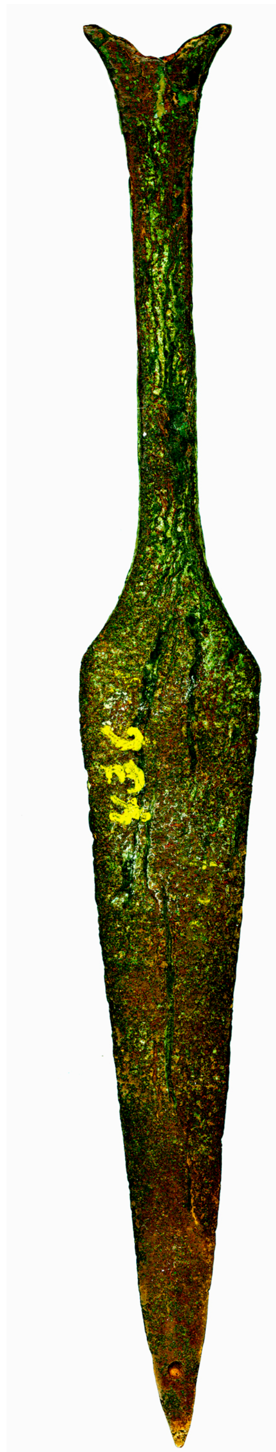
GREAT LAKES COPPER RESEARCH
COPPER JOURNAL



VOL. 3 NO. 1 **MARCH 2007**

Great Lakes Copper Research

Americas And The World

MISSION STATEMENT

The purpose of Great Lakes Copper Research is to add to our reservoir of knowledge on the subject of man's early use of copper, his exploration, mining, trading, crafting and use of copper, firstly in the Great Lakes area, secondly in the Americas, and finally in the world.

In pursuit of this knowledge, Great Lakes Copper Research will:

1. Collect and archive historical documents and research material relating to prehistoric use of copper.
2. Supply a repository for artifacts relating to copper mining, crafting and use.
3. Provide library services and materials pertaining to the early utilization of copper.
4. **Furnish a museum for public display of copper and copper related artifacts to increase interest in this area.**
5. Advance the study of early copper related subjects matter by providing facilities and scholarships to students for the study of copper related topics. Make grants to universities and individuals to complete carbon testing and other costly procedures relating to the advancement of knowledge about early copper use.
6. Train and provide public speakers on the subjects of early copper mining, manufacturing and use.
7. Engage in all other tasks to advance knowledge about the early use of copper in man's history.

We believe the study of early copper use will significantly increase our understanding of human development.

Great Lakes Copper Research
7890 West Leonard Street
Coopersville, Michigan
49404

GREAT LAKES COPPER RESEARCH
COPPER JOURNAL

THE

SWALLOW TAIL

ISSUE

TYPING THE SWALLOW TAIL PROJECTILE POINT AND IDENTIFYING SOME OF ITS CULTURAL MATES USING THE ORPHAN PARADIGM

By
Don Spohn

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Great Lakes Copper Research

Great Lakes Copper Research is a nonprofit organization established to collect information about prehistoric prospecting, mining, crafting, trading and use of copper; first, in the Great Lakes Area, second, in the American and finally, in the world. Although we use and value the literature, our research is base primarily upon a through examination and analysis of copper artifacts.

As our goal is the advancement of knowledge, we seek no profit. The fruit of our labor is free. We have nothing for sale.

We encourage input from others with parallel interest and a thirst for knowledge. Time, talent and finical resources are important to us, but our collection of data is based above all else, on weighing, measuring, and analyzing copper artifacts. Long term or permanent access to copper artifacts is, therefore, indispensable to our success.

Our Copper Journal

The purpose of our copper journal is to share knowledge. It, like the knowledge we labor for, is not for sale. What we publish in this journal is limited to what we believe to be true. What we believe to be true must be based on facts, but as the interpretation of facts is somewhat subjective in the social sciences, it is always open to revision. We welcome new facts and the reinterpretation of old facts, even if doing so requires admitting we were wrong.

This Issue Of Great Lakes Copper Research Copper Journal

This issue of our copper journal is dedicated to one subject, the typing of a single prehistoric copper artifact. Charles E. Brown made the first real attempt at a copper typology in 1903. He opened the door with the lament; there are so few students and so many collectors.

A quarter of a century later (1928) George West built upon Brown's work. Both used old Wisconsin collections as the basis of their typological studies. In 1940 George Flaskerd continued the quest for knowledge with a typology study of copper artifacts collected in Minnesota. Warren Wittry completed our latest typological study (based on Wisconsin copper) in his 1950 Bachelor of Arts thesis.

It is now time to build upon the foursquare foundation prepared by our Fathers of Typology. It is no longer sufficient to assemble types around prominent features found on artifacts across time and space. If types are to be useful in garnering knowledge about the ancient people who engineered and used them, they must rest upon sets of characteristics peculiar to the individual cultures that crafted them. A type must represent the culture that crafted it.

It is a fact, more than 90 percent of our copper artifacts have no archaeological record. This unfortunate circumstance has made cultural assignment difficult. Few have recognized this problem or worked to overcome it.

The Orphan Paradigm

Abstract

This report is a summary of findings rendered from our first use of the Orphan paradigm, one developed to assign type and culture to artifacts shorn of their archaeological record. 'Taxonomy,' is the major tool utilized in this paradigm and is defined as the exploitation of typology and nomenclature to identify sets of characteristics associated with specific types and cultures. Two other tools are: 'historical markers,' defined as (a) patination, (b) stages of oxidation and (c) erosion patterns, all natural markers requiring time to develop and mature, and 'creation marks,' defined as still visible tool marks or metallurgical reaction marks caused by man.

This research is based upon the theory that there are an infinite number of ways most copper artifacts could have been crafted. A coppersmith eliminated all but one, and his choice was directed by two guiding principles, intended use and culture.

In using the Orphan paradigm to reunite artifacts with their parent culture, we cannot always recognize the parent culture by name. That culture can be named, however, by identifying artifacts with identical sets of characteristics already assigned to a known culture. The parent culture can be further identified in distribution studies. This research prepares a foundation for such association and distribution studies.

Introduction

Typologist requires prolonged access to thousands of copper artifacts with quality archaeological records. Three reservoirs of copper exist, museum collections, copper excavated by archaeologists and private collections. The archaeologically excavated reservoir is small, scattered and inaccessible. Museum collections lack archaeological records and were sorted by what old collectors found interesting and valuable. The private reservoir is huge, growing, and inclusive. Recovered with metal detectors, private collections possess little provenance data and no archaeological records.

The typologist who requires prolonged access to thousands of copper artifacts with good archaeological records is doomed to failure. Necessity is the mother of all inventions. And so the Orphan paradigm was born. It would be a better world if our citizens valued history, passed millages, and provided archaeologists with funds to replace metal detecting with controlled digs. Shall we, then, deny knowledge because the world is imperfect?

In the following research we explain how the Orphan paradigm is used to assign type and taxonomic class name to a prehistoric American Indian copper artifact. Using cultural mates already identified, the projectile point is assigned to the culture that appears to have created it. Terms are defined as used in this research and the reader is referred to line drawings and photographs, which depict terms and concepts involved in understanding and using the Orphan paradigm. Further terms are defined in appendix No. 5.

The Orphan paradigm is not a quick fix; rather its genesis began in 1939 with this researcher's first recovery of a piece of American Indian copper. It has experienced dozens of revisions over a period of many years and is based upon an examination of 10,000 pieces of copper. This first published revision is founded, in part, upon the completion of a taxonomic classification of modified pieces of copper (Spohn 2006: 9-13). It is based, too, upon the taxonomy contained in this report and upon the patination categories, stages of erosion, erosion patterns and creation marks' analysis summarized in the appendix of this paper.

Finally, the Orphan paradigm has profited from input contributed by other students of copper, especially from assistance generated at Great Lakes Copper Research symposiums, Copper Conferences, 2005 and Copper Conference 2006. The Orphan paradigm works, but it will work even better with further refinements and updates of all its components. We welcome and will benefit from our readers' assistance in the form of input and criticisms.

A. TYPOLOGY

In this research typology is defined as the scientific study and systematic classification of copper artifacts into 'taxonomic classes,' especially the taxonomic class, 'type.' Different types of a 'genre,' spear point types, for example, have many characteristics or traits in common, but were created for many uses by a large number of cultures, over a period of thousands of years. They are, therefore, very different in many respects, yet each, studied in its type, reveals strikingly similar and parallel characteristics.

Typology is the methodical study of type details and the sorting of types by culture. Each type is associated with a single culture or with cultures that traded with or were influenced by the primary culture.

We are overdue for the special benefits that occur when members within a branch of science understand each other's language and use that language in classifying objects of study. In this research a unifying language involves taxonomy (typology and nomenclature).

Once taxonomy is in place, artifacts can be classified. Typed copper artifacts are diagnostic and diagnosis leads to temporal and cultural associations. Using this scientific tool (taxonomy), investigators can add much to what is known about the ancient people who prospected for, mined, manufactured, traded, and used copper in North America.

Copper artifacts fall easily and naturally into the following taxonomic classes: See Appendix No. 1.

1. Kingdoms

All prehistoric artifacts are crafted from materials already divided into three 'kingdoms:' plant, animal and mineral. Each kingdom is divided into 'families.'

2. Families

The mineral kingdom is divided into several distinct families. Some of these families are: lithic, bone, wood, iron and copper. Families are subdivided into 'kinds.'

3. Kinds

Within the copper family we have five kinds of artifacts: (1) tools, (2) weapons, (3) ornaments, (4) spiritual and symbolic objects: religious, ceremonial and musical, and (5) economic objects such as modified pieces of copper prepared for storage and shipment, for later use, and for trade.

Copper artifacts are classified by kind according to use and use can change. Man is free to change his mind and often does. A projectile point hammered out as a spear can be used as a knife. Another piece can be worn as jewelry, but function as a totem or charm. We look to the primary function for the most exact classification. See Appendix No. 2, Rules In Classifying. Kinds are divided into the taxonomic subclass, 'divisions.'

4. Divisions

Each kind is subdivided into its divisions. Weapon kind, for example is divided into the axe, celt, knife, projectile points and other divisions. Ornamental kind consists of the bead division, the ring division, the bracelet division and many other ornamental divisions. Divisions are composed of 'genres.'

5. Genres

Each division has its sub-taxonomic classes called genres. The projectile point division has five distinct taxonomic genres, spear points, arrowheads, harpoon points, blowgun dart heads, and atlatl points. Genres are further divided into 'types.'

6. Types

All previous sub-taxonomic classes are aids in diagnosing type. Type is a critical taxonomic class in the study of copper; it is the essence of the copper taxonomic classification. It is the most diagnostic taxonomic class; the one most closely associated to temporal and spatial relationships, and most important of all, type is culturally diagnostic. Each type is associated with a single culture and to cultures influenced by the primary culture. Multiple types for similar utility, associated with a single culture, are proof of experimentation.

Genres are made up of types and there are many types of spear points. Some of the established types include: Rat Tail, Swallow Tail, Serrated, the Ace of Spades and many more. Types are sub classified into 'varieties' of types.

7. Varieties

Artifacts, alike in major details or characteristics, may differ in one or more minor traits. They may be alike in every way except one has a rivet hole, for example, while the others do not. Artifacts showing small but consistent differences are classified as a variety of the type from which they differ.

There is an exception to this rule. If the variety in traits between two artifacts is due to distinct cultures separated by significant time, the artifacts will each require their own type name. We have added to their minor differences the major attributes, culture and time.

We surmise that varieties of a type were created to meet new needs and were reactions to associations with new cultures and new technologies, and one method of dealing with social and ecological stress (Trevelyan 2004). Varieties are proof and example of experimentation.

