Student: Kyle Wark
Class: ANTH A435-001, Northwest Coast Cultures
Professor: Dr. Steve Langdon
Semester: Fall ’09 (originally submitted on 11/30/09)

The Copper Age on the Northwest Coast: Early Indigenous Metalworking

In addition to such distinctive icons as the totem pole, the Chilkat blanket, and the dance mask, one of the most characteristic artifacts of Northwest Coast cultures is the Copper, the large decorated shield-shaped copper plate displayed or given away at potlatches. These artifacts are perhaps the pinnacle of a long history of metal working in the region, a history this paper shall explore, covering where the copper came from, how it was worked, and what products it was turned into; it shall also explore other metals utilized by natives in the region, such as iron, in both the pre- and post-contact eras. Finally, at the end of the paper, we shall discuss some of the social and spiritual dimensions of metalworking on the Northwest Coast.

The classic "unilinear approach to metallurgy" (Cooper 2007:167) divides metalworking into five stages: "the hammering and annealing of native copper, melting of native copper, crucible smelting of very pure ores, smelting of impure oxide and sulphide ores, and alloying of various metals" (ibid.). Of these, "the first 'stage' of metallurgy, *i.e.*, use of native metals, was well within the technological capability of people using a lithic technology" (Cooper 2007:169). In particular, Cooper (ibid.) quotes Halsey (1996) as pointing out that "hammering and annealing of native copper…are no more complex than other {lithic}[1] technologies such as the working of hides and the fabrication of clothing." The term native metal refers to "metals found in their elemental metallic form" (Cooper 2007:17) – as opposed to being mixed in with other elements as a mineral ore. "Native copper, sometimes termed 'malleable copper' or 'virgin copper'" (Acheson 2003:215), is generally "available at or near the earth's surface" (Cooper 2007:17), meaning it can be easily harvested by hand or with simple digging tools.

On the Northwest Coast, the earliest evidence for native copper use comes from ornaments unearthed from the Boardwalk site in Prince Rupert Harbour, British Columbia,

[1] Note: because many of the authors I quote are themselves quoting others, and use square brackets [ ] or parenthesis ( ) to make their own notes, in order to avoid confusion I shall consistently use curved brackets { } to make my own insertions; any comments, then, in [ ] or ( ) are in the original quoted text, while all { } are my own notes.

Canada, which may date back as early as approximately 1,000 BC (Cooper 2007:98-99), predating more northern Northwest Coast sites, such as in Yakutat (and even in south-central Alaska), "by more than 2000 years" (ibid.).[2] It is certainly conceivable that these early northern and southern Northwest Coast sites are unconnected: de Laguna *et al* (1964:204 – cited in Cooper 2007:100) wrote, "…there is no necessary connection between the copper work in these areas" and Bill Workman (1978 – ibid.) thought the southern sites and others from the Arctic were definitely unconnected "to the Late Prehistoric use of copper in south-central Alaska and the Yukon." However, although brought up by Cooper (2007:170) in a different context, it seems relevant to point out that "in the Levant {approximately modern Israel and Palestine}…after the initial introduction of metal objects, several millennia passed before metal objects became abundant." That is to say, just because the Prince Rupert Harbour finds predate the Yakutat and Ahtna finds by thousands of years, that does not mean they aren't connected sites. In any event, it also seems relevant to point out that, according to Dr. Steve Langdon (personal communication, 2009, in class), the level of archaeological investigation is much higher in B.C. (where the Boardwalk Site was unearthed) than in Southeast Alaska, meaning this seeming gap between northern and southern Northwest Coast native copper utilization could be more representative of the state of archaeology in this region than of the state of the archaeological record itself, as it were.[3]

---

[2] There is "archaeological evidence [that] native copper was being used in the Central Arctic by presumably Eskimo-speaking peoples as early as 3000 years ago" (Cooper 2007:175), or again, approximately 1000 BC.

[3] Whether or not the southern and northern Northwest Coast metalworking traditions are unified or stratified, there seem to be some linkage between the Athabascan use of native copper and the broader Arctic/Subarctic Eskimo traditions. Cooper (2007:152) references Nelson (1974) and VanStone (1974) in pointing out that one "characteristic of northern Athapaskan technology is the ease with which it has incorporated features from the technology of neighboring groups, especially that of Eskimo-speaking peoples." Similarly, Acheson (2003:217) writes: "The subsequent Thule {Eskimo} migration across the Canadian Arctic at c. AD 1000 coincides with evidence for the frequent use of native copper among Athapaskans by this time."

It seems that the most likely sources of native copper used by the northern Northwest Coast peoples were the Copper and White Rivers and their tributaries, such as the Chitna and Kletsan Rivers located in south-central Alaska and the southern Yukon Territory (de Laguna 1972; Cooper 2007; Emmons 1991; Oberg 1973; etc.). Emmons (1991:177) relates Tlingit oral histories tracing the Tlingit use of copper back to Athabascan groups in south-central Alaska. Similarly, the oral traditions of natives in the southern Northwest Coast also indicate that copper traveled from north to south: "Local residents still recognize the fact that, in the words of Soloman Wilson, a long-time resident of Skidegate {in the Queen Charlotte Islands - Haida territory}, the early copper came from Alaska" (Acheson 2003:215); "Meares, who was at Nootka {on Vancouver Island, B.C.} in 1788, saw 'pure malleable lumps of copper ore, …and the natives indicated that the copper came from the north'" (Emmons 1991:176).

Most accounts (Cooper 2007; Acheson 2003; etc.) indicate that almost all of the prehistoric copper was found in stream beds where it had eroded from the bank, with the average size of a nugget being 3-5 pounds. However, Sturgis reported that it was not uncommon to find "lumps of ten, eleven, and twelve pounds" (Jackman 1978:80) and de Laguna (1972:354) reports that "{Copper River} nuggets a cubic foot in size were reported." Offering a view of the whole range of the spectrum, Acheson (2003:215) reports "copper-bearing basalts flank the St. Elias Range, where copper can be found in creek beds as nuggets and slabs ranging in weight from less than half a kilogram to occasionally massive forms of over 900 kilograms."

Although local Northwest Coast sources probably accounted for most if not all copper artifacts in the area, it is worth pointing out that

> two copper artifacts from the Thule {ca. AD 1000-1400} components of archaeological sites in Resolute Bay on Conwallis Island in the High Arctic were subjected to neutron activation analysis. Both specimens were determined to be made of non-native {i.e., smelted} copper indicating that…industrial copper alloys were available prior to contact via trade with either the Norse or across the Bering Strait. (Cooper 2007:98)

Since Conwallis Island is just north of Hudson Bay, deep in the interior of Canada, about as far away from the Bering Strait as the northern Northwest Coast, it is therefore also possible that copper could be moving into the Northwest Coast region from as far away as Siberia – Iceland being a substantially less likely source for prehistoric Northwest Coast copper than Russia.

Additionally, before moving on, it is possible that the poorer native copper deposits in the southern Northwest Coast region could have supplied some copper to the wider region. Cooper (2007:100) cites numerous authors that have listed minor sources of native copper in "{coastal?} British Columbia…Washington…and the interior portion of B.C." and Acheson (2003:215) additionally reports: "There are a number of minor sources of native copper throughout British Columbia, including a possible source noted by Swan (N.d.) in 1883 on the northwest coast of the Queen Charlotte Islands and another at the western end of Kamloops Lake (Dawson 1879:116 B)." Dr. Langdon (personal communication, 2009) also informs me there is a small deposit of native copper in the southern Prince of Whales Island archipelago.

