CLASSICAL LOOP-IN-LOOP CHAINS

AND THEIR DERIVATIVES

JEAN REIST STARK
AND
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This book is a tribute to the beauty and variety of a chainmaking technique that has been in use for over five thousand years. We dedicate it to Robert Kulicke, who introduced us to the exciting and fascinating world of ancient jewelry and its technology.

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Photographs by Jean Stark

FOREWORD

This is not only a book of instruction in chainmaking but it is also a work celebrating man's continuous creativity over thousands of years. At times something that man creates has far-reaching effects; an example that quickly comes to mind is the wheel, which has enabled many developments, from pottery to computers. At this point it is important to note that these same wheels could not have been made without metal tools.

From early Neolithic times on gold was a favorite choice in the making of jewelry. During the Neolithic period these "shining stones," probably alluvial, were prized. Actually gold was cold worked as if it were a stone. There is a surviving example of cold-worked gold from Catahuyuk (present day Turkey) estimated to have been made in 6500 B.C.

There were only four metals on the earth's surface that were found in sufficient quantity to be used: gold, copper, silver, and meteoric iron. An understanding of the malleability of gold, and of the annealing effect of fire, changed jewelry making; new forms were found. Gold was no longer a piece of stone but a material that could be flattened and made very thin. Sheet and foil are the oldest forms of worked gold. The smiths' tools were stone, wood, and horn. Those ancient smiths, the feared, the revered guardians of fire, surely noticed what happened to metals in their hot charcoal fires and how blowing on them increased the heat! Indeed, charcoal was the fuel used by goldsmiths until the eighteenth century. Today, there is always a block, usually brick sized, of charcoal on every goldsmith's bench.

Goldsmithing has a long and distinguished history. Jewelry dating from 2500–3500 B.C. was found in ancient Mesopotamia at Ur of the Chaldees, the biblical Sumerian city. Gold was mentioned in the Ur tablets and found in quantity in Sumerian cemeteries. The skills shown in these works are so advanced that one thinks there must be earlier pieces as yet unfound. These are masterpieces of goldsmithing: chains, gold flowers for the hair, earrings, necklaces, and finger rings. The Sumerians also inlaid lapis and carnelian and agate, developed filigree, and attempted granulation.

Prehistoric goldsmithing took place in Western Europe and the Near East in the Neolithic and Bronze Ages. The histories of goldsmithing in Africa, the Far East, and South America are very different. It is most interesting that these ancient Sumerian goldsmiths actually made loop-in-loop chains from wire! For example, at Ur 29 a headband with beads of lapis lazuli, carnelian, and chalcedony attached to a gold loop-in-loop chain made from wire was found.

The making of wire is a tremendously important advance, almost on a par with the wheel in terms of its effect on mankind's production. Jewelry, as we know it, could not be made without wire, links, jump rings, and chain. Chainmaking would be impossible without wire.

Before wire was made, smiths had discovered gold's most important properties: malleability and ductibility. First they hammered it. Gold can be hammered laterally because of its malleability. Once hammered, strips can be cut and made into wire. Its ductibility permits drawing.

In *An Illustrated Dictionary of Jewelry,* Harold Newman defines wire as "metal in the shape of a thin thread or a very slender rod usually flexible and circular in section." Jack Ogden, in *Jewelry of the Ancient World,* tells us that wire's origin is in "ribbons of gold" that were used to bind together parts of objects that were made of sheet gold. In ancient times strips of gold were cut with flint chisels. One of the ways of making wire was to roll these strips between two hard, flat surfaces. Another was to hammer them. Yet another method used as early as 3500–3500 B.C. was strip drawing. Perhaps this was done by pulling wire through a bead or a bone. Also, narrow gold ribbon can easily be twisted into a spiral like a "drinking straw" or twisted about its own length to make wire. From about 2500 B.C. until 2000 A.D. or more than four thousand years, wire was made by twisting strips. The ancient smiths must have been very efficient, because in their times, a great quantity of wire was needed. A Hellenistic necklace may use up to twenty yards of fine gold wire!

In Roman and Medieval times the draw plate was developed. This tool enabled the smith to produce wire more easily and in any length required from a ductile metal. Just think that it only takes one ounce of gold to be drawn into a thirty-five mile long filament!

