMA. 95.15.146  Oxide on surface as an outcome of the copper salt joining process on the left and the other boiled in salt and vinegar.  Photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.23. Gold laboratory reproduction by Robert Baines of gold a baule ear ornament MMA. 95 15.146.  The structure is applied to a flat substrate and finally curved up forming the hoop shape.  Photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
4. Gold a baule ear ornament MMA.95.15.141, 142.
The ear ornament has a pediment and two side plates.

Grain Growth
On the substrate of the pediment and in the two concave bowls of MMA.95.15.141 recrystallisation has occurred during manufacture and individual grain boundaries are evident. There is grain growth on the surface of the concave bowls and a twisted wire appears to have been overfired on being joined to the substrate of the bowl. The centre ball has in contrast a pristine surface suggesting its placement and joining to the substrate as a later sequence in assembling. The sheet used to construct the bowls is possibly a remnant of previous construction. This may have been part of the substrate of the main section and have received a duration of heat and hence grain growth. A suggested sequence of fabrication based on the signs of manufacture indicates the dapping of a disc, which is then domed or made concave. The wire once joined to the perimeter is joined to the substrate of the pediment. At this point the granulation is rendered over the surface of the centre losenge. Following this extensive firing the ball is placed and joined to the centre of the adjoining concave bowls.

Recrystallisation
Recrystallisation is evident on the substrate in the centre of the side plate. When the present composition of alloy is to be compared to its original composition, proof is necessary that no component element has since been extracted from the alloy. This may have occurred via soils from its archaeological site, by some inappropriate cleaning or undue “enhancement” process following excavation. The question of surface depletion as a final part of the sequence of manufacture consciously applied by the goldsmith has to be considered in the research.

Conclusion
Constructing a baule by diffusion bonding with a copper salt results in a copper enriched surface. Compositional changes to surface alloys as a result of the application of copper during the heat joining process became an issue for reconsideration. The relevance of flux as a reduction agent of copper oxide on heat joined gold alloy became a major consideration as the interference of copper oxide on surfaces proved quite problematic during ongoing joining campaigns. Drawing copper oxide to the surface during the heat process also led to burnout of surfaces. Burnout holes were caused by particles of copper carbonate not fully dissolved into the joining solution of water, gum and copper salt.

I have found that there is a general theory within museums by scholars and conservators that all the design elements/iconography are located on the construction and held intact by the organic glue and this is followed by one firing using a copper salt. Through many demonstrations I have shown that this is quite false.

Flux
Following discussion with Dick Stone it was decided that flux would not be used in the heat joining process due to the understanding that there were no fluorates or borates in the Etruscan period. A mixture of water, copper-carbonate and tragacanth gum would be the solution applied to the gold alloys. The heat source was low-pressure gas with the injection of air by way of mouth.

In the Etruscan context there is an absence of chemicals that parallel contemporary fluxes such as sodium fluorate or sodium borate.
The chemicals suitable for making faience were of course available, and based on this a natron was made up in the anhydrous form consisting of two parts sodium carbonate, one part sodium chloride and sodium sulphate. Making of test pieces identified the following results.

94 See 2 Historical Background :4 Recrystallisation and Grain Growth.p.30
95 See note 7 for full reference
96 Ibid
First, as a flux for the joining of objects of small mass as in granulation and fine wires the joining was unsuccessful. The small objects tend to be displaced by the viscous action of the flux. However for the metallic soldering of objects pressed together where objects cannot be displaced by the flux it would prove an excellent flux due its condition to withstand sustained high temperature firing. Second, the solution when heated very effectively dissolved the copper oxide on the gold surfaces. Third, dissolving the lump form on flat gold sheet is very effective as the viscous material spreads throughout the piece over a broad area. This is most beneficial in the removal of copper oxide from sheetworked gold. For the structural three-dimensional objects it tends to flow away from the highpoints exposing the material to the atmosphere resulting in surface oxidation. Fourth, the natron is very easily removed from the object by washing of surfaces with water.

The subsurface copper level on the tested a baule ranged from 4%-4.6%

An accumulation of copper on some samples suggests there could have been a conscious depleting of surfaces as the final sequence of manufacture. A solution of vinegar and salt was considered as a possible pickling agent and this was applied on the laboratory sample. The treated surfaces were observed and analysed with the SEM. The initial non use of a flux in the constructing of replicas and test pieces caused some difficulties with multiple joining due to the copper build up. The natron was used in later samples as a flux agent for heat joining, and also for the making of button ingots. Surface treatment with the natron material for the reduction of copper oxide proved quite effective. Microscopy identified surfaces as not being ‘typically ancient’ however, and in later more heavily oxidised samples a more positive result was achieved. Further investigations of surface treatment of gold alloys were conducted using various proportions of iron sulphate and the natron material.

**Grain Growth**

Extensive grain growth was observed on sections of the a baule MMA 95.15.141,142 and this could be an indicator of sequence of manufacture. Three test pieces of typical gold alloys were soaked in an exposed atmosphere for various duration and temperatures. The results produced were unsatisfactory. The application of copper in a non oxidising situation could be the contributing factor required. The removal of the heavy copper oxide with multiple firings using the natron material achieved relevant surfaces for the study of ancient goldworks.
3.3. A Greek Disc and Pendant Ear Ornament

In the first quarter of the fourth century BC at Madytos on the north side of the Hellespont opposite Abydos was found a pair of Greek gold ear ornaments97(Figs.3.24-26). Interference by fire on the gold surfaces of the pieces indicates funerary pyre origins of the jewellery pieces.

This complex disc and pendant jewellery type with its multiple wire configurations in concentric formation in the pan shaped disc has connected to wires, spikey-leaved palmettes, spirals, trefoils, quatrefoils and pear shaped blocks (Fig.3.26).98 The disc/pan is outlined within the corrugated border by a series of wires joined to the substrate. In less complex types from Kyme99 patterned wire in concentric placing extend over broader surface areas employing fewer three dimensional motifs which are cold fastened to the centre.100 Centrally placed in the pendant is a boat/leech hollow form and on the front is finely granulated patterning.

Above the suspended boat shape is a muse playing a lyre and on either side is an elongated winged figure, possibly an Eros. Surrounding iconography is diverse: acanthus leaves, spikey-leaved palmettes, quatrefoils, tiered rosettes and protomes of the winged horse Pegasos. Further pendants of quatrefoils, swaddled women, plain and grooved seed hang from hoops and tight ‘loop in loop’ chains.101

Strategies of Working

The ear ornaments show that the goldsmith had an intimate feeling for the material. A tacit knowledge, an interaction between ideas and real matter happened not unlike the interchange between scientific theory and experiment-attractive at first but only a tentative idea. Technique rarely controls the major tangible outlines of gold objects in ancient antiquity. Intangible quality is strongly influenced by the properties of gold alloy, its internal or surface reaction with heat and atmosphere, and its ability to acquire liquid state or gradients of shape both on a near microscopic scale or in the clearly visible. The goldsmith cannot avoid being intimately and sensually aware of this relationship as he works, even though he may not have intellectualised it from the beginning.

Shaping of metal on a large scale can be arbitrarily done but on a very fine scale the goldsmith has little latitude. On the scale just visible to our senses there is balance and the intricate granulation and wirework of the complex gold in the Madytos (?) pieces lie in that balance with complex granulation and wire configurations.

Under close examination, the minute effects due to the gold and heat are seen to be just as dependent upon the relations between parts and wholes as the aesthetic quality of the entire work on the scale at which they are intended to be viewed. Both are ultimately structural, but the relevant structure of the gold is on a scale that is not resolved by the naked eye, or only marginally so. It may be a structure on a microcrystalline level as in the texture of metal.

Microscopy

The ear ornament was examined using light and electron microscopy. The disc and pendant MMA 06.1217.11 was selected and a series of drawings were made of the disc depicting possible sequence of

97 Pair of gold Greek disc and pendant ear ornament. New York, The Metropolitan Museum of Art, Rogers Fund, 1906, 1217.11-12. Higgins GRJ, pl.25A. Pfommer, (1990), pls.26, 14 and 31,14 (a chart suggesting the development of the type). Ear ornaments from Crete, BMCJ 1655-66; from Derveni, Tomb z8, Search for Alexander, no.1138; from Trebizond (Dallas, Schimmel collection), Deppert Lippitz (1985), fig.130; Williams and Ogden, (1994) 110,111
98 Working strategies can be characterised by a consistent use of the same iconographic structures observed on a number of jewellery pieces. The complex disc and pendant ear ornaments of the late fourth century BC show a consistent structural configuration in their manufacture. The repetitive use of double corrugated strip, concentric wire patterning on the outer perimeter of the discs and the same system of cold fastening of the wire structures in the centre all identify a common characteristic of surface and structure.
100 For the Kyme earrings see D. Williams and J. Ogden, (1994) nos. 49-50 and A. Greifenhagen (1960) II pl. 40, 1-2
101 For a detailed description see Williams and Ogden, (1994) 110, 111
assemblage and these were also used as maps for SEM observation. Markings and structures indicating manufacture of the decorative components were observed and photographed. This visual information on surfaces can reveal sequence of assemblage and goldworking methods. Varying evidence of reticulation, burnout and grain growth on surface adds further information particularly of the firing activities of the maker.

The complex disc with its diverse wire configurations, sheet and granulation is an assemblage of prefabricated layers. They are connected by a central tube, which is concealed by a rosette cap (Fig.3.28).

The background to the complex network is the polished gold surface of the bowl. This has been achieved by concentric burnishing inside of the border of one round wire and two braided wires joined to the substrate.

**Alloy**

Compositional analysis of surface and sub-surface using EDS was carried out and the relative weight percentages are taken from single readings on the surface and sub-surface, and no analyses of heat joined zones were conducted. The ear ornament has been manufactured from a relatively pure alloy with very slight gold variation of 0.05% could still suggest surface depletion has occurred. Whether this was a conscious process implemented by the goldsmith is questionable. Multiple firing campaigns using a copper salt diffusion joining system has as an outcome a copper enriched surface, and depleting with an acid solution as a final sequence of manufacture could have been carried out. 102

Depletion of the gold surface could have resulted from having been buried in a leaching soil environment. Other possibilities being the piece could have received some cleaning or chemical enhancement treatment on the surface as part of its history.

**Hot and Cold Joining**

The complex network of fine wires and granules together with all heat joined parts are all diffusion bonded with a copper salt. The reverse identifies typical joining contexts for copper salt diffusion followed by fusion of the parts. The maximizing of contact points and strategies of reinforcement are continual policies implemented by the goldsmith.

The high temperature atmosphere of the fire quickly melts the parts of very little mass and particularly when they are not connected to a substrate. Much of the complex iconography in the disc is “in the air” and to connect these fine structures to the broad mass of wire and sheet in the disc using a high temperature fusion process would result in melting of the fine parts prior to the joining process.

To overcome this dilemma the complex structure in the disc is a series of simplified structures built as layers each fabricated separately and safely away from the complex firing of the object. Once prefabricated independently, each layer is located over the centre tube in the disc and a cap fused at the top of the tube locking the layers on. The partly melted quatrefoil cap (Fig.3.28) identifies the difficulty of the final joining sequence. Following that joining, a ball was added to the centre of the quatrefoil. The cap has received intense heat and has been partly destroyed while the ball has received negligible surface interference from the heat and the initial dendrites crystal lattice on the gold surface remains clearly visible on the surface of the ball and attests to a further or final firing. 104 This sequence of construction is evident on the trefoils and quatrefoils (Figs.3.28,29).

102 Slight increases in copper as traces of diffusion bonding have been observed in an early Etruscan bow fibula. Analysis by emission spectroscopy was carried out by P. Parrini et al, (1982) 118-121. A sample was taken from the catch plate. The average composition of the alloy sample was found to be 65% gold, 32% silver; the copper content varied from 1.25 to 3.2% moving from the centre of the grain to the lamella. The copper content increases in the neck of the joint by as much as 5%.

103 Figs.3.33,34. The design element of wire and substrate is stabilised by the added mass of a second thicker substrate.

104 When solidification of the balls (granules) start, it does from a few isolated points in the melt, usually from impurity particles in the alloy or within the surrounding charcoal dust during manufacture. This is called nucleation, see M. Grimwade (1995) 66,67. “Nucleation occurs when a small piece of solid forms from the liquid. The solid must achieve a certain minimum critical size before it is stable”, D. Askeland, (1990) 218-251
Recrystallisation and Grain Growth

The condition on the gold surface suggests funerary pyre origins and this is characterised in recrystallising grain growth of the gold (Figs. 3.31, 3.32). Visible tessellated grain growth over the entire piece suggests the fragile piece has been saturated in heat for an extended duration. It is quite likely that the jewellery was immersed in a reducing atmosphere of hot ashes for a number of days. The reverse of the ear ornament identifies tessellated grain growth has not resulted from heat as an outcome of manufacture of the beaten sheet and worked wire. Heavily worked sheet gold is characterised by a different type of crystal compared to cast metal objects and following a number of annealing alloyed gold sheet results in a uniformity in the size of the grains. The reconfiguring of the crystal structure of the gold in the Madytos (?) piece has resulted from a duration of heat during cremation and subsequent period in ash.

As discussed above, during manufacture, annealing and heat joining causes increased temperature and the cold worked microstructure of the gold becomes more and more unstable. In this first stage of recovery the dislocations introduced during cold working undergo structural rearrangement into more energetically favorable configurations without any significant change in their concentration. This reduces the crystal lattice strain without causing any observable change in the metals microstructure and not visible on a jewellery piece. The second and most important stage of annealing and consequently heat joining is recrystallisation. This stage involves the replacement of the cold worked structure by a new set of strain free grains. These grains are not elongated or deformed as are the cold worked grains, but are approximately equiaxed.

In the Madytos (?) ear ornaments recrystallisation has occurred in the funerary fire rather than by manufacture as grain growth is the third stage of annealing and heat joining. This involves the growth of recrystallised grains at the expense of surrounding recrystallised grains. During the process of heat joining grain growth can occur and repeated campaigns of heat joining will further extend this growth. Usually there is no sharp distinction between recrystallisation and grain growth as grain growth may occur in the parts of the material which recrystallised first, while other regions are still recrystallising. The Madytos (?) pieces have an even tessellation over the surface suggesting a general as opposed to, localising heating and for a long duration.

Chisel Cutting

Gold when wrought to acute fine dimensions using such a high temperature joining system indicates the ancient goldsmith as one who worked ‘at the edge.’ Using a singular material (gold), the working is direct. That is, it is not labored over with a litany of processes such as the refining of surfaces by abrasion or returning to correct minor differences. There is honesty in the working - what is applied is observed. A chisel piercing the substrate or chopping a wire creates no residue or wastage of gold. The mark of the chisel action leaves a profile identifying the shape and angle of the cutting face and faceted edges from some cuts can become part of the aesthetic of the worked surfaces (Fig. 3.34).

Wire

The goldsmith who made the wire was right handed. All the wire is consistently right hand twisted resulting from holding the wire in the left hand and rolling a flat block in a forward direction across the wire. This causes a helix on the upper left going down to the lower right of the wire. The complex network of fine wires and minute iconography on the ear ornament is consistently of right hand twisted wire suggesting that the manufacture has been carried out by a single maker.

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105 Williams and Ogden, (1994) 108, "A tubular loop from the back of one of the rosettes has become fused to the disc of one of the earrings. The earrings and the flowers were therefore evidently close together on the corpse as the funeral pyre was lit; owing to the slightness of the damage it seems likely that they were quickly removed or the flames were speedily quenched." This scenario would not facilitate the extensive grain growth clearly evident on the pieces.

