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**Jewelry Technology  
in the  
Ancient & Medieval World**

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Jack Ogden

BRYNMORGEN PRESS

*Time will run back, and  
fetch the age of gold.*

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JOHN MILTON



Nubians bearing gold. Tomb of Sobekhotep at Thebes.  
Circa 1400 BCE. British Museum, London. 1869, 1025.3.

# Contents

<i>Introduction</i>	1	Specific Gravity	60
<i>Preface</i>	4	Other Tests	61
<hr/>			
<b>1 Design</b>	10	Accuracy	62
The Ancient Near East	11	Weights and Officialdom	63
The Classical World	14	The Karat	65
Medieval Times	17	“Hallmarks”	66
Allocation of Gold	20	<hr/>	
<hr/>			
<b>2 Gold</b>	23	<b>4 The Workshop</b>	67
Mining	23	The Workshops	68
The Earliest Gold	28	Seating & Workbenches	69
The Composition of Native Gold	28	Tools & Other Equipment	73
The Three Ages of Gold	29	Magnification	82
Native Gold	30	Lighting	84
The Introduction of Refining	33	Security	85
Medieval Times: Debased gold	43	Health & Safety	87
<hr/>			
<b>3 The Color &amp; Testing of Gold</b>	49	<b>5 Working Gold</b>	88
Color	49	Annealing	91
“Red Gold”	51	Sheet	92
Testing Gold	5	Rolling and Fakes	94
The Touchstone	53	<hr/>	
Fire Assay	59	<b>6 Forming Gold Sheet</b>	97
		The Alternatives	98
		Punches	99

# Contents

Formers, Pattern Punches & Dies	101	<b>10 Decorative Wire</b>	162
Reinforcement	118	Round Wires	162
Electroforming	119	Non-circular Wires & Strips	167
<hr/>		Beaded Wires	172
<b>7 Fillers &amp; Supports</b>	120	Half-beaded Wires	180
Supports	120	Fakes of Beaded Wires	183
Fillers	121	Flattened Decorative Wires	183
<hr/>		<hr/>	
<b>8 Cutting, Piercing &amp; Engraving</b>	126	<b>11 Filigree</b>	186
Chisels	127	Early Filigree	168
Scissors, Shears & Snips	127	Openwork Filigree	188
Saws	131	Flattened Rope Filigree	195
Engraving	131	The Underside of Filigree	196
Pierced Work	138	<hr/>	
Files	144	<b>12 Chains</b>	197
<hr/>		Early Mentions of Chains	197
<b>9 Wire</b>	146	Simple Links	198
Hammered Wires	147	Loop-in-Loop Chains	202
Strip-drawn Wire	149	Straps	205
Strip-twist Wire	150	Pendant Attachments	210
Recognizing Ancient Wires	156	Intersecting Loop-in-Loop Chains	211
Wire Drawing	157	Other Types of Chain	213
		Knits and Plaits	214
		Strip Folding	217

# Contents

<b>13 Soldering &amp; Granulation</b>	220	<b>15 Gem Setting</b>	276
The Behavior of Metals	220	Early Descriptions	277
Heat Generation and Control	221	Fitting Options	279
Positioning & Support	229	Settings for Seals	280
Pressure and Fusion Welding	231	Wires, Pegs & Wrapping	281
Three Approaches to Soldering	233	Adhesive	284
Alloy Soldering	234	Caps	287
Copper Salt Technique	236	Rubbed-Over	288
Hybrid Soldering	237	Claws/Prongs	295
Copper Salt Soldering	238	Filigree Borders	298
Granulation	243	Foils & Backings	299
Other Solders	249	Missing & Replaced Gems	302
Solder joins in Fakes	251		
The “Golf Ball” Effect	251	<b>16 Enamel, Niello &amp; Cinnabar</b>	303
Mechanical Joins	252	Enamel	303
		Niello	318
<b>14 Casting</b>	255	Cinnabar	325
Rarity in Early Times	255		
Molds & Patterns	257	<b>17 Surface Changes &amp; Finishing</b>	327
Examples of Early Gold Castings	267	Burnishing	327
Casting-on	271	Abrasives	329
Fabric Textures	272	Brushing	330
Modern Casting and Fakes	272	“Coloring”	331
Mercury Amalgam Casting	275	Surface Enrichment	334
3-D Printing	275		

# Contents

Internal Corrosion & Cracking	335	<b>Appendix</b> – Other Metals in Gold	365
“Helium Dating”	337	• Timeline	370
Acid Treatment	338	• Endnotes	372
Gold from a Watery Grave	339	• Glossary	395
Surface Precipitation	340	• Images	XXX
<hr/>			
<b>18 The Goldsmith’s Business</b>	342	• Bibliography	XXX
The Goldsmiths	343	• Index	
The Goldsmith’s Charge	346		
Time	348		
Liabilities	349		
Repairs	350		
<hr/>			
<b>19 Fakes &amp; Provenance</b>	356		
Provenance	361		

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# Introduction

*The past is a foreign country:  
they do things differently there.*

The opening line of L. P. Hartley's  
*The Go-Between*, 1953.

This is ostensibly a book about the early history of the jeweler's craft, but it is also very much a record of a personal voyage, the summing up of a linking of archaeological and jewelry interests that date back more than sixty years. My parents gift to me of Anne Terry White's 1956 book *Adventures in Archaeology* for Christmas that year first fired archaeological interests

in me. My evident enthusiasm for this meant that some five years later, at the age of twelve, I was handed some small boxes of miscellaneous antiquities and two books that had belonged to my great-grandfather, James R. Ogden (1866–1940). In addition to founding the jewelry company in Harrogate, Yorkshire, which bore his name for almost a century, he had been a keen amateur archaeologist, a popular lecturer on miscellaneous archaeological subjects and a friend to the likes of Howard Carter, the discoverer of Tutankhamun's tomb, and Sir Leonard Woolley who excavated Ur in Iraq, among other sites. The photograph in figure 1.1 was taken in 1913 on one of his many trips to Egypt.

The antiquities in the boxes were mixed, to say the least—beads from Ur given to him by Woolley, what were little more than “tomb sweepings” from Egypt intermingled with the inevitable fakes, fossils and other minor detritus from the past. After his death, most of his collection had gone to the Pump Room Museum in Harrogate or to the Brotherton Library in Leeds. His library,



*The author's great-grandfather, James R. Ogden, photographed in Egypt 1913. Photographer unknown.*



The hoop of a Ptolemaic gold earring from Egypt collected by the author's great-grandfather and given to him in childhood. Circa 2nd–1st century BCE. 1.5 x 1.3 cm.

including a huge collection of carefully collated news cuttings, had also gone to the Brotherton.

Just why those few boxes and the books had survived in some dusty corner of the jewelry shop's attics is a mystery, but for me they were a goldmine—literally. Among the bits and pieces of Egyptian antiquities was the twisted wire hoop from a Hellenistic gold earring—I still have it and here it is.