Although copper is the primary prehistoric metal utilized in the Northwest Coast, iron was also utilized before contact. Many authors (de Laguna 1972; Emmons 1991; Cooper 2007; Acheson 2003; etc.) list drift iron as a likely source of this material, that is, iron washed ashore embedded in timbers broken off of wrecked ships. In Emmons (1991:184, 187, etc.), oral histories of Natives from as far apart as the Aleutians, Kodiak Island, and northern California are provided that corroborate the idea that drift iron most likely accounted for at least some of the precontact indigenous iron. The main account given for how these wrecks came to American shores is the action of the Pacific currents, especially the strong eastward Japanese current: "The earliest knowledge of it {iron} by the natives came from wreckage of Asiatic vessels and drift carried eastward to the American shores by the Japanese current" (Emmons 1991:183). As Acheson (2003:216) writes:

> Iron was common in Japan by AD 300, and undoubtedly a potential, if sporadic, source was in the form of lost ships being swept by the Japanese current to the Northwest Coast. Keddie (1990:8), summarizing the work of Davis (1872a, 1872b) and Brooks (1876), cites twelve cases where Japanese vessels, or those of neighboring countries, are known to have come ashore between California and the Aleutian Islands in the years 1617 to 1876.

This sort of transoceanic movement is still being attested in the historical record: "In January 1916, a Japanese fishing boat, caught off the harbor of Shimoda, Japan, by a storm in which her mainmast and rudder were carried off, drifted helplessly for twenty-four days across the Pacific, and finally landed about Dixon Entrance" (Emmons 1991:10). Tlingit oral traditions relate instances of whole ships washing up on shore (Emmons 1991:183; de Laguna 1972:233, 412).

Although an unlikely source of precontact iron in the Northwest Coast, it is worth relating that substantial quantities of meteoric iron have been found in all corners of the globe – in one case, a chunk found "near Krasnoyarsk, in Siberia…weighed 1,440 lb" (Rickard 1941:56); however, this material has rarely been utilized in any great quantity by people to fashion tools, except perhaps in Greenland and parts of Canada where its use has been attested by Inuit oral traditions and ethnographic reports (Rickard 1941; Cooper 2007; Acheson 2003). However, even though there was no widespread use of meteoric iron in the Northwest Coast, Emmons (1991:365), in his discussion of "body medicine" (*daa naákw*), does report that charms stored in one daa naákw box he collected included "pieces of meteorite," and Acheson (2003:215) writes that there is at least one oral history "collected in 1854 on the Northwest Coast that tells the story of a Chilkat Tlingit woman who made fluted daggers from meteoric iron using a stone anvil."

It seems significant that the Chilkat woman made a fluted knife, since, for the most part, early metal tools generally resemble their lithic predecessors; Cooper (2007:170), for instance, quotes Basalla (1988:31-32) who thinks “metal tools were originally based on lithic ‘prototypes’ and that ‘…stone technology exerted a long-lasting influence on the shape of these {early} tools.’” Consider this description of some early Greenlandic iron knives: “In 1818 Lieutenant William Parry…met some Eskimos who had knives ‘made of small pieces, or plates of iron, which were set close together in a groove made in a piece of narwhal’s horn; the end piece was riveted, but the others were kept in place merely by being driven tightly into the groove’” (Rickard 1941:57). This method of fitting iron plates into grooves correlates with common Inuit microlith tools, made by fitting small flakes of stone (microliths) into prepared grooves. The fluting on the Chilkat woman’s knife, therefore, probably represents an older style of technology, not something she would invent for this knife, possibly implying a long tradition of metalworking. In any event, producing a fluted knife indicates an advanced level of metalsmithing. In describing a fluted iron Haida dagger collected in 1884, Acheson (2003:220) says, “the pair of ridges {that run down the middle} stiffen the blade and converge near the point to form a wide, shallow flute the length of the blade. Even by today’s standards, to form these ridges is a challenging task for an experienced metalsmith with a full complement of tools.”

In addition to drift or meteoric iron, one more vector iron may have traveled was through intercontinental trade across the Bering Strait. As mentioned above, the Conwallis Island site indicates copper could have been coming across the Bering Strait as early as AD 1000, and iron could have made its way across the channel as well. Acheson (2003:216-17) states that

> iron may have been present in eastern Siberia by as early as the late Neolithic (first millennium BC). An iron engraving tool recovered at Uelen, Chukchi, dated to between AD 200 and 500 (Levin and Sergeyev 1964), has led to speculation that iron may have penetrated to the Bering Sea region by the first millennium AD through tribes of the lower Lena or Amur regions. According to McCartney (1988:57), the use of metal around the Bering Sea regions was so common that Alaskan Neo-Eskimos developed an epimetallurgical technology about 1,500 to 2,000 years prior to direct Russian contact. Evidence of ancestral Thule cultures in the Bering Strait region using Siberian trade iron by the first few centuries AD includes engraving tools with iron bits from a number of

> Alaskan sites. Ipiutak sites in Alaska, dated to between AD 300 and 600, have yielded a number of iron tools (Clark 1977; Larsen and Rainey 1948). …Metal use became widespread throughout the Arctic and Subarctic by the fourteenth century (Franklin et al. 1981:3). Wrought iron fragments have been recovered from the Yukon coast, along with an assortment of copper artifacts, dating back to AD 1200 (Yorga 1978).

Regarding the southern range of the Northwest Coast, Emmons (1991:189) states that "the problem of determining the date and provenience of the earliest iron on the Northwest Coast has again been raised by the occurrence of iron tools at the Ozette site in Makah territory, Washington, in contexts dated to the fifteenth century," implying to him that the "iron had come from Siberia and been slowly traded southward along the American shore." Although it is certainly possible the Ozette iron came from Siberia, Acheson (2003:215-16) contends that

> a particularly strong case for drift iron on the coast is made by Gleeson (1980c), with the recovery of a large assemblage of iron tools, including chisels and assorted bladed knives, from precontact levels at Ozette. Gleeson (1981:3) fixed the age of the assemblage at AD 1613 through indirect dating of associated wood pieces using dendrochronology {tree-ring dating}. Spectrographic analysis revealed a high carbon steel with the probable source being drift iron, based on apparent similarities between the trace elements curves of the Ozette metal and examples from Japan.

Additionally, with reference to precontact Aleut iron briefly mentioned above, "it is also possible that the westernmost Aleut even may have traded with Chinese, Japanese, or Russian adventurers before Bering" (Emmons 1991:182). Although this seems like a slightly more fringe argument, Acheson (2003:217) reports: "McDonald's (1996:137) observation regarding the close parallels between northern Northwest Coast groups and Bronze Aga China, as regards the use of wooden helmets and visors in armour, is another strand in the idea of a Siberian connection. It is reasonable to expect that, along with the intercontinental movement of goods to the Northwest Coast, came ideas." It is also worth mentioning that several 18th Century explorers, such as Cook (Emmons 1991:185), suggested the aborigines' iron was traded from Hudson's Bay Company posts to the east or from Spanish missions to the south, but opinions like Cook's are in the minority now and were probably formed in part due to a lack of comprehension of how far native-to-native trade networks could extend.

In the historic period, it is much clearer where the metal came from. According to Gough (1992:57), there was an "insatiable aboriginal demand for iron, brass, lead, tin, copper, and pewter {which were traded for furs}…" but many explorers (Howay 1941, etc.) wrote that copper and iron were the two trade metals most in demand. Copper often came in sheets, originally carried by the ships to repair the lining of their hulls but later simply as a trade item (Cooper 2007); iron sometimes came in unformed bars but more often was in the form of chizels (chisel blanks fashioned after native adzes), nails, or hoop iron from barrels (Howay 1941, etc.). The acquisition of metal was not always so peaceable as negotiation and trade: there are reports of natives raiding European ships to plunder their metal and guns. Emmons (1991:187) reported that "…the Spaniards lost seven men and their longboat to the treacherous Indians of 'Rada de Bucareli.' They were probably the Quinault, or perhaps their neighbors, the Queets or Hoh to the north, south of Point Grenville on the coast of what is now Washington State;" he went on to speculate that "the attack was evidently for the purpose of securing iron" (ibid.).