106 For the effects of increasing annealing temperature on the properties of precious metal see M. Grimwade (1985) 80-82

107 D. Askeland, (1984) 213, ‘The recrystallization temperature is not a constant for a material but depends on the amount of cold work, the annealing time, and other factors.”

108 The same diameter no matter what direction they are measured in.
The spikey leaved palmettes are the finest network of wires in the disc and measuring 0.15 mm. diameter are of the ribbon twisted type. They are placed in the air and so are stabilised by being joined to a substrate. This facilitates a fineness of appearance and fulfills the technical necessity of stabilising and strengthening the wire construction. It also allows a more angular bending of the wire construction once stabilised on the substrate (Fig.3.36). The wire is a ribbon twisted type, though the broken hoop (Fig.3.27 Detail) is of a larger twisted strip. The option of a block twisted wire would seem stronger and practical for forging the end and making a taper.

Laboratory Reconstruction
The complex prefabricated system of construction for the decorative components in the disc is evidence of the dilemma of high temperature joining. This sequence of building components could be regarded as a logical outcome using a metallic soldering process, but the extreme fine detail and hence fine joins clearly point to copper diffusion followed by fusion as the joining system. The non-appearance of ‘flooding’ at the contact points and adjoining areas further indicates the absence of solder. The evidence of burnout on the substrate further indicates protracted fusing of the surface.

The laboratory reconstruction of the disc and its components was carried out based on the known technology of the era of the piece (first quarter of the fourth century BC) (Fig.3.37). Copper salt diffusion followed by fusion was the heat joining system carried out. Copper carbonate was combined with gum tragacanth and water for the holding in place and the diffusion process. By confining usage to the known and understood processes of the period specific parameters were established. The primary objective was to test the possibilities of construction of intricate detail within the complex structure of the disc/dish (Fig.3.37).

Following inspection using a low powered stereo microscope signs of manufacture were observed. Further study of the jewellery was enhanced by practical experimentation in a goldsmith’s workstation using a similar gold alloy.

Using the SEM, observations of signs of manufacture and drawings were constructed to record descriptions of process. The sequence of manufacture of the various components once established was constructed requiring the heat joining process. The various intricate parts are then each cold assembled over the central tube (Fig.3.37). The gold once beaten into sheet was cut into a disc and dished up around the edge. In the central flat a smaller flat dish was sunk. This was the location for the heat joining of the central tube.

In making the cross-corrugated border, a strip was cut from the sheet and using a multi-grooved anvil latitudinal creases were made along the strip. Grooves crossing the latitudinal grooves were worked into the sheet by locating a previous streak into the groove of the anvil, and making a sequence of longitudinal grooved strip.

Conclusion
In the gold disc ear ornaments the diffusion bonding system can be demonstrated to have employed a copper salt as the chemical joining agent simply by the design configuration of the decorative components. In considering the Greek disc and pendant ear ornaments of the fourth century BC structural identity and configuration of the design elements suggests a sequence of construction. Within the disc/pan component of the ear ornaments itself is a sequence of ‘building’ which can be compared with the Etruscan disc and a baule ear ornaments of the sixth and early fifth centuries BC. Diffusion bonding is characterised on the reverse of the discs by the increased surface contact that maximises the joined surfaces.

The ear ornaments of the early fourth century have elements heat-joined on both sides of the disc. Copper salt diffusion bonding facilitates this design opportunity due to a fundamental condition. The join does
not remelt (as in soldering) and this ensures a stable bonding during subsequent firing for even the smallest complex parts that had been joined previously.

The double corrugated strip follows and increases the outer circular border accommodates and protects the fragile three-dimensional structures on the front. The multi-layered rosettes, palmettes and wire constructions are cold-fixed to the centre of the disc. There is a recessed centre that is a dome on the reverse. The vertical tube joined to the centre becomes a central fixing point on the front. Decorative elements are pre-fabricated and placed over the central tube to be trapped by a rosette cap.

This is the technical configuration principally used in all disc ear ornament types. Prior to the cold assembly of the pre-fabricated parts in the centre there is an open central area on the substrate. This broad space facilitates a general heating and, therefore, reveals a high temperature joining system such as diffusion bonding.

The solution of cold-fixing complex elements that protrude out from the elevated central area is, in fact, a highly practical one which simultaneously conforms to expectations of Greek aesthetics. The laboratory reconstruction based on the building parameters of the known technology of the era confirmed other determining factors. It became quite evident having built three layers using such theoretical methodologies of making that fine complex structure of the disc/pan type can be constructed accurately with efficiency and minimum danger to the jewellery piece. The laboratory-constructed sample was placed in the SEM (Figs 3.38-40) and images were compared with the piece from the Metropolitan Museum of Art in NY.

The decorative wire in the disc/pan, chain wires and in the hoop is all consistently right hand twisted and this consistency of the many intricate parts, the complexity of structure and acute focus required in the construction attests to a single maker.

Following manufacture of the copy in the laboratory the sample resulted in a slightly oxidised appearance. The copper oxide on the surface was a response to the multiple applications of the copper salt during the heat joining campaigns.

Figure 3.24. Pair of gold Greek disc and pendant ear ornament. MMA 06. 1217.11-12. Photo courtesy of the Metropolitan Museum of Art in NY.
Figures 3.25, 26. Detail. A swaged gold hair ring has fused to the wall of the disc as a consequence of high temperatures within a reducing atmosphere. MMA 06.1217.12. photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.27. Reverse detail. Diffusion bonded joins characterised by increased contact points. 1-Broadened contact point of suspension hook. 2-Overlapped joins of jump ring. 3-Overlapped join of corrugation strip. 4-Attachment of corrugation strip over the broad curve of the disc/pan.
Figure 3.28. Centre rosette cap partly melted. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figures 3.29,30. Centre granule in a pristine condition joined to burnt out substrate. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figures 3.31,32. Close up of reverse of ear ornament. Growth of recrystallised grains. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.
Figure 3.3. Misplaced chisel mark in the extraction of the substrate. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figure 3.4. Faceted edge of chisel cut of thick substrate. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.

Figures 3.35,36. MMA 06.1217.11 SEM by Mark Wypyski photo courtesy of the Metropolitan Museum of Art in NY.
Figure 3.37. Test piece by Robert Baines Detail, Disc MMA 06.1217.11. Photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figures 3.38,39. Test piece by Robert Baines Detail, Disc MMA 06.1217.11 SEM photo by Safa Shawan courtesy of RMIT.
Figure 3.40. Test piece by Robert Baines Detail, Disc MMA 06.1217.11 SEM photo by Safa Shawan courtesy of RMIT.
3.4. A Group of Egyptian Boxes. Necklace Beads (?)
The eight pendant beads are box forms derived from Egyptian seals that became amuletic beads of faience and steatite. They are vertical hanging also but not having as much volume as the amuletic beads (Figs.3.40,41).
Shaped like square boxes, human heads in relief occur on the front and obverse surrounded by rows of inverted triangular patterned granulation. The sides of the boxes are of rows of alternating domes and granulation with openings for stringing. The boxes have been filled with plaster to stabilize the piece for wearing. There is an absence of repoussed heads on the beads MMA 23.2.46-49. This factor combined with the material quality and manufacture characteristics categorises the eight beads into two groups. Further reference will be Group 1, MMA. 23.2.42-45 and Group 2, MMA. 23.2.46-49.

Construction
In Group 1 each of the four walls of the boxes is one strip and terminating with an overlapped end. There is no consistent order in the group of where this seam occurs (Fig.3.42).

Group 1-The perimeter frame is made from two elbow right angle pieces placed together with mitred joins. Some have a gap, eg. MMA. 23.2.42-obverse, appears that it is possibly a three sided strip joined to one single side (Fig. 3.43). MMA. 23.2.43-obverse, MMA. 23.2.44-obverse and reverse, the gap is filled with granules.

There is no overlapped sheet evident in Group 2 and there appears to be one sheet making up the walls and terminating at a corner. The border frame has slipped chisel marks on the strip (Fig.3.48) and is frequently cracked at corners.

Group 2-The frame is made from two elbows meeting to make a square join, unlike the mitered corners of the other group. MMA. 23.2.49reverse the strip has three corner bends.

Centre Portrait Niche
Group 1 frame terminates consistently to the left except for the reverse of MMA. 23.2.42 and the reverse of MMA. 23.2.42. (Fig.3.43)

Group 2 the recessed niche on the obverse and reverse is constructed from fabricated sheet and heat joining.
Group 2 frame appears to terminate inconsistently at either the right or the left. The strip bent on a sharp corner has broken at that corner indicating from the time of forging there was no prior annealing to make the niche frame. The portrait niches are positioned consistently in the same direction as the string hole. The exception to this is the reverse of MMA. 23.2.47.

Portrait
Repoussed and chased portrait heads with necks occur on the obverse and reverse of Group 1. The hollow constructed forms have been crushed and though severely damaged due to wear the figures appear not to be Pharaonic in style, but possibly Greek. Chased lines indicate hair parted in the middle suggesting the heads are female. Distortion damage inhibits a clear reading of characteristics though there appears to be Venus rings on the neck (Figs.3.45, 46).

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110 There is no visible evidence of joining indicating repoussed inserts ever existed.
111 MMA Bull.(1928) 250, fig.3
112 See S. Walker, (2000) Figs. 56,60,68
Granulation
Granulation on the obverse/reverse is of parallel rows in continuous triangular sequence. That is, there are two granules placed against the three and then one against the two. An additional one is placed to fill a space on the obverse of MMA. 23.2.46. The rows of granules have been applied commencing at the bottom and working towards the top. There is consistently a starting from the left and moving to the right to compile each row. Sometimes gaps occur and ‘filling’ is carried out. Therefore gaps occur at the completion at the end of the row on the right hand side. There are 21 rows of triangles from the left hand side.

Granules are of a uniform size which is necessary to continue the sequence of equally sized triangles.

Billets resembling round wire occur amidst the triangle rows of granulation in two places. They are found on side one and the obverse of MMA. 23.2.48. This indicates the granules are formed from round wire stock.

A line of granules occur around the perimeter in MMA. 23.2.42-45 and only at the ends of MMA. 23.2.46-49.

MMA. 23.2.42, MMA. 23.2.45-Consistent single row around perimeter.

MMA. 23.2.43, MMA. 23.2.44-triangular border and single row at the ends.

MMA. 23.2.46, 47, 48, 49 triangular border and single row at the ends.

Wire :Niche frames
(Figs.3.47,48)
MMA. 23.2.44 slipped chisel cuts are evident.
1. At end of strips of niche frame (reverse side)
2. On outer frame (reverse side)
MMA. 23.2.45 strips of niche frame appears to be forged wire.
MMA. 23.2.46 left hand twisted obverse
MMA. 23.2.48 left hand twisted obverse

String hole
Group 1 beads have a creased wire ring around the string hole. The helical creasing on the wire is consistently right hand twisted (Fig.3.49). The ring is missing from MMA. 23.2.44 as a result of underfiring during the joining campaign.
Group 2 beads have a wire ring around the string hole and there is no evidence of creasing.

Domes on the sides
There are four rows of (?) domes on the sides of the boxes in Group 1.
There are three rows of domes on the sides of the boxes in Group 2 (Fig.3.53).

Domed up from square cut sheet and trimmed with a chisel reveal the original blank was not circular. There is an appearance that the domes have been flattened due to wear. There are signs of wear on the pieces with granules having worn flat faces and corners and edges are worn down. More than half of some granules are worn away.

There is also evidence that the flattening occurred prior to their positioning on the surface of the sheet. This would achieve a flattening out of the base to make a broad contact point with the substrate. This maximising of the base is extreme on side 4, of MMA. 23.2.46 (Figs.3.50-52).

There is an absent dome on side 4, of MMA. 23.2.49 that appears to have fallen from the piece following firing. There was a single fused contact point with the substrate and proving to be an inadequate contact join.

Group 1, domes have been squashed on side 3, of MMA. 23.2.45 and also side 3 of MMA. 23.2.44 in order to provide space for the ring around the string hole. On side 1, of MMA. 23.2.44 some domes

113 In the technical notes not published in this exegesis the sides are numbered from the corner that has been inscribed with the accession number.
overlap to fit in the space around the wire ring of the string hole. A folded dome occurs (Fig. 3.50). It appears to be as a consequence of lifting on one side a decision to bend it over onto the side that has remained fused to the base.

**Alloy**
Quantitative analysis of worn surfaces on two beads from each of the two Groups was carried out.

**Platinoind inclusions**
The box beads were examined through the microscope and visible platinoind inclusions were plotted on drawings for further observation in the SEM (Fig. 3.54). Those that appeared to be platinoind inclusions in Group 1 were analysed as collected and entrapped dirt which renders Group 1 absent of any platinoind inclusions. Clearly there is a spread of inclusions throughout group 2. Inclusions were identified on the frame strips, wire rings at the string hole and on the domes (Fig. 3.53). There is also a scattering of inclusions identified in the granules on the obverse and reverse of all the beads in this group (Fig. 3.53). A selection of possible platinoind inclusions were analysed on MMA. 23.2.46, 49 and these were all consistently found to be osmium iridium ruthenium group.

**Repairs**
Group 1. In the side frames the strip has an insert due to under calculating the correct length of the strip, side 3 of MMA. 23.2.42, side 1 of MMA. 23.2.43, side 1 of MMA. 23.2.45. At the obverse of MMA. 23.2.44 of the niche frame is a corner insert (Figs. 3.55, 56). On the frame at the same side, the goldsmith has filled a gap with granules. Rectangular patches have been fused to the portrait head and neck on the reverse of MMA. 23.2.43.

**Burnout on the Substrate**
There are generally two types of burnout. Over firing is the main cause of burnout particularly with an excess of copper salt. Burnout that appears as a neat hole is the outcome of a concentration of a small lump of copper salt has been applied to the surface and evidence that it was not a completely dissolved solution.

Group 1. There is burnout on the substrate at the overlapped seam in MMA. 23.2.42, 44, and 45. There is no burnt out condition on the overlapped seam of MMA. 23.2.43 and absent granules indicate there has been an underfiring, which saves the surface of the gold sheet of the substrate from burn out but does not assure adequate joining. MMA. 23.2.42, 43, 44, 45. There is severe burnout damage on at least one of the portrait sides.

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115 Osmiridium inclusions have been observed in a number of ancient gold jewellery. J. Ogden, (1977) 57, N. Meeks and M.S. Tite, (1980) 267-275. N. Meeks and M. Tite carried out analyses of platinum group element inclusions in a range of jewellery and coins from Egyptian, Eastern Mediterranean and the Near East spanning the period from 3200 B.C. to A.D. 300. Using the energy-dispersive X-ray fluorescent spectrometer attached to the Scanning Electron Microscope it was found that PGE inclusions occur fairly frequently in jewellery and that gold from placer deposits was extensively used in antiquity. Some 310 inclusions were found. All the PGE inclusions analysed were of the Iridium-Osmium-Ruthenium alloy type. No platiniridium inclusions were found. They found that "the Iridium-Osmium-Ruthenium alloy inclusion found even within a single object frequently exhibit a wide range of compositions. Although this probably reflects the compositional variations of the PGE inclusions from a single placer deposit rather than implying the use of gold from several placer deposits, it does not mean that the compositions of this type of inclusion do not necessarily provide a basis for characterising the gold source." J. Ogden, (1977) 53-72, Some Egyptian pieces could be an exception to this. Jewellery of the VIth Dynasty to 1st Intermediate period (25-40%) as compared to works of the X11th Dynasty onwards (<25%). This could reflect the change from the exploitation of gold sources in the Eastern Desert to those in the Nile Region north of the 18th parallel. See also J. Ogden, (1976) 142-143. N. Meeks and M. Tite (1980) 273 observed in some Sargonid jewellery from Brak inclusions containing broadly similar concentrations of at least one component of the alloy with some other objects.
**Laboratory Reconstruction**

Testing theoretical methodologies and challenging assumptions of manufacture can be done by laboratory reconstruction using known technology of the same era of the artifact. There is in this testing the methodology a developing experience of the subject and further refinement of the methodology.