One of the books, a large and by then rather fragile paperback, was the 1924 catalog of the ancient Egyptian gold jewelry in the collection of the New York Historical Society by Caroline Ransom Williams and John Heins. Caroline Ransom Williams has been described as the first professionally trained woman Egyptologist in America, while John Heins was a goldsmith and silversmith in the Department of Fine Arts of Columbia University. This amazing catalog thus broke new ground in the study of ancient jewelry techniques. Some fifty years after the book was published, armed with the jeweler's magnifying glass that was inevitably within reach in a jewelry family, I could see the tell-tale spiral seam lines on the earring wires so well described and illustrated by Williams and Heins, a characteristic of what we now call *strip-twist* wire. Serendipity indeed that I had found in my hands an ancient earring fragment and the only book ever written by then that could tell me how it had been made. My archaeological leanings melded with the jewelry gene and started me on the route to becoming a jewelry historian.

The second book that had come down to me from my great-grandfather was *Ancient Egyptian Metallurgy*, by Herbert Garland, a metallurgist, but better remembered today for being Lawrence of Arabia's explosives expert. Lawrence recounted how Major Garland treated explosives with a nonchalance verging on the insane, stuffing his pockets with detonators as he set off on a camel for sabotage trips. Garland's book was published posthumously after his death in 1921 and sadly didn't include his envisaged chapter on gold because the notes were too fragmented to be usable. Still, there was enough to peak my metallurgical interests. Garland also pointed out the difference between a scientist and an archaeologist, as I note below.

In 1967, eighteen months after I had joined the family jewelry business, I made my way to Paris to see the *Treasures of Tutankhamun* exhibition, the first of the great blockbuster museum exhibitions in Europe. This exhibition raised so many questions in my mind about the materials and techniques used for that extraordinary goldwork that I began to research the subject. The next year, 1968, I spent eight months working in Luzern, Switzerland, in the flagship jewelry store owned by the renowned gemologist, Dr. Edward Gübelin. This was ostensibly to gain experience outside of the family circle in a retail jewelry business—and for me to save enough money to travel to Egypt afterwards. My job in Luzern was to sell Swiss jewelry and particularly Swiss watches



to American and Japanese tourists visiting that gorgeous town at the end of Lake Luzern, under the gaze of the towering Alps. Dr. Gübelin realized, I think before my own family did, that my interests veered more to the technical and the historical than to sales of modern watches; he was a hugely encouraging. Very early in my stay there he suggested that I microscopically examine a collection of Pre-Columbian gold ornaments that had formed an exhibition at Gübelin a few months earlier. My first ride on a microscope.

On my return to Britain, I was back in the family jewelry business while furthering my more academic interests and eventually the older generation of my family agreed to support my attempt to combine things by starting to include some early jewelry among our business offerings. That, along with helpful dealers, some skilled and often charming fakers, generous academics and friends in many museums, gave me an unrivalled opportunity over the years to examine ancient and would-be ancient gold objects. Whether my great-grandfather had passed down any jewelry historian genes is a moot point, but there were still some that remembered him. The first time I went to get a closer look at ancient Egyptian gold objects in the British Museum, I was let into

the anteroom of the Egyptian department offices and the assistant went off to announce my presence to the then Keeper of Egyptian Antiquities, Professor I. E. S. Edwards. Out of sight, but not out of earshot, I heard the loud and incredulous voice of the professor: “My God he’s not still alive, is he?” Edwards had been at the museum from 1934 until he retired in 1974 and well-remembered my great-grandfather.

The fruits of my early research were published in some articles in the mid to late 1970s and in particular in my 1982 book, *Jewelry of the Ancient World*. A few years later I ceased dealing in artefacts because it was becoming an ethical nightmare, and concentrated on research and consultancy work in the jewelry history field—and stepped up the work on my doctorate as a part-time student at Durham University. The net result is that over the last fifty years I have looked at many thousands of pieces of ancient gold under the microscope. As the need to earn a living was paramount, much of this research related to consultancy work for museums, collectors, auction houses and dealers around the world. What follows in this book is based on this incredible journey and I hope will inspire others to study the materials and technology of jewelry of all periods and cultures.

# Preface

*“Those loveliest secrets and wondrous  
methods of the great art of  
goldsmithing.”*

Benvenuto Cellini

## Scope

This book is an overview of the development of gold jewelry-making technology over the four millennia or so from the Early Bronze Age until the end of the medieval period, about 1500 CE. It is neither a history of jewelry styles—there are ample works that provide that—nor a social history of jewelry. It is aimed primarily at the archeologist, conservator, curator or art historian and so, in the main, it is about what can be observed with a ten-times lens (magnifying glass) or, preferably, a digital or binocular microscope—to which all should have ready access. Working goldsmiths may also be interested to learn of the development of their craft.

When I started in this field there was still often a divide between the connoisseur with art historical knowledge and the scientist. Herbert Garland, mentioned in the Introduction, pointed this out a century ago. The art historian, he said, when encountering a necklace, imagines its owner and how it was worn and why. The scientist, on the other hand, wants to pry

into its construction to see how it was made and what of. This distinction probably has its roots in Victorian class prejudice, with art historians seeing themselves as aligned with the original elite wearers of the jewels while relegating the scientists to “trade,” that is, to the manual work of the people who got their hands dirty making the objects. Silly, and stultifying to the subject, but it lingers on sometimes with some jewelry historians still admitting to a lack of even a basic understanding of gold working or how metals behave. There is an amusing example from about the same year that I first looked at a piece of early jewelry under magnification. When the Melvin Gutman collection of ancient and medieval gold jewelry was exhibited at the Allen Memorial Museum, Oberlin, Ohio in 1961, the catalog assumed two beaded wire hoops to be earrings, no doubt just because there were two of them. There was no opening to attach them to the ears, so the explanation was that “The rings have been closed, probably after being placed in the ear, by a

soldered join on the bias.”<sup>1</sup>

This book does not delve deeply into the science, into the chemistry of refining or copper-salt soldering for example, mainly because that is not the intended scope and partly because the book tries to look at processes from the point of view of the ancient craftsperson doing the work. He or she did not know why certain things worked, only that some did and, of those, some worked better than others. The book is more about patterns of development than precise dating. Historians want to slot things neatly into decades, but here we are dealing with a huge geographical area and an often innate human conservatism and a secrecy, particularly in crafts, which could slow the dissemination of innovative ideas. I owned a mobile phone in the late 1980s, but a handful in my peer group still won't succumb to this “new technology.” We can hardly expect a novel jewelrymaking technique to have spread across the ancient world any faster.

