Metallurgy in the prehistory of America: a synthetic overview.

Roberto Lleras
Academia Colombiana de Historia

Foreword

This paper is the result of a conference delivered at the Master/Ph.D. in Quaternary and Prehistory at the Universita degli Studi di Ferrara in 2013. The purpose of the conference was to introduce archaeology students into a specific subject that would provide them with new theoretical and methodological tools even if American archaeo-metallurgy would not probably be pursued as a field of research by them. Much of this original design has been kept when preparing the paper. I would be happy if this text becomes useful for non-specialists and scientists with some degree of interest in America and its metallurgy. The paper might be useful also for people who want to find updated information on the subject, compiled and explained in context.

Graphs, tables and some maps have been drawn by the author. Other maps were extracted from Google Earth and subsequently modified; a few were taken from free Internet sources. Most photographs are also the property of the author; some others were taken by Clark Manuel Rodriguez / Museo del Oro de Colombia (marked as M.O.), Rudolf Schrimpf (marked as M.O.), Juan Mayr (marked as J.M.), Patricio Estevez / Ministerio de Cultura y Patrimonio de Ecuador (marked as P.E.), Luis Gonzalez (marked with full name), Museo Chileno de Arte Precolombino (marked M.C.A.P.), Museo del Banco Central de Costa Rica (marked M.B.C.C.R.), Museo del Banco Central de Reserva del Peru (marked M.B.C.P.), Musees Nationaux de Bruxelles (marked as M.N.B.) and free Internet sources. Where applicable sources are cited at the end of the paper.

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1. Research and the political setting

Treasure hunting, looting, illegal trafficking of archaeological objects and privately owned collections are frequent throughout Latin America. Among the most sought objects we can usually find metal artefacts, especially gold specimens. This has had several important effects on the preservation and study of archaeological metallurgy, as will become evident along this paper.

America – Countries and regions mentioned in the text (Google Earth)

1.1. Looting

The first and most harmful effect of the abundance of gold has been the incredible frequency and intensity of looting. Looting is, of course, a common occurrence in most regions of the world, but there are degrees of looting. In what is now known as Latin America looting started almost at the moment when the conquerors set foot in the first found lands. The greed for gold led many of the Spanish conquistadores, not only to grab whatever was available in the villages of the Indian communities but also to dig graves and sanctuaries where they presumed gold was buried. Captain Pedro de Heredia, the founder of the city of Cartagena, was famous for the extensive looting of large burial mounds in the Sinu region shortly after his arrival. In the province of Cañar, southern Ecuador, the Spaniards dug in 1563 a grave which belonged to a recently buried chief; his family was present and they had to beg the looters to let them take away the corpse without destroying it. Throughout the discovery and conquest of the new lands episodes like those were repeated. Looting of Indian sites and the quest for gold became part of the colonial culture.

Left - Treasure hunters digging a shaft and chamber tomb. Right - A Colombian *huaquero* with the tools of the trade

This tradition has not weakened; nowadays looting is known throughout South America as *guaqueria/huaqueria*, a word derived from the Quechua *huaca* or sanctuary. *Guaqueria* or grave looting is deeply embedded in the peasant culture of those regions where gold finds are frequent. During the second half of the nineteenth century and the first decades of the twentieth century in the Central Cordillera of Colombia a large scale peasant colonisation of new lands occurred

and was accompanied by intensive looting; there is even a book written by one of the guaquero leaders describing the types of tombs and objects found. The gradual expansion of agriculture, forest clearance, mining and the construction of roads and other large structures has led to accidental finds of Indian graves which quickly develop into large scale looting.

When the tombs of the Lord of Sipan were found in the Moche area of northern Peru and the archaeologists intervened it was necessary to have the Peruvian army firing regularly their machine guns during the night in order to keep aggressive looters away. In spite of that, many grave goods from Sipan were stolen and they were traded in the international market by prestigious auction houses.

As recently as 1992, Malagana, a large cemetery was found in the vicinity of Cali, Colombia. In a matter of days there were several hundred persons looting in the area; the police and the army were called in and they were not able to stop the looters. It was even rumoured that the Major of the town where the discovery was made, was doing business with the looters and that the armed forces were actually regulating the looting in exchange for money. A handful of the gold objects found were recovered by the Museo del Oro of Bogotá; most of them made their way to the hands of foreign collectors in the United States, the United Kingdom, Switzerland and Belgium.

Left - The leftovers of treasure hunters in the region of Nazca, Peru. Right - Extensive looting at the site of Malagana, south-west Colombia

Such widespread greed for gold and the culture of looting has meant that many sites have been destroyed. Archaeologists certainly agree that nowadays it is virtually impossible to find undisturbed sites belonging to certain cultures such as Calima, Quimbaya, Pasto and Cañar, precisely because they had gold rich graves and have, thus, been looted to exhaustion. Only a handful of the gold objects in the public domain have been obtained through controlled archaeological digs, the rest comes from the purchase of looted sets.

The handicap introduced by this phenomenon in the research of metallurgy is enormous. Basically the whole context is lost and data concerning association, stratigraphic details and spatial relations is non-existent. Up to date there is scarce evidence concerning what seems to be a workshop in central Colombia, a large one in southern Ecuador, an arrangement of furnaces in the Sican area of Peru, a couple of Vicus sites in Lambayeque, a bronze workshop in the Argentinian northwest and small scale sites elsewhere; just that for what was a large scale industry, which produced thousands of objects in many different sites. Our knowledge of the chain of production, of the processing of metals and minerals, the fuels used, etc. is precarious. We are limited to a great degree to the study of the objects themselves without their context.

Left - The "Quimbaya treasure", a large hoard dug in the 19th century in Colombia. Right - The Museo Larco in Lima, Peru, a privately owned archaeological collection

1.2. Collections and political manipulation

The reverse side of the coin with relation to looting is the activity of collecting. During most of the nineteenth century there was no real national interest on forming collections in any Latin-American country. In the meanwhile the large European museums had turned their eyes towards the continent. By the late 1800s most of what could be seized in Egypt, Greece, Italy, the near East and the far East had been divided among British, French and German museums, so that other areas of the world became interesting. Central and South America were explored for that purpose by all possible means. High rank diplomatic and consular officials were among the first to pursue these riches. By the early twentieth century, official missions from institutions such as the British Museum and the Museum fur Volkerkunde of Berlin were actively importing objects, since in most Latin-American countries there were no laws prohibiting it. In some cases the expeditions were accompanied by ethnographers and archaeologists who wrote reports and left records of the sites and finds.

Eventually national collections began to form. At the beginning it was a matter of private individuals, some of them involved in elite intellectual circles where history and native cultures became fashionable and were studied. Some early collectors were merchants who came across indigenous objects accidentally, but being rich and learned they had the possibility of keeping them. The fate of these early collections was varied, some were sold to foreign buyers, others were dispersed among the heirs of the original collectors and a few found their way to public museums. Exceptionally private collections acquired the character of true museums and established a permanent exhibition and public services; this is the case of the Museo del Oro del Peru and the Museo Larco, both in Lima, and the Museo del Alabado, in Quito, Ecuador.

Nevertheless, what was more significant in this process was the formation of public collections. In most Latin-American countries where this occurred the activity was sponsored and owned by the central banks. As surprising as it may sound, in this continent this made sense, since central banks were the only state institutions that had good financial resources, security and stability. Bank sponsored museums were established in Colombia in 1939, Ecuador in 1950, Costa Rica in 1950 and Peru in 1982. Each one has its particular history, but they all have in common at least three main things: the absence of real museum policies with regard to the

acquisition of objects for the collections; a very conservative and elite management of the exhibition and no real interest in the cultural and archaeological contexts of the objects. The collections grew steadily becoming, in some cases, very large. Gold was preferred over all other materials, even when it meant discarding very interesting objects of pottery, stone, wood, etc. In the case of the Museo del Oro in Colombia, metallic objects made of copper had little chance of being acquired and even less of being exhibited, the reason being that they were regarded as inferior with relation to gold objects and, therefore, not worthy of much attention.

Left - Museo del Oro de Colombia. Right - Museo del Banco Central (nowadays Ministerio de Cultura y Patrimonio), Ecuador.

All of these factors conspired to build a political manipulation of museum collections, particularly gold collections. In the hands of conservative elites these museums became elegant and refined sites where a particular notion of the past, the nation and national identity were portrayed and projected. The notion of archaeological objects as documents capable of conveying information about past societies came second. It became important, first of all, to build an “elegant” exhibition that would satisfy the refined taste of a few individuals. No effort whatsoever was made to share with native Indian communities the effort of interpreting their past or to interact with them in the construction of museum exhibitions. Once again gold and the greed that it awakens had determined this exclusive and unilateral handling of collections and museums. It took quite a long time to start changing this and even then to a very small degree. If we have to judge the situation nowadays, it would be closer to the truth to say that we are still handling the topic with a nineteenth century mentality.

Left – Museo Banco Central de Costa Rica. Right – Museo Banco Central del Peru.

2. The early origins of metallurgy in South America

There has not been up to date any archaeological project oriented towards the investigation of the origins of metallurgy in South America. Various early sites with metal finds, located in a large area between northern Chile and northern Ecuador, have been dated between 1800 and 700 b.C.E. (before the Common Era). Those finds represent an early stage in the development of metal work; it is at this period in history that the craft of metals began in South America. After the 7th century b.C.E. the panorama changes, there are many finds of highly elaborate metals in different zones; three well defined styles emerge (Chavín, Cupisnique and La Tolita-Tumaco) and metallurgy enters a phase of maturity.

2.1. Chile

The sites of Tulán 54 and Tulán 85 in Atacama, northern Chile, yielded burials with hammered gold and copper artefacts. Sites are dated between 1130 and 890 b.C.E. It is argued that herders that lived in the region in small dwellings around 1200 b.C.E. used native gold and copper, which was quite abundant in the area. Nothing else is known from that region for this period.

South America, sites where early (prior to 700 b.C.E.) metallurgical finds have been reported

2.2. Bolivia

Copper slag has been found in Wankarani, southern Titicaca, dating from between 1210 and 800 b.C.E. In the nearby site of Chiripa, copper minerals, used as raw material, were dated to 1020, 950 and 900 b.C.E. There is a third site yielding metal finds, Pucara, probably contemporary to Wankarani and Chiripa. Apparently the lower levels of the large city of Tiahuanaco (approximately 1000 b.C.E.) yielded some copper slag. There was an acute shortage of available fuels in the Bolivian plateau, a fact that may have hindered the development of metallurgy. However, some authors argue that dried llama excrements could have been used for metal processing at the time, as they were in the Colonial era.

Region	Site	Date b.C.E.
Desert of Atacama	Tulán 54	1130 ± 65
		890 ± 60
	Tulán 85	Contemporary to Tulán 54
	Tilocalar Phase	From 1200

Region	Site	Date b.C.E.
Plateau, south basin of the Titicaca lake	Tiahuanaco	1000 ± ?
	Wankarani	1210 ± 110
		800 ± 100
	Chiripa	1020 ± 120
		950 ± 140
		900 ± 110
	Pucara	Contemporary to Wankarani and Chiripa

Left – Early dates for metallurgy in Chile. Right – Early dates for metallurgy in Bolivia.