Varieties may have been used side by side in the same time-period, or change may have taken place over a span of many generations. We know changes in both variety and type occurred in historical times upon contact with Europeans and the availability of western trade goods. Indeed, the whole family of copper artifacts gave way to those of the iron family.

Ancient craftsmen created copper artifacts to meet practical or perceived needs. The various methods they chose to solve those needs were cultural decisions. Types and varieties, as well as artifact parts, segments, traits and characteristics are cultural tags left for us by these men of yore.

The Socketed Ovate point is an example of one spear point type. It has varieties. Three of these are: those with a pinhole, those with a step, and a variety without a pinhole or a step. We know that the variety with the pinhole has the distinct advantage of stabilizing the point on its shaft. The step prevents the shaft from moving forward upon impact. We do not know for sure, however, if the pinhole variety or the step variety were later technological improvements. It is possible that they were used side by side, but for different tasks; one needing the stability of a rivet, another demanding the sturdiness of a step, while the third required neither. Nomenclature is a tool for solving such problems.

Variety is typology's last copper taxonomic sub-class. There are many more taxonomic classes, but they involve segment and part names. The diagnostic tool used to study and assign segment names to individual parts is the nomenclature half of copper taxonomy.

Nomenclature

Nomenclature, as defined in this research, is the science or art of seeing, naming, and studying copper artifacts in their parts, segments, traits, and characteristics. It is the grouping of parts, segments and traits into unique diagnostic sets of characteristics, morphologically diagnostic of the culture that produced them. In our study, 'nomenclature' is a major diagnostic tool. The chief taxonomic classes of nomenclature are described below.

Parts

All Copper artifacts have two or three major parts. Most projectiles points and knives have two major parts, blades and tangs. Axes have bits and polls. Parts are composed of segments and traits. All parts have names and descriptions. See Fig. No.1, Projectile Point Parts.

Segments

Segments are the areas or sub-taxonomic divisions of parts. Blades and tangs are two parts, each composed of segments. Blade segments include the blade surface, cutting edges, blade point, blade base, blade outline and others. Some segments, a median ridge, for example, double as traits. Segments are defined by traits and all segments have names and descriptions. Segments are cultural decisions, cultural tags. See Figure No. 2, Projectile Point Segments.

Traits

Whereas a segment defines the location (tip, base, edge, outline, etc.) of a physical area, trait describes attributes of that area. Traits include rivet holes in tangs, other drilled holes, cross sectional shapes, tails, horns, nibs, serrations, barbs, and other traits. All blades (knives and points) have segment-points, but a beveled point is a trait.

All copper artifacts have cross-sectional segments, but the shape of that segment (round, oval, triangular, etc.) is a trait. An object's surface is a segment, but the convexity of that surface is a trait. Traits are refined cultural tags, each with its own taxonomic name and description. See Fig. No. 3, Projectile Point Segments.

Subjective Elements

Parts, segments and traits are elements easily observed measured and described. Copper pieces may also have subjective elements less easily measured, described, recorded and analyzed. These include elements like smoothness in design and craftsmanship as opposed to roughness, balance in place of a lopsided appearance, symmetry or irregularity, evenness verses imbalance, elegance and beauty, or crude, course and ugly, and other somewhat subjective perceptions.

It is not always clear why some pieces appear more beautiful or right in our eyes, than do others. Sometimes we may compare prehistoric objects to perceived perfection in our environment rather than to crude functional requirements in more primitive societies. At other times we may measure the masterpieces of senior craftsmen against the work of an apprentice. Then, too, cultures sometimes florescence and produce beauty or decline with debased craftsmanship. Base cultures copy more advanced neighbors. And sometimes we don't understand what we study. Despite the cause of what we observe, subjective elements may play a part in diagnosing a new type, or distinguishing a variety of a type already classified.

Characteristics

The characteristics of an object are its unique morphological blend of parts, segments, and traits. Sometimes we identify and include certain subjective elements. A set of characteristics may describe, the whole artifact, or a component elected for study. Unique characteristics distinguish a particular type, and others with near-identical blends, as varieties or cultural mates. All parts, segments and traits that make up sets of characteristics have names and descriptions. Sets of characteristics are even more closely diagnostic of a specific culture, than are traits. Characteristics, type, and culture are closely related. See Appendix No. 4, Swallow Tail Projectile Point Characteristics.

Cross Cultural Studies

The Orphan paradigm is designed to identify type, and individual types are associated with a single cultures or cultural complexes. Cross-culture studies are important in understanding how ideas travel temporally and spatially. An effective paradigm must provide tools for cross-cultural studies. The key for using the Orphan paradigm tools in cross-cultural studies is the temporary 'class' tool.

Any part, segment, trait or characteristic, or sets thereof, may be pulled into a temporary 'class' for cross-culture studies. We can, for example, build a temporary median ridge class by pulling together all artifacts from various cultures, which exhibit median ridges. In such a study we may learn how median ridges were used, the purpose they served and how the median ridge idea traveled or failed to travel through time and space.

We could just as well develop a temporary socketed class with pinholes, or a class with all the characteristics that make up a type such as the Swallow Tail type and call it the Swallow Tail class. On rare occasions, we may find types repeated or nearly reproduced (with most of their identifying set of characteristics) in ancient cultures separated by thousands of years or tens of thousands of miles. In our Orphan paradigm, specific types are limited to individual cultures or cultural complexes, but we sometimes find a type 'class,' a Swallow Tail 'class,' for example, repeated in cultures separated in time and/or space. Such instances are rare and significant differences will be observed.

If the Swallow Tail 'class' is found in other cultures, each must have a separate type name, the Athabskan "Bear Spear Type" and the Atharvavedic "Antennae Sword Type," for example. Both are pulled into a temporary Swallow Tail class for cross-cultural study. On those rare occasions when unique type technologies are found in cross-cultural class studies, successful *primum mobile* investigations will be interesting and rewarding.

In the Orphan paradigm, taxonomy (typology and nomenclature) is used to identify 'cultural tags' and leads to typing. Two other tools assist in collecting supporting evidence. These are 'creation marks' and 'historical markers.

CREATION MARKS ABSTRACT

Many types of tools were used to create various copper artifacts and copper reacted in certain ways to heating, annealing and pounding. Both tool marks and metallurgical reaction marks can sometime be found on copper artifacts and used to analyze and diagnose cultural affinities. Creation marks are not always obvious. Even when clear and distinct they are not consistently diagnostic. At best, creation marks provide supportive evidence. See appendix No. 2.

HISTORICAL MARKERS ABSTRACT

Patination, stages of oxidation (disintegration) and erosion patterns are markers caused by the environment over time. Because historical markers are related to time they can (after accounting for their vagaries and inconsistencies) be compared, graded and exploited to build evidence in identifying distinguishing artifact characteristics associated with cultures. Historical markers are always present and can usually be observed. While some historical markers are reliably diagnostic of great age and a few are consistently correlated with a select few cultures, most contribute clues at best. See Appendix No. 4.

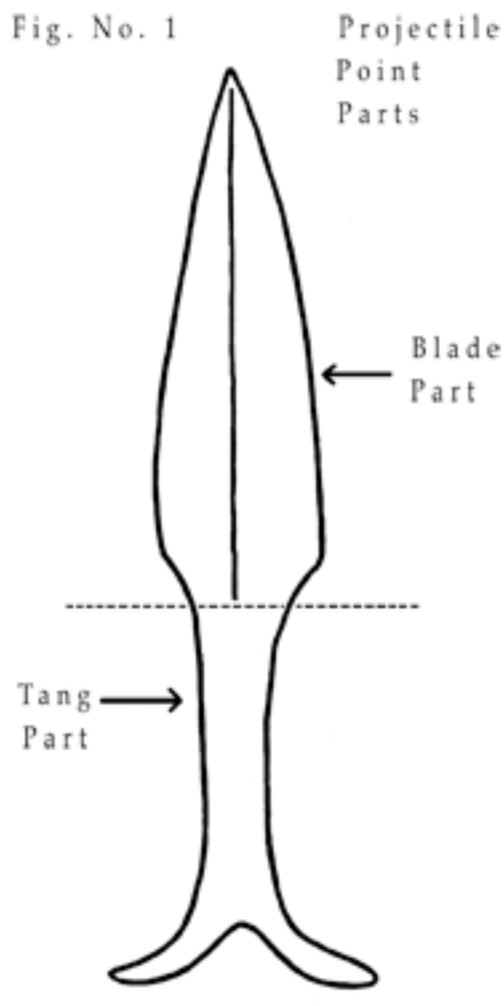
Line Drawings

The following pages contain line drawings and photographs of the Swallow Tail, its varieties and some of its tanged cultural mates. Line drawings also include aids in understanding point nomenclature, Swallow Tail nomenclature in particular, as well as the Swallow Tail rivet arrangement and Swallow Tail technology.

The cross-cultural study associated with the Swallow tail includes only flat tanged projectile points and knives thought to be Swallow Tail cultural mates. Further cross-cultural studies are recommended to determine if some socketed tang types also belong to the larger group of cultural mates associated with the Glacial Kame culture.