### **Helping Fakers**

In the 16th century, when Benvenuto Cellini referred to “Those loveliest secrets and wondrous methods of the great art of goldsmithing,” he was exposing the mysteries of his craft to his readers. Two centuries later, Godfrey Smith apologized for doing the same: “My aim, in the Publication of this Book, is not to hurt Any Body or Set of men in their profession; God forbid.”<sup>2</sup> I should perhaps follow suit because this book is about early

technology and thus to some extent about detecting fakes, and so I will be accused of giving away information that might help fakers. But realistically that ship has sailed. The last generation or so of ancient and medieval jewelry fakes include some that have become essentially undetectable unless examined in a specialized laboratory. So, most fakes of early jewelry made more than a quarter of a century ago should be detectable if examined with a trained eye and the basic tools of microscope and X-ray fluorescence (xrf) analysis, but any supposed early jewelry that has “appeared” more recently without a provable provenance should be viewed as suspect until there are strong, objective reasons to believe otherwise. It is important to recognize that those basic tools are not always sufficient to spot the more sophisticated recent fakes. It is equally important for less scientifically inclined art historians to acknowledge that while stylistic consideration will often unmask fakes, the reverse is not true; stylistic considerations alone can seldom prove objects to be genuine with any reasonable degree of confidence. The presumption of innocence has been an underlying legal tenet since Roman times, but assuming an object to be genuine until proved fake can lead to some expensive mistakes.

### **Provenance**

That mention of provenance may seem hypocritical when many of the details illustrated in what follows come from objects with

no known provenance. Some have been on the market over the last fifty years, others are in museum or private collections. Some were probably illicit finds. I do not condone illicit excavation, but the reality is that no laws on earth will stop people digging for treasure, whether they are seeking to finance terrorism, pay the rent or build a better house. The moral dilemma is whether it is better that illicit gold finds are sold on the illegal market and at least survive, likely to be studied eventually, or are melted down—a fate befallen by too many objects. It is wrong to say, as some do, that unprovenanced objects have no academic value. We may not have the burial context so beloved of archaeologists, but most objects will usually reveal something of their other contexts—the contexts in which they were made and the contexts in which they were used. Providing, of course, that the observer has learned to observe. In any case, even if some archaeologists would condemn me to

the fiery pits of hell for looking at unprovenanced objects, is it not better to record what I have observed than take that knowledge with me?

### Commerce

It is important to add here that attitudes to commerce in, or private ownership of, historic objects have changed considerably

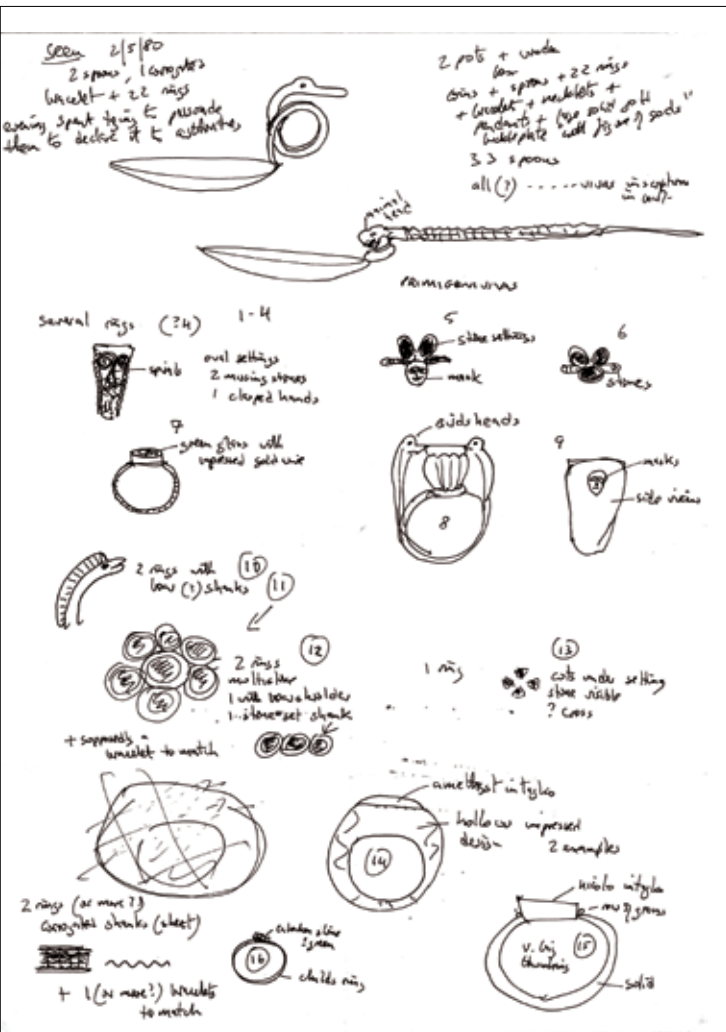
in recent years. The first time I visited Egypt in 1968, there were numerous licensed antiquities shops and even the Cairo Museum sold duplicate objects. That same year, the epitome of Egyptological scholarship, the London-based Egypt Exploration Society, moved from its old headquarters in Manchester Square to a new home in Doughty Mews. Just prior to the move, they sold off to their members a quantity of mostly minor objects that were from their allocations of finds from their excavations in Egypt, including objects from their published excavations at Amarna. This is where I bought the two little copper alloy tools of a type used by goldsmiths in figure 1.3 and the mold in figure 14.15. I have no documentation to prove that.

### Coverage

There is inevitable imbalance in this book. There is not space to cover everything and there are areas in which I have less experience or interest than I do in others, and some categories of jewelry have been more accessible to me than others. Also, the survival of early jewelry is far from uniform. Much ancient jewelry has come down to us because it was buried with the dead, but practices varied with time and place. For example, burying gold jewelry with the dead was considered wrong with the coming of Christianity. On the other hand, many medieval European precious metal treasures have survived because they were preserved in monasteries and churches.



Two small copper alloy punches from Amarna, Egypt. Purchased from the Egypt Exploration Society in 1968. Lengths 7.2 and 6.8 cm.



Some of the objects from the Thetford Treasure sketched from memory by the author after viewing them briefly in May 1980.

Much early jewelry in private or public collections today has survived because it was concealed in hoards for safe keeping and, for whatever reason, was never retrieved. Some spectacular hoards have been found including the huge Hoxne and Thetford treasures from Late Roman Britain—the latter I first saw under a kitchen table by flashlight before helping to steer it into official hands. Here is the simple sketch I made from memory after getting home.

These hoards were concealed around the time that the Romans left Britain and remind us of what we read in the *Anglo-Saxon Chronicles*, a history of Britain written in the ninth century of the Christian Era.

This records that in the year 418 CE the Romans “collected all the hoards of gold that were in Britain; and some they hid in the earth, so that no man afterwards might find them, and some they carried away with them into Gaul.” On that note, it is worth pointing out that in what follows I quote from ancient and medieval texts and discuss some early technical terms. Revisiting texts allows us to reconsider some of

the older published translations. Earlier translators did not always have a knowledge of jewelry materials and technology. So here again, there is bias. I can struggle, with some success, with some modern and ancient languages, but others are impenetrable to me and so I have had to rely on published translations where these are available.