2.3. Peru

In the southern Titicaca basin the site of Jiskairumoko yielded some gold objects. The context is described as a community in transition between the hunting-gatherer mode and an agricultural-herder society. By 2300 b.C.E. a small village existed and pottery appeared by 1500 b.C.E. In a burial dated 1783 b.C.E. there was a necklace with gold and stone beads. Metal beads were hammered out of native gold chunks. The site of Waywaka, Andahuaylas department of south Peru, is widely known for a date of 1490 b.C.E. There were two burials, one with a set of nine gold leafs and the other with 25 leafs and the working tools of a metal smith inside a stone jar.

Mina Perdida is a large ceremonial site in the valley of the Lurin River; platforms and pyramids were built for over eight centuries. Copper sheets associated to dates of 1100, 1170, 1080 and 1070 b.C.E. were found in the filling of the structures. It seems that native copper was used to form thin sheets by hammering. In the same valley there is another site: Malpaso, where a copper-silver alloy bead was dated at 700 b.C.E. In the north coast, site of Puémpaue, a gilded copper disc was found covering the mouth of a corpse in a burial dated between 1500 to 1300 b.C.E. A nearby burial at Huaca La Merced had a gold ring and a copper nose ring; dates range from 800 to 700 b.C.E. There is also a burial with two copper discs in Kuntur Wasi, northern Sierra, dated to 910 b.C.E. Yet another set of burials in Morro de Etén, Lambayeque River, exhibited crowns and breastplates dated at 760 b.C.E. There are a few objects in the early phases of Chavin, found at Kotosh, dated to 1200, 1150, 1120, 1050, 920, 890 and 870

b.C.E. and in Chongoyape, probably before 700 b.C.E. These last ones are quite complex because they combine hammering and welding.

Region	Site	Date b.C.E.
Tititicaca basin	Jiskairumoko	1783 ± 43
Andahuaylas	Waywaka	1490 ± 100
Lurín Valley	Mina Perdida	1170 ± 90
		1100 ± 90
		1080 ± 50
		1070 ± 100
	Malpaso	700 ± ?
Jequetepeque Valley	Puémpaue	1500 a 1300
	Kuntur Wasi	910 ± 60
North Coast	Huaca La Merced	800 a 700
	Morro de Etén	760 ± 80
Cajamarca, North Sierra	Kotosh	1200 ± 150
		1150 ± 130
		1120 ± 110
		1050 ± 80
		920 ± 230
		890 ± 170
		870 ± 120
	Chongoyape	Before 700
	Pacopamba	Before 700

Early dates for metallurgy in Peru

2.4. Ecuador

In the southern Sierra, the site of Putushio is noteworthy for the existence of a large complex of furnaces in what was probably the earliest metal workshop found in the continent. The most remarkable objects are small metal spheres cast in clay moulds. Dates start at 1470 b.C.E. but the metallurgical activity continues until 755 b.C.E. Gold, silver and copper objects are reported from Salango, central coast dated at 1500 b.C.E. A metal smith was buried in Los Cerritos, central coast together with his tools in 890 b.C.E. Finally, in the north coast, site of Las Balsas, a small gold-silver-copper alloy sheet was dated between 720 and 710 b.C.E.

Region	Site	Date b.C.E.
South Sierra	Putushio	1470 ± 255
		1260 ± 180
		865 ± 95
		830 ± 120
		755 ± 155
Central Coast	Salango	1500 ± ?
	Los Cerritos	890 ± 90
North Coast	Las Balsas	720 ± 35
		710 ± 60

Early dates for metallurgy in Ecuador

2.5. Summary

Even though this information is still incomplete, it is useful since it points out certain key facts associated with this Initial Period of metallurgy. First, the geographical distribution and chronology of the finds clearly suggests that there was no unique initial focus of development; on the contrary, it seems that in a large area between northern Chile and northern Ecuador, both in the Sierra and in the coast, different local communities experimented working metals at around the same time and that there was no communication or diffusion of experiences. Next, as new finds are announced it is evident that these processes are surprisingly early; probably around the end of the third millennium b.C.E. metals were already being used. Several sites have dates within the second millennium b.C.E. and many more at the beginning of the first millennium b.C.E.

The older age of metallurgy is interesting beyond its plain numerical value. Until recently there was a tendency, abundantly explained in publications, to associate the production and use of metals with what is termed as social complexity. The idea behind it is that metallurgy is an activity that can only be found in the presence of stable agricultural surpluses and a social hierarchy having on its peak an elite that used metal objects exclusively. It was said that societies not having these characteristics could not develop metallurgical industries. There are several arguments against this idea. The most important one arises precisely from the context of the sites containing very early metallurgical evidences. This is supported

by the contexts of Jiskairumoko, the Chilean sites, Waywaka and the Ecuadorian sites. Metallurgy emerged in various types of communities, not only those that were in the process of becoming complex, such as Tiawanku, but also among herders, hunters, fishers and gatherers that had acquired certain degree of stability and an efficient exploitation of their environment.

The other important conclusion is that in all of the early sites the metal or mineral sources were in the vicinity of the settlements. The availability of native gold and copper seemed to have played an important role. This is true also of the sources of fuel, with the probable exception of the Bolivian plateau. With respect to the metals and alloys used the evidence shows that both gold and copper were used very early. Native gold is quite abundant in South America and easy to use straight away, so that it is not surprising to find that it was chosen in most cases. Native copper is much scarcer; however not enough metallographic studies have been carried out, so it is impossible to state in which cases native copper was used. Copper minerals were certainly processed in most Chilean and Bolivian sites. Gilded copper found in the Peruvian coast is remarkable at such early dates; copper gilding is a complex and difficult process that requires good knowledge of metal properties and a precise heat control.

In most early sites the preferred technique is hammering; this is attested both in the structure of the objects as in the tools found which include hammers and anvils. Smelting must have been used wherever copper ores were processed and at Putushio where furnaces were found. The most striking feature of early technology is the processing of copper ores. The most important argument to disqualify the copper industry of the North American Great Lakes (4000 b.C.E.) as true metallurgy, is precisely the absence of ore processing. This difficult and lengthy process requiring large amounts of fuel and work was known in South America at least by 1500 b.C.E. It must be pointed out, finally, that from its very beginnings metals seemed to have been involved in the symbolical sphere; most objects found are body ornaments; there are no traces of very early metal tools.

3. The expansion and diffusion of metallurgy in the continent

Given our present state of knowledge it is very difficult to establish with an acceptable degree of certainty exactly what happened after 700 b.C.E. Probably

metallurgy did not evolve in the same way in the different foci that we have identified. In some cases these local limited experimentations might have ended very quickly leaving no durable trace. A different trajectory seems to have occurred in most sites of the Peruvian northern coast and the Ecuadorian north where, from this early period onwards, it is evident that culture after culture managed to maintain metallurgical knowledge and to add new techniques and formal creations, thus building in time a millenary tradition.

Whatever the particularities were, there are some general trends that we can briefly sketch. From the central region of development of metallurgy in the Initial Period the tradition expanded both to the south and north of the continent following always the axis of the Andes and the Pacific coast. The expansion to the south took place in an early date; by around 500 b.C.E. metallurgy was being practiced in northern Chile and north-western Argentina where several local traditions had their own particular evolution. The Tiawanaku-Wari state of Central Andes had a strong influence in those regions and later on they came under Inca rule. As we move south towards central Chile and central Argentina metallurgy is scarcer and in pre-Hispanic times it certainly did not reach the southern tip of the continent.

The expansion to the north is quite different. A very active metallurgical tradition appeared in north Ecuador - south Colombia in the Tumaco-La Tolita region of the Pacific coast around 500 b.C.E. and slowly expanded to the rest of the country. It is not until 300 C.E. (Common Era) that we have metallurgical activity in most of the Andean and coastal areas of the country. In the southern Andes, close to the early La Tolita focus, metallurgy appeared only 600 years later. The expansion continued to Central America, through Panama and Costa Rica (approx. 500 C.E.) and to southern and central Mexico (approx. 900 C.E.). The gold-copper metallurgy of the West Indies is much later, just prior to the Spanish conquest. In each of these regions the introduction of metallurgy was accompanied by new iconographic patterns, the preferential use either of hammering or casting and the development of new ways to use the metal and to symbolise it socially.

The geographical distribution of metallurgy is restricted; as we said it is absent in the southern tip of South America and it does not appear in the Argentinian and Uruguayan Pampa, the Chaco area of Bolivia and Paraguay, the huge Amazon basin and the rest of Brazil. In the north of the continent, finds are extremely scarce in Venezuela and the Guyana. This distribution cannot be explained satisfactorily in terms of the availability of metals and ores or with relation to the nature of the

social structure of the native communities of the continent. Even within smaller geographical units it is frequent to find that metallurgy is abundant in any given area and completely absent in the neighbouring regions.

4. Central Andes: Styles, periods, cultures

In order to understand this complex panorama we need to understand how archaeologists conceive the prehistory of the Central Andes.

4.1. Central Andes – Introduction to Periods and Regions

The Central Andean region comprises the territory that is now part of the extreme north of Chile and Argentina, all of Bolivia and Peru and southern Ecuador. Broadly speaking the area is characterised by the existence of three macro-regions: the Costa or coast, mainly a deserted stretch of land bordering the Pacific Ocean irrigated by several rivers descending from the Andes; the Sierra or mountain range of the Andes which in this part of the continent is wide and high. In it there are many valleys, canyons, the enormous Titicaca plateau and several snow peak mountain chains. The third region is the Selva, a giant patch of tropical jungle which constitutes part of the Amazon basin. Most important developments took place in the Costa and Sierra, even though contacts with the Selva were frequent.

The archaeology of the region is divided into the following major time segments:

a) Early Peopling – From 12000 to 4200 b.C.E.
b) Pre-ceramic – From 4200 to 1800 b.C.E.
c) Initial Period – From 1800 to 1400 b.C.E. Early metallurgy.
d) Early Horizon – From 1400 to 400 b.C.E. Chavin and Cupisnique cultures.
e) Early Intermediate Period – From 400 b.C.E. to 550 C.E. Vicus, Paracas, Nazca, Recuay and Mochica cultures.
f) Intermediate Horizon – From 550 to 900 C.E. Wari in the southern Peruvian Sierra and Tiawanaku in the Bolivian plateau; together they formed the Wari – Tiawanaku state.

g) Late Intermediate Period – From 900 to 1300 C.E. Lambayeque – Sican and Chimu cultures.
h) Late Horizon – From 1300 to 1533 C.E. Tahuantinsuyu or Inca Empire.
i) Conquest and Colonial Period – From 1533. Metallurgy of European influence.

Period	Main Cultures (metallurgy)	Dates
Early Horizon	Chavin - Cupisnique	1200 b.C.E. – 200 C.E.
Early Intermediate	Moche - Nazca - Recuay - Paracas - Vicus	200 – 600 C.E.
Intermediate Horizon	Wari-Tiawanaku	600 – 1100 C.E.
Late Intermediate	Chimu - Sican-Lambayeque	1100 – 1450 C.E.
Late Horizon	Inca	1450 – 1532 C.E.
Colonial	Inca-Spanish mestizo	1532 – 1820 C.E.

Central Andes, chronology, periods and cultures.