Developing a familiarity with the piece by drawing gives an understanding of the object. Constructing the object using same materials and technology brings a knowing, a learning of contexts of working with the intrusion of repairs along the way.

The reproduction of an Egyptian bead is based on the example of MMA. 23.2.42 (Figs.3.61,62). The sides were made from a single strip with an overlapped join and the niche frame was fixed to the obverse and reverse surfaces prior to attachment to the four sided frame (Figs.3.63,64).

**Granulation**

Using shears to cut strips is inadequate for making the required size granules. Making the granules from a 0.3mm round wire found the granules still not small enough to replicate the granulation in the museum bead.

A given space – 21 rows, requires specific sized granules of uniform size. Using a smaller size granule has to be followed by a compensatory larger one.

The gum must not be too watery so that once dry the placing of later granules does not dissolve the previous positioned work.

There must be some sifting/grading system. The size and uniformity is so critical. Peeling the ribbon from the sheet having scored it with a chisel produced very fine ribbons for making the round wire for the making the granules.

No preliminary marking out for the placement of the granules was required on the substrate.

The gum tragacanth which is not completely soluble (unlike gum Arabic) formed globules of tragacanth, which displaced the granules during their placement and positioning on the gold substrate.

**Substrate**

The substrate of the laboratory sample was too heavy at 0.17 mm. Thinner sheet at 0.07 mm was more suitable.

**Chisel Cutting**

Chisel cutting, scoring and peeling, uniform widths.

Making the frames (strips) was achieved by rolling the chisel along and then relocating it and continuing to cut through along the way. There is variation in the width and pressure which has to be exerted to cut while simultaneously moving through the material. There is no visual evidence of this in the Museum pieces. Alternatively by using the chisel as a scoring tool against a straight edge long strips of equal width can be achieved in abundance within a relatively short time. There is too much drag on the chisel to cut and direct the tool through the gold sheet. By using the chisel to score the line rather than cut the line the scribing needs to break through the sheet at the start. This allows a starting point for the peeling away from the scored line of the sheet. Providing the scored lines are parallel there is a strip of equal width achieved.

**Domes**

The chisel cuts are too few making a too angular base. The sheet is also too thick. The sheet was taken from that used to make the outer frame and not from the same sheet as the substrate. The frame strips are thicker than the substrate to increase the mass at the edges.
Conclusion
There is no indication that the portrait heads existed in Group 2. Why would one make the niche on the obverse and obverse of the beads if they are not to accommodate the portrait figures as in Group 1 beads? The absence of the overlapped seam in the Group 2 beads and yet overlapped joins are common modes of heat joining with copper salt diffusion followed by fusion in Bronze Age goldworks.

There is no burnout on substrate of Group 2. Both these factors indicate the heat joining process is accomplished gold working.

Figure 3.42. Detail Group 1. Overlapped seam over fired. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figures 3.43,44. Detail. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figures 3.45,46. Detail. Repoussed and chased portrait heads with necks occur on the obverse and reverse of Group 1. They are absent in Group 2. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figure 3.47. Detail. Evidence of niche frame is forged from round wire. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.48. Detail. Signs of slipped chisel cut. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figure 3.49. Detail. Right hand twisted wire ring at the stringhole. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figure 3.50. Detail. There is an appearance that the domes have been flattened due to wear. There are signs of wear on the pieces with granules having worn flat faces and corners and edges are worn down. More than half of some granules are worn away. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figures 3.51,52. Detail. Appearance that the domes have been flattened due to wear. There is also evidence that the flattening occurred prior to their positioning on the surface of the sheet. This would achieve a flattening out of the base to make a broad contact point with the substrate. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figure 3.53. Schematic drawing of walls of boxes and also plotting positions of suspected platinoid inclusions for SEM examination. Drawing by Robert Baines.

Figure 3.54. Detail of platinoid inclusions. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figures 3.55, 56. Detail. Repair work showing insert from miscalculated length of the strip, Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.

Figures 3.57, 58. Laboratory reproduction of an Egyptian bead is based on the example of MMA.23.2.42. Detail. Millimetre calibrations at side. Stereo microscope photo by Robert Baines courtesy of the Metropolitan Museum of Art in NY.
Figures 3.59,60. Laboratory reproduction of an Egyptian bead is based on the example of MMA.23.2.42 at The Sherman Fairchild Center for Objects Conservation at the Metropolitan Museum of Art in NY.
4. Development of Original Work

4.1. A Personal Vantage Point

Jewellery offers a view into history, of cultural descriptions of stylistic, chemical and methodological correctness. The research data identified from the jewellery corpus becomes the basis for authentication for curators/conservators/jewellery historians. For diagnostic purposes there is the expectation of an archaeological correctness within the fabric and manufacture of the jewellery object.

From the vantage point of a contemporary goldsmith, this has provided me with an arena for artistic interpretation-for ‘play’. Historical jewellery becomes contemporary jewellery forms and the ‘play’ functions as a stumbling block and an upheaval within orthodox classification of authenticity. There is in this disturbance an intervention with contemporary ephemeral materials into the jewellery artefact in which I manufacture a semblance of an identified “correctness”.

4.2. Jewellery and its Preservation

Jewellery remains in a better state of preservation when hidden or concealed- not exposed. The jewellery object once surfaced, discovered, excavated or plundered or even worn becomes available for reworking. It is not confined to its authentic past and becomes part of our time for reworking. Knowledge and applications of technology become the vehicle for scrutinizing these objects.

We live in an era where the ancient and the recent, the authentic and the bogus, have begun to mingle and interbreed in the corridors of hyperspace. Television stages Xena the Warrior Princess encountering the young Buddha in the entourage of King Arthur.116

‘The fake is recognised as “historical” and is thus garbed in authenticity’.117 A shroud of ‘history’ can encompass the object to the satisfaction of the naive connoisseur who wants to believe, wants to believe, wants to believe ……… Jewellery as document is available for interpretation-for ‘play’. There is potential to return to an imaginary history where fictional detail has been confused with historic fact and this can be both intentional and unintentional.

Jewellery of the past therefore exists in the present and the jewellery artefact becomes available for evaluation and for ‘play’. In the analysing and categorizing of type, jewellery as vehicle conveying the past can become a mixture of one’s own inventions and cultural inheritance.

From the vantage point of a goldsmith, I am considering how formulated heritage is available for reference, questioning and modification. The option to copy, to replicate, or to modify the historic document jewellery is a possibility and new input can verify authenticity or engender falsehood through the artistic reinterpretation.

The accuracy of the copy can engender perceptions of the authentic. “In semiotics, a sign that resembles what it represents is called an ‘icon’, and the special feature of an icon is that it also signifies itself.118 Appropriate materials and processes in the context of a specific style depiction are paramount to manufacturing an accurate recreation. In particular examples of ancient gold jewellery, the decorative configurations that accumulatively mark their style as has been argued earlier, can also be regarded as a consequence of technology resulting in a symmetry of technical factors and a consequent visual genre. The placement of iconography and relationship of parts to each other is a testimony to the joining technology carried out by the goldsmith.

The limited authenticated historical jewellery corpus available for reference means a restricted body of primary research material is available for consideration. A restrictive primary reference need not be a

116 S. Maloney (2000) “Robin Hood tries to solve the mystery of JFK’s assassination with the help of the Man of Steel”


118 C. Morris, (1938) 134
confinement to creative embellishment, “for it shares, through resemblance, some traits with whatever it signifies. Art is therefore a sign that points both outside itself and toward itself.”119

Making jewellery expands the cultural content, and ‘to make it new’ does not mean to erase the past, but to transport the work of the past into the present. The jewellery object generates symmetry with historical objects through an assymmetrical approach.

4.3. A Formulated History
At the start of Peter Carey’s book, True History of the Kelly Gang, William Faulkner quotes “The past is not dead. The past is not even past.” Falsification has a certain justification in that you will no longer feel any need for the original writes Umberto Eco.120 Enhancement makes it “more real”. The Palace of Living Arts in Beuna Park, Los Angeles has the philosophy, “We are giving you the reproduction so you will no longer feel any need for the original.”121

The sanitising of Enid Blyton’s books shows another altering of the historical document to the point of being morally absurd. The replacement of the golliwog, one of Blyton’s favorite characters, with a teddy bear in a republished edition is an exercise in political correctness. Gilbert the Golliwog has disappeared, while Noddy no longer feels ‘queer’ or climbs into bed with his pal Big Ears. Further altering of the literary work and the originality of the writer’s creation is the changing of Dame Slap to Dame Snap. Though Dame Slap is not an abuser in the text current thinking believes it is possible to read the name as a reference to child abuse.

In Black Beauty, Bessie, out of fear that her name had connotations of black slavery, now has the name Bess. Fannie and Dick have become Frannie and Rick. The word ‘girls’ have been deleted from Mother’s instruction, “You girls can put up a little bed for him.” Clearly this is an over reaction in the endeavour to be politically correct but the altering of written text challenges the preserve of the historical document.

Given or Taken-Appropriating the Authentic
“Authenticity is an interesting concept. It’s a kind of virtue isn’t it? Authentic – it’s also a judgement we use on work that comes from tribal communities. ‘This is authentic Maori/Aboriginal work.’ Who or what determines that authenticity? If it is the user that determines authenticity, then I believe the jewellery we made was authentic – an expression of a small section of urban, white tribes people, but no less authentic for that reason.”122

D. Skinner responding to an Object article by Douglas Lloyd-Jenkins123 ‘….it’s not a crime, not on the statute books of late 20th Century art practice that he uses. And in the case of New Zealand, a country attempting to create a bi-cultural society, I would maintain a society that is bi-cultural must be culturally appropriative.’124

Dr. John Macarthur describes the National Museum of Art in Canberra as “a coded but dangerously frank discourse on the national (Australian) identity”.125 Predicting an architect’s reaction to the use of controversial architectural references, “Elements of buildings by Le Corbusier, Walter Burley Griffin, Daniel Liebeskind, Eero Saarinen, James Stirling, and Jørn Utson are more or less visible in the design.”126

Ashton Raggatt McDougall, the architects of the Museum are noted for the appropriating of architectural references and a criticism has been that this mocks the client and lay visitor. The building is coded and

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119 W. Steiner, (1995) 76  
120 Ibid 19  
121 Ibid 19  
122 D. Skinner, (2004) 74,  
123 Douglas Lloyd-Jenkins described Freeman’s Jewellery from the 1980s as ‘culturally appropriative in the way it plundered the Pacific for materials and forms’. A Wilkinson, (1997) 14  
124 Ibid 13, 75  
125 J. Macarthur, (2001) 52  
126 Ibid, 56 Macarthur regards the Main Hall as the most dramatic and memorable space and can be “read as a built commentary on the Sydney Opera House”. Forming an end to one wing of the Institute of Aboriginal and Torres Strait Islander Studies is a full scale replica of the Villa Savoye except that it is coloured black.
“an architectural education is required to make the identifications and get the joke.”

Macarthur’s retort to the criticism is “If anyone is being mocked by the architectural references it is architects who think that the meaning of buildings can be self-evident and exist without interpretation.”

4.4. REDEVENT-The Intervention of Red

THE INTERVENTION OF RED (into historical and cultural locations) is a jewellery “account”. Jewellery, the document in question, offers a view into cultural descriptions of history. These descriptions are the stylistic configuration of iconography. Each jewellery piece has its own historical/cultural location. They have a visual genre with a chemical and methodological correctness. The stylistic and material data of each jewellery work identified becomes the basis for authentication by curators/conservators/jewellery historians. In the diagnostic purpose there is the expectation of an archaeological correctness within the fabric and manufacture.

This paradigm is upset in THE INTERVENTION OF RED by the intrusion-inclusion-interruption of the colour red, and furthermore by the possibility of its substance. The inclusion becomes an impediment and an upheaval within the orthodoxy of the classifier. A perceived genre or style is challenged. The substance of the red has no specificity to the time location. The material condition of red is not located within any historical period. Substances of glass, plastic, foil, paint and found objects become a confrontation and a vehicle for colour, offering new vantages for signage for what preexists.

Rather than being drawn to the preciousness of some gemset jewel but rather to the intrusion into something that was previously correct the observer is called to a new preciousness- the richness of plastic, glass - Coca-cola. Rather than questions of clarity, faceting and cut, one asks “Is that Coca-Cola?” (The Real Thing?)

This is a confrontation of what is initially perceived as alien which then leads to an accommodation bringing a new configuration. A rearrangement with changed structures occurs in order to comply with what was once an impediment. Surviving history becomes a vehicle for the contemporary planting of a new ideal from another time, and this places the past within the reach of a vicarious now.

A pseudo history this is not and neither is it the formulating of a new myth, but it does ask the question “what if”? There is a new instruction with “what if”. The invasive red changes the form of the object as it contorts in order to house the red. With the implant comes exaggeration.

The history remains, but played with. Making a new jewellery is expansive, and ‘to make it new’ does not mean to erase the past, but to transport the work of the present back into the past.

This work was first shown at Galerie Biró in Munch in 1997.

The Vehicle of the Car Bracelet

The bracelet as a jewellery type by its scale facilitates the making of a large piece. I have been able to examine large very substantial bracelets in major public collections during my research activities. I see such forms as potentially vehicle to build a large virtuoso piece with a substantial presence stylistically linking a contemporary jewellery piece with a historical or cultural location. The first large bracelet Bracelet with Fire Car, circa.? (Intervention of Red), 2001 was an interpretation of a Chinese bracelet circa.1910 and was widely published internationally. The central car chosen was a 1953 Buick ‘Fire Chief’.

127 Ibid 56
128 Ibid 56
4.4.1 The Intervention of Red. FERLINI’S SECRET

The enclosed pin from the “Micromegas”129 exhibition is one that Ferlini ‘missed’ or possibly secreted away at the excavation site at Meroe130 Stylistically the pin (Fig.4.1) is very similar to the tops of the “shield rings”(Figs.4.2,3) in the Munich Staatliche Sammlung Ägyptischer Kunst.131 The rings are the part of the personal jewellery of Queen Amanishakhetos and the work of goldsmiths of the Meroitic period after 300B.C. and though they are Kushite, they are profoundly Egyptian. The jewellery appears just as free with its Greek influence as in Egypt at the same time. Maybe there were Greek goldsmiths working at Meroe?

The granulation rows with adjoining wire borders on the aegis of the pin match the Meroe shield-rings. The chiseled rhomboid plates between the rows are also very similar to the Meroe gold work. It could be a lost piece from the jewellery treasure from the kingdom of Kush at Meroe in the upper Sudan!