Out of necessity, the number of endnotes and references has had to be limited. I apologize to authors and works I omit.

### Avoidance of Classification

Readers will note that I have a pet dislike of too much modern classification. If I read something like “Etruscan beaded wire type 4b” in an article I now usually switch off instantly. Classification may be useful for doctoral theses, not least because they give an illusion of an objective way of measuring how much work has been done. Classification is ostensibly about grouping similarities, but in practice it is about defining the boundaries. But things overlap—early goldsmiths were not working to modern tolerances. An example I mention later relates to sheet gold. Some have defined sheet gold that is less than 0.2 mm thick (or some other arbitrary measurement) as “foil,” and refer to material 0.2 mm and over as “sheet.” But how might you describe, say, a Hellenistic Greek diadem that was 0.2 mm thick at its center, 0.19 mm at the ends?

Where possible I have kept technical terminology as simple as I can. Terms and names that may

not be familiar to some readers are briefly explained in the glossary at the end of this book. Names of different techniques and tools have been kept to a minimum, which may bother some modern jewelers, but unless there is some evidence that such a multiplicity of terms were used in early times, it seems unnecessary to project them back into the past.

Similarly, I have used “jeweler” and “goldsmith” interchangeably as they now tend to be used in modern English. The origin of our word “goldsmith” is self-evident, but the roots of “jeweler” are more interesting. Our *jewel*, *jeweler* and *jewelry* are believed to stem, via the French, from the Latin *iocus* which meant a joke. One of the earliest uses of the term “jeweler” that I know of comes from the amazing 14th century English poem *The Pearl*. The relevant stanza (the 25th) includes, in modern English, “jeweler gent, if you shall lose your joy for a gem once dear to you ...” In the original it is spelled *jueler*. I like the way it expresses the idea that a jeweler—and may I add jewelry historian—should find joy in the things they deal with.

### Images

Some of the photos used in this book are of dismal quality. This was unavoidable because some are old, and some were taken in poor light conditions of an object only fleetingly in my hands. Images scanned from my old transparencies have often deteriorated to the extent that digital wizardry cannot breathe much new life into them.

The 3D drawings in this book are, I believe, an effective way to show construction in an accessible manner and, I hope, an aesthetically pleasing one because a book full of line drawings would be a bit dreary. They are to give an impression of how something was constructed, not precise reproductions of every detail. All have been produced with Rhino® 3D software with the output, the “photorealistic” renderings, created in V-Ray®. Curiously, or perhaps not, trying to work out how to represent certain constructions graphically in 3D has given me insights into how they were constructed originally and some of the challenges faced by the makers.

### The Future

Many of my observations and opinions in the following pages will be rejected, superseded, modified or abandoned as research continues. Almost every object examined can shine new light onto some aspect of manufacture or material, and new discoveries will continue to impact what we think we know. There is a story, perhaps apocryphal, that when Einstein was teaching in Oxford he was asked why he had set his students the exact same exam questions that he had used the year before. His response? Because the answers had changed. Einstein would have admired the Greek tragedian Euripides who said “question everything.” Very sensible. Euripides added, “Learn something,” which is self-evident because we learn from everything. And thirdly and more

cryptically, “Answer nothing.” His intention with this final clause has been much debated, but I take it to mean that you should never assume that you know the definitive answer. More recently, General George Patton made much the same point. He said, “When in doubt, observe and ask questions. When certain, observe at length and ask many more questions.” That should be printed, framed and hung above every jewelry historian’s desk.

We know pretty well the repertoire of techniques used in the past for making jewelry and, although the chronology will be continuously refined, we probably have the outline. The current stage of jewelry history is to see how techniques could be combined, and how approaches to assembly varied with time and place. Two Greek goldsmiths might have used identical technology to make earrings of near identical form, but the way in which they assembled those earrings can differ. It is those differences that will allow us to identify individual workshops. Naturally, the growth of our subject relies on good observation and cataloging of objects in collections and from excavations. Publications should detail materials and construction as well as style, and give us objective information we can build on, not just subjective, poetic descriptions. The art-historian-as-poet-syndrome can be frustrating. When I read about an object in a catalog I want objective information about it and not too much of the sub-

jective views of the writer. I can provide one example from many: Rodolpho Siviero was an art historian of renown, sometimes called the James Bond of Art from his work in World War II to track and recover Italian art works pillaged by the Nazis. His catalog of the ancient jewelry in the museum in Naples is an invaluable record of the collection, but he does veer into near-poetry sometimes. For example, when describing a Hellenistic gold diadem from Fasano, he says it was “like a flowering branch ... the attached decorative elements forming a thick vegetative growth that seems to have germinated from it.” Picturesque, but there is no information about the actual construction or type of decorative elements, no objective information that might provide links to other objects possibly from the same workshop. Really, he is only describing what the reader can see for themselves from the photos. Now, sixty years on, more is expected of the modern jewelry historian.

Some archaeologists and historians, of course, consider early goldwork barely worth study, the frippery of the long-dead elite. But the truth is that gold jewelry can involve a far greater range of constructional and decorative techniques than almost any other early art in any other media. Couple this with gold’s ability to survive almost unscathed for millennia and we have an unrivaled resource of permutations from which we can potentially derive an understanding of the geographical and chronological links between past societies and workshops.

# 1 Design

*Goldsmiths should have ... the spirits of wisdom, and of understanding, and of knowledge in order that they might devise and execute work in gold and silver.*

— From Theophilus' *On various arts*,  
preface to his Book III  
(Hawthorne & Smith translation)



Figure 1.1

A Greek gold ear spiral with griffin head from Cyprus. 4th century BCE. 3.5 x 2 cm. © Metropolitan Museum of Art, New York, 74.51.3373. [OA]

This book is not a history of jewelry styles, but before we move on to consider the materials and techniques used to make jewelry, it is worth pondering briefly the extent to which modern concepts of "creativity" in jewelry might have applied in the past.

In the early Renaissance, the Italian metallurgist Vannoccio Biringuccio advised a would-be jeweler that, "It is necessary first of all to be a good designer, because design is the key that opens the doors not only to the goldsmith's craft, but to all others."<sup>1</sup> That the design of a piece of jewelry is a first step, not an end in itself, is sometimes forgotten today when too many jewelry awards are decided on art rather than craft; the winners frequently decided on designs for pieces not yet made. You wouldn't judge a cake from the recipe, but it appears that in jewelry, creativity has often become more important than creation. This concept of creativity would have been a largely alien concept to earlier goldsmiths. Society, religion, superstition, status, economics, available materials and many other factors created the framework within which jewelers had to work.