Tracing the development and diffusion of metallurgy in the Central Andes is a very difficult task that has not yet been attempted in detail. There are, however, certain assumptions that can be forwarded safely. An early focus which must have endured to the point of giving birth to a lasting metal production tradition is the coastal northern one represented in the sites of Puémpaue, Huaca La Merced, Chongoyape and Morro de Etén. In there the Cupisnique tradition soon followed and was eventually replaced by the Vicus and Mochica cultures. When the influx of the Tiawanaku-Wari Intermediate Horizon receded, the Sican-Lambayeque and, in part, the Chimu traditions built over their ancestors knowledge in exactly the same area. The north coast was, therefore, a very dynamic area for metallurgy and a region with the capability of irradiating its developments to neighbouring and distant regions. We cannot forget also that this early coastal focus was closely linked to the Sierra developments; Kuntur Wasi and Kotosh where the first stages of the Chavin metallurgy are represented. This Sierra early metallurgy evolved through Chavin to Recuay in the Early Intermediate Period; thereafter metallurgy is not the subject of local evolutions in the northern Sierra. Altogether we have important evidences to link seven major metallurgical traditions to the early foci of the north coast and Sierra. The southern foci of the Titicaca basin with the sites of Jiskairumoko, Wankarani, Chiripa and Pucara may have played also a long lasting role in the region´s metallurgy. Certainly Tiawanaku evolved a copper and bronze

tradition, most probably based on these early experiences that reached northern Chile, Argentina and the central Sierra of Peru. As to what happened in the south and central Sierra and Coast of Peru, where we also have early sites such as Waywaka, Mina Perdida and Malpaso, it is still difficult to say. Now we will review the main metallurgical periods and cultures of the area.

4.2. Central Andes - Early Horizon

The Cupisnique metal style is somewhat problematic as to its periodical setting. As we have seen previously this culture is part of the Initial Period of metallurgy in Central Andes. On the other hand its developments go well beyond this initial stage. Cupisnique culture is dated from 1200 to 200 b.C.E. in the La Libertad Department of the north Peruvian coast. At this early date this society was highly hierarchical and had the capacity to build impressive structures. At the site of Morro de Eten there are important finds of Cupisnique metallurgy accompanying what seem to be elite tombs. Gold, copper and silver were extensively worked by hammering; also copper discs were plated with gold foil. The iconography is closely related to the Chavin style and, together with the technology, it constitutes the basis for the next metallurgical styles to follow in the north coast.

Cupisnique and Chavin, main sites. (Google Earth)

Cupisnique embossed gold bracelet

The advent of Chavin influence brought up a rapid development in metallurgical technology and an increasing use of metal objects. Most Chavin objects come from elite tombs located in the valley of Lambayeque, the north Sierra and Kuntur Wasi in Cajamarca. Body ornaments are mainly made by hammering, assemblage and embossing. There are crowns, diadems, nose rings, ear pendants, pins, spoons, necklaces and tweezers. Chavin iconography reveals a complex mythic and symbolic content that will prevail hereafter in Central Andean metallurgy. Felines (either jaguars or cougars), snakes, frogs and fabulous beasts dominate the decorative universe of Chavin. Techniques such as assemblage and painting with red and black dies are widely used. The surface of the objects is generally golden, but the analyses have revealed the use of ternary alloys of gold, copper and silver. It is presumed that casting was employed to make ingots which were afterwards hammered to obtain the final shape of the objects.

Chavin de Huantar, the main temple

Chavin metalwork. Left – embossed crown. Right – plaque for textile

The coherence and identity of the decoration employed in various materials; metal, pottery, stone, etc. clearly indicates that metal smiths, as well as potters and other artisans were following very strict patterns, possibly determined by religious specialists. In the Chavin Horizon archaeologists identify the first large scale embodiment of Andean ideology, a cosmology and mode of thought that dominated every aspect of human life.

Chavin metalwork. Left – gauntlets. Right – head-dress ornament

4.3. Central Andes – Early Intermediate Period

Vicus, Paracas (Ica), Nazca, Recuay and Mochica cultures had begun developing during the height of Chavin. In many ways the legacy of the Early Horizon set the basis for these cultures and allowed exceptional regional expansions, having both particularities and common traits.

Area of the Nazca culture in central and south Peruvian coast

Most objects belonging to Nazca culture, in the southern coast of Peru, come from funerary bundles or mummies, thousands of which have been found in the desert in very good conditions of preservation. There are very large ornaments, head-dress decorations, diadems, mouth masks with snakes or humming birds, bracelets and ear pendants. On the other hand there are also miniature pieces such as representations of trophy heads. Generally speaking, objects are laminar and very well polished; hammering is the preferred technique, only in the later phases there are a few spear thrower hooks made by casting.

Recuay metallurgy of the north Sierra is largely unknown. A few analysed objects come from a tomb excavated in Pashash. Copper and copper alloys were extensively used to produce bells, nails, ear pendants and pins, some of which were plated with gold foil, while others were decorated with stone inlays.

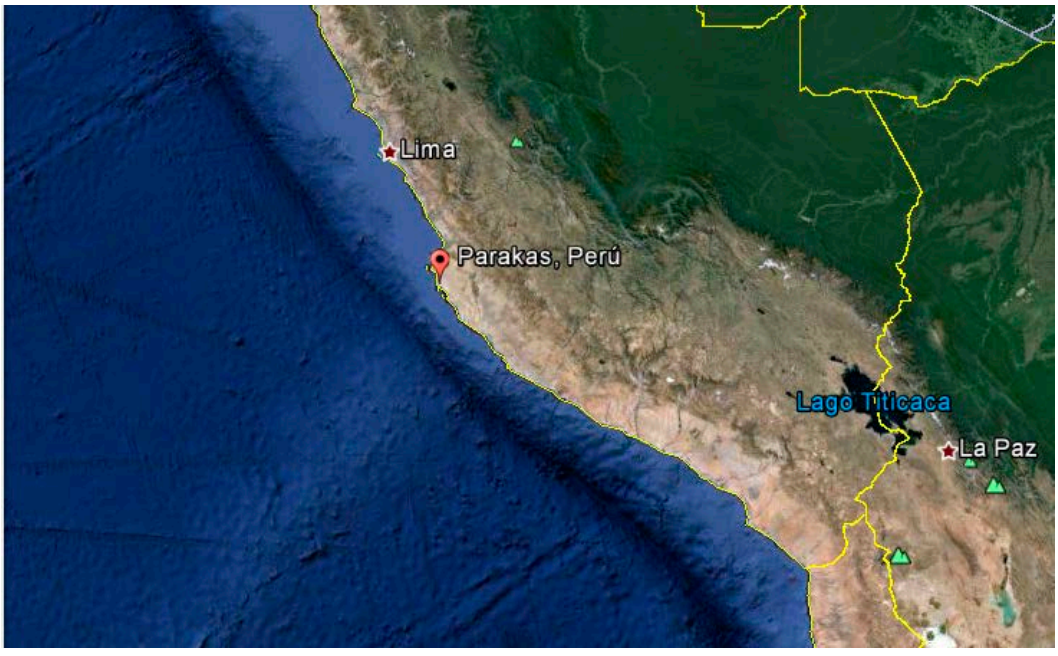
Left – A Nazca funerary bundle (mummy). Right – Nazca nose ornament

Nazca metalwork. Left – nose ornament. Right – funerary mask.

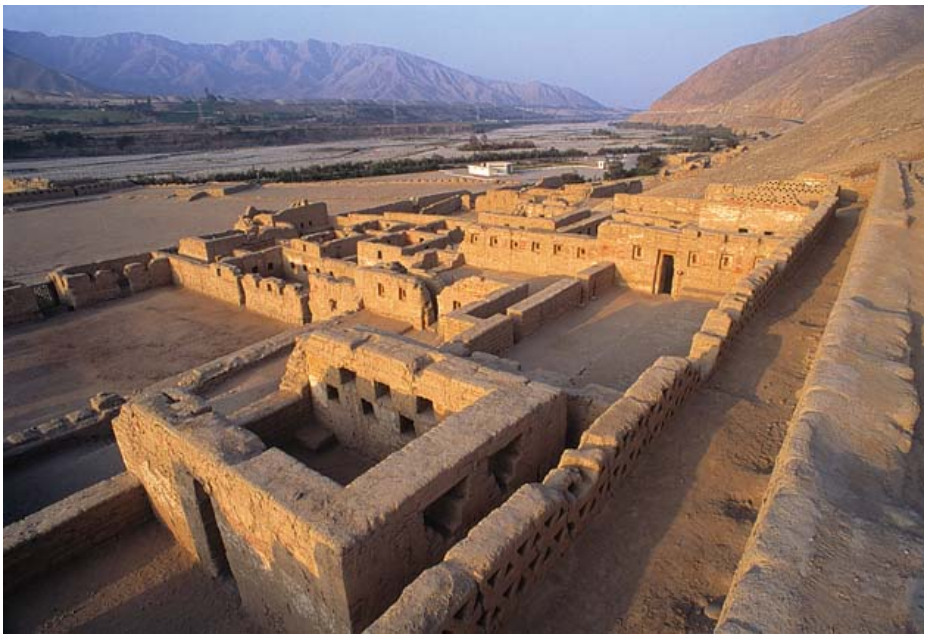
Area of the Recuay culture in the southern Peruvian coast

Recuay metalwork. Head-dress ornaments

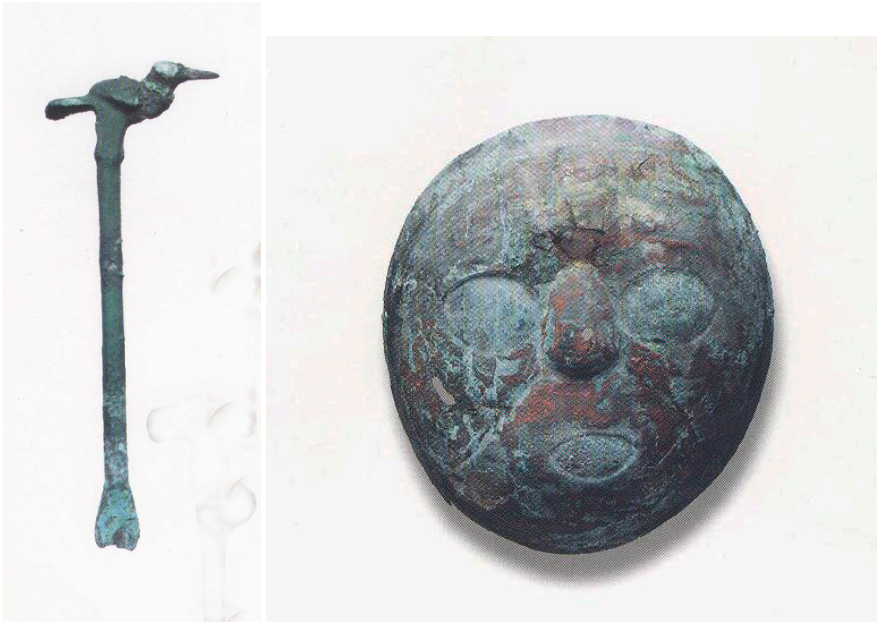
In Paracas (Ica), a huge settlement in the southern coast, well known for the existence of a large quantity of fine textiles, simple laminar ornaments of gold have been found; some are decorated by embossing. It seems to be a local industry with little influence on later developments.