Archeologists tell us that some sort of draw-plate was used by the Persians and also in Roman times. It seems to have been perfected in the Medieval period. In *On Diverse Arts,* written in the mid-twelfth century, the monk Theophilus, a brilliant craftsman, described the medieval draw-plate as "two iron plates, three fingers wide and pierced with three or four rows of holes through which wires may be drawn."

Chain is made from links of wire. The chain of precious metal is and was considered to be a jewel. Chains are found in many shapes and designs: necklaces, bracelets, earrings, and belts. Links and chains are also important in connecting parts of an ornament.

The basic unit of a chain is the link; this is also called the loop. Usually round wires are used to make links. These are produced by bending a piece of wire and fusing or soldering the ends together. The links are joined by weaving. In *Metal Techniques for the Craftsman* Oppi Untract says "repetition of units, flexibility and endlessness are ideas inherent in the concept of a chain." This seems to be a poetic understanding.

The authors of this book are to be congratulated for carrying out a tradition that is almost as old as man's known history. Using ancient chains as their models they pull the chain like fine wire into the twentieth century by proposing new patterns and designs. This is a fine work by the

best of craftspeople. A special tribute must be paid to Jean Stark for the legibility, clarity, and linear beauty of her drawings.

Among the readers and users of this book many will surely carry the ideas and techniques into the new century. It will then be their turn to thank their teachers by showing others.

Noma Copley

PREFACE

For years, my students have been asking me to organize the materials on chainmaking that I present in workshops and classes into a book; finally, with my sister, I have been able to meet their requests. The result is this manual, which describes and illustrates procedures for making a variety of chains based on the ancient loop-in-loop technique. We have tried to make the directions clear enough so that a person with some knowledge of the basics of working with silver and gold will be able to make satisfactory examples of these chains with only the book as a guide, assuming that he or she follows the procedures exactly.

Although directions for making classical loop-in-loop chains have appeared in recent books on jewelry making, no detailed instructions for projects are provided in these. The learning patterns of students at the Kulicke–Stark Academy and in my workshops over the last twenty-five years have indicated a need for instructions that are organized around projects, and our book has been designed and written with these patterns in mind.

In this book, we explain the techniques used in making these chains, show how to make all of the classical loop-in-loop chains, and, in addition, show how to make some interesting contemporary derivatives. Since little needs to be added to the equipment of the basic jeweler's workshop, goldsmiths and students will be able to use this book to construct and study chains with a minimum investment in special tools. There will be those who have made these chains and have developed procedures that differ from ours. We believe that there is no "one correct way," and our instructions represent approaches to and refinements of techniques that have evolved with us. As goldsmiths work and become more experienced with these chains, each will develop his or her own techniques to maximize efficiency and success.

The book begins with a brief historical overview and continues with a chapter that describes the equipment and basic techniques that are the foundation for making all loop-in-loop chains. Each basic chain type together with its ancient and modern variations is put into a separate chapter. In each chapter, the first chain is the simplest to make of that type, and usually is the most ancient. As one moves through a chapter, the chains become more complicated and the modern variations are given. For the most part only the steps in a variation that are significant departures from those for making the basic chain are fully described and illustrated. The final chapter describes the construction of simple, appropriate clasps for each chain type. In addition to the photographs that illustrate the chapters, the appearance of a chain is shown in a drawing at the beginning of the instructions for its construction.

We have attempted to include all the information needed to make these chains, and, with as little duplication as possible, put this where it will be most helpful. The basic tools needed for all or most of the projects are listed in Chapter 2 and in most cases they are illustrated and discussed. A complete list of the tools used in the book is included in the Appendix. We have also included a glossary, and if an unfamiliar term is encountered and not promptly explained in the text, students should be able to find it there.

We list the materials and any special tools needed for each project at the beginning of the directions and have tried to give the lengths of wire and the number of links that will be required to make a chain of a specified length. Because of individual variations in technique, these amounts can only be approximations, and we advise students to have extra supplies on hand until they have had enough experience to make estimates based on their own working styles.

The names we use for most of the ancient chains are those most commonly employed by modern English-speaking goldsmiths. Following suggestions made by students, we have tried to let a name indicate something about the construction of a chain; thus the quadruple loop-in-loop becomes the two-way double (now allowing for a two-way single), and the sailor's becomes the pinched loop.