The iconography though, of the pig with its pink plastic condition is curious though it does appear to be a happy pig resplendent with a fine gold wire necklace. It has been said that Egyptians banned swine herds from the temples for fear that their pigs carried leprosy. But schwein were happier in Germany as they were revered as a Mother Earth character feted for their fecundity. Maybe the pig’s finely made necklace of ribbon twisted gold wire is signage of the adoration. Certainly in Munich the celebration of the pig has followed through into the beer halls and restaurants. I’m not so keen on the hackepeter and I can’t stomach the pfälzer saumagen or the schlachtplatte and beuscherl essentially doesn’t miss an oink. Certainly my favourite in Munich (Münchner Spezialitäten vom Schwein) is the 1/2hintere Schweinshaxe ausgelöst mit geribenem Kartoffelknödel und hausgemachtem warmen Kartoffelsalat (Figs.4.4,5).

The connection with Munich is intriguing!! The schwein confirms it!

A further curiosity about the piece is the fine wirework seemingly representing letters of the alphabet132. These are located on the chiseled rhomboid plates. The wire letters identified are A, L, E, S, S, I (Figs.4.6-8). There are also wire constructions resembling ancient $ signs hanging as pendants. Could this be the earliest ALESSI piece? Does the first ALESSI piece occur in the first millennium B.C.?

The SEM imaging clearly identifies the manufacture as Bronze Age goldworking–granules, wire, sheet, joining are all correct.133 The characterizing of the process of making is typical of Greek manufacture of the fourth and third century B.C.

Curiously, four additional ’seal rings’ were bought from Ferlini’s heirs in 1913 and are now in the Munich Staatliche Sammlung Ägyptischer Kunst.134 The obvious question is did Ferlini’s descendants withhold the pin and under what circumstances did it surface at the Munich Staatliche Sammlung Ägyptischer Kunst? Did Otto Kunzli make a visit to the family home and receive the jewellery at that point? We know that this is what he did in preparation to building ‘The Wedding Ring.’135

129 The annotation in the Micromegas catalogue (Galerie für Angewandte Kunst of the Bayerischer-Verein) has a typographical error and reads,“Ferlini’s Secret from Merde.”

130 Having retired in 1834 as a military doctor in the service of the Egyptian army of occupation he excavated the ruins of Meroe in Upper Nubia. Ferlini published an account of his work and a catalogue of his finds in Bologna in 1837 and in a French translation in Rome in 1838. He doubtless wrote it to call attention to the treasure in his possession. Ludwig I of Bavaria purchased a portion of the cache in 1840, adding ninety objects to royal antiquarian, now the Staatliche Sammlung Ägyptischer Kunst, Munich. The remaining portion was still in the hands of an agent in London in 1842.

131 H. Schäfer (1910) 92-188

132 The wire is ribbon twisted with visible right hand helical creasing measuring .03mm. in diameter.

133 R. Lepsius was convinced of the importance of the pieces of jewellery and especially of their authenticity, which many had doubted. Scholars continued to express doubt for some time. Lepsius’s own stay in Meroe finally proved how unfounded such doubts really were. Karl-Heinz Priese, (1993)

134 The remaining portion was still in the hands of an agent in London in 1842, and it was there that R. Lepsius got to know it as he was preparing for his now-famous expedition into the valley of the Nile commissioned by the Prussian government (1842-45). The second portion of the find was acquired for the Berlin Museums in late 1844. Four additional ‘seal rings’ were bought from Ferlini’s heirs in 1913.

The misspelling of its findspot further veils the surprising appearance of the Bronze Age pin in the Micromegas exhibition that is a contemporary jewellery collection, not a collection of antiquities. The possibility of other pieces existing should be considered and in fact, I suspect others will surface within the near future.

Figure 4.1. After ‘Micromegas’, catalogue of exhibition by Galerie für angewandte Kunst of the Bayerischer Kunstgewerbe-Verein, Munich, 2001


Figures 4.4,5. After Bayerischer Donisl am Marienplatz zu München
Figure 4.6-8. Detail SEM photography by Safa Shawan and Robert Baines courtesy of RMIT.
4.4.2 The Intervention of Red. THE SAAREMAA BROOCH
(A new jewellery group from the Baltic?)

In 1277 the last ancient Estonian county-Saaremaa surrendered to the German crusaders. The biggest part of the county was allied to the Saare-Lääne (Oesel-Wiek) bishopric, the center of which was Haapsalu and the Castle of Kuressaare was formed as a bishop’s foothold, to rule over his territory on the little island of Saaremaa in the Baltic Sea.

Close by the medieval fortress, which is now a museum is a bric a brac antique shop at Saaremaa. This is where I found the silver filigree brooch. It was made entirely of wire with a variety of skills applied producing intricate structures and predominantly from one wire type. It is a well-crafted piece of accurately made constructions and finely soldered joins though it was probably a production piece. A fertile pasture for my research I decided to purchase it for 400 Estonian Kroons.

The find spot, my excavation site was an antique shop at Saaremaa in the Baltic Sea in the northern hemisphere. Not located at a significant ancient site in some damp tomb isolated and buried in centuries of sediment and unnoticed by tomb plunderers. The brooch lay amidst other jewellery pieces from diverse eras and cultural locations. The ‘tomb’ was a flat glass encasement of once varnished timber frame and within, the jewellery relics lay on a black velvet bed. It doubled as a counter – a meeting point for visitors and the proprietor. It was the negotiation point, the place where transactions of exchange and the ritual of wrapping was carried out. Connected to each jewellery item by a cotton thread was a paper tag and on this label were faded pencilled numbers. This was not evidence of some museological inventory system or accession number. It was simply the price devoid of denomination but understood to be Estonian Kroons. On payment my new jewellery reference was wrapped in previously used old white tissue paper followed by layers of the local newspaper and then placed in a saved pink plastic shopping bag for its journey to Australia in the southern hemisphere.

The wire brooch once relocated in my studio in Melbourne was available for examination. Not having the facility of an electron microscope or even a stereomicroscope, measurements were recorded and the piece photographed and drawn. The reference document, now more fully understood awaited copying,
replication and interpretation-the birthing of a new jewellery group from Saaremaa.

Figure 4.9. Five Brooches from Saaremaa (?) 2003, silver, gold, plastic, 54 x 36 x 8mm (each brooch)

Figure 4.10. A Brooch from Saaremaa? Bracelet from Saaremaa (?) 2004, gold, plastic car, metal car 75 x 47 x 62mm
Figure 4.11. A Brooch from Saaremaa? Bracelet from Saaremaa (?) 2002 silver, gold, metal car, plastic 105 x 75 x 68 mm
4.4.3 The Intervention of Red. BRACELET ’JAVA-LA-GRANDE’

There is a belief that in the early sixteenth century the Portuguese discovered and mapped Australia’s eastern coastline. This perception is based on the existence of several French charts known as the Dieppe maps based on Portuguese information of the mid—sixteenth century showing a large continent, called ‘Java-la-Grande’ south of what we know as Indonesia.

Vasco da Gama in 1498 sailed the first Portuguese ships to India, from which he returned with quantities of spices, woods and “jewels”. Did all the ships return or did some continue further east and to return later with even more “jewels”? Was one of these jewels brought back to Lisboa the Bracelet ‘Java-la-Grande’?

Figure 4.12. Bracelet ‘Java-la-Grande’ India, Goa (Indo-Portuguese) (?) Circa. Second quarter of the 16th century, Silver-gilt, iron, plastic, wood, 99 x 74 x 89mm

The History

The 129th meridian running from the North Pole south is the continuation of the Line of Demarcation as arranged between Spain and Portugal in the Treaty of Tordesillas. The line includes Timor on the Portuguese side, and skirts Australia’s Bathurst and Melville Islands, leaving them with New Guinea on the Spanish side. Disputes over the demarcation continued and in 1522 the evidence is that the Mendonça and the Portuguese voyage of discovery down the eastern and southern coastline of Australia questioning the Line of Demarcation.

Some scholars consider that Gomes de Sequeira in 1525 sailed from Tarnate and found northern Australia and New Guinea. Others attribute the first European discovery of Australia to Cristovao de Mendonça, who sailed out of Malacca with three ships in 1522.

137 McIntyre, K. (1977) 86 “……the Portuguese were deterred by the Treaty of Tordesillas. The Treaty contained explicit provisions forbidding trespassing across the Line into the territory of the other nation, and to be caught in the act would put the Treaty itself in jeopardy. As the weaker military power of the two, Portugal relied on the sanctity of the Treaty, and upheld it in every way”.
A “policy of secrecy” explains the silences together with the destruction of records in the Lisboa earthquake of 1755.138

The Australian discovery by the Portuguese is quite possible and various findings and fragments support this.139 There is evidence of a Portuguese caravel wrecked on Australia’s most rugged southern coastline a hundred miles west of Cape Otway in Victoria. A shipwreck locally named the Mahogany ship was a familiar sight to the few who visited the wild isolated coastline from 1836 to the 1880’s. By the 1880’s sand had fully covered the wreck and elderly local aborigines said that it had existed a long time before. There were reliable sightings by editors of the local paper and a retired harbour master. The wreck was reported to be 300 – 400 yards above the high water mark. The Mahogany Ship could have been one of three Portuguese ships secretly charting Australia in 1522 led by Cristovao de Mendonça and lost at that point where Rotz’s coast comes to an end.

If the Mahogany ship is Portuguese the first European landing could predate Captain Cook’s landing by 250 years.

The Bracelet

The bracelet140 is material evidence of the Portuguese discovery of the eastern and south eastern coastline of Australia in the sixteenth century. The substantial bracelet appears to be gold but is silver-gilt and has a large top and strap connected by a three knuckle hinge and barrel catch. The centre top has a steel Portuguese key set into a plinth like form with two straps locking it in to its reliquary like housing.

Seated majestically and looking out from four corners at the base of the reliquary plinth are almost sphinx like red kangaroos. Their intriguing character appears mysterious. Are these red sphinxes like kangaroos the daughters of the Chimaera protecting the ‘lost Geelong Key’ and in their crouching position ready to devour every traveller who could not answer her riddle? Could this riddle be related to the missing now found-‘Geelong Key’, evidence of the Portuguese discovery of Australia’s eastern and southern coastline? Between the two red kangaroos on either side of the ‘key reliquary’ is wood from the Mahogany Ship. The weathered round shaped wood has a cruciform cut at the top and appears to have a pediment as its bezel. The standing the wood is given in its gem setting signifies it as a precious and rare material. The construction of all the forms and surfaces is very fine goldsmithing techniques of filligree and granulation. The technical analysis identifies the wire and granulation work to be atypical of sixteenth century Indo-European goldsmithing. The filigree systems of construction and their various cartouche sections with borders of multi rows of beaded and twisted wires are very similar to other early sixteenth century filigree reliquaries and jewellery in the Nacional Museu de Arte Antiga in Lisboa, Portugal.

Other Examples in the Nacional Museu de Arte Antiga in Lisboa

There are two sixteenth century very substantial filigree artworks, Cofre-Relicario (early 16th century) Inv.no.114 and the Tabernacle (late 16th century) Inv. No.577 in the collection of Nacional Museu de Arte Antiga in Lisboa and the Bracelet ‘Java-la-Grande’ is very similar stylistically to both works.

138 In 1508 King Manoel I decreed that “……all Portuguese navigators engaged in voyages beyond the Cape of Good Hope must, on return to Lisbon, immediately hand over to the Maritime Archivist in the Casa da India all maps, charts, logbooks and journals, on pain of death”. Ibid 87
139 Ibid. 84 When Captain Phillip Parker King was exploring in Melville Island in 1818 he came across some aborigines who apparently knew some words of Portuguese. See McIntyre (1977) Chapter 7 note 1.
140 I was invited to make a special jewellery piece ‘to interact and establish a dialogue with the collection of the Museu Nacional de Arte Antiga in Lisboa’. The exhibition Closer, Interventions from the MNAA Colleccions was shown during X Symposium ARS ORNATA EUROPEANA in July –September 2005 in Lisboa Portugal.

In correspondence with the curator Luisa Panelva there was discussion about the location of the Bracelet in the exhibition at the Museu Nacional de Arte Antiga. The preferable placement of Bracelet ‘Java-la-Grande’ would be in the midst of Cofre-Relicario (early 16th century) Inv.no.114 and the Tabernacle (late 16th century) Inv. No.577. The bracelet will stand vertically without aid.
Figure 4.13. Tabernacle, India, Goa (Indo Portuguese), last quarter of 16th century, gold and enamel 14 x 19.5 x 9.6 cm, Convento da Graça, Lisboa, inv. No.577. Photo courtesy of MNAA, Lisboa.

**Authenticating the Manufacture**

Beaded wire in Bracelet ‘Java-la-Grande’ is swaged wire and this conforms to the descriptions of manufacture in the twelfth century AD treatise of Theophilus, On Divers Arts, The Medieval Treatise on Painting, Glassmaking, and Metalwork.

Two systems of making beaded wire are described in the chapters titled Beading File, Ch. 9, and The Organarium in Ch. 10.

SEM photography of Bracelet ‘Java-la-Grande’ shows powder solder flooded granulation typical of the sixteenth century era. The soldering of filigree is described in Cellini (1500-1571), The Treatise of Benvenuto Cellini on Goldsmithing and Sculpture includes Soldering Silver in Ch. 31 and Applying the Solder to Gold in Ch. 52.

The Cellini treatise clearly describes the principles of filigree making with powder solder.141 The finest work he describes ‘will make a man’s mouth water’.142

For many years methodologies of wire production have been considered in archaeological literature and the twelfth century treatise by Theophilus has been continually referred to as indicating the mode of manufacture even in the Classical era.143

A basis for authenticating ancient goldworks and major criterion in determining mode of manufacture is the observing and counting of creases on wire. This is of wire prior to the sixth Century AD, with the absence of the drawplate.144 Other than the draw plate, there were two systems for making wire in antiquity and the option to block twisting,145 is the twisting of strip or ribbon cut from sheet, followed by cross rolling.146

142 *Ibid* p.10
143 J. Hawthorne & C. Smith, (1979), Book 3.
144 For a comprehensive study on ancient and medieval wire manufacture see J. Ogden (1991) 95 – 105, N. Whitfield (1998) 82,83
145 W. Oddy, (1977) 83
146 See above p.39. “The gold was beaten into thin plates, cut and twisted into braid to be worked by a seamster with violet,
The twisting described will again identify helical creases and this technique known as strip twisting involves the twisting of a thin strip to form a regular tube and creating a single helix. Following a sequence of annealing, pulling and further gentle twisting, the helical creasing becomes tighter. A cross rolling of the wire between two blocks in the same direction of the creasing to minimise metal fatigue will swage the wire into a smooth surface and so diminish the helix. Creasing of wire can be further removed during the fusion heat joining process with molten surfaces flooding fine surface details.

The wire in Bracelet ‘Java-la-Grande’ has clearly been drawn—that is, pulled and reduced through an iron drawplate.

147 The first publication on the making of ancient wire by twisting was in the catalogue by C.R. Williams, (1924) 43, 140; also pls. 19-20, of an ancient gold jewellery collection of the New York Historical Society.

Label : Bracelet 'Java-la-Grande' Spectrum 1

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**Label**: Bracelet' Java-la-Grande' Spectrum 2

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**EDAX ZAF Quantification (Standardless)**

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**kV**: 20.00  **Tilt**: 0.50  **Take-off**: 35.47  **Tc**: 35.0

**Det Type**: UTW, Sapphire  **Res**: 130.75  **Lsec**: 500
The Bracelet and Portuguese History
There is some evidence indicating Bracelet ‘Java-la-Grande’ has been in Portugal since the first half of the seventeenth century. Its depiction in one of the most significant Portuguese portrait paintings is astounding occurring on the right arm of the famous figure titled, Portrait of a Lady, c. 1620-40. (Fig. 4.19).