The Paracas site in the central coast of Peru (Google Earth)



The site of Paracas, late Inca buildings.



Paracas metalwork. Left – copper spoon. Right – funerary mask

The discovery of the Vicus culture in the valley of Piura, at the extreme north of the Peruvian coast is a relatively recent event triggered by the impounding of objects illegally dug in the sixties. In the Loma Negra cemetery some tombs contained over a hundred gold objects, thus emphasizing the Central Andean trend towards the large scale use of metals. Copper is predominant and it is usually plated with gold or silver. There are large discs, nose rings, staff heads, pendants and crescent

moon shaped plates. Vicus iconography is closely related to the Moche culture, to the point that the same set of gods and monsters are shared by both. Recently metal workshops have been excavated in Pampa Juárez and Loma Valverde, allowing a better understanding of the relation among the casting sites, the mines and the dwelling places. Another result is a good estimative of the quantity of metal that could be processed daily and the technical restrictions of the available means of production at the beginning of the Common Era in that region.

Area of the Vicus culture, north coast of Peru

Vicus metalwork. Left – gold votive figurine. Right – copper funerary mask.

Vicus metalwork. Funerary masks, copper and gold.

The spectacular finds of the Lords of Sipan in the pyramids of the Lambayeque valley, north coast, in 1987, have uncovered one of the most complex and sophisticated metalworking traditions of pre-Columbian America, known as Moche or Mochica. The scientific analysis that followed have revealed that the metal smiths of this highly stratified society managed to make objects whose shape, colour and composition are difficult to replicate even today. Before the Sipan excavations many large Moche tombs had been looted, fragile corroded copper objects were destroyed and the gold pieces were sold to private collectors, thus becoming unavailable for study.

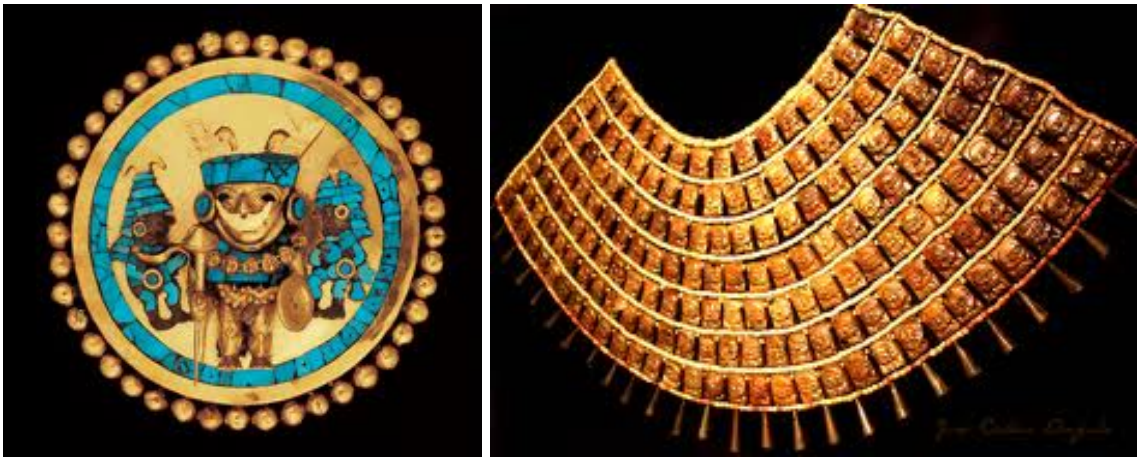
Area of the Moche culture, north coast

The Moche inhabited a large region in the central and north coast of Peru and constructed huge irrigation works that turned the desert into a fertile cultivating area. This, combined with intensive fishing in the rich waters of the Pacific Ocean, ensured a supply of resources that made them a rich society. At the peak of the social pyramid there were Lords whose political dominion had a powerful religious component. Their tombs were built inside enormous clay pyramids that look like hills in the present landscape. The abundant funerary offerings of the Lords give us a portrait of what the Moche society was like in the first millennium C.E.

Moche, eroded pyramids of Sipan

Moche, the grave of a Lord

Moche metallurgy employed copper massively to make objects in which this element appeared by itself, alloyed with gold, silver or arsenic, visible in the surface or covered by means of depletion, fusion or foil plating or electrochemical gilding. Surfaces may appear also smoothly polished or inlayed with emeralds, turquoise or sea shells. The variety of techniques is astonishing. Metalworking was centred on the production of ornaments for the Lords but, even so, they also made weapons and tools in arsenical copper. The ornaments of the Lords are, nonetheless, so impressive that they deserve a closer look. Typically on his head the Lord would have worn a large ornament shaped as a crescent moon, in his face he had a nose pendant, in his ears heavy spool ear pieces with hanging discs inlayed with turquoise, various necklaces, a large blanket that went down to his knees, literally covered with gold plates, semi-circular plates on his waist, coccyx protectors in his back and, finally, he would have held a large sceptre. Tombs contain many more objects; there are, in fact, several units of each of the objects described; many more than any individual could have used at any given time.



Moche metalwork. Left – lid of spool ear pendant with lapis lazuli. Right – gold pectoral.

Another striking feature of Moche metallurgy is its use of colours to portray sun – moon dualism. Some objects are made of two halves, one silver and the other golden coloured. They might also appear in pairs, one silver, and the other gold. In every case, silver, the colour of the moon is on the left side of the body, while gold, the colour of the sun, is on the right. There are many evidences that the Moche kept important contacts with other neighbouring cultures of the Coast and Sierra. Thanks to these contacts many cultures that followed acquired the technical expertise and the stylistic refinement that the Moche achieved and that contributed so much to the splendour of Andean metallurgy.

Moche metalwork. Left – gold and copper nose pendant. Right – funerary mask with cinnabar coating.

Moche metalwork. Left – gold and silver necklace. Right – pendant with bat figure.

4.4. Central Andes – The Intermediate Horizon

Even though most archaeologists agree that the Wari – Tiawanaku empire must have been a military state and that the peoples that came under its rule were submitted by force, the truth is that most metallic objects reflect a strong religious character, similar to the rest of the cultures of the pre-Hispanic story of the Central Andes. The advent of the Wari – Tiawanaku Empire brought along some

interesting metallurgical developments, the most important being the extended use of tin bronze. This was possible because within the territory of the Wari – Tiawanaku state there were the large tin mines of the Bolivian plateau. However, in the north, where tin was scarce, arsenical bronze was manufactured, thus establishing this dualism between the two types of bronzes in Central Andes, a feature that remained present for many centuries thereafter.

The Wari – Tiawanaku Empire in Peru and Bolivia

Left – Site of Wari, Peru. Right – Site of Tiawanaku, Bolivia

Gold and silver ornaments are not as refined and spectacular as the Moche ones; on the contrary, most copper, gilded copper or tombac (or *tumbaga*, a gold-copper alloy) objects are quite simple. Within this group there are many *tupus* (pins), *tumis* (knifes) and needles. A few luxury gold items tend to reproduce the figure of a deity with rectangular face with rays ending in circles, an emblematic Wari – Tiawanaku icon. This kinds of pieces are scarce and they come from a few sites like Pomacanchi near Cuzco, the Ica valley to the south, Pachacamac in the Lurin valley and Ancon in the central coast. This particular inventory includes bracelets, bells, silver plated copper or gold plated silver sheets cut in the shape of human figures, head-dresses and funerary masks. In the southern coast the Wari – Tiawanaku and Nazca styles fused to produce short term local styles.

Wari - Tiawanaku metalwork. Left – the attire of a Lord. Centre – bracelets. Right - Pectoral

4.5. Central Andes - Late Intermediate Period

Just as when Chavin declined, the gradual disappearance of the Wari – Tiawanaku state brought along the rise of regional cultures. Now the turn came for Lambayeque - Sicán and Chimu. The metallurgical style known as Sican was previously called Lambayeque, a name that is still used in non-specialised texts. To avoid confusions we shall refer to it as Lambayeque – Sican. In Peruvian museums there have been objects belonging to this style for many years, most of them coming from the Lambayeque valley in the north coast, but very little was known about them. Thanks to extensive excavations carried out in Batan Grande, at the Huaca Loro site we now have a better picture of this metallurgical tradition. These tombs are comparable in size and richness to those of Sipan, the Moche site.

The Lambayeque – Sican area in the northern coast of Peru (Google Earth)

In the Lambayeque – Sicán metallurgy we find yet again an emphasis on hammering and the construction of tri-dimensional objects by means of the assemblage of multiple pieces. There are animals, *tumis*, *tupus*, funerary masks, head-dress ornaments, ear spools and a special type of very deep vase, the *kero*, which was manufactured from a sheet, repeatedly hammered until achieving a depth of 20 to 25 cms. These keros are generally decorated with human figures. A particular anthropomorphic icon with rectangular face and rounded jaw is known as the Sican Lord; it is very frequent in many types of objects. Copper, the preferred material, was alloyed with arsenic to produce weapons and agricultural tools and alloyed with gold and silver for ornaments. Red paint obtained from cinnabar, a mercury ore, was extensively used together with inlays of precious and semi-precious stones, shells and *Spondylus* (a bivalve from the Pacific Ocean).

The careful examination of the objects has revealed that there was a close connection among artisans specialised in different materials, such as the metal smiths, the stone masons, the textile weavers and the wood carvers to produce complex, multi-material objects. There are stone vases plated in gold foil, large blankets covered with copper plaques used as separations or false walls inside the temples, for example. In turn, main metal objects included textiles, feathers, precious stones, shell and wood. The result is a fantastic multi-chromatic set in which textures and colours, dark and light areas, opaque and shiny surfaces play

together. Metal plaques clashing against each other during ritual dancing must have added a suggestive rhythmic sound.

Left – reconstruction of the grave of a Sican Lord. Right – funerary mask with cinnabar

Sican metalwork. Left – funerary mask with cinnabar. Right – *kero* ceremonial vase

The Chimu Kingdom was, doubtlessly, the largest and most powerful during the Late Intermediate Period. The Chimu conquered the central and northern coast and put an end to the Sican–Lambayeque developments. This conquest was accompanied by the imposition of the characteristic style of the Chimu Kingdom. A new icon, the Chimu Lord, an anthropomorphic figure of almond-shaped eyes, flanked by assistants with bunk beds, is popular in gold objects of that period**.** This icon was the subject of a careful manufacture made from separate parts that were riveted or welded together. The Chimu Lords were buried with large gold crowns with appendages imitating feathers, spool ear pendants with figures of animals assembled or inlayed in lapis lazuli, gold breastplates that covered the full torso, necklaces of spherical beads, vessels of gilded copper, headdress ornaments, dishes with intricate incised designs, *tumis* and *tupus*.