Additionally, shipwrecks continued to provide iron for native groups even after contact:

> Among the Makah, Swan (1870:34-35) remarked on the continuation of the practice of salvaging drift iron until as late as the mid-1800s: "some of them have managed to procure hammers and cold chisels from the various wrecks that have been thrown on the coast from time to time; and the wreck of the steamer Southerner, in 1855, about 30 miles south of Cape Flattery, afforded a rich harvest of old iron and copper, as well as engineers' tools which have been extensively distributed and used among the coast tribes of the vicinity." (Acheson 2003:216)

Besides metalworking tools and raw materials, the natives may have acquired men who knew how to work iron from plundering ships or shipwrecks: "Emmons cited one of the examples given by Rickard of a Spanish (?) ship that was wrecked at the mouth of the Columbia River, furnishing the Indians with both iron and a survivor who could work it. This was perhaps 1745"

(Emmons 1991:189). Finally, ships at port may have indirectly provided some technical knowledge as well: "European traders…whenever they stayed any length of time…set up a smithy on land and here in front of the natives made necessary repairs or manufactured chisel-shaped 'tohis' – out of iron rods for trade purposes" (Kruase 1956:149).

As outlined at the very top of the essay, hammering and annealing is the most common way to manipulate metals in early metallurgical traditions, and that is true of the Northwest Coast as elsewhere. The most common way to shape the metal was with a stone hammer and a stone or wooden anvil (Jackman 1978; Emmons 1991; de Laguna 1972; etc.), and this technique was seen from the Ahtna and Tlingit regions in the north all the way down to California. Much later in the historic era, Emmons (1991:190) described Tlingit silversmiths who used "improvised" anvils, including "a sited piece of old iron, let into a piece of wood." Wooden anvils seem to have been mostly used for softer metals: certainly silver, probably copper, but probably not iron. Emmons (1991:190-91) wrote that he observed Tlingit silversmiths who had carefully shaped their wooden anvils into molds, so that when an item was pounded into it, it took on a set shape: "The sheeves [pully wheels] of lignum vitae…are burnt in and worked out, and even lead is used, while the convex sections fitting into same are of ax handles or iron, and when beaten down with a wooden maul into place, assume shape." As a child growing up in a Tlingit community, I heard similar reports for how Coppers could be made: first a wooden panel was carved with a design (raised in relief) and later the copper plate beaten on it to assume the desired shape.

According to de Laguna's research on silversmithing: "silver and most other metals, except pure gold, become harder and more brittle when worked…they must be annealed (heated and quenched in cold water) at intervals as they are pounded, stretched, or bent, otherwise they will shatter" (Emmons 1991:190). Cooper (2007:123) provides a more detailed account:

> When native copper is cold-worked the grain structure becomes distorted making it harder (a phenomenon called work-hardening) and more resistant to further working, so that eventually it starts to develop cracks from the edges and/or, in the case of sheet, in the plane of the sheet (delamination cracks). The way to avoid this cracking is to anneal the copper periodically during working (by heating the metal to a temperature above 300 C for a few minutes)…Thus, to carry out extensive shape changes it is necessary to subject the copper to a series of cold-working and annealing cycles… (Cooper 2007:123)

> …Clark and Purdy (1982) found that after 15 minutes of cold hammering, i.e., without annealing, native copper became too hot to handle. (Cooper 2007:155)

Annealing can be done in a simple campfire. Cooper (2007:89) reported finding evidence of annealing among the copper artifacts recovered from archaeological sites in Gulkana, Alaska: "native copper by-products and 'unfinished implements' are often found in association with cemented ash from hearths perhaps providing evidence that heat treatment (annealing) was part of the technology of native copper working." Besides the macroscopic evidence of ash on the copper artifacts, annealing can also be detected by looking at the microstructure of the metal itself. After performing this sort of analysis, Cooper (2007:124) reported that "all of the GUL-077 {Gulkana} material analyzed appears to have undergone a final heat treatment without further cold hammering. This may have been done intentionally, as part of the manufacturing process, but the heating of these objects could also have occurred either accidentally or as a result of forest fires at the site." Of the age of the GUL-077 site, Cooper (2007:87) says, "though there is evidence of historic activity within the site, the majority of occupation and activity spans the period from AD 1150-1500 based on a recalibration of the radiocarbon dates…," meaning annealing has a long history in this region.

Some scholars thought that whether or not copper artifacts were annealed indicated whether they were utilitarian or ornamental: annealed products, they felt, would be too soft to suit daily chores, so they must be for non-utilitarian (i.e., ornamental) ends. However, Cooper (2007:162) quotes Leader (1988) as having

> conducted experiments that verified the functional ability of annealed tools by making projectile points out of native copper and testing their ability to puncture. He found that annealed tools would potentially last longer as they would bend instead of breaking upon impact, as non-annealed projectile points did. Annealed tools could be reworked and reused making them last longer and therefore more useful. As Leader (1988:57) points out, "metal hardness is only desirable when it is perceived by the user as desirable."

Cooper (2007:163) also uses Leader's research to refute the more general idea that no copper artifacts represented an actual technological advance over earlier stone technology:

> There are conflicting views concerning how useful tools of native copper (or metal in general) were to people in the past. …Halsey (1996:22) believes that they "offered no real practical advantage over tools of flint, slate, and granite." Renfrew (1978:202) also asserts that they were "less durable than their counterparts of stone." However, Leader's (1988) research demonstrated that annealed native copper projectile points could potentially be repaired and re-used almost indefinitely because unlike stone and antler points, native copper points would be much more likely to bend rather than break. Such re-use could have been one of the great benefits of native copper technology. The ability to reuse a tool over and over means a great reduction in the time and energy necessary to acquire raw material (Castro *et al.* 1998 in Chapman 2003). (Cooper 2007:163)

Hence, not only does annealing allow the metalsmith to work the copper (or iron, or silver) longer without causing stress cracks, it can also make the final tool more useful in terms of its life expectancy. However, it should be pointed out that "annealing was commonly practiced when native copper was used but may not be absolutely necessary in order to create an object. Smith (1965) performed a cold-working experiment on native copper and found that the thickness of native copper could be reduced by 96% by cold-working alone, without annealing" (Cooper 2007:155).

Not only has evidence been found for annealing in the archaeological record, there are also accounts of annealing in ethnographic reports and oral histories. In his descriptions of Tlingit silversmiths, mentioned briefly above with regard to anvils, Emmons (1991:190) described one man who first heated up the metal (in this case a silver dollar) by balancing it on a bar of hoop iron, the end of which "is insulated with a wrapping of bark or cloth," that he inserted into a fire: "The partially softened silver is beaten out a little, reheated, and so beaten until it has been shaped to [desired] dimensions [a bar or flat shape].” Emmons (ibid.) similarly described another Tlingit silversmith whose hoop iron was “wrapped with spruce root and hide.”