149 Luisa Penalva (MNAA) has written in a forthcoming publication, “In the “hallucinating” lecture made during the symposium, Robert Baines presented the audience with a profoundly ironical theory, in which this object, the bracelet would rise out from the mist of several moments of Portuguese history. In order to properly document this conjecture, the author showed a number of iconic paintings that testify different important moments of Portuguese history, as well as amusing photographs from the beginning of the last century picturing different moments of the bracelet’s life. In order to do so, Baines even “dared” to digitally introduce the object itself within the photographs. Against all odds, Bracelet “Java la Grande” survived time and historical distresses to remain a witness of the arrival of the Portuguese in Australia during the 16th century.”
Questions
Did Captain Cook have one of the Dieppe Maps? What is the significance of him naming Botany Bay (Coste des Herbaiges:Dieppe Map)?
Did the Lisbon authorities deliberately conceal the discovery of the east coast by Mendonça?
How does the Mendonça voyage involving the winter camp at Bittangabee Bay, the lost keys at Geelong and the Mahogany shipwreck at Warrnambool connect with the Bracelet ‘Java-la-Grande’?
Is the hardness and redness of the wood in the Bracelet ‘Java-la-Grande’ in accord with the characteristics of Portuguese Oak which is what the hulls of the Portuguese caravels were made of?
Does relocating the Bracelet ‘Java-la-Grande’ with other Indo-Portuguese artefact in the Nacional Museu de Arte Antiga in Lisboa provide the missing link? Does the mid-sixteenth century manufacture of the Bracelet ‘Java-la-Grande’ identify same authorship with the Cofre-Relicario (early 16th century) Inv.no.114 and the Tabernacle (late 16th century) Inv. No.577. If this is so should the Tabernacle manufacture be dated earlier?
Does the iconography of the filigree work and its stylistic configuration in the Bracelet ‘Java-la-Grande’ identify same maker/workshop or is it the use of same stylistic references by the maker?
Are the found objects located in the Bracelet ‘Java-la-Grande’ material evidence of a voyage of discovery of Australia (Java-la-Grande) in the sixteenth century?

Finally, the bracelet connects Portuguese and Australian history together.

150 There is evidence that the first arrival to the East Indies in 1595 by the Dutch under Frederick Houtman ‘had on board certain Portuguese maps which had been clandestinely obtained in Lisbon’. Ibid 86 ‘Tasman himself was carrying Portuguese charts, quite probably obtained as clandestinely as those on Houtman’s ship’. Ibid 87
4.5. REDEVENT - REDLINE
The work titled REDLINE further extends the meaning and experience of red. In this instance REDLINE is a construct for small jewellery forms that are built entirely of line. That is, sterling silver wire, powder coated. The coloured wire becomes a network of red lines, which makes a planar surface occur of variable patterning, with a repetition of line and space. The small structural forms evolve from the surface and offer the viewer new vantage points to examine the multi line surfaces.

The objects in REDLINE do not pursue a formal, recognisable identity in their structure. There are no conscious historical references. They pursue other purposes. Their identity of structure is pre-empted by the multi rows of red wires suggesting a symbolism rather than mere playing with cubes, cylinders or scrolls. The REDLINE objects have their own iconic values being simple readings of the multiple row surfaces; the object becomes suggestive of multiple layered or structured values. These forms are principally abstractions of linear space with pre-eminence of red.

4.6 REDEVENT - A Vesseled History
A group of five objects built during a Senior Fulbright research project at the Metropolitan Museum of Art in New York. This considered the placing of red into a personal reading of the history of vessels and this work won The Colin and Cicely Rigg Award ($30,000) [the richest craft prize in Australia.]

4.7 REDEVENT - BLOODIER THAN BLACK, 4.8 MEANER THAN YELLOW, 4.9 WHITER THAN RED
This work was commenced during the building of the Seppelt Art Award work and was mainly influenced by the statement on the condition of red by Claus Oldenburg:
‘I have just had an insight
red is redder than green, meaner than yellow,
and bloodier than black’151
Combining prefabricated powdercoated components on coloured silver structures with additional colouring, the spray can use brought single and multi colour variations. Further activities were the use of pigment to fill the filigree openings.

151 Claes Oldenburg, Notes, New York, 1961
5. Conclusion
5.1. Evaluation of Work in Relation to the Research Questions
In what ancient jewellery types is style or placement of iconographic forms as much a consequence of technology as the stylistic genre of the day?
The research described above provides evidence that a diverse range of jewellery types from a variety of periods and locations demonstrate the fundamental role played by the technology in the final form of the piece.
Copper salt diffusion as a system of joining facilitates the finest of joins. It is also a very stable join in that diffusion ensures that the join will not remelt. An important factor though is that in its most refined state it is quite fragile and not always a reliable join. This is overcome by a continuous strategy of reinforcement by the ancient goldsmith. This creates a recognisable character in the work that can be identified as Bronze Age goldsmithing.
A governing factor in all these considerations of manufacture is that copper salt diffusion joining is precariously close to the melting temperature of the gold… The joining temperature is so close to the destruction of the object. I think this is part of the wonder that has been universally appreciated, that very fine components with wires the thickness of a hair and granulation surfaces ‘the complexion of a peach’152 are joined in a charcoal fire at ‘near destruction’ temperatures.

What new knowledge of technology and modification of current theories can be gleaned from laboratory reconstruction of historical goldworks?
Scholarship as artist goldsmith in studio practice is the integration of this new knowledge and its application to build new creative works. The dating of ancient jewellery is given by the archaeological context. Technology applied by the ancient goldsmith is traceable through archaeometallurgy. Innovation in the understanding of the research in archaeometallurgy led me to a new methodology of scholarship and when published was an internationally recognised ‘breakthrough’ within the research community. A particular pursuit has been to gain an understanding of the thinking and character of the ancient goldsmith. This new knowledge has its own standing to authenticate historical jewellery and is also available to be synthesized in “fictitious” fine art jewellery or jewellery groups.

Is it possible to construct artefacts that are stylistically, chemically and methodologically conformable to ancient examples?
Both the possibilities and pitfalls of the reconstructive process have been demonstrated above. Many questions remain to be investigated, and it will probably remain impossible to achieve absolute certainty-though with a high degree of probability- on certain points.

The multi disciplinary research is comprised of three areas; first in archaeometallurgy, second as an artist goldsmith and third in publishing text or commentary. Each has its community of researchers and validity in the quest for new knowledge. Within my scholarship intellectual functions are tied inseparably and are also interrelated and influential to each other. Not confined to being a knowledge source the synthesized research offers methodologies for strategies of learning and vantage points for further considerations.

Archaeometallurgy is the synthesis of dissimilar disciplines principally directed toward Bronze Age gold technology and jewellery history. This interdisciplinary understanding of material science of metallurgy and chemistry is combined with the social and material history.

New applications of existing knowledge inform us of ancient and historical goldwork that makes up our material culture. This use of existing and integration of new knowledge informs us about artifact and the construction of artefact. It increases our knowledge of jewellery collections. This informed position facilitates the building and the ‘playing’ with the authenticated (sic) laboratory constructed artworks and identifying fakes.

152 I learnt of this wonderfully descriptive phrase as a student though regrettably cannot identify the literary source or give attribution...
How can my work express aspects of the knowledge gained from analysis and reconstruction in contemporary jewellery and object using both historic and current forms and materials?

Resultant laboratory constructions with their historical correctness become available in the making and are a source for reworking to convey a contemporary visual relevance and a statement of history. The results of these analyses and reconstructions form the basis of metalwork objects in which contemporary aesthetics are informed by historical practice, as I build fictitious jewellery groups and references.

In addition to building artworks here is a real world issue and within our cultural history synthesized knowledge through scholarship can authenticate artifacts, components of our intellectual cultural capital.

5.2. Summary of Contribution to Original Knowledge

The Presentation and Explanation of the Research

The philosophy and policies that have evolved from the research have personally evolved. This has been alongside and with the guidance of some of the most eminent scholars in the field of archaeometallurgy and contemporary art jewellery.

In the promotion of its research activities, RMIT University publications recognise the prominence of my scholarship. My research output positioned RMIT at the forefront of new information and as a centre of excellence. My activities as a researcher are intrinsic to this status. An outcome of the Senior Fulbright research at the Metropolitan Museum of Art in NY was the invitation from the vice chancellors office to deliver the Innovation Lecture “Gold” at the Celebration of Innovation & Research at RMIT, in Storey Hall, in 1997

Staatliche Antikensammlungen, München 2004

The exhibition of the scientific research of predominantly Etruscan gold jewellery was a personal milestone but also a significant breakthrough. Critical primary research identified in the Senior Fulbright Award, three Senior Research Fellowships at the Metropolitan Museum of Art in New York and ongoing consultation led to exhibition in internationally prominent museums. In 2004 the exhibition of my research, Entdecker der antiken Goldschmiedetechnik, Staatliche Antikensammlungen, München was ground breaking. I was the first living artist to exhibit at what is arguably one of the most important antiquities museums in the world.

Significant awards recognizing my scholarship and research have been both national and international in the areas of archaeometallurgy and as an artist goldsmith. Senior Fulbright Award, three Senior Research Fellowships at the Metropolitan Museum of Art in New York, Cicely and Colin Rigg Craft Award (richest craft Prize in Australia); Seppelt Contemporary Art Award, 2005 Bayerische Staatpreis gold medal, München.

Communicating New Knowledge

Not all new knowledge can be widely communicated.
It has been understood for many years that the sharing of knowledge of the discipline within museums is privileged. It is on this basis that I have had continual access to primary research material and the facilities for research in museums, especially at the Victoria and Albert Museum South Kensington; Antikensammlung Munich; Villa Giulia Rome; British Museum and the Metropolitan Museum of Art in NY. The senior research fellowships conducted at the Metropolitan Museum of Art were primarily seeking new knowledge and this has been an opportunity beyond all my expectations. This has given me such an enhanced vantage point of knowledge and goldsmithing skills that without it success indicators of international and national prizes and awards would not have occurred.

An increasing dilemma has been the restricted integration of the new knowledge. Requests within the museum to not publish or to reduce published information is valid though confining to one who is a publishing artist and researcher.
Some museums prefer restricted publication in relation to authenticating artworks. This has become an increasing dilemma considering the amount of time spent on research. My knowledge has been discreetly implemented for the understanding of an authentic history of our material culture. A major activity during the 1999 and 2002 Senior Research Fellowships was the authenticating of pieces from the treasure of the three foreign queens of Tuthmosis III at the Metropolitan Museum of Art in New York.

Figure 5.1,2. Intervention of Red, Bracelet 2003, silver gilt, powdercoat. Schmuckmuseum Pforzheim, 2005. Photography by Garry Sommerfield

153 Lilyquist, C. The Tomb of Three Foreign Wives of Tutmosis III, MMA, 2003, see index for extensive citations.
5.3. Selected Reviews and Commentary

1. “Baines is one of the greatest technicians, historians and philosophers among art jewellers. More than anyone else he has mastered the technical subtleties of the ancient Etruscan goldsmiths so as to subject them to rigorously scientific historical study and transpose this knowledge into the present day. The archaeological relevance of the jewel is challenged by the choice of colours. His imaginative floral compositions and his brooches made of miniature thread of silver are coated in a fine coloured powder. It’s a sort of industrial dye he has developed for his own needs. The texture is that of a finely-knit meshed structure, which has more than a simple aesthetic intention: the empty spaces or gaps in the material confirm the status of these brooches, suspended between existence and non existence.

Maria-Bettina Eich : Schmuck Magazin, 2000/4 P.64

2. Robert Baines is a studio artist goldsmith and lecturer. “He has made a significant contribution to Australian jewelry, object-making, and international historical scholarship for over twenty years. A graduate of the RMIT University in gold and silversmithing, Baines also holds a Master of Arts in classics and archaeology from Monash University. He has written and presented numerous scholarly papers on jewellery studies from ancient antiquity through to Renaissance. He has received many fellowships (Churchill, Senior Fulbright, Senior Fellow, the Metropolitan Museum of Art) prizes, and solo exhibitions (Italy, USA, Germany and New Zealand).”

Robert Baines is the Coordinator of Gold and Silversmithing at RMIT University
Marjorie Simon, (ed.) Metalsmith journal USA, June 2000

3. Robert Baines: Close Up
TarraWarra Museum of Art, Healesville, Victoria
8 March – 26 June 2005

‘Jewellery is not only adornment but also a cultural, archaeological and technological document. Technology applied by the ancient goldsmith leaves characteristic traces investigated by archaeometallurgy.’ So begins goldsmith artificer Robert Baines text in his recent Partyline 2004 catalogue. For Baines the intimate treasures of knowledge revealed incrementally by existing fragments of ancient jewellery holds continual fascination. Baines first research project to investigate Greek Etruscan goldsmithing techniques (particularly granulation) occurred in 1979. Since then the artist has undertaken more than ten international research projects, primarily to investigate Etruscan, Egyptian and Greek jewellery in collections including the Metropolitan Museum of Art and the John Paul Getty Museum in United States, the Victoria and Albert Museum in London, the Antikensamlung in Munich and the Villa Giulia in Rome.

From 1980 Baines has been exhibiting profusely, however since 1996 his exhibitions have been presented mostly in Europe and the United States. Fresh from receiving the prestigious Bayerische Staatpreis 2005 gold medal at the 57 Internationale Handwerksmesse, International Trade Fair in Munich, the artist has assembled over 70 works that are beautifully installed at the new TarraWarra Museum of Art in the Yarra Valley.

Robert Baines: Close Up includes pieces from eight different bodies of work spanning from 1998 to 2005. The earliest works are brooches from his Bloodier than Black series of 1998. Baines was motivated to create the work after reading a 1961 quote from Claes Oldenburg: ‘I have just had an insight, red is redder than green, meaner than yellow and bloodier than black.’ The most recent piece in the exhibition is his delicate Pig, Neckpiece 2004-5 from the Ferlini’s Secret from Meroe? series. Here the artist speculates on the possibility that the object has just been ‘unearthed’ and is in fact the work of royal goldsmiths from around 300 BC. Baines imagines that the piece had been ‘missed’ or ‘secreted away’ at an excavation site at Meroe in Upper Nubia.

The largest and possibly most spectacular piece in the exhibition is the Philadelphia Centrepiece: Candlestand 2001-2 that materialised from Baines’ time in 2000 at the Metropolitan Museum of Art. Whilst researching at the Museum, the artist encountered an elaborate eighteenth century Italian
centrepiece from the workshop of Carlo Albincini. Baines’ response was to create a work in red powder coated silver and silver gilt that resembled an aberrant maquette for a Russian Constructivist sculpture by Vladimir Tatlin. The work suggests untold imaginative possibilities as to its form and purpose and is breathtaking in execution.

Also included is the intriguing series, A Brooch from Saaremaa 2002-4, that was inspired by a filigree brooch ‘excavated’, as Baines explains, from an antique shop in Saaremaa, an ancient city of Estonia on the Baltic Sea. The bracelets and brooches that form this series offer a sumptuous and maverick exploration in gold, silver, powder coat, plastic and metal toy cars.