Area of the Chimu Kingdom in the central and northern coast of Peru

The Chimu city of Chan Chan in the Peruvian coast

Chimu metalwork. Left – pectoral made of plaques. Right – *Tumi* knife with stone inlays

Chimu metalwork. Left – copper twezeers. Right – handle for ceremonial staff

4.6. Central Andes – The Late Horizon

The process of expansion of the Incas, starting from the small chiefdom of the Valley of Cuzco, is well known in history. In some ways it was a process similar to the Wari - Tiawanaku expansion, six centuries before. What makes it special is the scale of the events; at the time of the Incas, for the first time all the regions of the

coast and mountains of the Central Andes formed part of the same political entity. With it came a profound standardisation of the life, language, beliefs and customs of the people. Metallurgy did not escape, of course, the effects of this macro - phenomenon. The Incas established control over areas of extraction of metals and mines and determined the types of alloys that should be used for tools and weapons. This led to the replacement of arsenical bronze, very popular up to then in the north Coast and Sierra in favour of tin bronze. With relation to the social distribution of metals, the exclusivity of the use of gold and silver was strongly ascribed to ruling groups, while intermediate groups could use gilded and silvered coppers and the rest of the population had to use copper. The scale of extraction and production of metals acquired immense proportions under a strict State control.

The Tawantinsuyu or Inca Empire

The ornaments of the nobles and the Inca himself, consisted of enormous headdresses, crowns, earrings, pectorals, ornaments, textiles covered with plates of gold and silver, necklaces and bracelets. To take their food they used cups, bowls and plates of gold and silver. Hammering, assemblage and inlaying of one metal into another continued to be the preferred practices. They used mould casting to make countless gold and silver miniature figurines representing men,

women, and llamas (*conopas*) that were dedicated for offerings. Many of these figurines have been found at shrines located at over 4,500 meters in which young ritually sacrificed bodies were deposited.

Inca metalwork. Left – gold gauntlets. Right – silver *conopa* (votive figurine)

Inca metalwork. Left – silver *arivalo* (vessel). Right – silver *kero* vase

Inca metalwork. Left –bronze head-breaker. Right –gold *tupo* pin.

Perhaps the most impressive example of Inca metallurgy is something which we know only through written documents because the Spanish conquistadors destroyed it altogether. It is the use of metals in religious buildings. The Temple of the Sun or *Quoricancha* in Cuzco was the greatest one. Those who knew it left testimony that it had a frieze made in gold sheet, one meter wide on all interior and exterior walls. The main altar had a gold disc of more than 2 meters in diameter representing the Sun and a silver disc representing the Moon of equivalent size. In other altars there were other similar discs. The mummies of some deceased Incas were on bunk beds lined in gold. A garden had a gold-plated fountain, twenty-five figures of llamas, life-size with their herders, also made of gold and a garden of silver corn plants with gold cobs. This was the most important, but not the only sanctuary of the Empire.

The Quorikancha in Cuzco

It took the Spaniards four months to melt in nine furnaces the objects that came from all over the Empire to pay for the rescue of the kidnapped Atahualpa. In this savage act of destruction and in many others that occurred along the Empire disappeared most of the treasures whose value as a heritage of humanity is immensely greater than what they would have had for their metal content. What has been rescued later of Inca metallurgy is only a tiny fraction that does not do justice to the scale and complexity of what was the industry of the last pre-Hispanic Central Andean artisans.

4.7. Central Andes – Summary

What we have studied as a sequence of cultures, techniques and iconographic traits can be better understood if we focus now on the trends, common characteristics and most relevant features of the metallurgy of this region of the continent:

a) Perhaps the most intriguing and conspicuous aspect of the metallurgy of this area is its continuity. For about three thousand years, passing from one to another geographical area and from culture to culture some patterns remain invariable, both regarding technique and form. These same forms and techniques are very specific to the Central Andes and disappear as you exit either to the south or to the north of it. Techniques presenting continuity include the inlaying of precious or semi-precious stones, resins, and shell, the custom of adding paint to the surfaces, sheet plating and the preference for hammering and assemblage over casting. Among the forms that pass from one to other culture are the *tupus* (textile pins), *tumis* (transverse ceremonial knives), tubular earpieces and the funerary masks. Somehow it seems that even between cultures that maintained rivalries and fought for regional dominance there was a high degree of transmission of technical knowledge and patterns concerning the function and use of metals.

b) Even though it has been mentioned previously, it is essential to emphasize the technological aspects as variables that mark the metallurgy in our area of interest. Normally when working metals, metal smiths have before them two technical paths that can be followed and that, regardless of the difficulties involved, can lead them to solve challenges with nearly equal efficiency. These technical roads are, on the one hand, direct work or hammering with all its complementary techniques and, on the other hand, casting or melting. In pre-

Hispanic America, especially in Central Andes, what determined the preference for one or the other technique were not the practical, work efficiency, economic or purely technological reasons, but rather cultural reasons, often religious ones. In this order of ideas we must affirm that Central Andes metallurgy definitely adopted hammering. Casting techniques were known long ago and within reach of the smiths. However, in the overwhelming majority of the cases they were used only to obtain raw ingots. Thereafter the metal workers hammered, folded, cut and joined sheets to produce two-dimensional or three-dimensional objects that could also have produced by casting.

c) Inlays and overlays seem to have been one of the obsessions of the Peruvian smiths. Some of the most ancient fragments of copper sheets are covered with gold foil. Over time the Central Andean smiths managed to develop various methods for coating surfaces of metal objects with layers of colour, texture, or physical properties different from the base material. This is how fusion, depletion, plating and electrochemical methods were developed to gild and silver surfaces. These complex processes allowed changing the primary colours of copper or tombac to obtain the most varied range of gold and silver shades. In addition, various cultures developed means to apply paints with mercury ores (cinnabar) to produce a striking red colour. At the same time artisans experimented with the inlaying of a varied repertoire of materials; precious and semiprecious stones such as emeralds, turquoise and lapis lazuli, *Spondylus*, amber, shells and fragments of other metals were embedded in the surface of objects or adhered to them with the help of vegetable glues. Multi-coloured objects were obtained in this way and the representation of animals, people and mythical beings became more efficient. A true inter-craft relationship was achieved.

d) This characteristic that we described from the technological point of view can be explained also from an outstanding feature of Central Andean metallurgy, which is its great attention to colour. The efforts deployed in the production of alloys, surface treatments and inlays most of the times only had to do with the intention of obtaining one or several specific colours. Undoubtedly in the background of this techno - cultural attitude there existed a symbolism of the colours that attached to each of them and each of its tones a particular meaning. We know little concerning this, since the most ancient cultures left no written testimonies and the European chroniclers did not collect much information about it. Perhaps the clearest example of the symbolism of colours has to do with Mochica metallurgy, which seems to reflect in the costumes of the Lords the dualistic thought materialised in the opposition Sun – Moon and expressed in objects that are half gold, half silver.

e) One of the technological aspects that have attracted most the attention of scholars is that of alloys. Even though the Central Andes metallurgy is, foremost, a metallurgy of copper and, secondly, of gold and silver, the truth is that the indigenous smiths were not limited to the options offered to them by these three metals separately. They experimented with virtually all possible two metal (binary) or three metal (ternary) alloys. Taking into account the overriding concern for colour and secondly the need to improve hardness, ductility, malleability and flexibility, as well as to solve practical problems of supply of raw material, they resorted to mixtures of ores and native metals into furnaces. On the other hand they were not limited to copper, gold and silver in their processes of experimentation. The archaeological record is well provided with examples of arsenical bronzes, tin bronzes, alpaca (silver – lead) as well as exotic alloys only recently known to us (bronzes having copper - arsenic – nickel or copper – bismuth). Even though many of these alloys might come initially from accidental events, such as the use of minerals containing arsenic as an impurity, soon the qualities of the alloys were understood and the intentional use continued consistently.

f) The symbolic nature of metallurgy has strongly attracted the attention of those who have studied this tradition in the Central Andes. It is this feature which explains the great attention paid to the texture and colour of the surfaces and the pursuit of different alloys. It has been noted that the main difference between metal industries of the Old and New Worlds lies in the fact that in the first one metalwork is oriented toward utilitarian uses (weapons, tools) while in the second it dealt more with ornaments and offerings. As far as this statement refers to the Central Andes it is true only in part, as in here huge amounts of weapons and agricultural tools were made along with objects of adornment and votive offering. However, the metal does not seem to have lost its sacredness at any time. Bundles of agricultural tools, weapons of war, ingots and even scraps of metal were used as offerings in the tombs of the Lords of Sipan and Sican. In daily life this sacred and symbolic character of the metal manifested itself in a differential social use; gold and silver were reserved for the elites while ordinary people used almost exclusively copper and bronze.

g) An important characteristic of the Central Andean metallurgical cultures was the creation of icons. In the Chavin, Mochica, Sicán and Inca metallurgy it is evident that there was a prototype whose manufacture was subject to strict rules that guaranteed that whenever it appeared it would look exactly the same. Because of this we can recognize anywhere certain deities or specific Lords whose portraits become repetitive.

h) The periodic sequence of the pre-Hispanic history of the Central Andes, as it has been exposed previously, shows an alternation of periods of differentiation and standardisation of cultures. This dialectic between the forces that lead to the imposition of homogeneous techniques and iconography and those that allow experimentation and diversity is palpable in metallurgy. For over three thousand years Central Andean metallurgy tilted between these extremes.

i) There is one final aspect that cannot escape this analysis. In contemporary civilizations we are used to measure the production of metal in thousands and millions of tons. In the ancient world the production of considerable masses of metal involved huge amounts of work; basic ores were difficult to extract and refining techniques prior to smelting were poorly known, the furnaces were small and it was a difficult problem to achieve and maintain the temperatures needed for melting metals and separating them from the slag. In most of the pre-Columbian archaeological record, it is usual to find tons of ceramics together with only a few kilograms of metal. Even in this context, it must be said that the production of metals in the Central Andes operated on a large scale. In a single stately Sicán tomb more than 500 kilograms of scrap metal were found; any of the stately tombs of Sipan contained more than one hundred adornments belonging to a single individual; the weapons and tools housed in Peruvian and foreign museums can be counted by the thousands; in the years that followed the fall of the Inca Empire the mines of the Tahuantinsuyu produced nearly 190 tons of gold and 635 tons of silver every year. The looting of Cuzco and the rescue gathered by the Empire to pay for the kidnapping of the Inca Atahualpa reported the Spaniards 61 tons of silver and 8 of gold. The five hundred years of looting that followed should have produced for the thieves of graves, illegal traders and collectors, similar quantities. We do not include in this account copper and bronze objects that were left aside. This scale of exploitation and production of metals has no parallel in pre-Columbian America.

5. Bronzes from the Argentinian northwest

The Argentinian northwest comprises a large region of valleys and alluvial plains in the provinces of Catamarca, Rioja, Salta and Jujuy, in the eastern foothills of the Andes. Metallurgical experimentation started in this area as early as 500 b.C.E. By the first centuries C.E. both arsenical and tin bronzes were manufactured. Important technological improvements were achieved during the Aguada period (400 – 900 C.E.) and by 1000 C.E. large scale production started. Metal smiths in

this area produced small quantities of gold objects used as body adornments. Tin bronze is the preferred type of alloy, both for ornaments and utilitarian objects. The technique employed in most cases is casting in open moulds followed by hammering. This secondary technique was used mainly to obtain and harden cutting edges. Objects manufactured include ceremonial axes, large oval bells and circular plaques.