An alternative to annealing is to “hot-work native copper, that is, hammer it while hot…Hot working native copper would have been more difficult than periodic cold-working and annealing as it would be necessary to find a way to handle hot metal while it was being hammered” (Cooper 2007:155). Apparently because it seems so hard to hold a hot piece of metal with lithic technology, Cooper (2007:123) thinks “it is unlikely that was done in the case of these objects.” Yet, as just mentioned, Tlingit jewelers in Emmons’ time (mainly the late 1880s) were reportedly able to use spruce roots, bark, cloth, or hide to soften silver on hoop iron; similarly, other activities, such as picking up hot stones from the fire and dropping them into bentwood boxes to boil water – an everyday occurrence in traditional Northwest Coast life – could be accomplished with tongs fashioned from a split piece of wood. It seems almost unreasonable to think that some sort of equivalent process could not have been managed by much older metalsmiths working with copper or iron. Finally, since “in their experiment working native copper Clark and Purdy (1982:47) found it nearly impossible to distinguish between these two processes {cold- and hot-working} microstructurally” (Cooper 2007:155), I see no reason not to leave the door open, and say ancient Northwest Coast metallurgists might have hot-worked metal.

While annealing is good in terms of keeping the metal soft, for working it or for use, to make a metal hard you have to temper it. Tempering a metal involves heating it up very high then cooling it very rapidly under controlled conditions. For example, Emmons (1991:188) reports of the Tlingits that “in working steel and iron, they learned to soften it by heating it with charcoal, enabling them to work it more easily, and then bringing the temper back by plunging it in a bath of oil and water when hot." Emmons (1991:178) also reported that in working copper during the old days, the Tlingit "claim to have tempered it by dropping when hot in old urine which was strong…{that is, urine that} had been allowed to stand for some time." Perhaps it was this sort of technique de Laguna's (1972:413) Yakutat informants remembered in describing that the old people could work copper so as to "make it as hard as steel. Now they can't do it. In the olden days they claim they tempered this copper almost as hard as steel." Cooper (2008:28) quotes Powell (1997) reporting similar stories for the Ahtna: "Powell (1997:187) was told by an Ahtna man that the Ahtna were able to 'harden copper fairly well with an application of urinal ammonia, but the process was tedious' and the result was a tool inferior to steel." Acheson (2003:221) describes other groups working metals while hot and tempering them:

> As Caamano (1938:203) observed among the Kaigani Haida in 1792: …These knives were so well fashioned and finished, that at first I felt sure they were not of native manufacture, but later I found that the Indians make them themselves quite easily from the iron that they obtain by barter, *heating it in the fire and forging it by beating it with stones in the water*. [emphasis added {by Acheson}] …Swan (1870:33-34) noted a comparable skill among the Makah nearly a century later, observing that they "employ considerable ingenuity in the manufacture of the knives, tools, and weapons they use, and are quite expert in forging a piece of iron with no greater heat than that of their ordinary fire, with a large stone for an anvil and a smaller one for a hammer. …They are first rudely fashioned with a stone hammer into the required shape, brought to an edge by means of files, and finely sharpened on stones; they are always two-edged, so as to be used as daggers… As they are experienced in the use of heat, they are able to temper these knives very well."

Since tempering is what allows a blade to take and keep a sharp edge, but makes it more brittle as well, it was definitely necessary for these early metalsmiths to be able to distinguish between situations that require tempering, annealing, or just cold hammering.[4]

[4] As a side note, Emmons (1991:127) actually describes the tempering of the wood for a bow, but since he does not provide a date for this technique, it is hard to know if it predates or postdates tempering metals. "When [the wood for a bow was] shaped, it was tempered by wrapping it in damp seaweed and placing it over heated stones from which the fire had been removed, where it remained an hour or two. When removed, it was plunged in cold water for a few minutes, then rubbed down with the hands and tested. If it sprung easily, it was considered a success." At any rate, this sort of technique offers some circumstantial evidence that traditional metalworking processes could have been adaptations of older lithic technology. Grindstones may be a similar translation from lithic to metal tools: de Laguna (1972) reports that sandstone was used by the Tlingit to grind the edges of stone tools and Acheson

In addition to simply hammering metal, Emmons (1991:181) reported that, although not a common practice, the original Coppers, or *tinaá*, were "pounded out of copper nuggets of small size probably 3 to 6 to ten pounds–pounded into thin plates which were rivetted [sic] together to make the tinneh {tináa} shape for they could not have hammered out a larger nugget to shape. I have seen smaller ones one or two feet in height of thin riveted plates but never really a large one." Sturgis (Jackman 1978:80), however, reports that the Ahtna hammered out lumps from 10-12 pounds: "They then laid it on a flat stone and pounded it into a sheet about two feet square in which form they sold it." If his observations are correct, and sheets as large as two foot square could be pounded out with stones, then it is conceivable that the larger 3-4 foot long tináa could have been made, through riveting, out of native copper.

Similarly uncommon, Emmons (1991:130, 190) described post-contact melting (he called it "smelting") of metals with regard to Tlingit silversmiths and bullet molds:

> Silver bracelets, spoons, nose rings, and [indecipherable] are made from coin {silver dollars, only introduced into Alaska well into the American period}. If the amount of metal required is more than that contained in a dollar, several pieces of silver are smelted in a crucible, consisting of a piece of brick lined with potash and glazed with potash…I saw a Sitka jeweler beating into shape a bar of silver the size of a finger. This must have been made by melting a coin in an iron spoon or ladle and running it into a wooden mold. (Emmons 1991:190)

> The ingenuity of the Tlingit is shown in the manufacture of shot. The mold consisted of a piece of cedar split in half for a certain distance like a pair of native tongs. At the meeting of the upper edges, a groove extended the length of the split, [in which were deep holes] at short intervals. [To make these holes], a small iron spike with a narrow neck and a knob at the end, the size of the proposed shot, was put into the fire, and when sufficiently heated was placed between the halves of the mold to burn out the hollows. To run the shot, the halves of the mold were drawn together and lashed at the open end. The mold was held at a slight inclination and the molten lead ran down the groove to fill the holes through the openings [that had been formed by the neck of the iron spike]. [Emmons gives the word for a stone bullet mold, *kuk-qwart-kli-ate* (probably kaqʷá˙ƛ̓i ye˙t, "[metal] melting receptacle"). This would have been equally appropriate for the wooden mold.] (Emmons 1991:130)

No mention is made as to what lead for the bullets were melted in.

(2003:221) reports that "among the Eyak, fine-grained sandstone was reportedly used to sharpen the edges of these {metal} blades (Birket-Smith and de Laguna 1938)."

The most common items of native manufacture (as listed by de Laguna 1972; Emmons 1991; Cooper 2007; Acheson 2003; Howay 1941; etc.) include the following. Native weapons included arrowheads, spear/lance points, daggers, and bullets (which were also formed by shaping copper, as well as melting lead). Ornaments included neck rings (large braided strands of copper or iron wire[5] strung about the neck and shoulders, which I imagine to be somewhat in the manner of earlier cedar bark wreaths), earrings, finger rings, strips of copper attached to ceremonial garb (including smaller versions of the traditional Copper (Jonaitas 1986:102; Emmons 1991:182)), etc. The tools most commonly reported were iron adzes, but de Laguna (in Emmons 1991:188) points out that the traditional wood working curved knife was "of necessity made with a metal blade." Of course, the large Coppers or *tinaá* were widely reported, but they are unusual enough that I will discuss them on their own below.