Baines has articulated a unique and respected space internationally through his contemporary interventions. In his 1997 catalogue ‘The intervention of red’, he writes: ‘The invasive red changes the form of the object as it contorts in order to house the red. With the implant comes exaggeration. … This historically incorrect jewellery becomes an offering of a (new) conversion to a (new) believing.’ To view Robert Baines: Close Up is as absorbing as it is provocative. The artist manages to draw from his immense technical and stylistic knowledge of historical jewellery making and interweave this with a masterful manipulation of materials to challenge our notions of material culture and its intersections with contemporary artifice.

6. BIBLIOGRAPHY

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CURRICULUM VITAE

ROBERT BAINES

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BIOGRAPHY

1949 Born Melbourne, Australia.
1969 Diploma of Gold and Silversmithing at Royal Melbourne Institute of Technology.
1973 Opened own goldsmith studio in Collins street, Melbourne.
1979 Awarded Winston Churchill Fellowship to study the fine metalwork of the ancient Greek Etruscan goldsmiths and the method of granulation in particular in order to apply such techniques to the artistic expression of the ancient but timeless quality of the Antipodes. Athens, Florence, Rome, Hamburg, Munich, Pforzheim, England, Cambridge, Brooklyn, New York, Boston.
1980 Commenced position of lecturer in goldsmithing at Royal Melbourne Institute of Technology.
1986 Undertook a study of ancient gold work at the John Paul Getty Museum, Malibu, California.
Lecture tour of New Zealand - Auckland, Dunedin, Invercargill, Hamilton.
1990 Invitation to present a paper at the "Fifth International Symposium on Jewellery Studies" conducted by The Society of Jewellery Historians in London.
Undertook a study of goldworks from the Barberini and Bernandini Tombs at the Villa Giulia in Rome.
1991 Invitation to present a paper at the International Symposium "Outils et Ateliers D'Orfevres 5000BC-1600AD" conducted by the Musee Des Antiquites Nationales Saint-Germain-en-Laye, France.
Invitation to conduct a granulation workshop in conjunction with the international symposium "Ancient Jewellery and Archeology" at the Indiana University, Bloomington, Indiana, USA.
Undertook a study of goldwork from the Egyptian Department at the Metropolitan Museum of Art in New York, USA.
1993 Awarded an Australia Council Fellowship Grant.

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Undertook a study of goldwork at the Villa Giulia, Rome; British Museum, the Victoria and Albert Museum, London; Metropolitan Museum of Art, New York and the J. Paul Getty, Los Angeles County Museum in Los Angeles.


1996 Undertook a study of goldwork at the Antikensammlung, Munich; British Museum, London; and the John Paul Getty Museum, Malibu.

Received a Senior Fulbright Award to conduct research project on Etruscan goldworks at the Sherman Fairchild Center for Object Conservation in the Metropolitan Museum of Art in New York. USA

Master of Arts in Classics and Archaeology, Monash University, Melbourne

1999 Received an Andrew Mellon Conservation Fellowship at The Metropolitan Museum of Art in New York, USA

2001 Invitation to present a paper Visual Communications: Rhetorics and Technologies Conference, Rochester Institute of Technology, New York USA

2001 Invitation to be a keynote speaker at the International Jewellery Colloquium, Tallinn, Estonia.

2002 Received an Andrew Mellon Conservation Fellowship at The Metropolitan Museum of Art in New York, USA

2005 Received Bayerische Staatspreis 2005, gold medal at the 57 Internationale Handwerksmesse, Munich, Germany

2005 Invitation to be a speaker at the international jewellery survey Schmuck 2005 Awards, at the Handwerkskammer für München und Oberbayern, Munich, Germany

2005 opening speaker at international symposium Ars Ornata Europeana X, Museu Nacional de Arte Antiga, Lisboa, Portugal

SOLO EXHIBITIONS

1977 "Sculpture, Jewellery and Other Objects"- Realities Gallery, Melbourne, Australia.

1978 "Sculpture to be Worn", David Jones Art Gallery, Sydney, Australia.

1979 Kym Bonnthon Gallery, Adelaide, Australia.


1985 "A Journey to the Plenitude", Realities, Melbourne, Australia.

1988-9 "Travel", Touring exhibition to Victorian regional galleries: Sale Regional Arts Centre; Latrobe Valley Arts Centre; Mildura Arts Centre; Benalla Art Gallery; Hamilton Art Gallery.

1989 "From the Plenitude", City of Horsham Regional Art Gallery, Victoria, Australia.


1993 "Adornments From the Waikato and Beyond", Lauraine Diggins Fine Art, Melbourne, Australia.

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INTERVENTION OF RED, part 3 of AAA.................REDEVENT, Galerie Biró, Munich, Germany.
AAA,AA.............REDEVENT : Survey, Brisbane City Gallery, Brisbane, Australia
2000 REDEVENT: bloodier than black, Helen Drutt: Philadelphia, USA
Toowoomba Regional Art Gallery, 9 September – 26 October 2003
2004 “Robert Baines Entdecker der antiken Goldschmiedetechnik,” Staatliche Antikensammlungen, München, Germany
2004 "Partyline", Galerie Biró, München, Germany

SELECTED GROUP EXHIBITIONS
1974 Diamond Valley Art Award, Victoria, Australia.
1975 Diamond Valley Art Award, Victoria, Australia.
1976 "Diamonds Today", Sydney, Australia.
1978 Australian Design Award, Melbourne, Australia.
1979 Practising Goldsmiths and Jewellers of Victoria Georges Gallery, Melbourne, Australia.
1980 Objects to "Human Scale" organised by Australia council, toured Japan, Hong Kong, Phillipines.
1981 Arm Jewellery, Makers Mark Gallery, Melbourne, Australia.
"One Year Later", Axion Gallery, Melbourne, Australia.
Australian Jewellery, European Tour, organised by Australia Council.
Australian Crafts, Meat Market Craft Centre, Melbourne, Australia.
1984 Brooch Exhibition, Makers Mark Gallery, Melbourne, Australia.
"Phantastische Figurationen", Friedrich-Wilhelm-Muller-Weltbewerb 1984
Hanau, Bonn, Pforzeim, Hannover, West Germany.
Four Directions, Mildura, Benalla, Morwell, Horsham, Galleries of Victoria, Australia.
1985 Treasures from Australian Churches, National Gallery of Victoria, Australia.
Orgehang, Galerie am Graben, Vienna, Austria.
1986 Australian Crafts, Meat Market Craft Centre, Melbourne, Australia.
1987 "Victoria" Osaka, Japan.
"Jewellery on the Move", Gold Coast, Sydney, Melbourne.
Australian Crafts, Meat Market Craft Centre, Melbourne.
Ernest Levy Commemorative Silver Exhibition, Castlemaine, Victoria, Australia.
Tenth Mildura Sculpture Triennial, Mildura, Australia.
1989 25 Years of Gold and Silversmithing from RMIT, RMIT Faculty Gallery, Melbourne.
1989-90 Directions- Silversmithing 1989, Australia High Court, Canberra, A.C.T., Australia, 1989;
1990 Australian Crafts, Meat Market Craft Centre, Melbourne, Australia.
1991-2 Contemporary Australian Hollow Ware, Canberra School of Art Gallery, A.C.T.; Art Gallery of Western Australia, Perth; Wagga Wagga City Art Gallery, N.S.W.; National Gallery of Victoria, Melbourne; Hamilton Art Gallery, Victoria.
1992 Third Australian Contemporary Art Fair, Lauraine Diggins Fine Art, Melbourne, Australia.
1993 Directions - Glass Jewellery 1993, Canberra School of Art, Craft Council of Victoria Gallery, Orange Regional Gallery.
"Armed", The Door Exhibition Space, Fremantle, Western Australia.
Australian Art, Lauraine Diggins Fine Art, Hong Kong.
1995 25: CRAFT VICTORIA ARTISTS AT ARTS VICTORIA,
Arts Victorian Foyer Gallery, Melbourne.
1995 Fine Art Department, RMIT.
Australian High Commission, Singapore.
1995 "VicHealth National Craft Award", National Gallery of Victoria, Australia.
1997 "In Praise of Make-Up", Plimsoll Gallery, Centre for the Arts, Hobart; University Gallery, Newnham.
1997 "19th & 20th Century Australian Painting Sculpture and Decorative Arts 1997,
Australian Antique & Fine Art Dealers' Fair, Sydney, Lauraine Diggins Fine Art, Melbourne.
1997 City of Hobart Art Prize, Hobart City Council, Tasmania
1998 Schmuck '98, Sonderschau der 50. Internationalen Handwerksmesse München
1998 "Contemporary Jewellery: Value Added", National Gallery of Victoria, Melbourne
The Deacons Graham & James Arts 21 Award, The Ian Potter Museum of Art, Melbourne
1998 Jewellery Moves, National Museums of Scotland, Edinburgh
1998 RMIT Fine Art at the Hong Kong Arts Centre, Wanchai, Hong Kong
Seppelt Contemporary Art Award, Museum of Contemporary Art, Sydney.
Skill, Craft Victoria Travelling Exhibition, Mornington Peninsula Regional Gallery.
1999 Water Medicine, John Curtin Gallery, Perth
1999 Handmade:Shifting Paradigms, Singapore Art Museum
1999 Trace, Museum of Art Craft, ITAMI, Gallery Yu, Tokyo.

2000 Bejewelled, Monash University
Spectaculum, Tarbekunstimuseumis, Tallinn Estonia
Hermanns Art Award, Sherman Galleries, Sydney
2001 Micromegas, Bayerischer Kunstgewerbe-Verain e.V. Germany
2001 Nocturnos, International Jewellery Colloquium, Estonia
2001 The Tactile Art Exhibition, Object Australian Centre for Craft and Design, Sydney
Schmuck, Robert Baines und Karl Fritsch Schmuck, Robert Baines und Karl Fritsch, Stadtische Galerie im Rathausfletz Neuburg an der Donau Germany

2002 Material Culture, National Gallery of Australia, Canberra
2003 Bijou Contemporain, Robert Baines und Karl Fritsch, Cagnes-sur-Mer, France
2003 Melbourne International Mokume Symposium and Exhibition, Melbourne
2005 Schmuck 2005, 57 Internationale Handwerksmesse, International Trade Fair Munich, Germany
2005 Closer, Interventions from the MNAA Colecciones. Museu Nacional de Arte Antiga, Lisboa Portugal

2005 ‘Transformations: The Language of Craft’, National Gallery of Australia, Canberra. 11 November
2005-29 January 2006
2005 ‘Inspired Across Time’ Powerhouse Museum, Sydney

AWARDS AND PRIZES
1970 Winner; L. Puzsar Award, RMIT
Best Third Year Jewellery Award.
1973 Selection for the "Australian Diamond Collection" while employed by M. Hurwitz, Crossley Street, Melbourne.
1974 Winner; Diamond Valley Award. (Non-acquisitive).
Selection for the "Australian Diamond Collection" while employed by M. Hurwitz, Crossley Street, Melbourne.
1975 Winner; Diamond Valley Award. (Non-acquisitive).
1979 Awarded a Winston Churchill Fellowship.
1980 Commendation Australian Design Award, Melbourne.
"Medibank Private Bicentennial Craft Acquisition", Australian Crafts.
1989 "Artist in Residence" Waikato Polytechnic, New Zealand.
1992 Australia Council for the Arts Fellowship Grant.
1994 Winner; Twentieth anniversary of Diamond Valley Art Award sculpture commission. (National competition $20,000)
1995 Short-listed for the Acquisition of a Ceremonial Mace for Ballarat University. (National competition)
Winner; VicHealth National Craft Award acquisition, ($11,000) Melbourne.
1996 Received a Senior Fulbright Award to conduct a research project at the Sherman Fairchild Center for Object Conservation in the Metropolitan Museum of Art in New York.
1997 Winner; Cicely and Colin Rigg Craft Award, 1997, ($30, 000) National Gallery of Victoria
1998 Finalist, The Deacons Graham & James Arts Award, The Potter Museum, Melbourne
Winner; The Seppelt Contemporary Art Award, ($15, 000) Museum of Contemporary Art, Sydney
Received an Andrew Mellon Conservation Fellowship at The Metropolitan Museum of Art in New York.
2002 Received an Andrew Mellon Conservation Fellowship at The Metropolitan Museum of Art in New York.
2002 Australia Council Development Grant
2003 RMIT Innovation Research Award in the Portfolio of Design and Social Context
2005 Bayerische Staatpreis 2005 gold medal at the 57 Internationale Handwerksmesse, Munich. (£5000)
2005 Distinguished Research Award, ACUADS (The Australian Council of University Art and Design Schools)
2005 Received Teaching Award, Research Supervision, Portfolio of Design and Social Context RMIT University.
2005 Received Teaching Award, Research Supervision, RMIT University.

CATALOGUES
'Sculpture to be Worn', David Jones', Art Gallery, Sydney, 1978
'A Visible Likeness ....', Robin Gibson, Sydney, Australia, Georges Gallery, Melbourne, 1979/81
'Journey to the Plenitude', Realities Gallery, Melbourne.
'From the Plenitude', City of Horsham Regional Gallery, 1989.
'The Plenitude', text by Dawn Mendham, Melbourne, 1996
'AAA, AA…………REDEVENT : Survey, Brisbane City Gallery, 1998
'Stopping at the Red', Helen Drutt: Philadelphia, Galerie Biró, Munich, 2000
'Partyline', RMIT University Press, Melbourne, 2004

ARTICLES AND REVIEWS:
Diamond Valley News, October 1974, "Top Jewel Man Wins Award Again".
The Australian, August 1978, "God Guides an Artist in Gold", Lyndall Crisp.
Gallery, National Gallery of Victoria, August 1985, "Treasures From Australian Churches", Judith O'Callaghan.
The Herald, November 1985, "Small Sculpture - Big Concept" Grant Hannan.
Cosmopolitan, September 1986.
Art and Australia, Spring 1986, Exhibition Commentary.
Wimmera Mail-times, February 1989, "From the Plenitude", Caroline Field.
Otago Daily Times, New Zealand, Contemporary Artist Links Ancient Craft, Lee Harris, October 10 1989.
Southern Skies, Frontline, New Zealand, October 1989, p.5.
The Canberra Times, "The Rare and the Conventional", Feb. 1 1993, Helen Ennis.
SELECTED BIBLIOGRAPHY:
6. Art and Australia, Volume 19/4, p.396.
11. Phantastische Figurationen,
Fredrich Muller, Wettbewerb 1984 Catalogue, p.6.
14. "Spiritual Values", Craft Australia, Winter 1987/2, front cover, pp.64-7 by Dawn Mendham
32. Art and Australia, Spring 1983, Exhibition Commentary.
33. Art and Australia, Spring 1986, Exhibition Commentary.
40. Cicely and Colin Rigg Craft Award, 1997, National Gallery of Victoria, pp.8,10,11.
46. Front cover, American Craft, Feb - March, 1999
49. Craft from Scratch, eine spur von handarbeit 8. Triennale Für Form und Inhalte-Australien und Deutschland, Sept, 2000, pp.53, 171
52. ” Material Culture” by Robert Bell, National Gallery of Australia, 2000
SELECTED PUBLIC COMMISSIONS
1969, All Saints Greensborough, Communion Set;
1984, St Edward's Blackburn Sth, Memorial Board;
1987, St Faith Montmorency, Altar Cross;
1988, National Gallery of Victoria, Tea Set;
1994, Diamond Valley Shire, Twentieth Year Commemorative Art Award Sculpture;
1995, Powerhouse Museum Sydney, Tea Set
1997, Office of the Vice Chancellor, RMIT, Innovation Award Pins.
2002, Australia Council Emeritus Awards

WORKS IN PUBLIC COLLECTIONS
Schmuckmuseum, Pforzheim, Germany
Victoria and Albert Museum, London
Ville de Cagnes-sur-Mer, France
Deutsches Blockflötenmuseum, Fulda, Germany
Museum of Fine Arts, Houston, USA
Waikato Museum of Art and History, Hamilton, New Zealand
Waikato Polytechnic, Hamilton, New Zealand.
Galerie am Graben, Vienna, Austria
Australian National Gallery, Canberra
National Gallery of Victoria
Royal Melbourne Institute of Technology, Victoria
Prime Minister's Department, Canberra
The Victorian State Craft Collection, Melbourne
Art Gallery of Western Australia
Diamond Valley Art Award Collection
Banyule City Art Collection
Art Gallery of South Australia
Powerhouse Museum, Sydney
Queensland Art Gallery
SELECTED PUBLICATIONS:
7. "Diamond Valley Art Award - Metal Section", JMGV, 1986.
Jewellery Philosophies: Contexts of working 1999, Robert Baines (ed.) JMGA Vic, 1999
33 Cosmic Reciprocity”, The Jewelry of Karl Fritsch O Book Publisher, Amsterdam 2001.
36 “Debbie Sheezel:Mappings of the Heart”, Craft Arts International no.58, 2003
“Partyline” RMIT University Press 2004
40 “Vicky Shukuroglou: ALT” Object Magazine 4, p. 45

SELECTED CITATIONS IN TECHNICAL JOURNALS
Etruskische Granulation Eine antike Goldschmiedetechnik, Gerhard Nestler-Edilberto Formigli, Nouvo imagine editrice, Ausgabe, 1993,p.93
The Manufacture of Ancient Beaded Wire: experiments and observations, Niamh Whitfield, JS, vol.8, pp.57-86
The Tomb of Three Foreign Wives of Tutmosis III, Christine Lilyquist, MMA, 2003, see index.