Line Drawings And Photographs

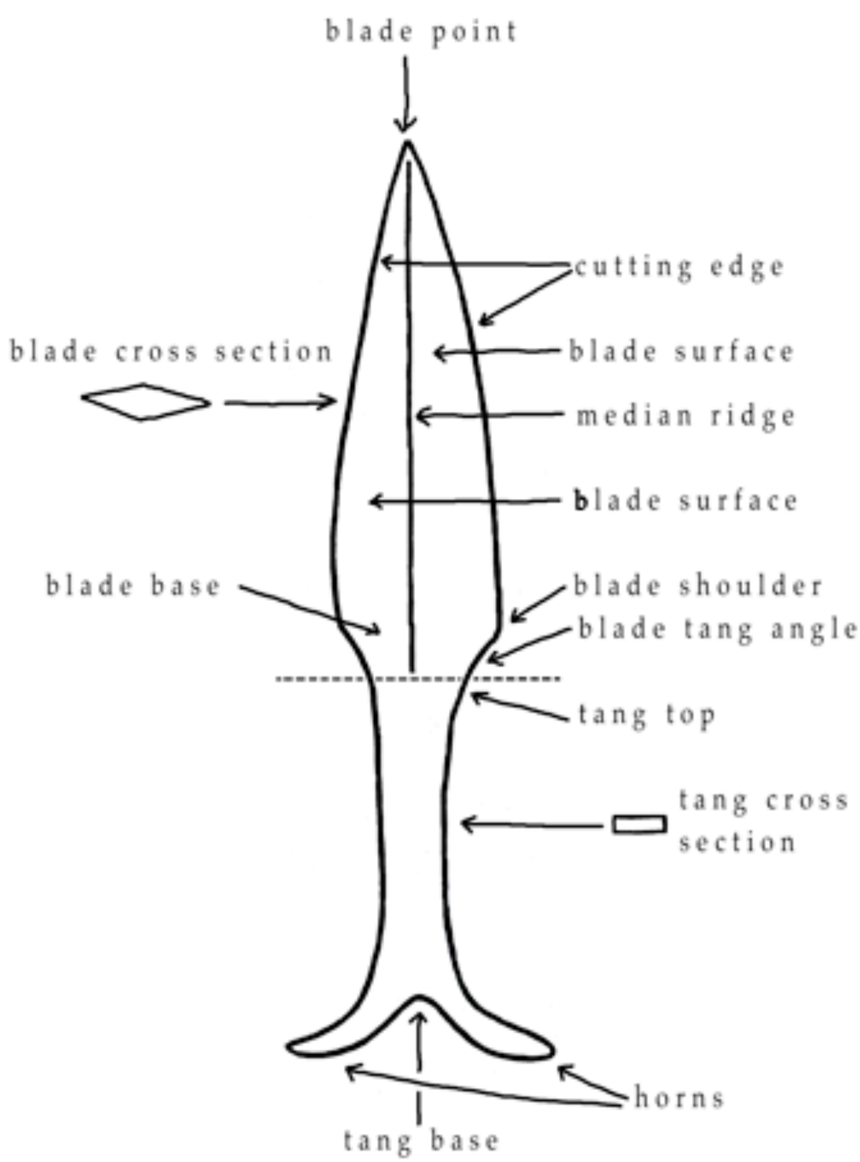
Fig. No. 1
Projectile Point Parts



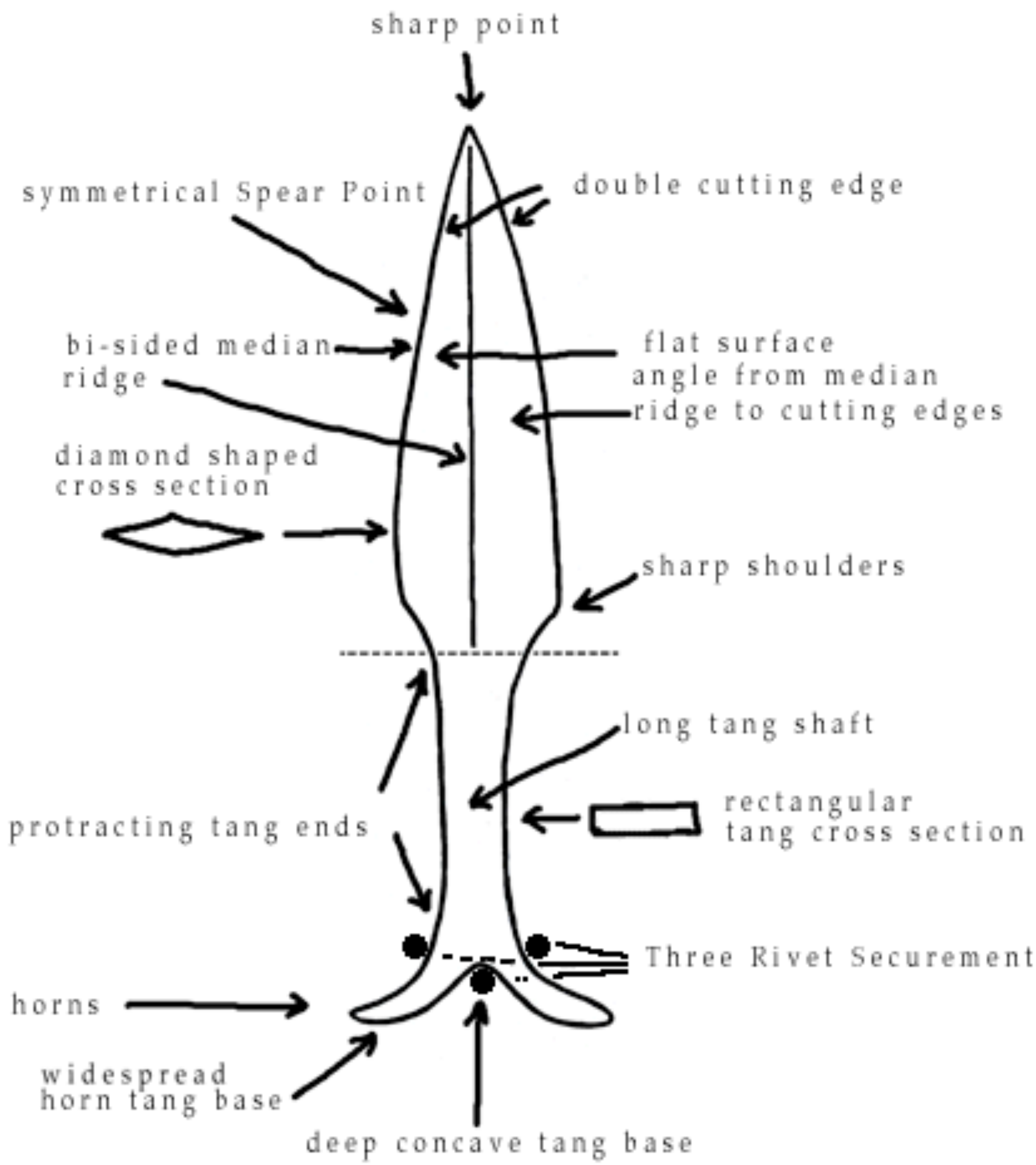
Projectile Points Without Tangs Have A Slightly Different Part Division. See Figs. 2, 3, & 4 On Following Pages.

Fig. No. 2

Fig. No. 2 Projectile Points Segments



Projectile Point Segments
Fig. No. 3
Projectile Point Traits

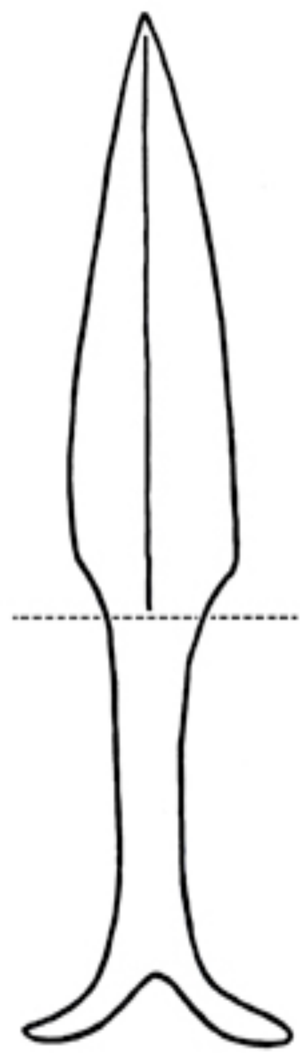


Swallow Tail Type Median Ridge Variety
Fig. No. 4
Type Characteristics

Swallow Tail Projectile Point Characteristics

Blade Characteristics
Symmetrical blade
Elongated slender blade
Thin blade
Sharp point
Double-edged cutting blade
Diamond shaped blade
Median ridge obverse and reverse
Sharp shoulders
Diamond shaped blade cross section

Tang Part Characteristics
Elongated tang shaft
Protracting tang ends
Rectangular tang cross section
Three rivet securement
Triangular rivet arrangement
Horned tang base
Widespread horns
Concave tang base
Thin flat tang



The Swallow Tail line drawing in Figure No. 4 above pictures the tang base horns as they were created, before any damage that was often caused when horns slipped between the two top hafting hafting rivets. See Fig. No 5.

Fig. No. 5
Rivet Arrangement – Hafting Defect

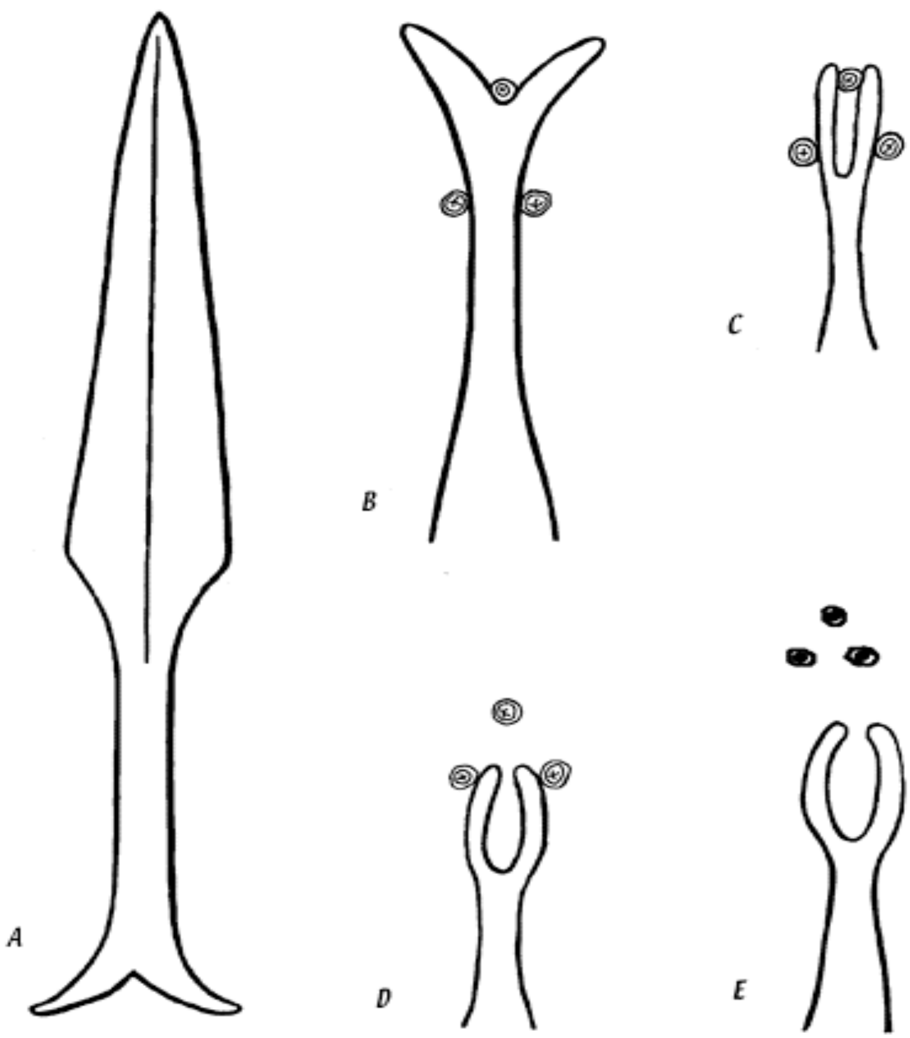


Figure No. 5, A is a line drawing of the Swallow Tail spear point before hafting. B depicts the Swallow Tail with its tang up to demonstrate normal rivet arrangement. The top single rivet in the triangular placement prevented the copper point from slipping back and splitting the wooden shaft upon impact. C and D show what happened when the point became lodged in a bone or entangled in hard tissue. As the hunter pulled on his spear shaft to disengage it from the target, the tang base horns sometimes slipped between the pair of rivets intended to hold the point on the shaft. The twin rivets forced the horns together in an elliptical outline as the copper point was pulled out of its wooden shaft. Found as E, early typologist saw the bent horns as an eye and thus named it, the "Eyed Point" (Brown 1904: 72).

Typing The Swallow Tail Projectile Point

The swallow Tail is a dagger-like, very elegant and unique spear point or knife, long and graceful with smooth, symmetrical curves. The lengthy triangular blade is complimented with median ridges running the full length of the blade, obverse and reverse. A beveled variety exhibits bevels in place of median ridges (Mason 1981: 189) and a Convex variety shows an oval blade and cross cut sectional view. See Fig. No. 7A. The blade itself is sharp on both cutting edges with a pointed blade tip and exhibits sharp or occasional rounded shoulders on the blade base, giving it a diamond-like outline. These blade segments and traits are not unique to the Swallow Tail. Rather, it is the tang part, especially its long graceful horns that sets this utility apart from companion Old Copper culture complex implements. See Figures Nos. 3-4.

The extended horns on the tang base of the larger spear points prevented the spear point from penetrating a target too deeply, separating a vicious prey from the hunter. The shallower penetration also prevented a spear, otherwise thrust in too deeply, from breaking off in a powerful struggling victim. A wounded animal might also carry away a spear thrust in too far. And a strong animal might wrench the spear form the hunter's hands if forced in too deeply, leaving him defenseless. Finally, a controlled penetration allowed the spearman to withdraw the spear and thrust it in again and again.