Less commonly reported items include the following. Native armor may have been augmented by copper. Acheson (2003:223), in describing an ancient site in Prince Rupert, lists a set of "copper tubes {that} were uncovered aligned in double, parallel rows, along with a cache of weapons (a slate dagger and clubs), which suggests to MacDonald (1983:105-106) that the copper pieces may be the remains of a suit of rod armour." Also with regard to copper (and iron) being used in armor, de Laguna (in Emmons 1991:183-184) relates that:

> The very first report and sketch of a "copper" is that made in August 1787, in the *Journal* of Captain James Colnett (manuscript 1786-88) when anchored in "Port St. James," probably…{in} the southernmost of the Queen Charlottes {Islands}. Here the natives (Haida) reminded him of those at Nootka in most manners and dress, except that they were apparently more warlike. He sketched a suit of wooden slat body armor, not unlike Lisiansky (1814, pl. I, *a*), and alongside it (but to a larger scale?) a typical "copper," which he described as "their Copper Breast plate which is their under armour…There may be justification for taking Colnett's word that the "coppers" he saw in 1787 were, in fact, "under armour." He was not only an accurate and interested observer of the native

[5] In describing one copper wire recovered from a Haida site dating to around AD 1150-1400, Acheson (2003:223) reports "microscopic examination shows the wire to have been made by hammering, a technique not common in Europe after the mid-1600s." Presumably, then, many early wire ornaments were similarly made by folding and hammering thin strips of metal.

> scene, but also, on several occasions during the ten days he was at "Port St. James," he saw the natives donning and taking off their armor in attempts to intimidate the Englishmen with their military equipment…He would have seen the copper plates under them…By 1804, the Sitka Tlingit had strengthened their aboriginal armor to meet the new form of warfare {firearms}, for Lisiansky wrote: "Their war habit is a buck-skin, doubled and fastened round the neck, or a woolen cuaca [a sleeveless vest obtained from the U.S. traders], to the upper part of which, in front, iron plates are attached, to defend the breast from a musket-ball." This was, I suggest, an improvement made on the earlier plates of native (?) copper that had been used as protection against aboriginal spears, daggers, and arrows, and also perhaps the first guns.

One of the last unusual items mentioned are "Copper Boxes, in which was small Stones serving as part of the music" at a potlatch observed somewhere in the southern end of Vancouver Island around 1792 (Howay 1941:386). Howay (ibid.) is of the opinion that "it is possible that they may have been manufactured from the sheets of copper purchased from the traders. It is certain that they were not manufactured from the native copper."

Back to the subject of Coppers or *tinaá*, their origins have been hotly disputed. "Keithahn (1964:77-78) believed that the prototype was an Athabaskan-made copper arrowhead, used as a charm, which was expanded in size when sheet copper became available" (Emmons 1991:182). De Laguna (ibid.) herself entertained the notion "that the copper or brass medals and coats of arms given by the Russians to native chiefs or buried to claim the land for the tsar might have furnished a prototype {for later tináa}. But these objects do not seem to have had the traditional 'copper' shape, with its widened top ('head'), and T-shaped ridge dividing the bottom ('body') and separating it from the top." It seems reasonable to me that the Copper existed on a relatively small scale as a traditional art form in the Northwest Coast, which expanded in size and frequency of use as new materials and technologies were introduced into the region; this is the same sort of trend that totem poles followed (Emmons 1991:194), with the older art form being transformed, becoming much more prevalent and elaborate, after the widespread introduction of iron tools.

It is hard to gauge the value of these Coppers in dollar amounts. For example, de Laguna (1972:353) complained that:

> It seems impossible to secure any idea of the relative value of goods, for anything which my informants knew had been formerly prized was apt to be considered as "worth one slave," or "cost one slave." This price was suggested for a prehistoric bracelet of native copper…a piece of copper big enough for a sea-otter arrowhead, a piece of iron from drift wood {probably one nail}, or a necklace of glass and brass beads…The only equivalence that seems to emerge from all the various statements is that a big sea-otter pelt was at one time worth one slave.

We need, then, the value of a slave. Emmons (1991:42) reported that:

> Values {of slaves} seem to have been generally standardized. The following were quoted to me by old people who remembered an earlier period when the traffic in slaves was carried on:
>
> At Yakutat a man was worth 20 pounds of copper, or 6 prime sea otter pelts. A woman was worth 10 pounds of copper, or 5 ordinary sea otter skins.
>
> At Angoon…a man was worth 30 fox skins, or 10 moose skins, or 2 martin skins, or 1 Chilkat blanket. A woman was worth the same, less 10 fox skins.
>
> At Sitka, a man was worth 15 moose skins, and a woman 10 moose skins (Dick Sat-in)
>
> Among the Stikine in 1860, a man was worth 40 blankets or $200. A woman was worth 20 blankets or $100
>
> A jade adz was worth from one to three slaves. A "copper," tinneh [tiná] {tináa} that in length reached from the tip of the finger to the elbow…was worth 20 slaves; one that reached from the tip of the finger to the hollow of the neck…was valued at 40 slaves (Dick Sa-tin)

Another computation given in Emmons (1991:182) to demonstrate the high value of a copper was "when they were sold they could be exchanged for ten slaves or for a thousand blankets [the last by the Kwakiutl?]." Ten slaves is the most common figure reported by de Laguna (1972), etc. We do see a dollar figure given above, of $200 for one slave in 1860 dollars. Various websites and tables have been built up to help convert dollars from different years to some kind of standard. The figures I use below came from Sahr (2009), who offered a table that used the Consumer Price Index to help calibrate purchasing power against 2008 dollars.

According to these calculations, $200 (the price of one male slave) in 1860 dollars is roughly equivalent to $5555.55 in 2008 dollars. Multiplying that amount by 10 (assuming the

Copper is traded for male slaves), we get a value of $55,555.55 in 2008 dollars for one large Copper – probably from 3-4 feet long, since that is a fair average for the distance from finger tip to neck; this distance is also roughly half a fathom. Being the son of a commercial fisherman, I know we often measured out fathoms (six foot lengths) of line by stretching the rope from hand to hand – hence, half that distance, from fingers to neck, should average right around 3 feet. If the 10 slaves are females, that calculation works out to $27,777.77 in 2008 dollars. If the higher figures of 40 slaves, mentioned by Dick Sat-in, are used, that works out to $222,222.22 in 2008 dollars for male slaves, or half as much, $111,111.11 in 2008 dollars for female slaves. Alternatively, if 40 blankets equaled $200 in 1860, and a Copper was worth 1,000 blankets (as quoted above), then one Copper would be worth $138,888.88 in 2008 dollars.

Gough (1992:57) provides a different base point: when the HMS Resolution carried Captain Cook into Nootka Sound in 1778, one large sea otter pelt "sold for as much as three hundred dollars in China;" $300 in 1778 dollars works out to $4,687.5 in 2008 dollars. Since a male slave in Yakutat was worth 6 prime sea otter pelts, that works out to $28,125 in 2008 dollars per male slave, or $281,250 in 2008 dollars at an average 10 (male) slave price for a large Copper, and as much as $1.125 million in 2008 dollars for a single premium 40 (male) slave Copper; females were not calculated in prime sea otter pelt units, so I cannot offer a range for this calculation.