So, in general, the goldsmith was trying to make his work as close to the expected form as he could. With figural details, such as the griffin-head terminal on the fourth century BCE Greek spiral earring in figure 1.1 or the image of a saint on a medieval ring, the degrees of intricacy and accuracy reflect the abilities of the jeweler and his presumed determination to make it as perfect as he could. There was a sense of the ideal which he sought to achieve. "Ideal" is a more appropriate word than "realistic," because who is to say whether a representation of a griffin head or saint is realistic? The opportunities for innovation were limited. If a Greek gold griffin or Byzantine saint has weird proportions or strange ears, we see it as evidence for a degree of incompe-



Figure 1.2

Three of the seven gold pendants from a necklace depicting the Mistress of Animals. Kamiros, Rhodes. 7th century BCE. Pendants 3.5 cm high. British Museum, London. 1860,0201.61.



tence or, as archaeologists are wont to say, “provincial work.” We don’t attribute it to some avant-garde ancient jeweler casting aside the shackles of convention.

This doesn’t mean that individual artistic whim was impossible, but it is more likely to be found in the detail than the overall form. Figure 1.2 shows three out of seven pendants on a necklace from Kamiros, Rhodes dating to the seventh BCE. The form is well known, and we find examples of various purities of gold and with varying complexity of decoration.<sup>2</sup> The basic motif, the winged Mistress of Animals, is constant, but the granulated decoration on the long skirts of the goddess shown here is varied. The other pendants on this necklace are equally diverse in their granulated decoration. It is possible that these patterns complied with some defined canon, but it seems more likely that we are seeing some expression of creativity by an accomplished goldsmith. The social or religious framework that allowed or even encouraged such flexibility in the decoration of a sacred image, and what it says for the status of the goldsmith in that society, are topics that deserve consideration.

Whenever there was more than one way to put a piece of jewelry together and choice was not solely dictated by practical necessity, we need to think

about why one way was chosen rather than another. As an example, figure 1.3 shows just two of the ways in which a well-known Mycenaean ring type of about 1450 BCE could be assembled. The basic ring form was the same and the same soldering, cutting and shaping techniques were likely used in both cases, but the constructions are very different. We cannot fathom what was going through the minds of those goldsmiths more than three thousand years ago, but we can assume that there were different goldsmiths involved and likely different workshop traditions for making such rings. It is tempting to assume that assembly approaches varied because the goldsmiths were copying rings without seeing how they were made. There could be different ways to construct outwardly similar jewelry at all periods.<sup>3</sup> Assembly details such as these have huge potential in defining chronological, geographical or workshop variations and are one of the most fertile areas for future jewelry historians to study.

### The Ancient Near East

To consider design in ancient and medieval jewelry we can start by contrasting two societies. In Egypt there was a strictly defined iconography. The form and proportions of the two figures of Horus, the hawk god, flanking the pectoral of Princess Sithathoryunet in figure 1.4, dating to circa 1870 BCE and now in the Metropolitan Museum of Art, New York, was identical to that rendered many meters high on a temple wall, or written meticulously as part of an in-



Figure 1.3  
Drawing showing two of the ways used to construct a Mycenaean ring type.



Figure 1.4  
Pectoral of Princess Sithathoryunet.  
Lahun, Egypt. Ca 1870 BCE. Height  
4.5 cm. © Metropolitan Museum of  
Art, New York. 16.1.3a, b. [OA].

scription on fragile papyrus. Every motif on a piece of Egyptian jewelry had a meaning; it was quite literally, a hieroglyph. Every part of this pendant means something, from the two falcons to the little symbols of protection they clasp in their talons. Taken altogether the pendant reads something like: "The god of the rising sun grants life and dominion over all that the sun encircles for eternity to King Khakheperre." Khakheperre (the pharaoh Senwosret II) was possibly Sithathoryunet's father.

Originality in Egyptian jewelry lay not in the form of the motifs but in their combination, relative proportions and arrangement, so the "designer" had to be highly literate with a deep understanding of the theology and symbolism. A scribe was needed, not a lowly

working goldsmith with fingers like crocodile skin and stinking like the offal of fishes (to quote a passage describing a metalsmith in the ancient *Egyptian Instructions of Duauf*). If we look at the famous wall painting of goldsmiths in the joint tomb of Nebamun and Ipuky in Thebes dating to around 1390–1350 BCE, the only named figure is "the scribe of [the god Amon] Pasanesu, also known as Parennefer" (Figure 1.5). He is shown equipped with brush and paint palette and is drawing something onto a gold vase. Paint or ink are not ideal for permanently decorating the surface of metal, so it seems possible that Pasanesu was drawing on an inscription or motif for a goldsmith to emboss, a crucial part of its planning and manufacture. This image is taken from the me-



Figure 1.5  
Wall painting of goldsmiths in the joint  
tomb of Nebamun and Ipuky. Thebes,  
Egypt. circa 1390–1350 BCE. A copy by  
Norman de Garis Davies.

ticulous copy of the wall paintings made by Norman de Garis Davies for the Egyptian Expedition of the Metropolitan Museum of Art, New York, in the 1920s. Such copying has proved its worth—Pasanesu disappeared when this section of the wall painting was stolen. Two millennia after Pasanesu worked on the vase, an unknown goldsmith in Ireland made the gilded silver chalice and paten, part of what is known as the Derrynaflan Hoard found in County Tipperary, Ireland in 1980. The various components of the paten had identifying letters to show how it was to be assembled which led Michael Ryan to say that “there is little doubt that the process of creation involved the collaboration of a literate individual, almost certainly a cleric.”<sup>4</sup>

In 1402 the daughter of Henry IV of England married Louis II of the House of Wittelsbach of Bavaria in what is now southern Germany. She took with her the splendid gem-set gold crown in figure 1.6 which had been made a generation or so earlier and is now in the Treasury of the Munich Residenz Museum. The crown is made of sections and can be dismantled for transport. To ensure the parts are reassembled correctly, they bear Roman numerals to show where each goes (Figure 1.7).<sup>5</sup>

The strict canons of Egyptian art meant that the jewelry designer/scribe had limited flexibility in the choice of his motifs but, unlike the hieroglyphs carved on a temple



Figure 1.6  
The crown of Blanche, the daughter of King Henry IV of England. Circa 1380. Residenz Treasury, Munich.



Figure 1.7  
Detail of the inside of one of the sections of the crown in figure 1.6, showing the Roman numeral VIII as registration markings to aid assembly.

wall, he sometimes had to have some leeway in their proportions to ensure good contact between motifs in order to be able to create a rigid, self-supporting whole when translated into a gold ornament. This was unnecessary to the master who designed the pendant in figure 1.4; the constituent motifs are all correctly proportioned. In some other cases, some motifs are slightly stretched or distorted to allow good contact between them.