The larger elegant Swallow Tail was a close-up weapon and could be used against dangerous game like bear, man and other targets that stood and fought. Spears engineered for thrusting in, pulling out, and thrusting in again, faced two possible failures. First, a large bone might stop a powerful thrust and the energy generated could drive the base of the projectile point back into a splitting wooden shaft. Second, in jerking a point from a large animal, the point might remain lodged in the animal. If either scenario occurred, as they surely did so many times, the hunter found himself defenseless.

Copper smiths worked to produce a weapon least likely to fail, particularly against other men and large vicious animals, which might otherwise prey upon the hunter. The Swallow Tail performed this requirement with three rivets placed about the tang and tang-base horns in a triangular pattern. One on either side of the tang, under the horns, preventing the point from remaining in the wounded animal and a third snuggled up above and between the spreading horns, prevented the spear from backing up upon impact and splitting its shaft. See Fig. No. 5.

In the absence of harder metals, copper was greatly valued and often preferred over stone. Still, even hardened copper bent under stress. And the thinner the copper, the smaller its diameter, the more readily it bent. The weakest part of this elegant and uniquely engineered Swallow Tail was its long thin retracting horns. Upon pulling the spear from its target, the horns of the tail sometimes slipped between the twin rivets designed to hold it in place, forcing the horn tips closer together. If not recovered and repaired, Swallow Tails are found with tails pressed together by the two rivets through which they slipped, nearly closed in an ellipse circle. See Fig. No. 5.

Brown (1904: 72) noted the egg shaped enclosure and named this point the "Eyed Point." He thought the tails were purposely crafted in a near circle to receive a single rivet. Of course, with the tail ends pressed together, they could not hold a single rivet nearly so well as when spread apart with three triangular placed rivets, one on either side of the tang, under the horns, and a third in the center bottom of the "Y." West (1928: 70) followed Brown's lead and called the Swallow Tail an Eyed Point and noted its resemblance to an eye. He didn't, however, suggest the eye as a receptacle for a rivet. Brown and West classified Wisconsin points, while George Flaskerd (1940: 35) classified Minnesota points. Even so, Flaskerd kept the "Eye Tang Type (1)" name and he noted the tang base has a notch resembling an eye. He did not suggest its purpose or mention a rivet. See Fig. No. 5.

Wittry (1950: 16-17) recognized a similar point with bevels along the blade edges, but with no tang, which he baptized with a long name, "Stemmed, beveled, flat tang IG1." Wittry also described a variant of this point, alike in every way "but with a notch in the tang base," rather than horns. He pictured a Swallow Tail with bevels running the length of each side of the blade and called it the "Stemmed, beveled, flat tang IG2." The Swallow Tail is thereafter mentioned as IG2 in the literature.

IG2 is a short easy name, but it doesn't call any particular point to mind. Perhaps "Stemmed, beveled, flat tang IG1" does, but unofficially, this graceful copper point has long answered to the name, Swallow Tail. Those who first called it by this descriptive name, did so for the same reasons, they called some points Turkey Tails and named another the Dove Tail. Although the long open horns on Swallow Tail are too fragile for use in flint, the graceful swallow is well honored with this elegant point name. Swallow Tails are found mainly in Wisconsin, but also in Minnesota, Michigan and Canada (Brown 1904, West 1928, Flaskerd 1940, Wittry 1950, Baldwin 178).

Swallow Tail points often show a noble patina and a worm track erosion pattern. They are found in Old Copper culture complex areas in association with Old Copper culture complex artifacts. Although the worm track erosion pattern is common on the Swallow Tail, it is not so consistently present as it is on some Old Copper culture complex points, suggesting Swallow Tails may not be quite as old as some Old Copper culture projectile points. Swallow Tails average 4 to 8 inches in length. The Royal Ontario Museum of Toronto, Canada, curates a foot long Swallow Tail.

There are several variations or cultural mates of the Swallow Tail. First, the blade parts of variants are nearly identical. Nearly all have long blades with median ridges or bevels on both sides. All are somewhat triangular in outline and have angled or rounded shoulders. Most variations are found either in the tang part of the Swallow Tail or in overall subjective perceptions of the Swallow Tail. Variations in the tang are found primarily in the tang base segment and involve horn traits, especially horn traits size, shape and distinctness. Variations are also found in tang length.

Some smaller versions or cultural mates of the Swallow Tail appear to be more useful as knives or atlatl points. The knife and projectile point (cultural mates) have less distinct horns, some reduced to ears or to simple concave tang bases. These are called the Fish Tail variety of the Swallow Tail. See Figure No. 8. There is a correlation between overall size, well-developed horns, distinct overall features, and elegance.

Characteristics of Brown's "Bevelled Point," spelled with two (l's)," (Brown 1904: 71-72 Plate 7) require its classification as a variation of the beveled Swallow Tail. Brown's Bevelled Point" is in turn a variation of the beveled Ace of Spades. See Figure No 7. Five Ace of Spades points were recovered from between the feet of a male in Reigh Site burial 1 (Meyer 1956: 123 Plates 20 & 24). The Reigh site is classified as Glacial Kame (Ritzenthaler 1956: 97). The characteristic sets for the Swallow Tail and Ace of Spades assign these two points as cultural mates with the Glacial Kame as the parent culture. Most Swallow Tails are missing part or all of their tang base horns.

Prehistoric man used countless types of spears. The Swallow Tail class, using spread horns to control penetration, was only one in a myriad of types. Other types of spears required deep penetration. Some hunters preferred a crippled animal encumbered with a spear protruding from its wound. Other hunters used detachable fore shafts, some with draglines. At least, one culture used huge toggle headed copper harpoon spears with one or more rope attachments for large game. The Swallow Tail exemplifies only one copper spear point class, uniquely designed to control penetration.

Cross Cultural Study Of the Swallow Tail Class

The Swallow Tail is unique in another anomaly. Characteristics identifying it as distinctive among prehistoric American Indian copper artifacts, relate it, both in tang and blade characteristics, to a pair of distant copper cultures. Both are significantly removed, temporally and spatially, from prehistoric Great Lakes area Old Copper culture complexes. The first of these is the Athabskan Indians culture of the Yukon Valley in Alaska. Frederica De Laguna explored along the Tanana River, which runs into the Bering Sea, and described the Dena Indians clan of the Athabskans during the summer of 1935.

At that late date (De Laguna 2000: 54-55), the Dena used a copper implement of the Swallow Tail class. "Titus had a bear spear but wanted $10,00 for it, a high price in those days, so I did not buy it. I took pictures of it and a wooden dish and spoon that he had. Titus laughed at this performance. The spear consisted of a large copper dagger, the handle of which ended in a pair of spirals, lashed onto a long pole. The spiral ears (horns) of the dagger blade would prevent the spear from going too deeply into the bear, thereby holding the bear too far away to claw the hunter. Normally the knife would be worn in a beaded skin sheath, hung from the hunter's neck." De Laguna pictures several other Indians wearing similar copper knives of various sizes, hung from belts. This Athabskan Swallow Tail class copper spear and knife appeared to be a common utility among the Dana Indians, and the only metal knife described and pictured by De Laguna (2000: 56,78,81,85 & 99).

The second Old Copper culture to use a Swallow Tail–like implement was the Atharvavedic civilization, an Indo-Aryan culture which flourished along the Ganges River in Northern India, from 4800 to 3500 years ago (Sharma 2002: ix). This time coincides, in part, with our own Old Copper culture complex. The Swallow Tail-like implements produced by the Atharvavedic culture are called Antennae Swords by Indian archaeologists and divided into two types. Type I has a longer (56.9 – 76.6 cm) blade with a sharp median ridge, while

Type II has a shorter, broader (40.5 – 47.8 cm) blade with a much wider convex median ridge (Sharma 2000: 6).

Antennae Swords are found in large hoards with several other types of big heavy copper implements, ornaments and anthropomorphic objects. These artifacts are collectively referred to as Ganges Hoard copper. Unlike our Old Copper culture artifacts, Ganges copper was cast.

Antennae hilts on Ganges copper swords are very much like the "spiral ears" described by De Laguna on Dena Indian bear spears in Alaska. They are even more like the smaller horns found on the bigger well-formed Old Copper culture complex Swallow Tail spear points. Indian archaeologists have measured and recorded, but not commented on the grip sizes of Antennae Swords. Compared with other prehistoric copper implements, these swords are huge, probably the largest copper weapons in the prehistoric world. But their grips are tiny, too short, even for a child's hand.

Most ancient sword grips run at least 3.5 to 4 inches in length. Some are much longer. Sharma (2000: 112) mentions a 4 cm Antennae Sword grip. That is a bizarre 1 & 7/16-inch handgrip. Great Lakes Copper Research curates 2 Antennae Swords, a Type I Ganges Hoard copper sword (nearly 2 feet long) with a 2-inch grip and a Type II Ganges short Antennae Sword (13 inches long) with a 1 & 3/8 inch handgrip.

If one attempted to haft a longer handle behind the horns (antenna), using the horns as a hand guard, physics dictates the purchase would be too week to deflect a blow from a sword or shield of equal weight. The handle would break away form the blade upon first impact. Hafting a handle behind the horns would require a protruding tang; an easy task never performed on a single example of the hundreds of Antenna Swords, but provided on companion Ganges Hoard copper Hooked Swords. The Antenna sword was engineered for deep penetration (thrusting – piercing) into very large animals. It is obvious that Indian archaeologists have misidentified these ancient copper implements. Except for their carefully measured miniature handgrips, they look much like other prehistoric metal swords.

Ganges Hoard copper includes the Hooked Sword that provides a 4-inch and longer handgrip. This leads us to believe Ganges Hoard copper people were not midgets and they knew how to make usable sword grips. If we return to the Dana Indian's explanation for a similar hilt on the end of his weapon, we may understand the Antennae Sword. De Laguna paraphrased the bear hunter's explanation as, "The spiral ears (horns) of the dagger blade would prevent the spear from going too deeply into the bear, thereby holding the bear too far away to claw the hunter."

The Antennae hilt (long horns) surely served a similar purpose and the Antennae Sword is not a sword but a giant copper spear, consistent with other giant Ganges Hoard copper types. And like so many other Ganges types, this big long spear probably used a fore shaft and the wide sturdy horn may have served double duty, securing a dragline. What Indian archaeologists call a handgrip is the area where the fore shaft was secured and around which a dragline was looped.

A careful examination of the weapons contained in Ganges copper hoards is insightful. They are large and heavy. Some are best described as massive. Many are smash up. Some of these were probably killed before interment. A detailed analysis of worn, bent and impaired parts indicates many were damaged in use. Large heavy points are often very blunt, not from use, but in design. One blunt point type was rigged with two heavy spool-like protrusions for draglines and was probably fired from a machine 3500 to 4000 years before the present. Two foot long copper spear points fit well among these ancient copper weapons of the hunt.

Why did the Athabskan American Indians, thousands of years distant in time from the Old Copper culture complex Indians, develop a Swallow Tail class spear so similar to the much earlier Great Lakes area Indians? And how did it happen that an entirely different group of people, half way around the world, but in a similar time period discovers the same spear class? It is easy to answer that all three cultures, having the same raw material and the same needs, simply solved a similar problem in the same way and perhaps that is exactly how it happened.

Still, Indians in South and Central America, and even in ancient Mexico certainly faced these same problems and using copper, they failed to craft a Swallow Tail class spear. Africa is a large area and has a great diversity of spears, yet while using copper they, too, failed to develop the Swallow Tail class spear. Egypt may have used copper first, but they found no need for the Swallow Tail class spear. Mesopotamians used copper early and were the cross roads for peoples and ideas, but they knew not the Swallow Tail class spear or knife. Both the Anatolians and the Balkan people developed early copper industrial centers and experimented with a plethora of axes, knives and projectile points, but they also failed to invent the Swallow Tail class. We can say the same of copper cultures in China and South East Asia.