Now, one copper would certainly be a lot of wealth, but several stories relate events involving multiple coppers. One of the most extravagant stories of this kind (in de Laguna 1972:237), which will serve as the outlier for the largest type of expenditures made on the Northwest Coast, was the purchase of land and a humpback salmon stream by the "K^{w}ack'q^{w}an {Kwashkikwaan}" – now a Tlingit clan but originally from "up the Copper River," which is why they had “tınna [coppers]” (ibid.) – who was buying the property from another tribe, the Gotex. This story has several variations, with different prices paid in each, but the most extravagant version relates that the Kwashkikwaan paid for the land “with a canoe. It had 7 cross bars, with 14 coppers tied on them, 7 on each side. Each copper was worth 10 slaves” (ibid.). That means, at the lowest female slave price of $27,777.77 in 2008 dollars for 10 slaves calculated above, the Kwashkikwaan paid a minimum of $388,888.88 plus the price of the canoe. At the most premium price, using the sea otter calculation from Cook’s 1778 data, of $281,250 in 2008 dollars per 10 male slaves (which makes more sense in a way because it was based on the price of a slave in Yakutat and the Kwashkikwaan purchase was for territory near present day Yakutat), the purchase would have cost $3,937,500 in 2008 dollars plus the price of the canoe.[6]

As should be obvious, the above ranges for my calculations are huge, and on top of that, there is a tremendous amount of variability in prices between regions. For example, among the southern groups especially, such as the Kwakiutl, “the value…increased on the southern journey [of the traded “copper”], and with each time that it was displayed or sold” (Emmons 1991:181). In some sense, this situation is analogous to how, among antique dealers, an 18th Century table by itself may be valuable, but it would be worth ten times as much if it had been owned by Thomas Jefferson. Hence, my comparison of Nootka sea otter pelts sold in China in 1778 to the price of a slave in Yakutat in the mid to late 1800s is not necessarily indicative of the actual

[6] More commonplace extravagances of wealth include de Laguna’s report (1972:354) from one of her informants “that a father might give coppers to those who tattooed his child, thereby ennobling the latter, or might lay out coppers for his daughter to walk on at her marriage, which were given to the groom’s people. She was clearly thinking of Tsimshian or southern Tlingit customs, for these practices were not mentioned by other Yakutat informants.” Emmons (1991:179) also reports that Coppers could be “broken into pieces and given to the more honored guests {a practice also done with Chilkat blankets, which were occasionally torn up and distributed to potlatch guests (Oberg 1973:118)} or wholly destroyed, in order to humiliate a rival or wipe out an insult, and such an act would require an equal or greater destruction of property by the opponent. The “copper” might {also} be placed on the gravehouse or mortuary column to honor the dead.” Oberg (1973: 117) reports that “if a copper was broken and a piece thrown into the sea, it increased in value equal to the part thrown away. That is, if half was thrown away the copper was worth one and a half times as much as originally.”

value of a Copper in Nootka, Yakutat, or anywhere else along the coast, but it is the best estimate from the evidence I have to work with.

Compounded with these internal variations, there is a world of difference between a market economy, such as we engage in here in the U.S., where wealth (mainly money) can be traded for commodities, like pork bellies (a.k.a., bacon), stock, or labor; and a prestige economy, where wealth is almost never directly traded for commodities, but is instead 'spent' in displays that enhance the giver's social status and prestige. To illustrate the difference between market and prestige economies, consider the following example given from Oberg (1973:118): "The blankets and money used for potlatching are never used for economic purposes. The blankets are stored away in large cedar chests and eventually wear out by exchange and transportation or are eaten up by moths. A Tlingit would never consider using these blankets for keeping his back warm. Potlatch money, likewise, is kept hidden away…" and never spent (cf. Oberg 1973:100). What the dollar figures above represent, then, is not so much purchasing power as such: a Copper would never buy tens of thousands of dollars worth of bacon, as it were; rather, these figures represent a level of economic commitment – the price reflects how hard one has to work to garner enough resources, such as salmon, fish oil, etc. to host a potlatch, following which one would have a return potlatch reciprocated, in which one might be presented with a Copper. In effect, one does have to perform tens of thousands of dollars worth of work to earn the right to possess a Copper, even if that work cannot be calculated in wages and the Copper is not generally acquired in the sort of transaction that can be covered by a bill of sale. Instead, the work is measured in the size of a party one can host, and the Copper could almost be thought of as the formal recognition of the status gained by hosting such a grand party.

In any case, the most valuable Coppers were those made from native or virgin copper. To prove their Copper was authentic, chiefs reportedly had their slaves beat the Copper as they walked towards the potlatch house or wherever the item was to be displayed, since “when struck {an authentic Copper} should give forth a dull sound and not ring,” which is apparently what happens to industrial trade Coppers: they “ring” when struck (Emmons 1991:181). Early explorers like Lisiansky confused this striking for a musical performance (ibid.).

Several reasons are given for why the introduction of sheet copper into the Northwest Coast economy devalued the traditional Copper – either the traders themselves started producing cheep imitation knock-off Coppers, or the large amount of raw material meant the natives themselves could mass produce Coppers (Emmons 1991:181, 182; etc.) – but basically it amounted to the market being flooded. It is, however, worth pointing out that “the use of native copper did not end with the appearance of iron or industrial copper metals. Native copper was still being traded to the coast even when finished Euroamerican copper goods were being traded inland as late as the mid-1860s (Legros 1984)” (Cooper 2007:94). As a parting thought on the value of copper, Jonaitis (1983:104) points out that copper is symbolically linked to the color of freshwater salmon flesh, which is one of the fundamental bases of the Northwest Coast economy.

In closing, I would like to say a few words about the social and spiritual dimensions of metallurgy. On the social front, from the above calculations, it should be clear that for the most part, copper articles represented the pinnacle of wealth, something only the elites could afford to wear, give away, or even conspicuously destroy, as de Laguna (1972:413) was told by her informants: “‘{copper items} were expensive. Just rich people had them–respectable people; ‘anqawu {*ankaawu* – village heads} use them. Whoever had it would be the proudest.’ ‘Just high people use them things. A man like me {a commoner} can’t use it. ‘AnyAdi [nobles] is the only one that use it…'" On a different level of social organization, it seems that work in metal or with metal was primarily a male activity, insofar as Oberg (1973:85) reports that among the Tlingit, "tool, weapon and utensil making" are "among the male activities," as are those tasks that would most directly benefit from metal or metal tools, such as "house building; canoe making; carving of all kinds; trading; hunting and fishing." Cooper (2007:28) similarly reports that "according to Reckord (1983) copper working was a male activity" among the Ahtna.

Cooper (2007:163-164) writes that copper weapons might have been seen to possess some sort of special spiritual efficacy: "…the association of native copper with a powerful animal such as the wolverine (McKennen 1959) and its use as a weapon against bears (de Laguna and McClellan 1981) {cf. Emmons 1991: 130} and humans (McClellan 1975) implicate native copper as not only the raw material for an effective weapon but a spiritually powerful one as well." This report is corroborated in Emmons (1991:130), who says "when manufactured bullets were not to be had, pieces of lead or native copper were beaten into slugs, and these were often preferred for bear hunting." It remains unclear to me to what extent the preference of copper weapons for bear hunting or war had to do with what Cooper said above (copper is a good "raw material for an effective weapon") and what extent can truly be attributed to copper's spiritual power. Bears, for example, have extremely thick, strong bones, especially around the front of the skull and shoulder blades, meaning, although I don't have a strong ballistics background, it seems reasonable to think that copper may have a better chance of shattering and hence penetrating a bear's bones than softer lead bullets (which may simply deform and deflect off of bear bones) or stone spear heads (which might shatter before the bone does).