Northern Chile and Argentina (Google Earth)

In the province of Catamarca a large bronze-producing workshop was excavated. The site is known as Rincon Chico and there is ample evidence of uninterrupted metallurgical activity for 600 years. In an area of about 1,500 square meters there are large circular casting structures, huge quantities of slag, metal scraps, casting moulds, metal ores, stone tools, and partially burnt fuel. The scale of production must have been very large indeed and it is possible that such workshop could have provided finished objects that were traded at long distances both to the north and south. The area was conquered by the Inca Empire around mid-15th century and thereafter metallurgical production was regulated by the strict imperial rules. It is believed that the Incas were especially attracted to this area precisely by the wealth represented by the large metallurgical production.

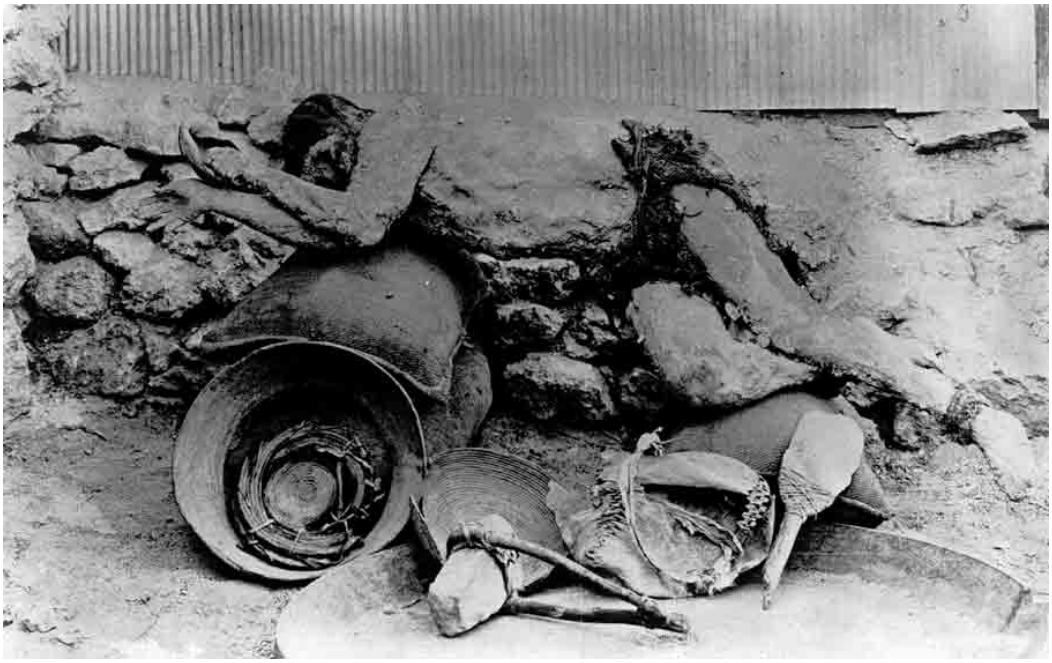
North-western Argentinian metalwork. Copper discs. (Luis Gonzalez)

North-western Argentinian metalwork. Left – bell. Right – axe. (Luis Gonzalez)

North-western Argentinian metalwork. Axe. (Luis Gonzalez)

6. The Atacama and northern Chile

The Atacama Desert and northern Chile are one of the richest areas of the world in terms of copper mines. There are early evidences of copper mining in this area, including miners who apparently died when the tunnel in which they were caving collapsed in the mine of Chuquicamata, in the sixth century C.E. One of them was found in the 16th century, another one in 1899. Ancient copper mines have been documented in other sites like La Serena, El Salvador, Calama and Copiapo. A workshop was found in Ramaditas with abundant evidences of metal work including slag, copper ores and complete finished objects dated to the 1st century C.E. Further south, in central Chile copper objects are scarcer; most are body ornaments belonging to the Aconcagua phase and dated to 950 C.E. Most copper objects in Chilean museums lack burial contexts and it is difficult to assign dates or cultural affiliations.



Atacama, the mummified copper miner found in 1899.

A singular set of tombs appeared in the Casa Parroquial cemetery, San Pedro de Atacama. Funerary offerings included objects made in gold, silver and copper. A couple of *keros* or ceremonial vases show a close relationship with similar Tiawanaku objects. There are also a “portrait vase”, diadems, axes, rings, *tupus* and hammered sheets. Dates range from the fifth to the ninth century C.E. Up to now this one is an isolated find, not indicative of the existence of a local gold working industry in the area, but rather an extension of the Tiawanaku influence.

Northern Chile metalwok – various copper objects

7. Ecuador, regional perspective

On the basis of the developments achieved in the Initial Period (see section 2) new socio-technical dynamics took place in the Ecuadorian coast and Sierra. The period that goes from 500 b.C.E. to 200 C.E. was marked by an extraordinary production; platinum technology was developed and gold, gold alloys and copper were handled proficiently. The Tolita metallurgy radiated its influence northward on the Pacific coast up to Choco, the Western Cordillera and the Cauca Valley in Colombia; in the south the Tolita influence reached the coast of Manabi and the Guayas basin. As a result of this expansive wave, there emerged in Colombia the Calima, San Agustin and Tierradentro metallurgies and in Ecuador the Jama – Coaque and Bahia cultures.

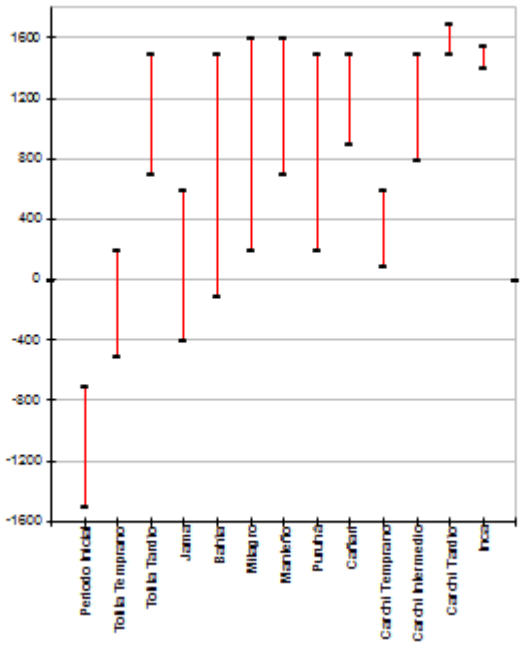
While in the Tolita area this first impulse became gradually exhausted, new trends converged in the Bahia area. Bahia metallurgy seems to have gathered the Tolita inflows with those of the initial focus of Santa Elena; the technological and iconographic reworking that took place there formed the base of the late coastal metallurgical core. During the first centuries of our era the basis of what would be the Milagro-Quevedo and Manteno-Huancavilca metallurgy already existed. The

Milagro-Manteño influence reached the north coast where many of the features of the Late Tolita period are derived from it.

Ecuador, distribution of pre-Hispanic metallic objects (red dots)

In the meanwhile the initial focus of Putushio radiated its influence over the north of Peru and the Ecuadorian central Sierra; in the following centuries many of the elements that make up the technological and formal Central Andean complex can be seen there (*tupos, tumis*, projectile points, head-breakers, silver-copper alloys, silvered and gilded copper); those were in part derived from the initial focus of Putushio and in part from the Cupisnique focus of the north Peruvian coast. Be as it may, the truth is that the technological and formal Central Andean complex appeared in Cañari and Puruhá in the first centuries of our era.

Cañari and Puruha are two closely related metallurgical traditions. The extraordinary dynamics of these metallurgies in the south and central Sierra determined all the further development of this industry, even in the northern highlands. Canari-Puruha influence must have reached the Quito area rapidly; by the third century C.E. there was a tradition that evolved locally and was then able to radiate its influence northward. First in Imbabura, then in Carchi and Nariño, this tradition set the foundations of the metallurgy of the southern Andes of Colombia.



Ecuador, chronology of main metallurgical traditions

7.1. La Tolita – Tumaco Regional Group

The La Tolita - Tumaco Group developed in the lowlands of the north coast, Esmeraldas and north Manabi provinces, and on the Pacific coast of south Colombia. A large proportion of the objects come from *tolas* and tombs in what must have been the large ceremonial sites of La Tolita and Tumaco. The initial date of this Group is probably around 500 b.C.E. and the final one around 400 C.E.

La Tolita - Tumaco, sites marked with blue dots

The La Tolita - Tumaco technology is possibly the most varied and complex in this territory; the most remarkable feature is the handling of platinum by variations of sintering, allowing the goldsmiths to create solid objects, sheets, as well as coatings and inlayings of this metal. This technological option was, of course, strongly influenced by the presence of platinum in the auriferous sands. The hammering of gold, silver, rich gold tombacs and copper was also practiced. The mastery achieved in hammering and cutting of metal sheets enabled the production of highly complex pieces, such as the famous "Golden Suns". Lost wax casting is less frequent. Other techniques include assemblage by mechanical means such as flanges, sheet folds, hooks, rings and nails and metallurgical means such as welding. Gilding techniques and the setting of precious stones (emeralds) and semi-precious stones was used for finishing. The range of forms of the La Tolita - Tumaco metallurgy is dominated by a variety of small pieces and miniatures, especially facial nails; there is a marked preference for the adornment of the face and head and less emphasis on the trunk and extremities.

La Tolita – Tumaco metalwork (gold and platinum). Left – mask. Right – pendant (P.E.)

La Tolita – Tumaco metalwork. Left – Sun mask. Right – platinum and gold ornament (P.E.)

After the end of the period of the La Tolita Group the Atacames culture appeared in the same region, around 700 C.E. and it lasted until the conquest in C.E. 1500. These new settlers also produced metal objects, but their technology was different from that of the previous period. In the later period the metallurgy of platinum disappears, while the use of tombac became more frequent, as well as that of copper which was used unalloyed or alloyed with arsenic.

7.2. Jama - Coaque Regional Group

The Jama – Coaque region, sites marked with blue dots

The Jama - Coaque Group objects are concentrated at sites located on the coast or close to it in the north of the province of Manabi. The chronology can be estimated between 400 b.C.E. and 1533 C.E. Technologically the Group is characterised by a preponderance of gold hammering; casting seems to have been used only in the manufacture of small components. The combination of the two basic techniques is not common. Embossment and the plating of organic materials with sheets of gold or tombac are usual. Assemblage was done by means of tabs and hooks; there is evidence of welding also. Three-dimensional figures that originally could have wood cores were made through assemblage. Semi-precious stones such as serpentine, jadeite, turquoise and quartz were integrated to gold ornaments. Small nose rings and ear rings account for a very high proportion of the objects. The decoration of the face and head is emphasised; the items to be used in this part of the body represent more than 85% of the total sample. There is also a quantity of hand ornaments. Snail shells were covered with gold foil.

Jama – Coaque metalwork. Left – alligator pendant. Right – tinculpa style mask. (P.E.)

7.3. Bahia Regional Group

The Bahia region, sites marked with blue dots

The Bahia Group is distributed all over the central and northern coast, from Esmeraldas to the north of Guayas. With little available archaeological evidence to support it, its chronology is estimated between 100 b.C.E. and 1500 C.E. Alluvial

gold and gold - copper alloys of different composition, as well as silver, were used to manufacture the objects. The predominant technique is hammering, efficiently handled in most cases, even when done on difficult materials such as the silver - copper alloys. Hammered plates were used to build complex three-dimensional objects. Mechanical assemblages involved the use of long strips of wire which fixed together loose parts. Welding of gold, silver and copper objects is also frequent. To decorate they used embossment, usually on small surfaces and forming intricate designs. Another outstanding feature of decoration is the use of semiprecious stones (jadeite, turquoise and sodalite); these are embedded or suspended with hooks and metal wires.