As far as we know, the unique technology used to build a Swallow Tail class spear was used first by our Old Copper culture complex Indians, followed by the Atharvavedic Indians of Northern India, and much later by the Athabskan Indians of the Yukon Valley. We are not sure why Atharvavedic and Athabskan Indians used the Swallow Tail class technology.

Conclusions

The Orphan paradigm was developed for use in the unfortunate absence of an archaeological record. It is most effective, however, when used in conjunction with the archaeological record. In this study we have used the Orphan paradigm to reunite the Swallow Tail projectile point with its probable parent culture, the Glacial Kame.

The Orphan paradigm can also be used in conjunction with 'class" studies or cross cultural studies to determine the effect or absence of diffusion on the history and development of certain copper technological innovations. Quimby (1960: 62, 1962:78) and Steinbring (Hlady 1970: 71-75), for example, believe that long-term northwesterly diffusion of the waning Old Copper culture may have influenced the Copper Eskimos around Coronation Gulf. If this is true, the same diffusion may have led to the Athabskan Indians' use of the Swallow Tail class technology. It does not, however, explain the Atharvavedic Indian use of the same technology. Further cross-cultural class studies in this area are needed.

Finally, the Orphan paradigm may be used in conjunction with all available evidence to effectively reunite most other orphaned copper artifacts with cultures that produced them. The Orphan paradigm was not designed to replace archaeological records and in no way deflects from the primary importance of archaeological histories. Indeed, with increasing metal detecting activity, controlled archaeological digs are all the more imperative and time is running out.

Front Page

The cover page of this journal pictures, life sized, a classic Swallow Tail spear point and like the cultural mates pictured on the back page, curated by Great Lakes copper Research. The Swallow Tail is 7 1/2 inches in length and, except for a missing horn digitally, replaced in this photograph, it remains in near perfect condition. It shows a worm Track erosion pattern and may be older than some of its cultural mates including the Ace of Spades.

This beautiful Swallow Tail spear point is pictured in the 1978 Specialized Copper Issue of The Redskins Volume XIII Number 4: 48. John Baldwin, editor of the Redskins indicates a Michigan or Wisconsin provenance. This Swallow Tail is also pictured in the 1988 issue of Who's Who In Indian Relics No. 7: 232.

Back Page

In the top row, left to right, 1st and 6th are Ace of Spades, Convex Tang Base variety. The 2nd is Brown's Parallel Point, the Eared variety of the beveled Swallow Tail, The 3rd is a Swallow tail with a reworked blade. No 4 is a Swallow tail, Median Ridge variety. No. 5 is an Ace of Spades, while the bottom two are Swallow Tail types with missing horns.

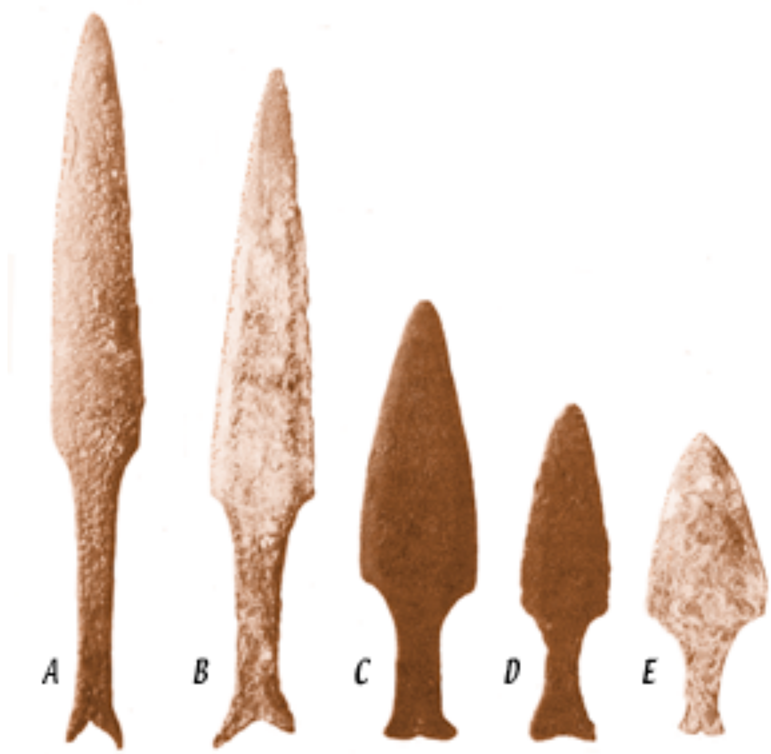
A Tiny Ace Of Spades

The tiny Ace of Spades to the right is a sample of water copper, and has experienced hundreds of years, perhaps a couple millennia, in water or watery soil. It is missing normal tang base ears, or perhaps it never had ears. The expected blade bevels may have worn away in its watery grave. Out of water, it will eventually (a year or two) acquire a black patina.

Fig. No. 6 – Assorted Swallow Tail Projectile Points

A is an example of a Median Ridge Variety of the Swallow Tail with excellently preserved horns and a blade reworked to half size. B is a well-preserved Median Ridge variety. C is Brown's Bevelled Point type or a Beveled variety of the Swallow Tail. D and F are Median Ridge Varieties with damaged horns. E is an example of horns forced into an elliptical eye as they slipped between their rivets (Brown 1004, West 1928). All are probable Glacial Kame.

Fig. No. 7
Progression: Swallow Tail Spear Point Type To The Classic Ace of Spades



Example A is a classic Swallow Tail spear point, but a Convex Surface Variety, whereas most Swallow Tails are of the Median Ridge variety and many are the Beveled variety. B is a classic Beveled variety, named the Bevelled Point by Brown in 1904. C is a much-shortened beveled point probably no longer used as a spearhead. It was most likely used as a knife or atlatl point. Notice that both the blade and tang were shortened. The blade was also widened. The tang base horns shrunk to ears, but it retains the beveled blade. D is an even shorter point; a somewhat elongated Ace of Spades and retains the beveled blade. E is a classical Ace of Spades with the same beveled blade. The blade has become still shorter and even wider, wider than much longer varieties, A and B.

Example E has become different enough in characteristics to be classified as a separate type while retaining sufficient characteristics in common with the Swallow Tail to be identified as its cultural mate. While A and B are distinct Swallow Tails, D and E are obvious Ace of Spades. C is a diagnostic transitional cultural mate, either a variety of the Swallow Tail or the Ace of Spades. In analyzing the patina and erosion patterns of all, we find the Swallow Tail is probably 500 years or so older than the Ace of Spades. Because the Ace of Spades was excavated with an archaeological record (Reigh Site) and identified as Glacial Kame (Ritzenthaler 1956: 97-98), all cultural mates, including some socketed points, were probably created by the same culture. Mason (1981: 172-200) identifies these points as Old Copper culture complex, and the Ace of Spades as possibly one of the core artifacts diagnostic of an Archaic Old Copper culture.

Fig No. 8

Fish Tail Variety of The Swallow Tai

A

B

These two points are crude Fish Tail varieties of the beautiful Swallow Tail pictured on the front cover. A is a land point while B is a water point. Both retain the following blade part characteristics: double edged, symmetrical, a somewhat pointed blade tip, diamond shape (especially B), sharp shoulders, thin blades and beveled blades. They have both lost the elongated blade characteristic.

A's tang part has retained the elongated tang, but lost the graceful curve between the blade base and the tang base. Both have retained ears and a concave tang base. B has lost both the elongated tang and the graceful tang curve between the blade base and the tang base. Both have lost the subjective characteristics elegance and beauty. Both retain sufficient type characteristics to be recognized and classified as Swallow Tail varieties.

These two variations are probably knives or atlatl points. It is not known why the Fish Tail variety lost their elegance and beauty. Cultures fluoresce and decline. Rude cultures sometimes copy sophisticated neighbors. Some tasks need less elegant tools while beautiful examples were sometimes required for ritualistic purposes. And then, we sometimes compare the master's work with that of the apprentice.

It is most likely that the crude Fish Tail variety represents a debased culture or a baser culture associated with a more sophisticated one. The Fish Tail variety appears to be as common or more common than the classic Swallow Tail. Fish Tail knives and points are found at typical Old Copper cultural complex sites. They may be younger than the Swallow Tail variety.

Fig. No. 9
Athabskan Indian Bear Spear

A

B

A is an Athabskan Indian copper Bear Spear. B is a close up of the same type, dagger variety. Both are of the Swallow Tail class with nearly identical characteristics: elongated flat symmetrical double edged dagger-like blade with beveled edges and sharp shoulders which give it a diamond outline. One exceptional blade characteristic is its beveled point. Stefansson and Jenness collected several types of copper hammered points with similar double blade and point bevels in the Coppermine River-Coronation Gulf areas (Steinbring 1970: 70-75). The point tips on these types appear to be broken off and re-sharpened in a beveled form.

The tang characteristics of the Bear Spear type are also like the Swallow Tail with a long graceful symmetrical tang, retracting down from the blade base and protracting to the tang base. The tang base grows into two graceful horns. These horns are exaggerated in curled feather appearing horns on the Bear Spear. The handgrip is about 4 inches.

Fig. No. 10 Atharvavedic Antenna Sword Type I And Type II

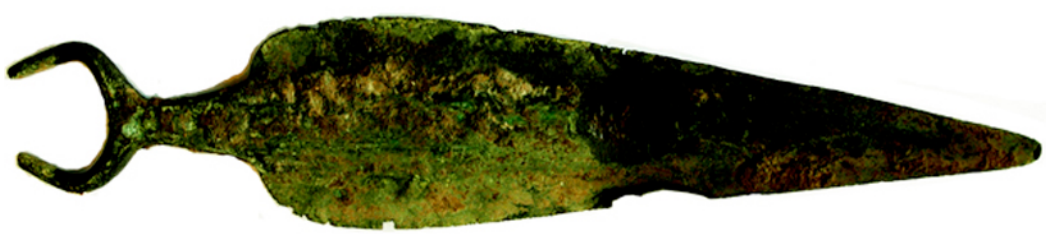
A

A, is a 2 foot long Type I Antenna Sword. It has all the type characteristics of the Swallow Tail type and the Athabskan Bear Spear with three exceptions: (1) It is much larger, but (2) the handgrips are much smaller than the Athabskan Bear Spear, and (3) its point, like the Swallow Tail and unlike the Bear Spear is not beveled.

Blade characteristics are: elongated, thin, double edged, asymmetrical, with a median ridge and sharp shoulders giving the blade a somewhat diamond shape in outline as well as in cross sectional view.

The tang retracts from the blade base and although short, protracts into broad spread tang base horns with a concave tang base.

B is a 13 inch long Atharvavedic Type II Antenna Sword. It has a wider blade, a broader median ridge and round shoulders. Both are probably spear points and may have used fore shafts. Handgrips are probably toggles used to fasten draglines.



B

Appendix No. 1
Copper Typology - Spear Point Type

1. Kingdoms	**Plant Kingdom** Animal kingdom **Mineral kingdom**
2. Families (of minerals)	Silver Family Iron Family **Copper Family** Other Families
3. Kinds (from copper family)	Tool Kind Ornament Kind **Weapons Kind** Modified copper Kind Other Kinds
4. Divisions (of weapon kind)	Knife division Axe & celt division Projectile point division Other division
5. Genre (of projectile points divisions)	Arrow genre Dart point genre Atlatl point genre **Spears point genre** Harpoon point genre
6. Types (of spear points)	Oval Rat-Tail type Turkey-Tail type Serrated type **Socketed-Triangulate type** Socketed–Ovate type Other types
7. Varieties (Socketed-Triangulates)	Step variety barbed variety (harpoon) Round shoulder variety

………

Appendix No. 2 Creation Marks

In pounding copper, both the craftsman and his metal were guided and restrained by the laws of nature. Creation marks are the marks of man, still visible on copper artifacts. Such marks were caused by man's choice of smithing techniques, his choice of tools, and finally, by copper's reaction to those choices. The three categories are, (a) 'treatment marks' (b) 'tool marks,' and (c) 'metallurgical reaction marks.' Marks from all three categories can be observed and studied with the naked eye or with the help of a simple magnifying glass.