For much of the information contained in this book, I thank all the friends, associates, and students who have supported me so well over the last twenty-five years with their encouragement, questions, advice, tips, procedures, and especially their enthusiasm. I wish to acknowledge the contributions of the Kulicke–Stark Academy to the development of many of these techniques and also its role in establishing them as significant paths for modern jewelers to follow, both as designers and craftsmen.

A number of people have aided in the preparation of this book. We thank Noma Copley, Phil London, and Julia Woodman for reading a draft of the manuscript and for their helpful comments. We thank our editor at Chapman and Hall, Henry Flesh, for his patience, knowledge, and prompt and effective responses to our questions. We thank our husbands, Bernard D'Andrea and George Smith, for the many errands and chores that they have cheerfully done and for putting up with wives in the throes of authorship.

Finally we especially want to acknowledge the contributions of Amy Stark Cote, who worked on many chain projects in the past, and our chainmakers: Sara Ryan, Wendy Emery, Jan Wunch, Jane Ferrar, Cal Gangi, and Stephanie McNamee, who tested our directions by making many of the chains and who provided us with invaluable feedback. We express our heartfelt thanks for their much-appreciated assistance.

Jean Stark

Chapter 1

ORIGINS AND APPLICATIONS OF LOOP-in-LOOP CHAINS

The loop-in-loop was the predominant chain type used for gold and silver jewelry from the early Bronze Age in the Middle East, through the Classical period until the end of the Middle Ages. Among the earliest surviving examples of loop-in-loop chains were those discovered in the royal graves at Ur which have been dated to around 3000 B.C., but mastery of the problems associated with the technique and the quality of the craftsmanship indicate that simple chains of this type had probably been produced for some time before this. Loop-in-loop chains also have been found in jewelry from Troy II, from prepalatial Crete, and from Egyptian burials of a somewhat later date (2100 B.C.). Since there is evidence of trading contacts between some of the

FIGURE 1.1
Basic Loop-in-Loop Chain Types (from top to bottom): Single, Double, Pinched Loop, Two-Way Single, Two-Way Double.

centers of civilization during the early Bronze Age, the place where loop-in-loop chainmaking originated cannot be definitely determined.

The earliest examples are single loop-in-loop chains, but double, two-way double (quadruple), and three-way double (sextuple) chains and pinched loop chains appear in jewelry dated from the early part of the second millenium.

There were no significant innovations until the seventh century B.C., when Greek goldsmiths developed the technique for weaving several rows of loops into a strap; this became a prominent feature of Etruscan, Hellenistic, and Roman jewelry. By the third century B.C., multirow necklaces woven from either single loops or pinched loops soldered together had appeared in Hellenistic jewelry, as did the incorporation of gemstone beads into chains during weaving. Both chain designs became more prominent during the Roman period.

FIGURE 1.2
Strap Necklace, 6th Century B.C. Greek

The loop-in-loop technique spread through Europe from Italy and the Mediterranean regions to Germany, the British Isles, Scandinavia, and Russia. During the Byzantine and Medieval periods the more elaborate forms were gradually replaced by chains made by other methods, but the simpler loop-in-loop chains, particularly the cordlike double variations, continued to be made. From the Renaissance to the nineteenth century, loop-in-loop techniques were used rarely, if at all, by European goldsmiths.

By the Hellenistic period, loop-in-loop chains were made in eastern Asia, where, especially in India, the technique was important for more than a thousand years, and then significantly declined both in Asia and Europe. However, in a few isolated areas loop-in-loop chainmaking continued through the tradition of handing down craft skills in families; these chains are frequently found associated with folk art.

The archeological excavations which began in the eighteenth century awakened an interest in classical jewelry making techniques as goldsmiths attempted to duplicate ancient pieces. Castellani, the most significant of the Nineteenth Century jewelers, replicated many of these pieces and extended the techniques to the creation of new designs. The work was continued by his sons and by goldsmiths whom he trained, and lasted for about fifty years from around 1830 to the 1880s.

In the latter part of the twentieth century at the Kulicke–Stark Academy of Jewelry Art in New York City, techniques of ancient jewelry making were researched, redeveloped, and taught. Here, fused links were redeveloped and popularized and the technique was adapted to modern equipment.