If we turn from Egypt to Western Asia, to the early jewelry of what are now Anatolia, Syria, Iraq and Iran, we find a vivid contrast. Generally speaking, Western Asiatic jewelry prior to the first millennium BCE largely lacks figural elements apart from simple floral/vegetal forms. This stylistic limitation led Classical jewelry specialist Reynold Higgins to comment (in a book review) that Western Asiatic jewelry had a tendency to look much the same wherever and whenever it was made. For example, the figural jewelry found on the body of Queen Puabi of the ancient city of Ur in Iraq, dating to around 2500 BCE, is limited to flower heads and leaves (Figure 1.8).<sup>5</sup> There are variations and developments in forms, of course, and varying qualities of workmanship, but there is little that can be deduced about the nature of the design process. Can it be coincidence that texts in Western Asia were written with highly abstract wedge-like markings—cuneiform script—not in the overtly representational hieroglyphs so typical of Egypt?

## The Classical World

We have minimal information about design from Greek and Roman times, but there are odd artifacts that might be designs for jewelry. One example is a piece of sandstone that was found at the ancient city of Taxila in what is now Pakistan.<sup>6</sup> This has scratched representations that may be designs for jewelry because they seem too shallow to be any type of die as Sir John Marshall, their excavator, had suggested.

We find closely related jewelry forms over the very wide expanses of the Hellenistic and later the Roman Empires. What were the origins of the forms and how did they spread? The Classical Greek jeweler is unlikely to have observed a lion closely enough to reproduce its facial details on a bracelet terminal



Figure 1.8  
The jewelry of Queen Puabi of Ur, Iraq. Circa 2500 BCE, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia.

like that in figure 1.9. And certainly he hadn't seen a griffin. When Dyfri Williams, former Keeper of Greek and Roman Antiquities at the British Museum, and I were preparing the *Greek Gold* exhibition back in the early 1990s, a superb pair of bracelets in the Hermitage Museum, St Petersburg puzzled us. The terminals represented gender-fluid lions—with shaggy manes and teats.<sup>7</sup> We were pondering the symbolic or mythological implications when it dawned on us that the goldsmith had probably never seen a lioness. Why wouldn't she have a mane?

The lion head on a necklace terminal found in the Greek colonies in South Italy may look very similar to one from a thousand miles away in the Greek colonies on the Northern Black Sea. Clearly there were derived



Figure 1.9  
The lion head terminal from one of a pair of gold and blue glass bracelets. 4th–3rd century BCE. Greek. Terminal about 3 cm long. Metropolitan Museum of Art, New York, Inv. 57.11.8-9.



Figure 1.10  
Sheet gold strips, perhaps diadems, with repeated gorgon and lion heads. Late 5th century BCE from Asia Minor. Width of gorgon strip, 1.3 cm. British Museum Inv. 1877,0910.37 and 38.

from the same original source and part of the answer may be coinage. There are few motifs in Classical or Hellenistic Greek jewelry that don't have a good prototype depicted on a coin—lionheads, griffins, flower buds, Nike the Greek goddess of Victory in her chariot and so on. Marble, bronze and terracotta sculptures could also act as design blueprints. Compare, for example, the fourth century BCE gold strip with impressed Gorgon-head designs from Asia Minor in figure 1.10, top, with the late fifth century BCE—silver half drachma coin in figure 1.11. There is more to it, though. Homogeneity across the Greek jewelry world is also found in the combinations: the way a pendant in the form of the Greek god of love, Eros, hangs below a rosette disk as in figure 1.12, or the style of the twisted hoop and filigree collar on an ibex-headed

earring. The similarities in combinations cannot be attributed to coinage and there are also sufficient subtle regional differences in these combinations to keep doctoral students occupied, and to show that in most cases it was not the jewelry wearers who travelled.

There was little long-distance trade in finished gold jewelry items in early times, so we must assume that the spread of jewelry forms around the Classical and Hellenistic Greek world was largely the result of goldsmiths travelling to new markets. Among the hundreds of little lead tablets on which Greeks wrote questions to the oracle at Dodona in northwest Greece (now preserved in Ioannina Museum), is one on which the writer asked whether he would be successful in his craft if he migrated. His craft is not specified, but he may well have been a goldsmith.<sup>8</sup>

Travel to new markets was not always voluntary. Goldsmiths could be taken from invaded lands to work for the victors, or dispatched by rulers for diplomatic reasons. As an example of the latter, when building his temple in Jerusalem, King Solomon sent a message to Hiram, king of Tyre, asking him to send “a man skilled to work in gold, silver, bronze, and iron ...” (2 Chronicles 2:7). He was to train or supervise Solomon's own craftsmen. When the Persian King Darius was building his palace at Susa around 500 BCE, the goldsmiths used were Medes and Egyptians.<sup>9</sup> Whether these had come voluntarily is unknown.

The Classical Greek world saw the introduction of a greater



Figure 1.11  
Silver drachma coin with gorgon head minted at Parion (northwest Turkey). Circa 400 BCE. Diameter 1.3 cm. Cleveland Museum of Art, Inv. 1917.991. (CC).



Figure 1.12  
A pair of gold earrings in the form of winged figures of Eros below a gold disk. Circa 300 BCE. Height 9.5 cm. © Metropolitan Museum of Art, New York. Inv. 30.116.1, .2.

naturalism into art but still within a recognizable representation. The speedy flight of Eros on those earrings in figure 1.12 was shown in his outstretched wings. The “essence” of a deity or other figure was displayed by stressing its important features, not by stripping off the less-important ones as might a contemporary artist such as Brancusi.

When we get to Roman times, we have minimal information on the design processes but still a considerable homogeneity of forms across the Empire, now extending as far as the British Isles in the west. There are variations, of course. Roman jewelry from what we might term the Levantine coast, from Syria down to Gaza, often has a very different feel than that from Asia Minor. That from Egypt is remarkably similar to that from around Pompeii. Perhaps one player here was the Egyptian

goldsmith who moved to Italy for work in the first or second century CE, as we learn from an inscription preserved in the museum in Alexandria.<sup>10</sup>

The most intriguing feature of Roman jewelry is its move away from the abundant representational imagery of later Hellenistic Greek goldwork that preceded it. This happened faster in some parts of the Empire than others, but the overall process is clear. By and large, the naturalistic figural elements, from lions’ heads to acorns, that decorate Classical and Hellenistic Greek goldwork all but disappeared. In their place came simple geometric shapes and usually, other than in the eastern peripheries of the Empire, a considerable diminution in the number of components that comprise an ornament. I have no explanation for this. But, recalling the possibility that the imaginative Greek

coins inspired Greek goldsmiths, we can note that Roman coinage typically had a portrait of the emperor on one side and a standing deity on the other—not an exciting repertoire of inspiration for the jeweler, although a godsend for a gem engraver. Figure 1.13 shows a fine Roman gold ring of the first half of the third century BCE from the finger of a man whose body was found on the island of Funen in Denmark. There was a silver coin in his mouth to pay for the journey to the kingdom of the dead. The goldwork is massive, but of simple angular design with just vaguely vegetal motifs on the shoulders. It is set with a banded agate of the type called a *nicolo* engraved with a figure of Bonus Eventus, the deity of good luck and a popular subject of coin reverses. I chose this example of this ring type because I wanted an excavated one; there are many



Figure 1.13  
Roman gold ring set with a nicolo intaglio from the burial of a man at Hågerup on the island of Funen, Denmark. 3rd century CE. National Museum, Copenhagen. Dnf. 30/32.