Altered microstructure of copper artifacts during their creation is still another physical record of its craftsmanship technology. Altered microstructure, however, is not attended in this research; except (a) as pounding and annealing cycles caused recurring microstructure realignments, hardening and softening copper, and affected crafting techniques, and (b) occasional micro structural related 'twain marks' visible to the eye, and (c) patterns left by eroding copper ions. These changes are observable with the naked eye or with the aid of a hand held magnifying glass.

A. TREATMENT MARKS

In creating copper artifacts, the ancient coppersmith treated his copper first, by lapping the outer edges of his work back upon the main mass of copper and pounded them down. He often introduced other pieces into that mass. He folded and pounded, working much the way grandma folded and pounded bread dough. Pounding and lapping is associated with 'base ingots,' and when the craftsman stopped at that point, base ingots are what he produced.

Next, he began to draw the copper out, into the general form he intended for it. This stage is associated with 'preforms.' Then, he began to shape the object, and the shaping stage is associated with 'blanks.'

Finally, the ancient craftsman pounded out segment forms and identifying traits, such as, 'tang ears,' 'nibs,' 'serrations' and 'notches,' together with 'blade-edge' and 'point-tip' 'bevels,' 'median ridges,' various forms of 'socket' characteristics, and other characteristics used to identify types and varieties.

Treatments, such as 'lapping' and adding pieces of copper to the main mass resulted in lap lines or 'fuse marks.' Annealing resulted in a smoothing out and an almost melted appearance to some modified pieces of copper. Hammering produced 'stress marks' and 'fissuring.' Treatment marks can be seen best in 'modified pieces of copper' such as 'base ingots,' 'bar ingots,' 'preforms' and 'blanks.' Tools used to finishing the product often eradicate treatment marks. Treatment marks are often manifested as tool marks and metallurgical reaction marks.

B. TOOL MARKS

Ancient craftsmen created hundreds of different copper objects using an assortment of tools. Regardless of time, culture, and geography, the most common tools were hammer stones, and stone anvils. Some are surprised at the crude tools ancient craftsmen used to create beautiful sophisticated copper implements and ornaments. Most hammers and anvils were made of stone of various sizes. Copper hammers and anvils were also used on occasions. No doubt, wood and bone hammers were also drafted into some finish work. Hammer and anvil impressions are among the most frequent tool marks.

Another tool mark, common with some cultures, is the chisel. Stone chisels were used to cut patterns from sheet copper, to create tang serrations and notches, and as trimming tools. On rare occasions, drilled holes are found in copper objects and even more rarely saw tracks are observed. Some copper objects have graver marks; others demonstrate gouge marks. Ancient craftsmen formed sheets by pressure rolling copper between two stones. 'Abrading' striations are another common tool mark, and grinding, like polishing, often obliterated other tool marks. Finally, some few implements and ornaments show decorative punch marks, called indentations or poke marks. Winn, (1942: 50-83), thought punches were most likely made of copper. Punches were also used to punch holes in thin copper. Livernash (2006) believes some punch marks are blue prints for crafting certain artifacts.

Drier & DuTemple published an article by P. R. Hoy, president of the Wisconsin Academy of Sciences, Arts, and Letters, 1879. Hoy found a cavity carved in a large granite boulder. He believed the cavity, in the shape of a hatchet, was used for swedging, which he described as, "…. were swedged: that is a matrix was excavated into the stone, into which the rudely fashioned copper was placed, and then by repeated blows (with a hammer stone) the article was made to assume the shape of the mold." To prove his theory Dr. Hoy placed copper in the mold and successfully cold swedged, "…. The beautiful axe, deposited in the collection of your Historical Society." It is not known how swedged marks might differ form hammer stone and anvil marks (Drier & DuTemple 1965).

Recent Wisconsin finds (Livernash 2005) include a cone shaped piece of solid copper, together with a conical point into which the solid cone fit perfectly, indicating it was used as a 'mandrel,' around which the conical point was framed. The mark of a mandrel might be a smoother interior than the exterior surface of a conical point. This list of tool marks is not inclusive.

Stone tools and anvils used in creating copper often go unrecognized, or if recognized as tools, their purpose remains un-guessed. Extemporaneous tools (temporary make-use tools crafted from copper) were usually recycled to create objects of greater value. Other copper crafting tools are recovered, but remain unidentified. Organic tools used in crafting copper have mostly decomposed, or if found, they remain unrecognized as coppersmith's tools.

To date, no complete copper workshop, replete with tools and copper objects, has been subjected to a thorough comparative research. Such research is imperative. Great Lakes Copper Research now curates a small workshop with one anvil, one stone hammer and 93 pieces of worked copper recovered by Livernash (Spohn 3005).

C. METALLURGICAL REACTION MARKS

Native copper, at more than 99.9 % pure, was soft and pliable. Pounding copper caused it to harden and become brittle. Before the coppersmith could continue his pounding, he had to anneal it, heat it to a cherry red 225C for a while and douse in cold water. Stretching copper out too far before an annealing left occasional stress marks in the form of a wood grain like appearance. Infrequent annealing also caused minute fracturing which is sometimes misidentified as inverse worm tracks.

Annealing re-crystallized copper, realigned its internal structure, and relieved stress built up by pounding. Annealing also prevented stress marks and fissuring. Annealed (micro restructured) copper became safe to pound and lap lines were more easily hammer fused. The hammering and annealing cycle was repeated thirty times or so to complete an object. Hardwood was sufficient fuel for annealing fires. Annealing and internal restructuring, compounded with hammering, left an occasional pair of parallel rings called twain marks.

Lap lines are treatment marks, but as the laps were hammered they were fused to the main body of copper. With continued hammering, fused lap lines disappeared. Sometimes the weaker fused lap lines separated in heavy use or in weathering and the loss of copper ions. Lap lines are the most common metallurgical reaction marks remaining visible today. Other such marks include fracturing, stress marks and twain marks. Creation marks found on copper artifacts give us clues about the cultures that created them. These clues are not yet as diagnostic as cultural tags, or at least we cannot yet read them so well.

Another set of transformations occurs over time and we call such changes historical markers. This second set of alterations did not occur haphazardly, but followed the laws of physics and chemistry.

Appendix No. 3 – Taxonomic Classification Rules

Rule No. 1: Each copper artifact receives a permanent classification.

Rule No. 2: Look first to the information sought. Taxonomy is a research tool and we use the tool to order copper, depending on the kind of information sought. Example: While studying trade, we classify modified pieces of copper as ‘economic kind.’ On the other hand, we classify the same pieces as ‘ modified kind’ in researching the manufacture of copper implements and ornaments. Double classification is rare.

Rule No. 3: If a piece of copper fits one or more taxonomic classes, choose the class definition that most accurately describes the piece.

Rule No. 4: If a piece of modified copper fits into two or more taxonomic classifications, use the most advanced or descriptive classification.

Example: A piece of modified copper fits the description of the Sheet Copper taxonomic classification, but it also fit the description of a Point Preform. Sheet Copper has many uses, from beads to projectile points. Point Preform more accurately describes the modified piece’s intended use. We, therefore, classify the piece a Point Preform.

Rule No. 5: If a piece of modified copper fits two or more taxonomic class definitions equally well, classify it as an earlier stage of development class.

Example: A piece can fit equally well in either the Knife Blank or Point Blank classes. Classify the piece as a simple Preform, because a Preform, an earlier stage of production, is associated with options, i.e., knife or point.

Rule No. 6: Symmetrical blades are classified as Points. Asymmetrical blades are classified as Knives. If a preform or blank is symmetrical, symmetrical-like or going symmetrical, it is a projectile point. If the blade is asymmetrical, asymmetrical-like or going asymmetrical, classify it as a knife.

Rule No. 7: If a symmetrical blade (classified as a point in rule No.6) shows evidence of having been used as a knife, it must be classified as a knife, even if this violates the rule of symmetry, No. 6 above. Two examples of knife-use evidence are: wrapped tangs and knife blade wear on one edge only.

Rule No. 8: If a piece of modified copper fits two or more class definitions equally well, look to its cache mates for additional evidence.

Example: It the piece in question is one of 5 cache mates and the other 4 are clearly knives, it is safe to class it as a knife. This is only true, because it already fit the knife description. Had it fit the point description slightly better, its cache mates would not have influenced our decision.

Rule No 9: Look into the past to see what similar pieces were used for or how they were classified.

Rule No. 10: Look into the future. How does the piece resemble ornaments and implements of today? An interesting number of object of the past are very similar to their descendents. A ring is a ring is a ring. The same can be said of a bead, a pendant, and a bracelet. It can also be said of wedges, chisels, awls, axes, harpoons and many more.

Rule No. 11: If a piece clearly fits no classification, create a new class and watch for more pieces which fit the new classification. An attempt must be made to create a theoretical basis for the existence of the new taxonomic classification. Each piece of copper that man modified had to serve some perceived practical or theoretical purpose. We cannot, yet, identify all the tasks performed and purposes perceived by ancient man.

Rule No. 12: A blank's identification and classification is tied to its degree of completion. Example: A blank can be classified as a simple blank, a harpoon blank or even a Rat-Tail spear point blank, each depending on its stage of completion.

Rule No. 13: A preform cannot be positively identified and classified beyond its genre. If it could be identified as a group, i.e., knife, point, celt, etc., it would be a blank, not a preform.

Rule No 14: In describing points place drawings and photographs with the point up. This avoids confusion when the blade or tang top or blade tops and bottoms are described. Exceptions can be made in studies of tang parts only.

Rule 15: Most artifacts have 6 sides. Use the following terms for the various sides. The first pair is top and bottom. The second pair is right and left sides with point up. The final pair is obverse and reverse The obverse side being the side with the most prominent characteristics, the open socket side, for example This is a temporary list of rules.

Appendix No. 4 – Historical Markers

PATINATION

For this study, copper patina is narrowly and distinctively defined. It is an addition to the surface of copper. Patina forms as (1) a coating of copper corrosion, and (2) an encrusting of other non copper elements. Both the corrosion coating and the encrustation of separate elements are chemical activities or additions called patina. Nearly all patina is a combination of corrosion and encrustation. Copper itself possesses a distinctive salmon red color. Even copper artifacts, thousands of years old, will show this identifying color if scratched. All things that cover copper's pure color are called patina.

There are at least nine categories of patination and each category consists of several stages. Stages of patination are acquired over time. Patination is, therefore, a historical diagnostic marker, necessary to read in making temporal associations.

Ideal conditions of preservation or deterioration can cause the characteristics described below to occur quickly or require very long periods of time. The purity of the copper, the quality of workman-ship, and copper's environment determine the time required. In identical environments, a dense, thick patination requires more time than a thinner, less dense patina.

The types of patination described below are categories of patination. Stages of patination exist within the categories. Only the last four categories, residuum, crusted, noble and enamel patination are positively associated with great age (several hundreds to thousands of years). Advanced coloration and greed oxides are stages sometimes associated with cultures thought to be at least a few hundreds of years old. Commonly a single artifact will exhibit two or more stages of patination or even more than one category of patina. The stage associated with greatest age is most diagnostic. Certain categories of patination are associated with various stages of oxidation and with some patterns of erosion. Oxidation Stages are seen as: (1) a coat of corrosion called patination and (2) stages of oxidation, loss of copper ions, and (3) scars left by the escaping copper ions, and called erosion patterns.