De Laguna (1972:679, 746) lists several ways metals, including iron, lead, and silver but curiously not copper, had spiritual power over Land Otter Men (*koóshda.ka*),[7] one of the most powerful and feared spiritual monsters in the Tlingit landscape. However, there are some points of confusion in her report. There is the general feeling summarized by one informant that "the kucda {land otter}, she's scared that iron, that money {silver}, too" (de Laguna 1972:746). That is why ordinary people carry metal with them: to scare away kóoshda.ka. "One sure protection against land otters is to carry something made of metal–money, a ring, a knife, a gun, any kind of metal tool, even a nail. If you have money in your pocket or a ring on your finger, you should put it in your mouth, I was told…" (de Laguna 1972: 746). Hence, de Laguna (1972:679) says that prospective shamans, who, in their spirit quest, want to attract land otters to gain their powers (through a process that involves cutting out their tongues), wouldn't carry iron knives with them since iron scares off land otters. Instead, they used other knives, such as those made out of copper or mussel shell. Contradictorily, she notes that "according to the notes accompanying Emmons' catalog {presumably of items he collected from shaman's graves}… A knife with an iron blade and a decorated handle might be used {by the shaman} to cut the tongue {of his new spirit animal}" (de Laguna 1972:677). It seems that iron isn't simply a repellant: people carry metal with them "because the Land Otter Man is afraid of it" (de Laguna 1972:746), yes, but its actual effect is that the kóoshda.ka "will be forced to 'show himself' in his animal form, so that you are no longer in danger of being deceived by him" (ibid.).[8] Hence, it seems to

[7] Land Otter Men are shapeshifters that can take the form of loved ones who have died either by drowning or by being lost in the woods (both situations in which the corpse is lost). When encountered in the forest, they try to lure you back to their den, where they will turn you into a kóoshda.ka yourself. There are several cosmological principles at work here (Dr. Langdon, personal communication, 2009, in class), but the basic idea is that they are horrible because they remove people from the social order and therefore erase any potential of future reincarnation.

[8] "Swanton (1908, p. 456) also explained that the Land Otter Men eat evil-smelling things (cak^{w}) on the beaches and therefore when they breathe on someone their foul breath makes the person faint. However, "if one put native tobacco, iron, or lead into his mouth it counteracted the influence." This use of tobacco was not mentioned at Yakutat" (de Laguna 1972:746).

me the more nuanced view is that metal (especially iron, it seems) had some power over kóoshda.ka, which is why, contrary to de Laguna's views expressed above (that prospective shamans avoided carrying iron knives), we actually see instances of shamans being buried with iron knives (as noted by Emmons, quoted above). Similarly, in her description of shamans' regalia, de Laguna (1972:689) mentions a shaman's bracelet that consisted of "copper wire twisted around a core of iron." Perhaps this shaman was trying to combine the spiritual power of bear- and man-killing copper with the control iron had over Land Otter Men. Alternatively, the shaman may have merely been advertising his noble status.

To close out the paper, I'd like to say a few words about the spiritual dimensions of finding copper. Cooper (2007:28) mentions that "according to de Laguna and McClellan (1981:645), {the Ahtna thought} copper 'demanded religious precautions to secure the nuggets…'" as well as indicating that among both the Ahtna and Dena'ina there are oral traditions that cultivate an "association of native copper with *luck*, wealth and prestige" (emphasis mine, Cooper 2007:163). Similarly, de Laguna (1972:412) reports that "after the White people lived on the Pacific Ocean, after that there were boats on the ocean, there would always be iron, nails from floating logs. People used to look for it. Anybody who found it would be a rich person, and *lucky*" (emphasis mine). What I wanted to point out here was that there are two ways to read these references to luck: one way indicates that to find a copper deposit (or drift iron) requires a certain amount of luck. There are plenty of indications that locating copper deposits, for example, can be difficult, even if you know generally where to look.[9] However, an alternative reading of "luck" or "lucky" is that if you find copper, *thereafter*

[9] "Though there are numerous locations throughout south-central Alaska, especially WRST-NP/P {Wrangell/St. Elias National Park & Preserve}, and southwestern Yukon Territory where native copper has been reported, exact locations are not always provided in the geological literature. More common is the reporting of native copper being found at certain streams leaving one to search several kilometers of stream drainage." (Cooper 2007:130)

you will become lucky. This reading seems more consistent with Northwest Coast spirituality, especially based on reports such as de Laguna's (1972) with regard to *kayani* (lit., leaves) which are charms that, when found, bring luck or other spiritual power. Metals, then, are not simply something which, when put to use (such as in a weapon or a tool), possess some sort of extraordinary power – simply finding metal imparts an extraordinary quality to its owner, such as luck.

The transformative power of discovering metal perhaps has another confirmation in the story of "Ka-Kakh-ta" (Emmons 1991:177), the man who killed sleep. Because he killed sleep, which looked like a little bird flying around his canoe, the man's whole village died. So he traveled inland, and lived among the Athabascans, teaching them his ways, and learning about copper from them. After he came back to Tlingit country, he founded his own clan, and they had the rights to trade copper with the interior people. In de Laguna (1972:821), there is a reference to a man "who caught Sleep in the form of a bird" who became a "wealth-bringing Being," and who is apparently the sister of "Property Woman." It is good luck to see these Beings in the woods, if also laced with danger – not behaving properly after seeing them can kill you. However, if you do behave correctly, you will almost certainly become wealthy. Incidentally, Property Woman is often described as having Coppers strapped to her side or on her back. What is important here is that discovering copper and bringing it back to his people seems to have transformed the man who killed/caught sleep into a powerful immortal being. This transformative view of metals also corresponds with a story relayed by de Laguna (1972:899-900) called "The Discovery of Copper," which tells the story of a young Tlingit outcast who has a series of dreams in which the copper itself speaks to him, telling him where to look for the copper deposit. After he finds it, he and his mother are re-integrated back into their village and become wealthy. As a side note, the story ends by saying "every spring they {the villagers} look for it. They can't find it unless they boy's mother shows you where to find it" (de Laguna 1972:900) – reinforcing the idea of how difficult it can be to locate copper sources, and perhaps indicating that copper can hide itself from you if you are not worthy of it.

Bibliography

(including both directly and indirectly cited sources)

Acheson, Steven
2003 "The Thin Edge: Evidence for Precontact Use and Working of Metal on the Northwest Coast." In *Emerging from the Mist: Studies in Northwest Coast Culture History*, edited by R. G. Matson, G. Coupland and Q. Mackie. Vancouver: UBC Press.

Basalla, G.
1988 *The Evolution of Technology*. Cambridge: Cambridge University Press.

Birket-Smith, Kaj and F. de Laguna
1938 *The Eyak Indians of the Copper River Delta, Alaska*. Copenhagen: Levin and Munksgaard.

Brooks, Charles W.
1876 *Japanese Wrecks Stranded and Picked up Adrift in the North Pacific Ocean*. California Academy of Science. (Originally published by Ye Galleon Press, Fairfield, in 1964.)

Caamano, J.
1938 The Journal of Jacino Caamano. British Columbia Historical Quarterly 2:189-222; 265-301. (Translated and edited by Harold Grenfell, H.R. Wagner, and W.A. Newcombe.)

Chapman
2003 *Archaeologies of Complexity*. London: Routledge.

Clark, D. E. and B. A. Purdy
1982 Early Metallurgy in North America. In *Early Pyrotechnology: The Evolution of the First Fire-Using Industries*, edited by T. A. Wertime and S. F. Wertime, pp.45-58. Washington, D.C.: Smithsonian Institution Press.

Clark, D. W.
1977 *Huhanudan Lake: An Ipiutak-Related Occupation of Western Interior Alaska*. National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper No. 71. Ottawa: National Museums of Canada.

Colnett, Captain James
(1786-88) "Journal, Prince of Wales, 16 October 1786 – 7 November 1788." Unpublished Crown-copyright manuscript in Public Record Office, London (Adm. 55/146).