Modern goldsmiths use a variety of names for these chains. Although loop-in-loop is the widely accepted generic name today, confusion exists with respect to the terminology associated with some of the different forms. The terms single and double loop-in-loop are appropriate and self-explanatory (foxtail is a machine-made chain that looks very much like the hand-made double loop-in-loop) but a variety of names exist for several of the others. Our aim was to find and use names that are simple, clear, and, if possible, to some extent describe the construction. The most significant innovations are changing the name of the sailor's chain (also known as the figure-eight loop-in-loop) to the pinched loop chain, and using the names to indicate the orientation of the higher orders of single and double loop-in-loop chains. This provides appropriate names for the multidirectional single weaves (two-way single, three-way single, etc.) as well as the multidirectional doubles. Thus the quadruple loop-in-loop becomes the two-way double, the sextuple loop-in-loop becomes the three-way double, etc.

Today, goldsmiths want to make these chains for a variety of reasons, which may include the desire to own a copy of an antique piece of jewelry, the desire to have a beautiful and unique piece of jewelry, or the interest in using these techniques to create new jewelry designs, since these chains can be worn alone as complete pieces or can be used as components in many jewelry types.

The following brief selection of books provides further information about goldsmithing in the ancient world. Although information about chains is scanty in all of these, some material can be found and it is a rewarding challenge to seek it out.

Anne Garside, *Jewelry, Ancient to Modern,* Viking Press with the Walters Gallery, Baltimore, 1979

Reynold Higgins, *Greek and Roman Jewelry,* University of California Press, Berkeley, 1961

Jack Ogden, *Jewelry of the Ancient World,* Rizzoli, New York, 1982

Dyfri Williams and Jack Ogden, *Greek Gold,* British Museum Press, London, 1994

Geoffrey Munn, *Castellani and Guiliano,* Rizzoli, New York, 1984

Chapter 2

GENERAL INFORMATION

USING THIS BOOK

Although loop-in-loop chains are not difficult to make, their construction can require varying amounts of time, patience, and materials depending on the choice of chain type and size. There are three basic chain types: single-loop (one loop through one loop), double-loop (one loop through two loops), and pinched loop or "sailor's (one loop through one loop at right angles to each other). All of these basic types can be made in meshlike multiples. In addition, the two-way single and two-way double-loop chains can be expanded into three-way, four-way, and even six-way versions.

The construction of a loop-in-loop chain involves three fundamental procedures: (1) making links, (2) shaping the links, and (3) weaving them into a chain. In other types of chains the open links are successively put through each other, after which the ends of each link are usually joined with solder. The technique used in the construction of loop-in-loop chains reverses this order; first the ends of the links are joined by fusing or soldering, then the links are woven together into a chain.

Fusing involves heating the link under special conditions so that the metal at the join melts and runs, filling the space between the ends. If done correctly, this produces a link that is a continuous loop of the same metal with no joint: a link that can withstand the strain of being woven and that can be worked smoothly into a chain.

In this book, fusing is the method used for joining the ends of the wire circles to make the links. Even though this will probably be a new technique for many, it is not difficult for a person with some metalworking skills to learn. The technique for preparing the fused links described later in this chapter should be used to make the links for all our loop-in-loop chains. Links for all types of loop-in-loop chains are prepared and fused in essentially the same way.

Before links are woven into a chain, they are shaped by stretching, squeezing, and bending. Different chain types are achieved through shaping and weaving, so the directions for making a particular chain type mainly involve how to shape and weave the links. Where some of the procedures are the same for more than one chain, you may be referred back to the first chain in which a procedure is described for detailed directions.

In addition to some background information on loop-in-loop chain construction and directions for making fused links, this chapter contains general information about equipment and supplies, together with advice to help you avoid common mistakes and tips to make the work go more smoothly. It is advisable to read all of the sections on materials, tools, fusing, and weaving in this chapter before attempting to make any of the chains because much of the information is basic to all chains and will not be repeated in the individual directions. In addition, some general practical information is included that will be helpful in making any of the chains. The sequence of groups and of chains in each group is from the simplest and easiest to make to the more difficult. One way to proceed in mastering these techniques is to learn the basic loop-in-loop weaves of the ancient chains that are the foundation of all of the variations. This can be done by following this progression:

First chain: Chain 1, single loop-in-loop, p. 24

Second chain: Chain 6, basic pinched loop, p. 47

Third chain: Chain 11, basic double loop-in-loop, p. 68

Fourth chain: Chain 16, two-way single loop-in-loop, p. 91

Fifth chain: Chain 19, two-way double loop-in-loop, p. 100

Another way might be to make all the chains described in a chapter before continuing on to another chain type.