Figure 1.14  
A pair of Roman gold earrings with green stone, probably variscite, pendants. From Cyprus. Circa 3rd century CE. Height 4.1 cm. © Metropolitan Museum of Art, New York. 74.51.3948. [OA].

excellent fakes of this type. The Roman gold earrings in figure 1.14, from Cyprus, are typical examples of the minimalism often seen with Roman jewelry.

With the Late Roman and Early Byzantine periods, and the move of the cultural center from Rome to Constantinople, we see something of a renaissance of Greek naturalism. Vine scrolls become lush, and we find lion heads terminating necklaces again. An example of the latter is shown in figure 1.15, a necklace of the fourth or fifth century CE. This necklace was found in Asia Minor in the 19th century, passed into the Count Michel Tyszkiewicz and then Henry Walters collections before it was bequeathed to the Walters Art Gallery, Baltimore. As is typical for this period, the lionheads are more spherical in form and have closed mouths, unlike the more realistic, open-mouthed Greek ones as in figure 1.9. Perhaps this signifies a more passive form of protection.

### Medieval Times

The medieval jeweler in general would find little to spark their creative juices in the rather tedious designs of the sparse coins in circulation. Initially we have the highly stylized and complex interlaces and patterns of Migration Period and Viking jewelry. Figure 1.16 shows an early Anglo-Saxon pendant excavated at the Streehouse Anglo-Saxon cemetery (Grave 70) in North Yorkshire, England. It dates to the second half of the seventh century and is now in the Kirkleatham Museum, Redcar.<sup>11</sup> The knotted snakes here



Figure 1.15  
A gold folded strip necklace with lion-head terminals. Asia Minor. 4th or 5th century CE. Length 18.5 cm. Walters Art Gallery, Baltimore. Inv. 57.588. (CC)

are relatively simple although we must surely discern a true love of the challenge of producing such work. The archaeologist trying to work out what is happening in the more convoluted forms can only have enormous respect for the craftsman who designed them in the first place. Figure 1.17 is that rare thing, an actual ancient layout sketch for a piece of jewelry. It is the precisely drawn form of a Celtic ring brooch on a flat piece of slate. This was excavated at the hillfort at Dunadd, Argyll, one of one the major royal sites of Dál Riata, a Gaelic speaking kingdom in the west of Scotland with strong Irish links. It dates from the seventh century CE. Robert Stevick showed that the ratios of the radiuses of the various circles and arcs

related to the square root of three.<sup>12</sup> This is not as astonishing as it might sound because these ratios can be simply laid out with just a pair of dividers and the craftsman quite likely had little concept of square roots as such.

A few centuries later, goldsmiths could turn for inspiration to the impressive architecture springing up, from sturdy Romanesque arches to delicate Gothic tracery, being faithfully reflected in turn in the jewelry. As an obvious example, compare the Norman arcade at Canterbury Cathedral in figure 1.18 with the setting for an amethyst in figure 1.19. This setting is on the eleventh century CE reliquary of The Holy Roman Emperor Henry II, also known as Saint Henry the Exuberant, the last Ottonian ruler (973–1024 CE). It was made about 1010 CE and is now in the Residenz, Munich. It has been described as one of the finest examples of surviving goldsmith's work of this period. The 14th century crown in figure 1.6 can be compared with typical gothic architecture.

We have some documentary information about design from the later medieval world. In the early 12th century, Theophilus, a Benedictine monk and possibly Roger of Helmarshausen, wrote his *De diversis artibus* ("On Various Arts").<sup>13</sup> This describes how goldsmiths made things, but gives no information on the creative processes to decide what they will look like other than telling his readers, as quoted at the head of this chapter, that goldsmiths should be "...suitably filled with the divine spirit, they will excel in their work."<sup>10</sup> **More** pragmatically, a few decades later the English scholar Alexander Neckam explained that a goldsmith had to be skilled in draughtsmanship and that the goldsmith's apprentice "should have a waxed or painted tablet, or one covered with clay, for portraying little flowers and drawing in various ways. That he may do this conveniently, let him have litharge [red paint] and chalk."<sup>14</sup> Clearly, planning was an important step. Perhaps the production of sketches was also for the customer's benefit, to make sure that both goldsmith and customer had the same result in mind. We have a good example of this. The contract survives for the commissioning of the goldsmith Francesco of Milan to make St. Simeon's shrine in Zadar in what is now Croatia, which also



Figure 1.16  
Gold and garnet pendant from the Streethouse Anglo-Saxon cemetery (Grave 70) in North Yorkshire, England. Circa 650 – 700 CE. Diameter 3.7 cm. Yorkshire Museum, York.

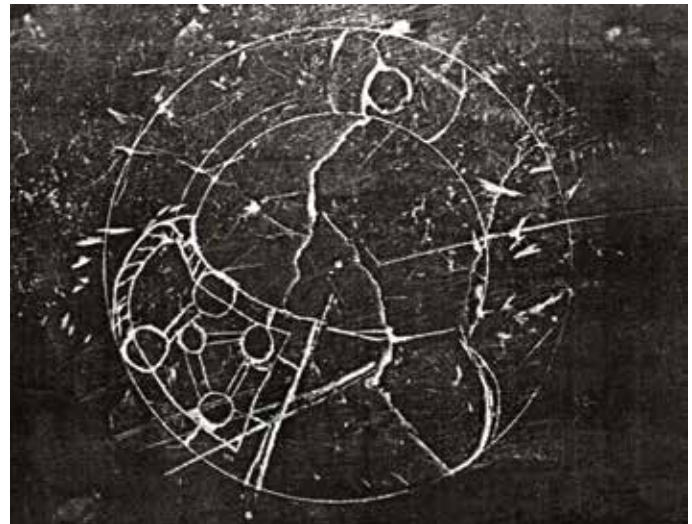


Figure 1.17  
The design for a ring brooch incised on slate. From the hillfort at Dunadd, Argyll, Scotland. Circa 7th century CE. Outer diameter of design 36 cm. National Museums Scotland, Inv. X.GP 21. © Niamh Whitfield.