CATALOGUE ESSAYS AND REVIEWS
"Secrets of Gold", Innovation@ Work, RMIT University, December, 1997.
"Architecture For The Body", Fusion, catalogue of Kathryn Wardill, RMIT University, December, 1997, p.5
Demi Parure, Foreward to RMIT Graduate catalogue 1999
ARTFACT, Immigration Museum, November, Melbourne, 2000
“ Travelling with Loose-ID “, Foreward to Loose-id, CD ROM Catalogue, 2001
LEAF, Graduate exhibition, Gold Treasury Museum, 2002
In the Drawer, Craft Victoria, catalogue of Kirsten Haydon, 2002
“Ad Astra per Aspera”, Gold Treasury Museum, Melbourne, 2003
CAD is not a Castaway, catalogue of Nicole Jacquard, 2004
Housing the Memory, catalogue of Katherine Bowman, 2004
Body-Vessel-Landscape: The work of Vito Bila, catalogue of Vito Bila, 2005

CHURCHILL FELLOWSHIP STUDY, 1979
1. Athens, National Museum - Strathatos Collection, Benarki Museum
2. Rome, Villa Giulia, Museo Della Terme, Pigorini Museum
3. Florence, Museo Archeological
4. Hamburg
Museum for Kunst and Gewerbe
5. Munich, Antikensumlung
6. Pforzheim, Schmuckmuseum
8. Brooklyn, U.S.A., Brooklyn Museum
9. Boston, Boston Museum of Fine Arts
10. Richmond, Virginia Museum of Fine Arts

To undertake a study in Europe and the U.S.A. of the fine Metalwork of the Ancient Greek and Etruscan
goldsmiths and the method of Granulation in particular, in order to apply such techniques to the artistic
expression of the ancient, but timeless quality of the Antipodes.

APPOINTMENTS
1975 Founder and co-convenor, Craft Workers Guild of Australia.
1977,1983 Selector and advisor of acquisitions at the Diamond Valley Art Award; Metal Section.
1984 Invited to Advisory Committee for the accreditation of the Associate Diploma in Jewellery and
Silversmithing at the South Australian College of Advanced Education.
1992-5 External Examiner, Undergraduate and Higher Degrees, Monash University, Faculty of Art and Design.
1995 Panel Chairperson, committee member, JMGA National Conference, Melbourne.
1986 Lecture: "Etruscan Goldsmithing", San Diego State University, San Diego, California.
1994 Lecture: "Granulation Applications", Central Saint Martins College of Art and
Lecture: "Own Work", Royal College of Art, London
1996 Lecture: Central St Martins, Royal College of Art, London.
1997 Lecture: "Contemporary Goldsmithing and Archaeological Research" Fine Art jewellery classes at
New York University, New York, April 28 and May 7.
Lecture: "Personal Goldworks", The Fashion Institute of Technology, New York, May
1998 Lecture:"Research and The Intervention of Red", University of New South Wales, 1st June.
1998 Lecture: "AAA……...REDEVENT", Academy of Fine Arts, Prague, Czech Republic,
1999 Lecture: "Own Work",La Salle-SIA, Singapore
Juror, "Contemporary Wearables”, Toowoomba Regional Gallery
2002 Invited speaker, Contemporary Wearables, Maroondah Art Gallery, Melbourne.
2002 Invited speaker, Oba lala, First Site Gallery, Melbourne.
2002 Invited speaker, Out of the Drawer, an exhibition by Kirsten Haydon, Craft Victoria
2002 Invited speaker, Pearl Gillies, Craft Victoria
2003 Judge and selector of acquisitions, “Contemporary Wearables 2003,” Toowoomba Regional Art
Gallery
2002-03 Chairman, Melbourne International Mokume Symposium and Exhibition, Melbourne, RMIT University
2003 Chairman, Jewellers and Metalsmiths Group of Australia International Conference, Melbourne
Feb. 13-15
MAJOR PUBLIC LECTURES

1. "Jewellery, Manufacturing and Design"
Australian Institute of Metal Finishing, Clunies Ross House, Melbourne, 29 May 1983.
"Greek and Etruscan Gold"
National Gallery of Victoria, Melbourne, 9 March 1983.
"The Art of the Renaissance Goldsmith"
National Gallery of Victoria, Melbourne, 24 October 1984.
"Technical Forms of the Etruscan Goldsmith"
"Robert Baines - Goldsmith"
"Ancient Irish Gold: The Materials and Technology"
"The Gold of the Pharaohs: The Egyptian Goldsmith"
"The Ancient Goldsmith: Reference. An Expression of a Deity"
Auckland City Art Gallery, 13 September 1989.
"An Historical Survey of the Goldsmith"
National Gallery of Victoria, 18 April 1990.
"Civilisation; Ancient Treasures from the British Museum"
Lecture series No. Fifteen. "Buried Riches; The Oxus Treasure"
"Technology: The Ancient Goldsmith"
Australian National Gallery, Canberra, 17 May 1990.
"Ancient Gold Technology"
Museum of Victoria, Melbourne, 8 July 1990.
"Metallic Hollow Ware: Egyptian to Post Modern"
"Word Action Artefact: Worship"
Annual General Meeting Celebration Arts, St. Johns Southgate, Melbourne, 1 September 1995.
"Diffusion Bonding in Goldworks of the Classical Era"
"Etruscan Goldsmiths: Troubleshooters of Diffusion Bonding"
The Institute of Fine Arts, New York University USA, 5 May 1997
20. "Jewellery Making in Ancient Times"
"Research of Ancient Gold"
The Knowledge Makers Forum, Craft Victoria, Royal Society, 19 July 1997
"Etruscan Goldwork-The Finest in Antiquity"
Monash Friends of the Australian Archaeological Institute at Athens, Monash University, Clayton, 29 October 1997
"The Rigg Award: Contemporary Metalwork."
National Gallery of Victoria, 8 November 1997.
"Concepts and Technology of Contemporary Hollowware"
National Gallery of Victoria, 11 November 1997.
Innovation Lecture "Gold", Celebration of Innovation & Research at RMIT, RMIT Storey Hall, 2 December 1997.
SKILL : A question of process, Craft Victoria, Melbourne, 8 May 1999
"Gold Treasures of the Etruscan, Greek and Romans", Sunday Forum, in conjunction with the exhibition Ancient Lives: Greeks, Romans and Etruscans, National Wool Museum, Geelong, 03 October, 1999
“Reading the Artifact”, Winter School Lecture Series, RMIT University, School of Art, 5 July, 2000
“Bloodier than Black-Survey”, Germany and Australia Seminar, Art Gallery of South Australia, 9 March 2001
‘The Authentic Fake”, Sydney College of the Arts .........................
“The Authentic Artifact and the Destruction of History,” Radio Theatre, RMIT University, 19 September 2001
“Authoring the Artifact,” Postgraduate Winter school, RMIT, July 2003
“Pettus või lihtsalt mäng?”, Eesti Kunstiakadeemia, 28 April, 2004
“Unecht Oder’Nur Verspielt”at the international jewellery survey Schmuck 2005 Awards, at the Handwerskammer für München und Oberbayern Munich. 12 March
"Bracelet’Java-la-Granda’", opening speaker, Ars Ornata Europoeana X, Museu Nacional de Arte Antiga, Lisboa, 7 July 2005

SEMINARS, SYMPOSIA & WORKSHOPS:
1. Presented Paper: Latrobe University Christenson Collection, RMIT Faculty Gallery. May 2 1988. Title: "Coptic Crosses"
16. Lecture and Seminar, at the Akademie der Bildenden Kunste, Munchen, February 1997
Presented Paper: Celebration of Innovation and Research at RMIT, RMIT Bundoora Campus, December, 1997. Title: "Bronze Age Gold in the Classical Era",
23. Presented paper Winter School, RMIT
Artists Workshop “Reading the Artifact”, Goulburn and North East Art Alliance, Wangaratta, August 17-20
Jewellery Workshop ‘Goldschmiedspiele’, Sommerakademie für Bildende Kunst, Neuburg an der Donau, Germany, 4-17 August 2002
Symposium Convenor: ‘Artefact and the Expression of Belief”Kaleide Theatre RMIT, August, 2002
Forum Speaker, ‘Dutch Jewellery’ Forum, RMIT Gallery, February 2002
36 Granulation Workshop in conjunction with JMGA (Vic) International Conference, Melbourne, RMIT University Feb. 17-19, 2004
37 Master Class workshop, ‘Filigree’, Eesti Kunstiakadeemia, 28 April, 2004
EXHIBITIONS CURATED MANAGED
1992 "Designer Cutlery from Germany and Australia", Craft Council of ACT/Goethe Institute Australia Council, Storey Hall, Melbourne.
1994 "9 LIVES", Customs House, June, Melbourne.
1995 "The Beast Won't Sleep", 300 Russell St, Melbourne.
1996 "TOY TO TOY", Customs House, June, Melbourne.
1999 Demi Parure, Reserve Bank, Melbourne
2000 ARTFACT, Immigration Museum, November, Melbourne, 2000
2001 Head Heart Hand, Reserve Bank, Melbourne
ARTFACT, Immigration Museum, November, Melbourne????????
2002 LEAF, Graduate exhibition, Gold Treasury Museum, 2002
2002 “Melbourne International Mokume Symposium and Exhibition”, Project Space, RMIT University, Melbourne
2003 “Ad Astra per Aspera”, Gold Treasury Museum, Melbourne
8. THE RESEARCH PROPOSAL

TITLE OF PROJECT:
The Reconstruction of Historical Jewellery and its Relevance as Contemporary Artefact

SUMMARY OF PROJECT:
The dating of ancient jewellery is given by the archaeological context. Technology applied by the ancient goldsmith is traceable through archaeometallurgy. The aim of this research is to analyse historical jewellery and to construct copies based on the known technology of the era. Resultant laboratory constructions with their historical correctness will then be available for reworking to convey a contemporary visual relevance and a statement of history. The results of these analyses and reconstructions will form the basis of metalwork objects in which contemporary aesthetics are informed by historical practice.

Background

Scientific examination of historical jewellery has its genesis in the nineteenth century. Although chemical analysis of objects was carried out, assemblage and configuration became a major interest. This was the catalyst responsible for the archaeological revival jewellery of the second half of the nineteenth century. These early enquirers were mostly practical jewellers with a knowledge and understanding of metalsmithing processes. In Italy the two Castellani brothers Alessandro and Augusto inherited from their father the business practice of goldsmithing as well as antiquarian pursuits. 154

Between 1910 and 1925 the German dealer and collector Marc Rosenberg published major studies in ancient goldsmithing technologies. 155 Caroline Ransome Williams’ 1924 catalogue of the collection of the ancient Egyptian goldworks then in the collection of the New York Historical Society provides a combination of technical information and replication experiments particularly in the making of ancient wire and granulation. Included in the survey are some of the earliest published microphotographs identifying ancient gold manufacture. 156 The catalogue Greek Gold concerning the high Classical era has a very important introduction identifying alloying by X Ray fluorescence in the goldsmithing of Greek jewellery. 157

Joining characterization needs specific methods. With electron microprobe, analyses can be made on the object but are more often made on a sample. This results in a limited number of tested joins. Parrini 158 at al published information on a cylinder from Marsiliana d’Albegna in 1982 and more recently Duval and Eluere in 1989. 159

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156 C. R. Williams, (1924) 1-160.
Analysis and Reconstruction

In particular ancient jewellery, the decorative configurations that accumulatively mark their style can also be regarded as a consequence of technology. Their placement and relationship to each other is in part a testimony to the joining technology carried out by the goldsmith. The aim of this research is to identify the mode of joining first by visual inspection, as observation of contact points reveal the characteristics of particular heat systems of joining. Further identification will be made by comparing the joined core by qualitative analysis with the substance of the joining material using an energy-dispersive x-ray fluorescence spectrometer. An objective in such methodology is to articulate metal analysis and define its contextual meaning with regard to the period of gold technology of the Classical Era. Laboratory reconstructions will be based on the known technology of this period.

A further objective is to identify worked surfaces and structures and place them in a technological and chronological context. Such evidence can also develop the source and location of theories of manufacture.

Following selection of jewellery types predominantly from the Classical era, observation with microscope and the compiling of working drawings for developing strategies of analysis will be made. Scanning Electron Microscope (SEM) will further identify manufacturing idiosyncrasies and surface and subsurface analyses of alloys will be carried out.

The same scrutiny will be made of laboratory samples for comparative analysis. This provides a vantage point to consider the broad manufacturing aspects of sheet, wire and granules.

Series of drawings will be made of selected artefacts depicting possible sequence of assemblage based on the copper salt diffusion joining system. The drawings will be used as maps for the scanning microscopy. The Energy Dispersive Spectrometer (EDS) elemental analyses of artefacts and samples identify surface and subsurface alloys and this is integral to the research and discussions. Using the SEM, markings and structures indicating manufacture of the decorative components will be observed and photographed. This visual information on surfaces can reveal sequence of assemblage and identify goldworking methods.

Applications

Samples will be made replicating artefacts by means of goldsmithing skills based on typical technology of the same era.

The laboratory constructed samples will be available for reinterpretation. The pieces will be reworked and physically changed in response to the inclusion of contemporary materials. Found object and modern materials placed into the previously historically correct jewellery will interfere and confront the previous orthodoxy of the jewellery object.

What was once historically correct will become stylistically distorted. The jewellery objects having been interfered with will offer a new experience of jewellery as a historical document.

Research Questions:
In what ancient jewellery types is style or placement of iconographic forms as much a consequence of technology as the stylistic genre of the day?