SUITABLE METALS AND WIRE GAUGES

Fine silver and 22k gold have similar working properties and can be used interchangeably for most jewelry designs. Both are very malleable, can be easily fused, and are clean, that is, undergo very little or no oxidation on heating. Because of the inclusion of copper in the 22k alloy, it is a little more resistant when worked and does oxidize a little when heated, in contrast to fine silver, which does not change under heating.

The directions in this book call for the use of fine silver; in addition to being clean, soft, and simple to fuse, this metal is relatively inexpensive (see the Appendix for a list of some suppliers). All the chains can also be made in gold; for fused loop-in-loop chains, a 22k alloy that approximates the proportions of gold, silver, and copper found in the ancient examples should be used, since some commercial 22k alloys will not fuse properly. This ancient 22k alloy is not readily available on the market except by special order; the Appendix contains information on suppliers and instructions for making the alloy. An appropriate 22k gold alloy can be substituted directly for the fine silver in the instructions; 18k gold wire can be substituted for the sterling silver used for clasps.

Although these chains can be made of sterling silver and 18k and 14k gold, it is more time consuming to make the links, as these metals require that the joint be soldered. Not only does soldering take more time than fusing, but because of the greater hardness of the joint and the metal, it is not possible to get the tight, even weaves that give these chains such a unique beauty.

When making many of the chains shown in this book for the first time, 22-gauge fine silver wire and a 5/16" dowel are specified; some chain designs will require other wire gauges and dowel sizes. The wire gauge(s) and dowel size(s) will always be given at the beginning of the directions for making a particular chain. We specify particular gauges and sizes because these are the easiest to use when learning to make a chain, but both can be varied after one gains experience with the weave. The approximate length of silver wire required for a particular length of chain will be given at the beginning of the directions for each project. Since at first there may be times when one is less successful in making links or weaving, it is strongly recommended that extra wire of the proper gauge be kept on hand, especially when constructing a chain for the first time.

Since every goldsmith works differently, each will bring an individual quality both to techniques and to the pieces produced. Experimentation with minor modifications in the directions may be necessary until the methods best suited to an individual's own style are found. The characteristics of a chain can be altered significantly by varying the specifications for it. Many interesting results can be achieved by changing dowel size and wire gauge; a 1/16" alteration in the diameter of a dowel can make a large difference in the sizes of links made with the same gauge wire, and this in turn can greatly affect the appearance of a chain. Chainmakers are encouraged to experiment with dowel sizes and wire gauges after learning the weave on the first chain. Table 1 in the Appendix gives some wire gauges and dowel sizes for creating variations of basic chains with the greatest aesthetic appeal.

When working with wire, one should be aware that any kind of handling—working it with tools, fingering, hammering, wrapping, burnishing, drawing, etc.—will work-harden it and will necessitate annealing to restore maximum malleability.

BASIC HANDTOOLS AND EQUIPMENT

Most goldsmiths will be familiar with the tools and equipment on this list; however, it is important to note the special requirements for some of the tools and supplies that are used in making loop-in-loop chains. Below is a list of the basic tools that you will need; the special requirements for the ones that are followed by an asterisk are important and are explained in the text. If additional tools are needed to make a particular chain, they will be given at the start of the directions. Lists of all the tools and equipment used to make the chains in this book can be found in the Appendix.