A PATINATION CATEGORIES

1. Tarnish

Tarnish is the first stage of mild oxidation. At this point, the metal turns a dark copper red or brown. Under ideal conditions, a new piece of copper may tarnish mildly in hours. In a perfect environment for preservation, it could take years. On very rare occasions copper objects, buried for more than a hundred years, are recovered with little more than a tarnish patina visible to the naked eye. Copper artifacts recovered from watery graves may be recovered as bright and shiny as a new penny after hundreds, even thousands of years.

2 Coloration

The second stage of mild oxidation produced color, but no noticeable erosion of copper. The first red-brown color darkened and sometimes changed to other colors. The following colors and combinations are common: various shades of copper-red, ochre, brown, dark yellow, gray, black, and especially, hues of green.

Exposed to the elements these colors may appear within months or require many years. Colors appear singularly, in pairs and in groups. In areas near salt water, it is not uncommon to find copper pennies, lost for a couple years or less, with a green coloration patina.

Color is soon followed by oxidization that may occur and recur. Some of the delicate corrosion (patina) may have worn off or washed away and recurred. Time and chemical environmental factors may harden the oxides and increase color variations. Hardened green oxide patina is not easily scratched with a wooden probe (toothpick). In aging, coats of patina are added; softer ones on top with harder, denser layers beneath. In the fist few years of aging color is followed by and associated with pitting oxidation.

In still later stages, artifacts often exhibit a blotchy surface showing various stages of mild oxidation, multiple colors and mixed layers of patina, some single layered, others multiple layered. All but the most recent layers are hard. Sectors of tarnish are sometimes mingled with the patinaed areas. Many (more than a hundred and up to a few hundred) years are usually required to reach advance stages of coloration patination.

The coloration category contains several stages and is closely associated with the green oxide category. Coloration can advance to the residuum category or even to noble.

3. Green Oxides

If exposed to the elements copper will begin microscopic oxidation. Green oxides first appear in pits and crevices. Eventually it spreads. In the beginning, it can be wiped off with a soft cloth. Later it may cover much or the entire artifact, but it will break loose if the artifact is tapped. Green oxides can, under ideal conditions, cover most of the copper in a year or so. Still, fresh patina will exhibit a powdery characteristic. Oxides easily fall off in one's hands while the piece is handled, exposing tarnish below.

There are several stages within the green oxide category, which are closely related to, and sometimes mixed with coloration patination and pitted oxidation. In the proper environment, either category can advance, over time, to the residuum category.

Advanced green oxidation can be found on artifacts thought to be several hundred years old. Even at such an age, the freshest green oxides may sometimes appear as a powdery green dust atop harder under layers. The green oxides may be mixed with various colors. Green oxides may advance to residuum or noble category.

4. Calcium patination

Calcium is one of the hard, dense patinas that can coat a piece of copper in a relatively short time. If an artifact were lost, for example, and hot spring water rich in calcium flowed over it continuously, the exposed areas could collect up to a quarter of an inch of dense tight calcium-sodium patina in a year. This phenomena is occurring and has occurred for hundreds, perhaps thousands of years in an ancient Roman bath in use to this day in Beuren, Germany (Anagewandte Chemie, Stuttgart-Feuerbach, (1993: 1-2). See figure No. 11 below. This process similarly occurs in many areas of the world, and this is the manner in which stalactites and stalagmites are formed, and sometimes form very quickly.

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Fig. No. 11

Two Examples Of One-Fourth Inch Thick Mineral Deposits Which Develops In One Year At Thermalbad (Hot Water Springs) In Beuren, Germany.

Examples Of 1/4-Inch Deposit Per Year

It can, on the other hand, require hundreds of years or more, to acquire a much smaller amount of calcium leached naturally from the soil. The inside bottom of our teakettle is an excellent example of an ideal environment for collecting calcium. Calcium is a from of residuum, and often observed as a patch or irregular patches mixed with other categories of patina.

5. Residuum Patination

Sometimes residue from air, water and soil collect on copper artifacts. Occasionally artifacts were caused to be associated with organic materials. This residue coating was often preserved and hardened over time by copper salts. Residuum can begin as quickly as dust settles, but for purposes of this research, residuum is defined as a moderately thick, dense and tight patination of any color. Residuum patination requires many years and is sometimes associated with scarring oxidation and with most of the classic erosion patterns. Residuum is closely associated with most advanced stages of coloration and green oxides, and also with the beginning stages of noble patina. Over time, residuum is seen as noble and it is an historical marker. Residuum patination is related to, but less dramatic than nodular patination.

6. Nodular Patination

On rare occasions due to extraordinary environmental circumstances, chemicals, sometimes mostly soil or even sand, are attracted to copper and it may quickly and at other times more slowly layer with a thick coat of soil, minerals or perhaps other environmental elements. A nodular coating may be tougher or less sturdy than crusted patina, but never as hard or tough as enamel patina. Nodular patina, which develops slowly, will contain a denser copper content (from escaping copper ions) than will similar coatings collected more rapidly. Nodular patina may reach two inches or more in thickness and it is the copper ions, together with salt, calcium or other minerals which hold it together and these minerals together with time determine its is thickness, hardness and toughness. Nodular patina is usually the earthy color of its surroundings. Slow growth nodular patina is likely to be tighter with its denser copper content, while rapidly growing modular patina is less likely to be as tight or tough, although it may show a hard outer crust. Nodular Patina may be an extreme form of residuum patination. It can also be related to calcium patination.

7. Crusted Patination

Crusted patina is normally acquired over a period of hundreds, usually thousands of years. Although thick, it lacks tightness, is often cracked and may crumble, flake and scale away from the artifact leaving it much thinner that it was created, exposing green oxides, other patination categories and sometimes exposing its erosion patterns. Whereas most patina is multi colored, even on the same side of individual pieces, crusted patina is normally one uniform color, by and large brown with a slight greenish tint. The thick patina is a combination of organic and inorganic materials including soil, collected over a very long period of time and permeated with copper ions. Although crusted patina may afford protection from the loss of copper ions, that protection is not nearly so great as other categories of thick patina.

8. Noble Patination

The characteristics of a noble patina are: a thick, dense, hard (usually a dark green or brown) coating on some part of the artifact. Noble patination is often associated with scarring oxidation and the worm track erosion pattern. If not contaminated with organic material, it will not burn off if held over a gas burner for a minute or so and it is a clear historical marker. Noble patina may be the accumulation of some previous categories and stages. The laws of advanced patination are not clearly understood; they cannot be duplicated in the laboratory (artificial chemical patina is easily created). We believe that over a period of time, patina collected escaping copper electrons and the patination thickened, tightened, hardened and formed a tight attachment to copper artifacts. This process also slowed and eventually prevented further shedding of copper electrons.

It is thought that noble patina occurs over a period of many hundreds, and sometimes thousands of years. Like worm tracks, it commonly occurs on artifacts identified with Old Copper Cultures. In an examination of 24 Old Copper culture spear points representing a single type (Socketed Triangulates), all but one showed noble patina.

Noble patina is the result of little understood natural laws associated with great time, and the combination of chemical elements and physical events during that time. Noble patina is also found on aged, pounded, copper artifacts from the Old World.

9. Enamel Patination

On rare occasions, calcium, oxidation, residuum patination or other combination are introduced to heat or to some unknown natural treatment. The result is a tight, often bright green, dense, smooth and hard exterior with an enameled or glazed-like surface. Enamel-like patination is usually found in patches, but may cover all or most of the artifact. It is probably an advanced form or stage of noble patination and is sometimes exhibited on examples not clearly pounded by man.

The patination process and its association with age, is not clearly understood. The categories of patination are not as clear or neat as we might desire for diagnosis. It is apparent that patina growth is affected by time. Opportunity, however, in the form of ideal conditions for oxidation or preservation, determines the time needed to create historical markers associate with age.

It is better, therefore, to compare the patina on unknown artifacts to artifacts with similar patina, but already associated with time and culture. It is also profitable to measure our conclusions based on patina, with diagnosis based on stages of oxidation, erosion patterns, cultural tags and creation marks.

Advanced stages of patination are more diagnostic than beginning or intermediate stages. An ancient artifact might show mild patination, but an historical copper artifact will never show an enamel patina. A few historical pieces from the contact period may show a noble patina. The presence of advanced stages of patination is far more diagnostic than its absence. Most copper artifacts exhibit various categories and stages of patina. The most advanced is most diagnostic.

Whereas patination adds a coating to a copper artifact, oxidation subtracts copper. Patination tends to protect the copper, but oxidation also erodes away copper leaving a scarred surface. Erosion of copper electrons marked copper and sometimes stages of oxidation can be associated with age.

B. OXIDATION STAGES

1 Tarnish Oxidation

A fresh piece of copper, under the right conditions, may tarnish in a few hours. It requires only a little moisture and oxygen. Although tarnish is the genesis of oxidation, all we see is a change in color on the surface of tarnished copper.

2. Pitted Oxidation

In a span of years, colonies of shedding electrons left blemished areas and tiny pits. These were the beginning of oxidation scars. Under ideal conditions, this may occur on modern copper in two or three years. In the absence of moisture, it may never occur.

3. Scarring Oxidation

Tarnish grows into blemishes that mature into pits. If conditions are suitable, pits grow and erode into grooves and valleys. Any of the serious oxidation patterns may eventually develop singularly, in pairs or in groups. A piece with a scarred oxidation pattern may show some blurred irregular profiles due to missing copper. Still, seen as a whole, the piece will be easily recognized for what it is.

A majority of prehistoric American Indian Copper artifacts show at least a mild or beginning stage scaring oxidation.

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4. Disfiguring Oxidation

As pits, valleys and grooves grow, oxidation eats away at thin blade edges, socket flaps, pin holes, etc. Eventually so many copper electrons are lost that pinholes enlarge, blade edges become uneven, shoulders are rounded, hairline cracks grow and appendages are lost.

We find many old copper pieces in near perfect conditions. It is thought that some of these are thousands of years old. Still under perfect conditions for oxidation, scars occur quickly. Buried 6 inches or so in the soil under the drip line from a roof, for example, I have found modern copper tubing so disfigured as to be hardly recognizable. This occurred in only 15 years. Some modern copper is significantly less pure than the 99.9 + percent pure native copper used by the early craftsmen in the Great Lakes area. Less pure copper disintegrates faster than native copper. Rapid disintegration of manufactured copper does not follow classic oxidation patterns. It normally takes hundreds of years to disfigure heavy pieces made from native copper.

5. Consuming Oxidation

In the near perfect environment for oxidation, artifacts are so consumed by oxidation that they are unidentifiable. Occasionally pieces are found in such a fragile condition that they fall into dust upon touch or upon exposure to air. Sometimes archaeologists find no artifact at all, only copper oxides leaching in to the surrounding soil.

Stages of oxidation are clear and distinct. They are also associated with time. Agents, other than time, are so active in the loss of copper ions, that by itself, the degree of deterioration is a poor diagnostic tool. Used with erosion patterns, it has greater diagnostic value. Associated with patination, erosion patterns, cultural tags, and marks of man, it can add much to our diagnostic tool kit.

Tarnish is the first step to disintegration. Further steps follow the laws of nature set in motion during the pounding of copper. Escaping electrons depart in ordered egress leaving behind natural patterns familiar to many copper artifacts. These erosion scars are called oxidation or erosion patterns.

C. EROSION PATTERNS

Once copper is pounded, laws of nature dictate the erosion pattern phenomena. Chemistry is the engineer and nature the artist. As copper oxidized, the shedding of electrons, called corrosion, formed a pattern on the surface of the copper objects. Sometimes these copper electrons mixed with associated residuum to form a protective coating of patina that hid the erosion patterns already formed. The same patina may protect the copper from further erosion.