160 The stylistic configuration of the most complex goldworks can be characteristic of the diffusion bonding system. This theory was first presented by the author at the international conference The Art of The Greek Goldsmith held at the British Museum in October 1994.
What new knowledge of technology and modification of current theories can be gleaned from laboratory reconstruction of historical goldworks?
Is it possible to construct artefacts that are stylistically, chemically and methodologically conformable to ancient examples?
How can my work express aspects of the knowledge gained from analysis and reconstruction in contemporary jewellery and object using both historic and current forms and materials?

Rationale
Laboratory reconstruction and the making of copies of these particular jewellery types have a number of attributes. Principally it tests assumptions and theoretical strategies of working of the ancient goldsmith. Laboratory reconstruction, based on a putative sequence of assembly with the copper salt diffusion joining system is a recent development in the enquiry of jewellery history. Dr. Joan Mertens of the Metropolitan Museum in New York in correspondence to the Fulbright Review Committee “To my knowledge, Mr. Baines is the only person who is focussing specifically on the process of construction of ancient jewellery and the degree to which technical factors determine the appearance of the finished object. His research is revealing that features generally interpreted on stylistic or artistic grounds in fact are determined by the technological requirements of goldworking”(07-08-95).
Added to this, in some instances the observation of stylistic configurations determined by technical factors of gold works suggests the using of the copper salt diffusion joining system. In correspondence to the Fulbright Review committee on this subject Barbara Deppert-Lippitz wrote, “His (Baines) articles on the gold cylinders from Praeneste, published in 1992 and 1993, have set a completely new standard in the scientific as well as in the art historical analysis of ancient jewellery. For about 30 years most of the research on ancient goldsmithing techniques has been quite repetitive. Mr. Baines’ work was the only remarkable exception. His approach led to the discovery that in ancient goldwork stylistic features are often the result of technical necessities”(05-09-1995).
The documentation, exhibition, and publication of the research outcomes will increase awareness of jewellery knowledge to historians, jewellery conservators and jewellery practitioners.
By utilising this knowledge in my own work I will contribute to the evolution of contemporary metalwork which is both an expression of a current aesthetic and a transmitter of techniques and methodologies of past goldsmiths.

Methods
Location and Resources:
Laboratory based work will be conducted at the Gold and Silversmithing area of the Fine Art Department at RMIT, the Metropolitan Museum of Art in New York and within my own studio. The research will include access to Scanning Electron Microscope for qualitative analysis. The Faculty of Chemical and Metallurgical Engineering at RMIT together with the Scientific Research Laboratory at the British Museum and the Sherman Fairchild Center for Objects Conservation at the Metropolitan Museum will be the primary laboratories for this work. The author has had access to these facilities over a period of twenty years.
Jewellery subjects will be selected from museum collections within Australia and overseas. Some data gleaned from previous research including a four month Senior Fulbright programme will be combined with new knowledge collected.
Using museum contacts established over the past twenty years the research will be drawn from works in collections at the Villa Giulia and the Vatican Museum, Rome; the British Museum, the Victoria and Albert Museum in London and the Fitzwilliam Museum at Cambridge. The Staatliche Museum, The Antike Museum in Berlin (Charlottenburg) and The Antikensammlungen in Munich and The Museum für Kunst und Gewerbe in Hamburg in Germany will be other sources. In Athens the Benaki Museum and the Stathatos Collection in the National museum will also be other sources. In the USA the Metropolitan Museum of Art in New York, The Los Angeles County Museum and the J. Paul Getty Museum at Malibu collections will be considered.

Phase 1 : Investigate and collate existing data and drawings
Initial Resource Search  
February 1999 – January 2000 (12 months)  
Part-time study  
Collate data and drawings

Phase 2 : Collection of data  
February 2000 – May 2000 (4 months)  
Full-time study  

Investigate catalogues and indexes in public collections.  
Select and examine primary research material for analysis, considering technical factors. Formulate technical data file.  
Compose technical and working drawings.  
Decide on appropriate subject matter.  
Carry out laboratory samples with note taking of laboratory findings.  
Incorporate relevant information into the visual project.

Phase 3 - Analysis and Collation  
June 2000 – May 2001 (12 months)  
Part-time study  
Analyse data and drawings.  
Carry out appropriate laboratory test pieces with note taking of laboratory findings.  
Consolidate technical data file.  
Select appropriate subject matter.  
Develop a body of visual artworks  
Develop and consolidate written text for supervisors comment

Phase 4 - Consolidation  
June 2001 – May 2002 (12 months)  
Part-time study  
Carry out laboratory samples with note taking of laboratory findings.  
Consolidate technical data file.  
Develop the body of visual artwork  
Develop and consolidate written text for supervisors comment

Phase 5 - Review and Resolution  
June 2002 – September 2003 (16 months)  
Part-time study  
Develop the body of visual artwork  
Analyse, evaluate and refine visual research and written text.  
Consolidate technical data file.  
Provide written text to supervisors for comment  
Selection and compilation of durable visual record.  
Finalise presentation for examination in consultation with supervisors.
Phase 6 - Review and Resolution
October 2003 – November 2005 (26 months)
Part-time study

Develop the body of visual artwork
Analyse, evaluate and refine visual research and written text.
Consolidate technical data file.
Provide written text to supervisors for comment
Selection and compilation of durable visual record.
Finalise presentation for examination in consultation with supervisors.
9. APPENDIX A

Research Workshop and Seminar ‘Vessel Making: High Raising and Sinking’
Sherman Fairchild Center for Object Conservation, Metropolitan Museum of Art in NY, May, 2000
APPENDIX B

Research Workshop and Seminar ‘Granulation and the Hearth Fire’ 1
Installer’s Workshop, Sherman Fairchild Center for Object Conservation, Metropolitan Museum of Art in NY, April, 2003
APPENDIX C

Research Workshop and Seminar ‘Granulation and the Hearth Fire’ 2
Installer’s Workshop, Sherman Fairchild Center for Object Conservation, Metropolitan Museum of Art in NY, May, 2003
APPENDIX D

Robert Baines, Entdecker der antiken Goldschmiedetechnik
Staatsliche Antikensammlungen, München, 2004
Robert Baines – Entdecker der antiken Goldschmiedetechnik

Antiker Goldschmuck kann durch die Fundumstände, aber auch durch Eigenheiten im Filigran erkannt werden. Die Herstellungstechnik des antiken Goldschmuck ist auch durch eine genauere archäometallurgische Untersuchung herauszufinden.

Die zur Untersuchung ausgewählten Schmuckstücke stammen aus eurasischen und griechischen Werkstätten.


Besonders die Herstellungspunkte der Verbindungsstellen werden unter dem REM untersucht und ausgewertet. Auf diese Weise kann die Montage der einzelnen Elemente, die der Arbeiten zugegan...
Goldschmieds nachvollzogen werden.

Da die Charakteristika der Arbeitsprozesse als Kriterien für die technologische und chronologische Einordnung der Schmuckstücke herausgezogen werden, können nun auch Argumente für die Zuweisung zu einzelnen Werkstätten entwickelt werden.


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LABORATORY RECONSTRUCTION SAMPLES

1. Baule MMA 95.15.139 Copy

2. Baule flat, MMA 95.15.139 Copy
3. Baule Pair, *MMA 95.15.138 Copy*

4. Baule, *MMA 95.15.146 Copy*
5. Egyptian Box Bead *MMA.23.2.42* Copy

6. Rosette samples pair

7. Disc samples pair
8. Baule Copy
39 x 27 x 20mm
9. Disc
   15mm dia.
10. Disc open center
    34mm dia.
11. Disc open center
    37mm dia.
2.1 THE INTERVENTION OF RED

Bracelet with Fire Car, circa.?, 2001,
Silver gilt, plastic cars
98 x 93 x 69 mm

National Gallery of Victoria
Chain Intervention of Red 2003,
Gold, plastic
650 x 13 x 47mm
Bracelet Intervention of Red 2003,
Silver-gilt powdercoat
205 x 32 x 32mm

Schmuckmuseum Pforzheim, Germany
2.2. Ferlini’s Secret

Pin, 2001
Gold, silver plastic
68mm high
Neckpiece, 2004-5
Gold, silver plastic
240 x 28 x 21mm
2.3. The Saaremaa Brooch

A Brooch from Saaremaa
Bracelet from Saaremaa (?) 2002
Silver, gold, plastic car, metal car
105 x 75 x 68 mm
Five Brooches from Saaremaa (?) 2003,
Silver, gold, plastic
54 x 36 x 8mm
Neckpiece from Saaremaa (?) 2002,3
Gold
140 x 270 x 12mm
Close UP

**Neckpiece from Saaremaa (?) 2002,3**

Gold

140 x 270 x 12mm
Bracelet from Saaremaa (?) 2004,
Gold, plastic car, metal car
75 x 47 x 62mm

Banyule City Council Collection
2.4. Bracelet ‘Java-la-Grande’

Bracelet ‘Java-la-Grande’, 2004,5
India, Goa (Indo-Portuguese) (?)
Circa. Second quarter of the 16th century
Silver-gilt, iron, plastic, mahogany
99 x 7 x 89mm
5.REDLINE

Neckpiece, 2001,2
Silver, powdercoat
270 x 160 x 21mm

National Gallery of Victoria

Brooch REDLINE 2003, no.2,
Silver powdercoat
55 x 42 x 29mm

Brooch Whiter than Red 2004, no.1,
Silver powder coat
62 x 41 x 32mm
**Pendant REDLINE 2003, no.1**
Silver powder coat
74 x 80 x 42mm

**Pendant REDLINE 2003, no.2**
Silver powder coat
75 x 70 x 22mm
Pendant REDLINE 2003, no.5
Silver powder coat
78 x 59 x 59mm

Pendant REDLINE 2003, no.6
Silver powder coat
72 x 75 x 42mm
Pendant REDLINE 2003, no.7
Silver, plastic, powder coat
80 x 60 x 69mm

Pendant REDLINE 2003, no.8
Silver powder coat
41 x 35 x 35mm
Neckpiece, REDLINE 2003,
Silver, powder coat
290 x 290 x 30 mm

Neckpiece REDLINE 2003, no.1
Silver powder coat
315 x 195 x 25mm
Pendant REDLINE 2003, no.3
Silver powder coat
76 x 109 x 24mm

Pendant REDLINE 2003, no.4
Silver powder coat
80 x 60 x 40mm
Neckpiece REDLINE 2003, no.1
Silver powder coat
315 x 195 x 25mm

Neckpiece REDLINE 2003, no.2
Silver powder coat
240 x 170 x 46mm
Neckpiece REDLINE 2003, no.3
Silver powder coat
320 x 24 x 90mm

Five Brooches 2003
Silver, plastic, powdercoat
Smallest: 35 x 13 x 22mm
Largest: 54 x 45 x 28mm
6. A Vesseled History

Philadelphia Centerpiece
Candlestand, 2001-2,
Silver, silver-gilt, powdercoat
790 x 710 x 530mm
With Candle total height 1090mm
Philadelphia Centerpiece
Vase 2004-5
Silver, powdercoat
400 x 450 x 450 mm
Philadelphia Centerpiece
Tray 2005-6
Silver, plastic, Coca Cola crate, collected object, powdercoat
620 x 455 x 250 mm

A Vesseled History no.6, 2004
Gold, silver, powdercoat
Height
Weight 133.9 gms, box 77.3 gms, lid 56.6gms.
Private Commission
7. Bloodier than Black

Wreath 1999, no. 75,
Silver, powdercoat
320 x 320 x 90mm
Brooch 1999, no.122,
Silver, paint
Helen Drutt Collection

Brooch 1999, no.123,
Silver, paint
100 x 67 x 31mm
Brooch 1999, no.124,
Silver, paint
92mm x 65 x 37mm
Brooch 2002, no. 1,
Silver, paint
95 x 81 x 22mm

Brooch 1999, no. 82,
Silver, powdercoat
85 x 120 x 20mm
Brooch 2001, no. 2
Silver, powder coat
172 x 149 x 44mm

Ville de Cagnes-sur-Mer, France
**Brooch 2001, no. 5,**
Silver, powdercoat
35 x 145 x 20mm

**Brooch 2001, no. 8,**
Silver, powdercoat
175 x 50 x 25mm

**Brooch 2002, no.1,**
Silver, powder coat
180 x 80 x 32mm

**Brooch 2002, no.2,**
Silver powdercoat
165 x 60 x 30mm

**Brooch 2002, no.3, silver powdercoat**
200 x 205 x 70mm
Brooch 2004, no.1, silver powdercoat
200 x 140 x 46
Bayerische Staatpreis 2005 gold medal at the 57 Internationale Handwerksmesse, Munich. Brooches nos.1-6

Brooch no.1, Bloodier than Black 2004
Gold, silver, powder coat
59 x 42 x 37mm

Brooch no.2, Bloodier than Black 2004
Gold, silver, powder coat
77 x 58 x 28mm
**Brooch no.3, Bloodier than Black 2004**
Gold, silver, powder coat
89 x 53 x 25mm

**Brooch no.4, Bloodier than Black 2004**
Gold, silver, powder coat
80 x 59 x 40mm
Brooch no.5, Bloodier than Black 2004
Gold, silver, powder coat
68 x 44 x 31mm

Brooch no.6, Bloodier than Black 2004
Gold, silver, powder coat
74 x 60 x 35mm
8. Meaner than Yellow

**Pendant 2002, no.1,**
Silver, powdercoat
90x100x35mm

**Pendant 2002, no.2,**
Silver, powdercoat
80x65x50mm

**Pendant 2002, no.3,**
Silver, powdercoat
62x65x45mm
Brooch 2002, no.10,
Silver, powdercoat
67 x 30 x 30mm

Brooch 2002, no.7,
Silver, powdercoat
75 x 42 x 20mm

Brooch 2002, no.8,
Silver, powdercoat
80 x 54 x 20mm
Brooch 2002, no.2,
Silver, powdercoat
68 x 30 x 15mm

Brooch 2002, no.3,
Silver, powdercoat
65 x 30 x 20mm

Brooch 2002, no.1,
Silver, powdercoat
80 x 35 x 27mm
9. Whiter than Red

Bracelet Whiter than Red 2004, no.1
Silver, plastic powdercoat
105 x 88 x 75mm

Bracelet Whiter than Red 2004, no.2
Silver, plastic powdercoat
120 x 82 x 85mm

Bracelet 2004 no.7
Silver
95 x 82 x 80mm

Bracelet 2004 no.9
Silver
148 x 148 x 37mm
10. Other Works

The Crinkle and Crankle of Water, 1999

Who has measured the waters in the hollow of his hand
And measured off the heavens with a span?
Fire causes water to boil –
He turned the waters into blood and
Now the water, yellow and black is bent and shaped.

The Crinkle and Crankle of Water, Yellow.
Brass, powdercoat
480 x 500 x 30mm

The Crinkle and Crankle of Water, Black.
Brass, powdercoat
640 x 640 x 40mm
Drummer’s Gig 2000-2001,
Gold, silver, powdercoat and snare drum
250 x 390 x 390mm

Galerie Biró Ten Year Birthday, 2002
Gold, silver, plastic, powdercoat
145 x 95 x 30mm
2002, Emeritus Medal William Wright,
Gold, silver, alloys
2002, Emeritus Award: Robert Owen
Silver, powder coat
Brooch, 2004
Australian Saphires, fine gold, coloured gold, silver
56 x 50 x 20 mm
Private commission