Bahia metalwork. Left – gold ear spool pendants. Right – silver votive figure, raft. (P.E.)

Objects intended to be used in the head and face such as sub-labial ornaments; skin applications, nose rings and ear pendants are the most frequent ones. The nose rings and earrings are also the finest and most elaborate objects. An exceptional votive offering figure represents a raft with a main character in the centre, flanked by two oarsmen and a helmsman. This piece, made from a silver-copper alloy, required an initial process of hammering and cutting of sheets that were then rolled and assembled by welding and tying with metal wire. The human figures were fabricated separately, also using foils that were bent and welded; then each figure was welded onto the surface of the raft.

7.4. Milagro - Quevedo Regional Group

The Milagro – Quevedo region, sites marked with blue dots

While the Milagro- Quevedo metallurgy is thought to be restricted to the Guayas - Daule basin, it is actually distributed over a much larger territory which includes parts of the north and central coast and some isolated places in the Central Sierra. Milagro - Quevedo chronology covers the period from 400 to 1533 C.E. During this period a copper and arsenical-copper metallurgy developed that achieved production volumes that have no parallel at the time; large staffs, giant axes and thousands of money-axes came out of moulds in workshops that also made delicate objects of gold, tombac, silver and silvered and gilded copper. In the Milagro society the domestic production of utilitarian objects in copper was very important; in small workshops located inside dwellings, ornaments for popular use were made. At the same time there was a specialised production for the elites performed by specialists. The equipment of a goldsmith consisting of crucibles, chisels, tweezers, and copper nozzles with hollow tubes to be set to blowers and conical "breads" of clay used for polishing was found in a tomb in Guayas.

There are two predominant categories of objects: nose rings and money-axes which represent almost half of the objects of the Milagro metallurgy. In the Milagro - Quevedo Group facial decoration is all important; nose rings, are not only the

most abundant type, but also the most diverse, even though the spiral shape is predominant. In contrast ear pendants are very few and simple. Equally few are necklaces, beads and breastplates. Personal ornaments are not as important as tools, instruments and utensils such as needles, hooks, chisels, crucibles, axes, moulds, tongs, bowls and tumis. The money-axes are numerous; a type of object whose function continues to be enigmatic. There is a pattern of metallurgical production oriented towards needs other than the personal adornment; this explains the massive use of copper over gold, even though locally it was easier to obtain gold than copper.

Milagro – Quevedo metalwork. Left – copper lime container and pin with *Spondylus* inlays. Centre – copper axe-monies. Right – copper staff head. (P.E.)

7.5. Manteño - Huancavilca Regional Group

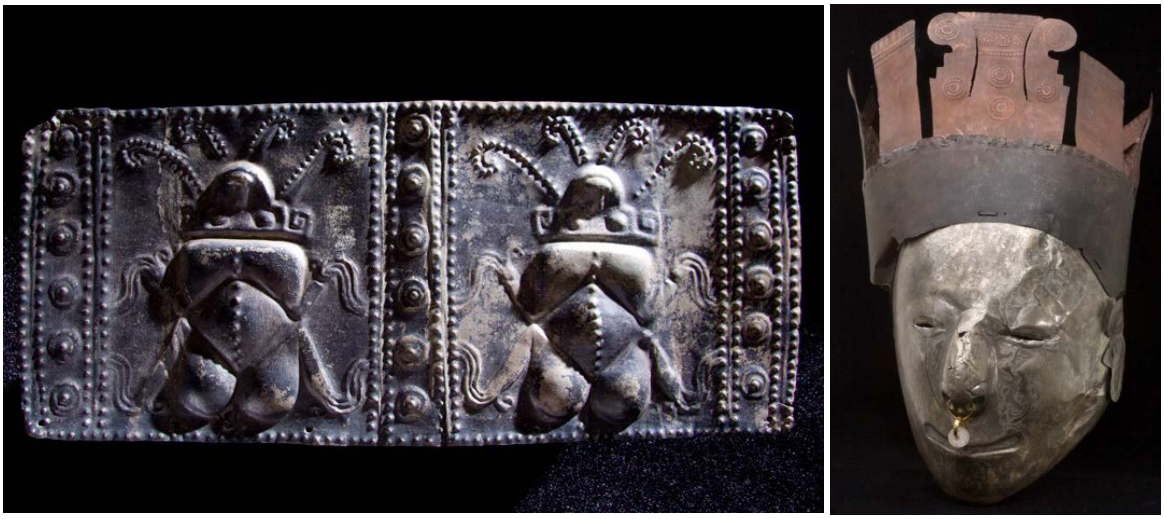
The Manteño – Huancavilca region, sites marked with blue dots

The Manteño – Huancavilca Group is distributed on the central coast, provinces of Manabí, Guayas and Los Rios. This distribution is very consistent with the delimitation traditionally accepted for the territory of the historical Manteño - Huancavilca culture. Foci of concentration are in the Santa Elena peninsula and in the surroundings of Portoviejo, but Manteño objects also often appear in the Daule - Guayas basin. The chronology covers the period from 600 to 1533 C.E. Manteno - Huancavilca metallurgy is very complex, both with regard to metals and alloys used, as to the technologies employed. However, it shares with the Milagro - Quevedo Group several features, techniques and processes. Gold pieces are, however, relatively rare in this region in comparison with copper and silver finds. Silver, gold and copper, or gilt copper, appear combined in bimetallic objects such as masks (of silver) with crowns (of copper). Hammering is the preferred technique, combined with assemblage techniques to achieve large and three-dimensional objects. Small gold objects were assembled or welded. Long strips of hammered wire were shaped to form nose rings and ear rings in spiral patterns. Inlays of turquoise and lapis lazuli were used for decoration.

Manteño – Huancavilca metalwork. Left – copper *tinculpa* style breastplate. Right – silver breastplate depicting twins. (P.E.)

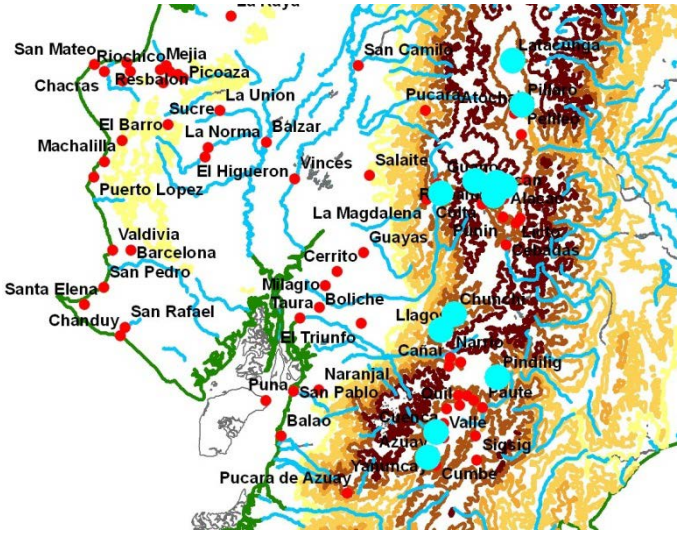
Money-axes have been found by the thousands, as well as other copper objects; this metallurgical tradition has such magnitude that it appears to have spread its techniques to the west coast of Mexico. Manteño goldsmiths had a long-distance trade and kept work instruments that included "Roman" class scales for weighing metals. In the Manteño metallurgy the face and head ornaments are not very important, most of the objects are utensils and tools. On the other hand,

breastplates, the most important pieces for the upper trunk, are varied and the subject of careful elaboration. Another notorious feature of this Group is the appearance of Central Andean types, as the *tupos* and *tumis*.



Manteño – Huancavilca metalwork. Left – silver plaque. Right – silver mask with copper crown. (P.E.)

7.6. Puruha Regional Group



The Puruha region, sites marked with blue dots

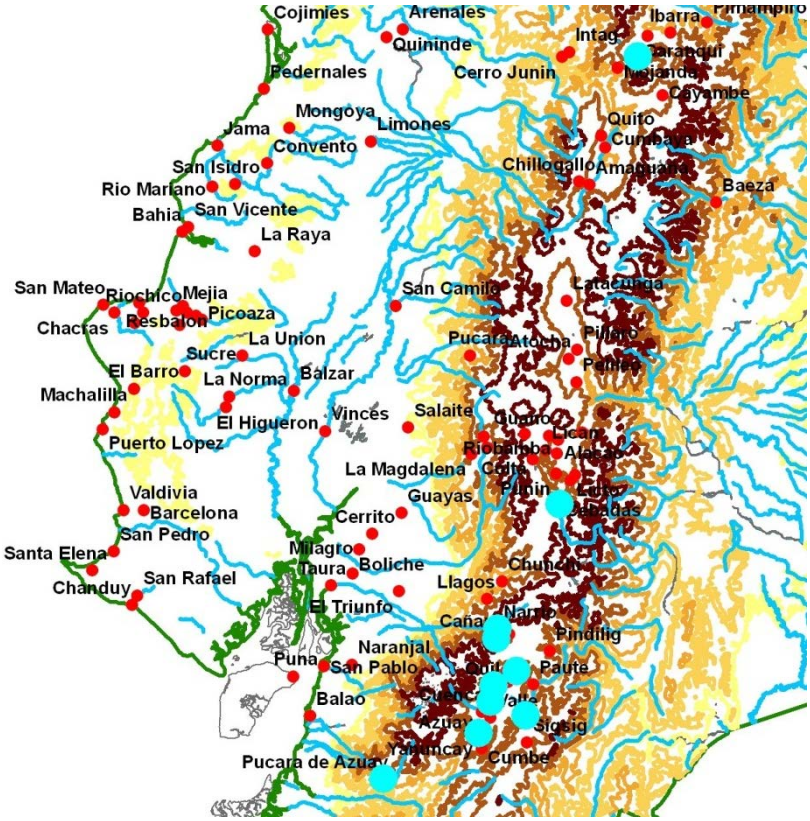
The distribution of this Group is very consistent with the territory of the archaeological culture and the historical Puruha ethnic group in the 16th century. The focus of concentration is on the centre of the province of Chimborazo, in places where presumably the power centres of the Puruha chiefdoms were in pre-Inca times. Its chronology is still incipient, but based on the available dates it is calculated between 1200 and 1533 C.E. The objects found demonstrate that gold, silver and copper were widely used, either by their selves or combined. The Puruha smiths made extensive use of these metals mainly by hammering and cutting; techniques in which they achieved great mastery. There are several cast objects, and cast and hammered components were sometimes combined. Casting techniques include the lost wax method for figurines and spear thrower hooks and mould casting for axes. There is a special technique which resulted in bi-metallic objects (gold, silver), a technological feature known only in this area and Cañari.

Puruha metalwork. Left –giant copper *tupo* pin. Right – copper crown. (P.E.)

The most varied and elaborate objects are the ear rings, pendants and *tupus*. Ear pendants are, sometimes, very large, lavishly decorated and with hanging plates that make them true rattles; pendants reproduce this pattern and, although not very large, are finely and carefully prepared. The largest objects, proportionately, are the *tupus*; some of them are over a meter long.