Certain oxidation patterns are similar on both pounded and un-worked copper, but most patterns are specific to pounded copper. Advanced erosion patterns require hundreds, if not thousands of years to form.

A majority of the Old Copper culture complex artifacts examined by this researcher were found years ago and the finders cleaned many. Although some or all of the patina was removed in the cleaning, the erosion patterns were left undamaged.

Modern copper objects, less pure than native copper, are quickly and seriously disfigured by oxidation and do not exhibit classic oxidation patterns. Classic patterns are acquired slowly over a period of hundreds or thousands of years.

Although un-worked copper doesn't exhibit all of the recognizable erosion patterns, pounded copper does. Pounding and annealing predisposes copper to erode in visible designs called erosion patterns. The oxidation pattern a copper artifact is dictated by its milieu. Mini environments can result in more than one pattern on a single copper artifact. Quality of workmanship may do the same. If pieces of like quality craftsmanship are found in identical environments, time dictates the quantity of erosion.

Oxidation disfigures copper artifacts and impedes classification. The silver lining in this cloud of destruction is the time required to form certain classic erosion patterns. Functioning as it does, nature provides us with historical markers called erosion patterns. To read these markers it is necessary to type artifacts with and without various erosion patterns. These patterns are described below.

1. Pitted Erosion

The early pitting stage is a common erosion pattern found on both pounded and un-worked copper. A pitted surface varies greatly, not only in the number and the sizes of pits, but in their shape. An early pitting pattern exhibits only a few shallow pits, while advanced stages exhibit numerous deep pits. Advanced pits are irregular in shape and as they grew, they joined and elongated in the direction of pounding.

Pitting may be more pronounced or advanced on one side than on the other. Deep pitting requires at least a few hundred years in native Michigan copper. Advanced pitting may lead to a plateau erosion pattern. Advanced, pitted oxidation patterns are limited to worked copper. Modern, less pure copper reacts differently. It pits. The pits become more numerous and grow in size until the copper disintegrates.

2. Mushroom Erosion

Tiny nodules or outgrowths, sometimes resembling odd shaped mushrooms, appear on an otherwise fairly flat or pitted surface. This erosion pattern is often observed best under a magnifying glass. Nature does not require hundreds of years to produce some mushroom patterns, but may use that much time in creating others. This pattern may not be limited to pounded copper. It is an easier pattern for forgers to reproduce using acid.

3. Plateau Erosion

The plateau erosion pattern is more advanced, but not so common as the pitted surface. The plateau pattern exhibits two levels; a lower level eroded away, and plateau-like upper levels. Both levels are irregular in shape and the plateaus are often elongated running in the direction of pounding. Plateaus are frequently concave on top and wider across the top than at the bottom. Some plateau patterns advanced to a chasm or to worm track pattern. The plateau oxidation pattern eroded slowly over a period of hundreds, perhaps thousands of years. Occasionally the area between the plateaus may exhibit other erosion patterns, usually pitting. The plateau erosion pattern is limited to worked copper. It may be some form of advanced mushroom erosion.

4. Chasm Erosion

Gorges or chasms, fine and shallow or deep and wide, are eroded length ways on the surface of copper artifacts, in the general direction of pounding. It is believed that at least some chasm erosion resulted in eventual worm tracks. Chasm erosion is one of the classic erosion patterns found on the surface of pounded copper. This pattern is acquired slowly over a period of hundreds and perhaps thousands of years. Chasm erosion patterns are more likely to occur on thicker pieces of copper. This oxidation pattern is limited to worked copper and may be an older marker than the plateau pattern. Chasms may be associated with poor workmanship.

5. Pre-worm Track Erosion

Pre-worm track erosion is much like advanced pitting, but not as deep. The shallow pits are long, like superficial valleys leaving rounded ridge tops between them. Some rounded ridges may have become worm tracks. Ridges, valleys and pits run in the general direction of pounding. The erosion may not be so well developed as advanced pitted, plateau or chasm erosion. Still, it is not certain that the copper artifacts exhibiting pre-worm tracks are very much younger than those with worm tracks. The difference between pre-worm track and worm track may be associated with age, or with better quality pounding and annealing. It is believed that pre-worm track patterns of erosion are limited to pounded copper. Old world cast pieces, dated to 2,000 BC or older and lightly pounded in refinement may show immature worm tracks.

6. Worm Track Erosion

Worm tracks are the most illustrious of the erosion patterns and the easiest to recognize. They appear as raised veins and vary from shallow and fine to large and coarse. If a blade is straight the worm tracks wind and twist, but however serpentine, they follow the length of the blade and the direction of pounding. On a curved blade, the worm tracks clearly trail the arch of the blade. Worm tracks never move in a straight line, yet they always track the direction of pounding.

Worm tracks show a wide variety of characteristics. At the opposite extremes are: (a) those, short or tall, that arise out of a confusion of rough copper exhibiting one or more uneven surfaces and (b) perfectly formed and clearly distinct worm tracks winding their way across an utterly smooth surface. The second example is a beautiful pattern, one probably associated with fine craftsmanship.

Worm tracks, more obvious than other oxidation pattern, are conceived in the pounding and annealing (microstructure realignment). From conception to birth may be a very long time, but longer for some than for others. It is doubtful that worm tracks exist on artifacts created very much after the late archaic period. Worm tracks are not, as some believe, the erosion of softer copper from around harder veins of silver.

Some pieces show only a few immature indistinct worm tracks while others are exhibits of nature's bold and unambiguous art. It is thought that immature worm tracks are the result of fewer pounds from the hammer or less years in the making. On very rare occasions when worm tracks are found on pieces which exhibit no other clear or suspected marks of man, glacial pounding is presumed a possible source.

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7. Inverse Worm Tracks

Inverse worm tracks, which appear as intaglio worm tracks, are not true worm tracks. True worm tracks emerge as raised veins. Inversed, or upside down worm tracks, are actually tiny fissures. They behave like worm tracks in the way they follow the craftsmen's hammering and one may need a magnifying glass to discriminate between fissures and raised worm tracks. There is a clue, however. Because they are fissures, they do not reflect light and appear as dark or even black worm tracks. Intaglio or inverse worm tracks are fissures caused by pounding copper too long between annealing treatments and are not true erosion patterns. As fissures are ideal locations for moisture, they may encourage local erosion.

7. Haphazard Erosion

Sometimes, while erosion is clear and scarring visible, patterns are not discernible. This is generally true of un-pounded copper, but it is sometimes true in early erosion stages on pounded pieces. It is also true, occasionally, with very old and seriously corroded pieces of worked copper. The surfaces of such pieces are uneven, but without pattern. Scaling, crusting, pitting, and other signs of verdigris are common. Pieces that were chiseled from sheet copper with little hammer work may show a haphazard erosion pattern. No annealing or little annealing may also be related to the haphazard pattern.

The size of the pounded piece of copper does not appear to have a relationship with a perceptible pattern, except the erosion scars may be deeper on larger pieces. The presence or absence of a protective patina may be related to the absence of a classic erosion pattern. The age of the artifact may be similarly related to the erosion pattern. It is common for a single artifact to exhibit more than one erosion pattern. An object of copper may exhibit one pattern on the front and another pattern or no pattern at all on the back.

Some erosion patterns, especially worm tracks, are diagnostic of great age. Many ancient pieces of copper do not have worm track erosion patterns. On the other hand, pieces of copper, very much younger than the Old Copper cultures, never show worm tracks. Early Hopewell may, while late Hopewell does not. The absence of worm tracks is not as diagnostic as their presence.

Old World cast copper artifacts show few erosion patterns and those exhibited are indistinct. Some cast copper artifacts, similar in age to the New Worlds' Old Copper cultures, were lightly pounded in the finish work. A few of these exhibit fine, immature worm tracks.

Cast copper differs from pounded copper in two primary ways. First, it is heated once, melted, poured, and pounded only in the finish work. Second, pounded copper is heated (annealed) many times and receives a great deal of pounding. These differing methods of craftsmanship surely affect the presence of clear erosion patterns on New World copper artifacts, as opposed to their paucity on Old world ones. Occasionally very old pieces may lose sufficient surface copper to destroy worm tracks that once existed.

The three diagnostic tools devised this research paradigm, (1) cultural tagging (typology and nomenclature), (2) creation marks, and (3) historical markers, patination, stages of oxidation and erosion patterns, were all develop to associate orphaned copper artifacts with their parent cultures.

Appendix No. 5 – Definition Of Terms Not defined Within The Paper

Analysis: To separate a artifacts, concepts, and facts into their parts and study the parts and the structure of the whole for the purpose of rendering data and drawing conclusions.

Artifact: An object created by or at least worked on by man.

Diagnostic: Parts of a whole, objects, formulas, paradigms and other tools which aid in and lead to a diagnosis.

Diagnosis: To identify or classify on the basis of a scientific investigation or analysis, to similarly answer a problematic situation. In this research diagnosis leads to identifying type and culture.

Implements and Ornaments: A catchall phrase used to include all prehistoric copper artifacts, even if the artifact is technically neither an implement or ornament.

Marks of Man: Marks observable on copper, however few or slight, determined to have been made by man.

Modified Pieces of Copper: Copper showing the mark of man, but unfinished. Modified pieces include base ingots, mini ingots, bar ingots, preforms, blanks, and other ingots created as units of storage or prepared for shipment, trade or for crafting implements and ornaments at a later date.

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The Archaeological Record

The archaeological record or history is a term used to denote buried remains unearthed during an excavation. It includes all archaeological evidence including the physical remains of past human activities which archaeologists seek out and record in an attempt to analyze and reconstruct the past. Archaeology teaches that the value of an artifact lies primarily in the data that can be acquired about its culture – obtained in an interpretation or analysis of the artifact's archaeological history during professional excavations. Archaeologists understand that without that archaeological record, much valuable data is lost and artifacts are sometimes made more or less useless.

Collectors, on the other hand, see value in the artifacts themselves, as primitive art, valuable treasures, and objects of sentimental value. Some collectors accumulate much knowledge and experience in recognizing distinctive differences, even cultural distinctions between specimens with similar and contrasting traits. But most collectors do not perform professional excavations, nor do they note soil conditions, features, artifact links, associated carbon materials, and other elements of an archaeological history. If untrained collectors dig, archaeological records are lost.

The vast majority of artifacts collected by amateurs over the years consist of surface finds. If they possessed an archaeological history, it was lost long before the artifacts were picked up by finders. For most of our nation's history, it was farmers following horses who found copper artifacts. Collectors walking freshly worked fields found still more, while construction workers uncovered the remainder as fortuitous finds.

Late in the game, archaeologists excavated burial sites and recovered the first copper with an archaeological history. Archaeologists' knowledge of copper is based upon these two groups of copper artifacts, old surface finds, without an archaeological record, and later professionally excavated grave sites with clear archaeological histories.

Finally, since the 1980 or so, metal detecting has added a third reservoir of copper artifacts. Like the first group of old surface finds, metal detected copper no longer possesses an archaeological history. It often had one, a good clear archaeological history, but it was nearly always lost in the recovery.

Archaeology, for the most part, has chosen not to study metal detected copper. This is true, in part, because it contains no archaeological history. It is also true because archaeologists cannot professionally encourage the acquisition of copper artifacts in ways that assure the loss of archaeological data; a necessary element in the discharge of tasks required in the practice of their profession.

At Great Lakes Copper Research, we developed a paradigm designed to harvest previously unavailable data from copper artifacts separated from their archaeological record. We do not wish to encourage the separation of artifacts from their archaeological history. We wish all artifacts had archaeological histories and recognize the superior data associated with archaeological records. But, we also recognize the fact that most copper artifacts are shorn of their archaeological records, and we wish to benefit from potential valuable data that can be harvested from orphaned copper artifacts.

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