Cooper, Harold Kory
2007 The *Anthropology of Native Copper Technology and Social Complexity in Alaska and the Yukon Territory: An Analysis Using Archaeology, Archaeometry, and Ethnohistory*. Ph.D. Dissertation: University of Alberta

Davis, Horace
1872a *Records of Japanese Vessels Driven upon the Northwest Coast of North America and Its Outlying Islands*. Worcester, MA: American Antiquarian Society.
1872b Japanese Wrecks in American Waters. *Overland Monthly* 9:353-360. San Francisco: John H. Carmany.

Dawson, George M.
1879 *Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia, 1877*. Montreal: Geological Survey of Canada, Dawson Brothers.

de Laguna, Frederica
1972 *Under Mount Saint Elias: The History and Culture of the Yakutat Tlingit*. Smithsonian Contributions to Anthropology 7, in 3 volumes. Washington, DC: Smithsonian Institution Press.

de Laguna, F. and C. McClellan
1981 Ahtna. In *Subarctic*, edited by J. Helm, pp. 641-663. Handbook of North American Indians. vol. 6. W. Sturtevant, general editor. Washington, D.C.: Smithsonian Institution Press.
de Laguna, F., F. A. Riddell, D. F. McGeein, K. S. Lane and J. A. Freed
1964 *Archaeology of the Yakutat Bay Area, Alaska*. Smithsonian Institution Bureau of American Ethnology Bulletin 192. U.S. Washington, D.C.: Government Printing Office.
Emmons, George Thornton
1991 *The Tlingit Indians*. Edited with additions by Frederica de Laguna. Seattle: University of Washington Press.
Franklin, Ursula M., E Badone, R. Gotthardt, and R. Yorga
1981 *An Examination of Prehistoric Copper Technology and Copper Sources in Western Arctic and Subarctic North America*. National Museum of Man, Mercury Series, Archaeological Survey of Canada Paper No. 101. Ottawa: National Museums of Canada.
Gleeson, Paul
1980(c) Ozette Woodworking Technology. Project Report No. 3. Pullman: Laboratory of Archaeology, University of Washington.
1981 Analysis of Pandora's Box: The Ozette Experience. Paper presented to the 46th Annual Meeting of the Society of American Archaeology, San Francisco.
Gough, Barry M.
1992 *The Northwest Coast: British Navigation, Trade, and Discoveries to 1812*. Vancouver: UBC Press.
Halsey, J. R.
1996 Without Forge or Crucible: Aboriginal Native American Use of Metals and Metallic Ores in the Eastern Woodlands. *The Michigan Archaeologist* 42 (1):1-58.
Howay, Frederic W. ed.
1941 *Voyages of the "Columbia" to the Northwest Coast 1787-1790 and 1790-1793*. New York: Da Capo Press.
Jackman, S. W. ed.
1978 *The Journal of William Sturgis*. Victoria, BC: Sono Nis Press.
Jonaitis, Aldona
1986 *Art of the Northern Tlingit*. Seattle: University of Washington Press.
Keddie, Grant R.
1990 *The Question of Asiatic Objects on the North Pacific Coast of America: Historic or Prehistoric?* Contributions to Human History No. 3. Victoria: Royal British Columbia Museum.
Keithahn, Edward L.
1964 "Origin of the 'Chief's Copper' or 'Tinneh.'" *Anthropological Papers of the University of Alaska* (Fairbanks) 3 (1):17-20.
Krause, Aurel
1956 *The Tlingit Indians: Results of a Trip to the Northwest Coast of America and the Bering Straits*. Translated by Erna Gunther. Seattle: University of Washington Press.
Larsen, H. and F. Rainey
1948 *Ipiutatk and the Arctic Whale Hunting Culture*. New York: Anthropological Papers of the American Museum of Natural History, No. 42.
Leader, J. M.
1988 *Technological Continuities and Specialization in Prehistoric Metalwork in the Eastern United States*. Ph.D. Dissertation: University of Florida.
Legros, D.
1984 Commerce entre Tlingits et Athapaskans tutchones au XIX siècle. *Recherche Amerindiennes au Quebec* XIV(2):11-24.
MacDonald, George
1983 Prehistoric Art of the Northwest Coast of British Columbia. In *Indian Art Traditions of the Northwest Coast*, edited by Roy L. Carlson, pp. 99-120. Burnaby: Archaeology Press, Simon Fraser University.
1996 *Haida Art*. Vancouver: Douglass and McIntyre.
McCartney, Allen P.
1988 Late Prehistoric Metal Use in the New World Arctic. In *The Late Prehistoric Development of Alaska's Native People*, edited by Robert D. Shaw, Roger K. Harritt, and Don E. Dumond, pp. 57-79. Aurora: Alaska Anthropological Association Monograph Series.

McClellen, C.
1975 *My Old People Say: An Ethnographic Survey of Southern Yukon Territory*. National Museum of Man Publications in Ethnology 6(1), in 2 volumes. Ottawa: National Museums of Canada.

McKennen, R. A.
1959 *The Upper Tanana Indians*. Yale University Publications in Anthropology. New Haven: Department of Anthropology at Yale Univeristy.

Nelson, R. K.
1974 Relationships Between Eskimo and Athapaskan Cultures in Alaska: An Ethnographic Perspective. *Arctic Anthropology* XI (Supplement):48-53.

Oberg, Kalervo
1973 *The Social Economy of the Tlingit Indians*. American Ethnological Society, Monograph 55. Seattle: University of Washington Press.

Powell, A. M.
1997 Trailing and Camping in Alaska. Valdez: Prince William Sound Books. Originally published in 1909 by Newold Publishing Company.

Reckord, H.
1983 *Where Raven Stood: Cultural Resources of the Ahtna Region*. Cooperative Park Studies Unit Occassional Paper No. 35. Fairbanks: Cooperative Park Studies Unit.

Renfrew, A. C.
1978 Varna and the emergence of wealth in prehistoric Europe. In *The Social Life of Things: Commodities in Cultural Perspective*, edited by A. Appadurai, pp. 141-168. Cambridge: Cambridge University Press.

Rickard, T. A.
1941 "The Use of Meteoric Iron" in *The Journal of the Royal Anthropological Institute of Great Britain and Ireland*, Vol. 71, No. 1/2, pp. 55-66

Sahr, Robert C.
2009 Consumer Price Index (CPI) Conversion Factors 1774 to estimated 2019 to Convert to Dollars of 2008. Accessed online from <http://oregonstate.edu/cla/polisci/faculty-research/sahr/sahr.htm>

Smith, C. S.
1965 *Metallorgraphic Study of Early Artifacts Made from Native Copper*. Paper presented at the 11th Congress of the History of Science, Warsaw, Poland.

Swan, James G.
1870 *The Indians of Cape Flattery, at the Entrance to the Strait of Juan de Fuca, Washington Territory*. Smithsonian Contributions to Knowledge, 220. Washington.
N.d. Journal of a Trip to Queen Charlotte's Islands, BC, May 1, 1883 to September 16, 1883. Seattle: Suzzallo Library, University of Washington.

Swanton, John R.
1908 *Social condition, beliefs, and linguistic relationship of the Tlingit Indians*. Bureau of American Ethnology, 26th Annual Report for 1904-1905, pp.391-485.

VanStone, J. W.
1974 *Athapaskan Adaptations: Hunters and Fishermen of the Subarctic Forests*. Worlds of Man Studies in Cultural Ecology. Chicago: Aldine Publishing Company.

Workman, William
1978 *Prehistory of the Aishihik-Kluane Area, Southwest Yukon Territory*. National Museum of Man Mercury Series, Archaeological Survey of Canada Paper No. 74. Ottawa: National Museums of Canada.

Yorga, Brian
1978 Final Report, Archaeological Reconnaissance of the Yukon Coast. Report on file, Archaeological Survey of Canada. Ottawa: National Museum of Man.