Dowel set*

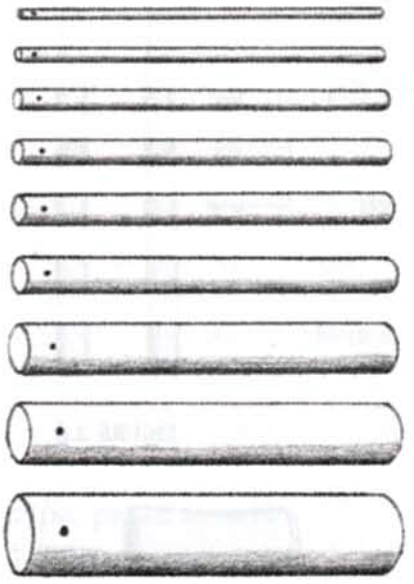

FIGURE 2.1
Dowel set*

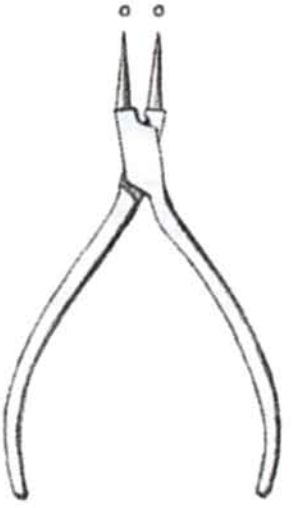

FIGURE 2.2
Small (⅞″) round-nose pliers*

Small (⅞″) round-nose pliers*

1″-1½″ round-nose pliers

Small (⅞″) chain-nose pliers*

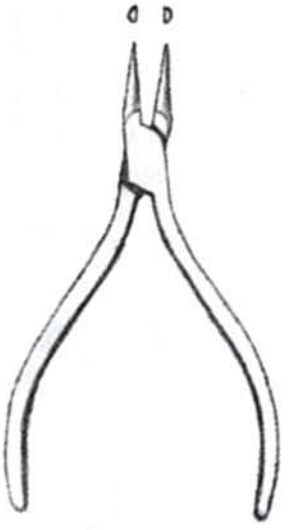

FIGURE 2.3
Small (⅞″) chain-nose pliers*

Jeweler's saw and No. 05 or 06 blades.

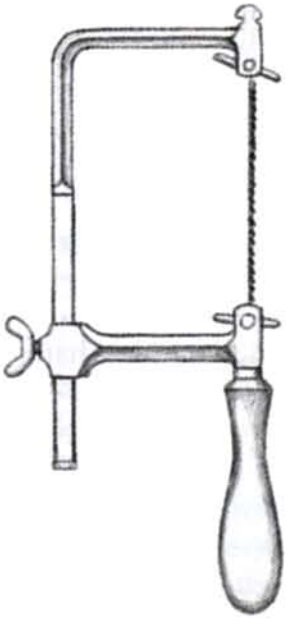

FIGURE 2.4
Jeweler's saw

Two metal blocks

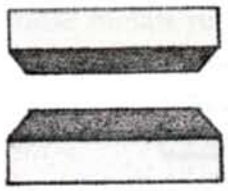

FIGURE 2.5
Two metal blocks

Two scribes of the same size

FIGURE 2.6
Two scribes of the same size

One pair of fine tweezers for forming

One pair of tweezers for firing

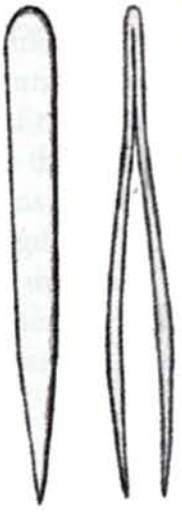

FIGURE 2.7
One pair of fine tweezers

Scissors or snips

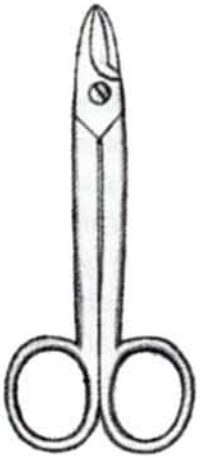

FIGURE 2.8
Scissors or snips

FIGURE 2.9
Leather (or plastic) mallet

Leather (or plastic) mallet

Small planishing hammer

FIGURE 2.10
Small planishing hammer

Files—medium (2-cut or 4-cut)—rat-tail, barrette, half-round

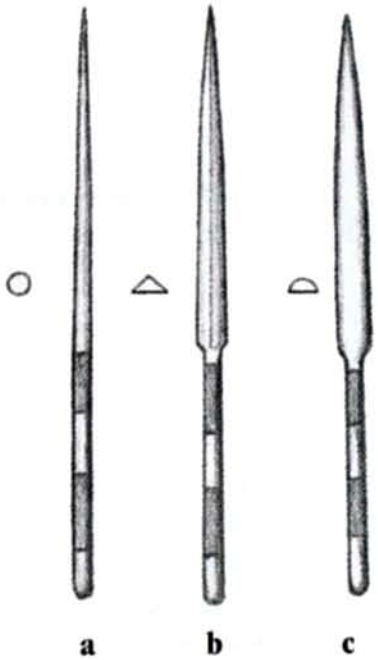

FIGURE 2.11
Files—medium (2-cut or 4-cut) a. rat-tail, b. barrette, c. half-round