Figure 1.18  
The Norman arcade at Canterbury Cathedral, England. 11th century. Photo T. Taylor [PD]



Figure 1.19  
Gold setting for an amethyst, on the reliquary of the Holy Roman Emperor Henry II. Early 11th century. Residenz Treasury, Munich.

survives. The agreement, dated 5 July 1377 notes that there was a representation “on carta bum-bicina [paper] and made in the likeness of the said silver shrine ...” for the goldsmith to follow.<sup>15</sup>

A few centuries later, the 16th century master goldsmith Benvenuto Cellini left us both his autobiography and his book on goldsmithing. He was particularly fond of self-aggrandizement which manages to provide insights into the jewelry design process.<sup>16</sup> His first love, he says, was drawing. His subjects included Roman antiquities and, no doubt, the pebbles and shells which he tells us he regularly picked up on the seashore. When the Pope chose Cellini’s design for his cape clasp rather than those submitted by other goldsmiths, Cellini commented, “a jeweler, when he has to work with figures, must of necessity

understand design, else he cannot produce anything worth looking at.”<sup>17</sup> Things had to be planned. In the context of filigree work he said, “Though many have practiced the art without making drawings first, ... those who made their drawings first did the best work.”<sup>18</sup> He boasted of the fine chalice he was asked to make for the Pope, saying, “So I made both drawing and model for the piece.” The latter was constructed of wood and wax (Figure 1.20).<sup>19</sup> Naturally, he did not make all the pieces himself, any more than Fabergé did in recent times. He admitted this when he said, “These jewels were excellently executed by my workmen, after my own designs.”<sup>20</sup>

The most memorable figural features of Renaissance jewelry are representations of biblical and classical myths, and a menagerie



Figure 1.20  
A carved pear-wood model for goldsmiths work depicting Adam and Eve. South German. Ca 1530. Height 12.3 cm. © Rijksmuseum, Amsterdam. BK-16987. [OA]



Figure 1.21  
A gold "iconographic" ring engraved with Saints Barbara and Christopher. English. 15th century. Ring diameter 1.9 cm. © Victoria and Albert Museum, London. 690-1871.

of fantastic creatures. Cellini and his contemporaries had no more access to a mermaid than a Greek goldsmith had to a griffin, but things were changing. During the Renaissance, a goldsmith could refer to the large-scale representational art in various media that was blossoming and, of course, to books. The invention of printing completely changed the way in which jewelers could be introduced to, or transmit, representations suitable for rendering into jewelry. Now a jeweler or his customer could see a drawing of what a mermaid or griffin was supposed to look like. It was even possible to transmit the secrets of the craft. Cellini was quick to take advantage of this. His *Treatise on Goldsmithing* was first published in Florence in 1568, three years before his death.

There may even be a close technical relationship between jewelry and printing. The compactly designed engraved "iconographic" designs of gold rings and other ornaments of the 15th century might have been prompted by the copperplate engraving appearing at that period—or vice versa. An example of such a ring is shown in figure 1.21. This is English and the bezel depicts Saints Barbara and Christopher. This is in the Victoria and Albert Museum, London and was previously in the celebrated collection of rings formed in the mid-19th century by Edmund Waterton. I have chosen a ring that has been known for more than a century and a half because there are now abundant fakes appearing in auctions and entering collections.

## Allocation of Gold

There was an important planning step between deciding the form of an ornament, and the goldsmith starting to work his gold. He had to decide how best to make it with due regard to the constraints imposed by his materials, technical skills and customer's budget. The allocation of the raw materials was particularly critical when the gold was provided by the customer. It would be inexcusable if a Greek goldsmith made one earring, such as those with the pendant figure of Eros as in figure 1.12 and then found he did not have enough gold to complete its companion. Conversely, having gold left over would seldom be acceptable.

To make the Eros earrings, we might suppose that the goldsmith would start by dividing the available gold into two parts, one to form each earring. It is not surprising that the two earrings in an ancient pair typically match in weight to within a fraction of a gram. Next, each of those two parts would have been subdivided into smaller portions from which to make each of the components of the earring. A certain fraction to form the body, another for the wings, and so on. This allocation would be based on experience and the traditions within the jeweler's particular workshop or family unit. Detailed study might allow us to recreate the likely approach to apportionment, but the basic principle can be seen in a far simpler ornament type. The well-known "tablet bezel" form of Early Byzantine gold rings was usually made from just two pieces of gold,



Figure 1.22

*Drawing of the way in which the gold might be allocated into two equal amounts to make a typical Early Byzantine “tablet bezel” ring.*

the hoop and the bezel. From the numerous examples of these I have examined over the years, it strikes me that these two components were often of near equal weight.

So, as figure 1.22 shows, a piece of gold might be divided into two and these used to form the hoop and bezel. The many fakes of such rings are often, but not always, cast in one. A similar easy apportionment could work with some of the circular medieval Byzantine enameled medallions with the heads and shoulders of saints (Figure 1.23). As shown here, these were often in two layers of gold sheet, the upper one thicker. In theory, a piece of gold, a coin perhaps, could be hammered into a thinner, smooth disc. The round piece cut out to accommodate the head and halo was then hammered thinner still to form

the lower sheet and the gold cut out for the shoulder recess would be hammered thinner and cut into the cell walls. Whether this hypothesis is correct or not, the basic principle of allocation was described by Theophilus in the 12th century. He explained how, when making a small chalice, the bowl took half the available silver, the foot and paten a quarter each.<sup>21</sup> With Theophilus’s chalice, the tablet bezel ring, or a Byzantine enameled, precise weighing was almost certainly unnecessary, because the goldsmith could judge with sufficient accuracy by eye. I suspect the same was true with many of the more elaborate ornaments. Never underestimate what an experienced craftsman can judge by eye. Indeed, weights and scales are not always useful here. You cannot use a scales and

weights to work out where to cut an ingot into two; you can only check the accuracy with which you have done so after cutting it. The simplest way to divide an ingot exactly in two is to find its point of balance and cut it there.

Nevertheless, the allocation of gold for ornaments that involved a substantial number of minute components is a mystery to me. Consider, the Greek gold necklace, the center section of which is shown in figure 1.24. The necklace is constructed from around 1500 minute wire links and other components. Some necklaces have twice this many. How could a goldsmith, presented with a set amount of gold by a customer, work out how many links they would need and the right length and diameter of the wire to make each of these? Either there was more flexibility in the provision of gold for elaborate pieces or it was a case of considerable experience with the goldsmith using formulaic procedures for apportioning the gold that were passed down from craftsman to craftsman.

We might not understand the designing processes and limitations for gold jewelry in antiquity, but we cannot deny the incredible combination of planning and experience that went into making some of it.



Figure 1.23  
Drawing showing how a piece of gold, perhaps a coin, might be divided effectively to construct a Middle Byzantine enameled medallion.



Figure 1.24  
The center section of a gold necklace with chains and central medallion. Greek from Italy. Circa 300-200 BCE. Diameter of medallion about 4.5 cm. © Metropolitan Museum of Art, New York. 13.234.1. [OA]