Puruha metalwork. Left – gold / silver pendant. Right – gold plated silver nose ornament. (P.E.)

7.7. Cañari Regional Group



The Cañari region, sites marked with blue dots

Cañari metallurgy is found in the highland provinces of Azuay, Cañar and south Chimborazo. Unfortunately this rich heritage has been heavily looted since the time of the conquest. Archaeological excavations have yielded some dates which, together with estimates, allow us to locate this Group between 500 and 1533 C.E. It is probable, though, that metallurgical activity was present in the area much earlier. It is also known that metallurgical production was at its peak at the arrival of the Incas and that interbreeding occurred resulting in a metallurgy with mixed Cañari tradition features and Inca patterns. Cañari technology shares many elements with Puruha. The metal most frequently used was copper that, on many occasions was gilded, by fusion or plating. They also used silver, possibly the usual silver - copper and gold alloy. Hammering is the most frequent technique; casting, as manufacturing technique had a very restricted use. Lost-wax casting was used for small items such as spear thrower hooks; open mould casting in bivalve or compounds moulds, was employed for large copper objects, such as axes. To form complex and three-dimensional objects from hammered sheets they used flanges, sheet bending, welding and rivets. They decorated objects with embossing, engraving and embedding of *Spondylus* beads.

Cañari metalwork. Left – gold pendant. Right – lid of ear piece with *Spondylus* inlays. (P.E.)

Cañari objects include various ornaments for the face, head and upper torso, as well as instruments, tools and utensils. Spear throwers, textiles coated with metal plates, vases, large solid rings, gold ribbons that wrapped skeletons, crowns, pendants, defence shields, flutes, staff heads with figures, diadems, plates, needles, weapons that combine head breaker and axe, zoomorphic figures and gold and silver feathers, were found in the lootings carried out in the area.

7.8. Pasto (Carchi-Nariño) Regional Group

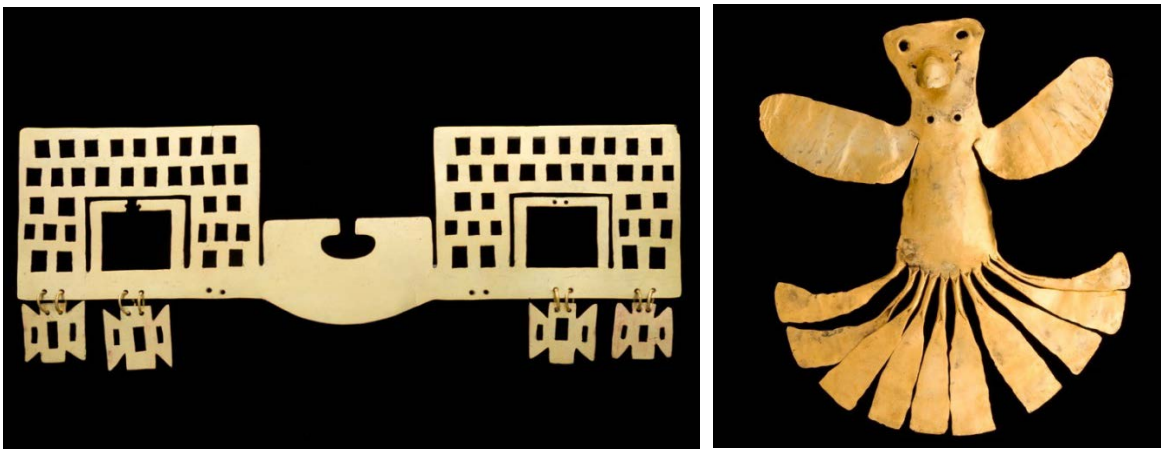
The Pasto (Carchi –Nariño) region in Ecuador, sites marked with blue dots

The objects belonging to this Group are found in the highlands of Carchi and Nariño, north of the Chota Canyon and south of the Patia Valley, in Colombia, Research has allowed us to distinguish three distinct periods of development of the metallurgy covering a time span from 100 to 1700 C.E.; the Early, Intermediate and Late periods. The distribution of Pasto metallurgy is very consistent with the territories of the ethnic groups of the 16th century in north Ecuador and south Colombia. The technology used varies between periods of development, even if certain common traits are preserved. The analysis of the materials used reveals that copper-rich alloys of gold are prevailing and that there are many objects of very pure copper, while the rich gold tombacs are scarce. Silver is present in the vast majority of the samples and there are some objects that are, in reality, silver - copper alloys. Hammering was used mainly.

A surface treatment technique known as zoned scraping allowed them obtaining objects with two colours and two textures, an unusual visual game without the help of coatings or encrustations. There are few tools in this Group; most of the objects are body ornaments, especially for the head and face, such as nose pieces with carefully balanced geometric motifs. In the Early and Intermediate periods most of

the ornaments seem to be made for the use of elite individuals, while in the Late period simple objects are abundant, probably meant to be used by the common people. A very special ritual object type is the rotating disk.

Pasto (Carchi –Nariño) metalwork. Left – mask. Right – bird shaped pendant. (P.E.)



Pasto (Carchi –Nariño) metalwork. Left – *tumbaga* nose ornament. Right – bird shaped pendant. (P.E.)

7.9. Inca Integration

With the Incas there was in the Ecuadorian Sierra a true metallurgical integration. However, the Inca occupation did not enlarge the territorial scope of production and use of metallurgy. The Inca objects come from the same places where the Cañari, Puruha, etc. objects came from, thus indicating that previous traditions had been replaced by the imperial one. Some Inca objects appear on the coast, but most come from the Sierra, mainly from the south and central parts. The exception is the far north (Carchi). The arrival of the Incas, by about 1450, marks the introduction of a massive and organised work that homogenised material, tools, shapes and decorative motifs. Inca metallurgical technology is a very complex theme. It not only covers an enormous territory in South America, but involves a variety of metals and alloys, complex manufacturing and finishing techniques and, above all, a scale of production and consumption unrivalled in the continent. Lost-wax casting was replaced by casting in bivalve and multi-part moulds and cold hammering alternated with annealing in forges. Copper and bronze are most abundant; the latter (intentional alloy of copper and tin) seems to have been an Inca introduction in Ecuador, where it replaced arsenical copper, widely used in former times.

The Incas in Ecuador, sites marked with blue dots

To manufacture containers, hammered sheets were joined by welding their edges. Welding was also employed to make *tupos* and other objects of copper, gold and silver. Sheets of gold and silver were used also to plate, sometimes silver and gold, in other cases gold or silver on wood. The moulds in this industry are sophisticated; to overcome the limitations in terms of the geometry of the object casted, they used moulds made of several parts that were assembled together and could also be easily disassembled to take out the cast object without damage.

The most abundant ornaments are the simple *tupos,* as those that were authorised for common women, pendants and rattles. Other adornments, presumably for the exclusive use of certain people (bracelets, nose rings, ear-rings, pectorals) are much scarcer. Very important are tools and weapons; pins, bolas, head breakers, axes, chisels, projectile points, drills, tumis and spear thrower hooks. The other abundant type of objects whose use must also have been much extended in accordance with the precepts of the State religion, are the votive offering figurines.

Inca metalwork. Left – gold votive figures. Right – copper *tumi* knife. (P.E.)

7.10. A summary of iconography

Among the most frequent geometric shapes we find the circle and the two-dimensional and three-dimensional forms related to it. The circle is also present as a decorative element and comes as part of the configuration of pieces that have

other general forms. Altogether this preponderance is quite overwhelming. Another very frequent form in the Ecuadorian metallurgy is the spiral, a derivation of the circle, as well as its projection in three dimensions, the spring. The human motif is present in all Groups; it may appear as a whole body but sometimes just the head or other parts of the body such as arms, legs, ears or noses are represented. The anthropomorphic representation is frontal, hieratic and devoid of movement.

Animals represented include birds first of all and, in descending order of frequency, monkeys, snails, felines, owls, insects, reptiles and crustaceans. In certain Groups birds are very characteristic and play key iconographic roles. In Carchi, it is likely that birds appearing in pendants and breastplates are condors. In Manteño - Huancavilca plates and pectorals have the shape of what appears to be an eagle with outspread wings. The other important animal is the monkey; it appears in Carchi and Manteno - Huancavilca *tinculpas* and Puruha spear thrower hooks. Felines, possibly jaguars, are important in La Tolita where their representation focuses in mouths with large fangs and in Cañari where their figures are stylised.

Dualism, or the conception of society and nature as an ordered and balanced set of opposite principles, is a salient feature of Andean thought. The expression of the dual in the pre-Hispanic metalwork is expressed, for example, as the game of the concave and the convex, filled and empty, bi-colour and bi-texture, bi-metallic and two-headed *tinculpas*. Dual iconography has a different specific expression in each Group. The use of platinum and gold in La Tolita allowed creating two coloured objects and figures. In Bahia silver configures dual expressions based on the opposite colours of this metal and gold; identical parts, some gold and some silver seem to have formed part of single sets of grave goods. In Milagro - Quevedo double coils are unusually frequent. In Manteño - Huancavilca is where dual iconography is more explicit; breastplates, pendants, plaques and axes have pairs of human figures and, less frequently, monkeys or protrusions (in pairs or quartets). This pair of identical "twins" appears at times holding hands or supported in a bar that divides the space in four quarters. Dualism is present as a game of colours in the surface of Cañari and Puruha objects; in this case identical objects in silver and gold were deposited in pairs in the tombs of the elite. They also sought to integrate the two colours into a single object; rectangular danglers in gold with silver corners, semilunar nose pieces of gold with silver centres and spear thrower covers made in gold and tied with silver ribbons.

8. Colombia, regional perspective

We have stated previously that the Central Andes region is characterised by a geographical setting in which there are three main axes running in a broad north-south direction: Costa, Sierra and Selva. This is true as well of Ecuador and the extreme south of Colombia. However, north of the massif known as the *Macizo Colombiano* this setting changes abruptly. The landscape of the country is dominated by two huge inter-Andean valleys running south-north onto the plains of the Caribbean coast. This imposes radical changes to the ways in which population movements and cultural interchanges operated. On the other hand, to the north of parallel 3° the tropical jungle is replaced by relatively dry savannahs while tropical jungles are now located in the Pacific coast, something that is also completely different from the Central Andes. The particular geographical transition that happens in the Colombian territory and which also links the lands of Central America in an ecological sense has a definite bearing on the diffusion and development of metallurgy and metallurgical traditions.

Colombia, main metallurgical areas (Google Earth)

8.1. Chronology and Periods

Given the present state of our knowledge it is only possible to affirm the following general and particular facts:

8.1.1. In the territory of what is now Colombia metallurgy appeared around the 5th century b.C.E. in the south Pacific coast and spread in various regions of the south, centre and north in the following five centuries, i.e. until the beginning of the Common Era, approximately.

La Tolita – Tumaco metalwork, bowl. (M.O.)

8.1.2. In other areas, not necessarily further from the likely focus of introduction, metallurgy appears later; between the first and third century of our Era. By 300 C.E. there are evidences of metal working in all areas of the Andean region and the Pacific and Caribbean lowlands.

8.1.3. Within each area we can detect diverse trends with relation to the styles or periods of metallurgy. In the south Pacific coast, there is only evidence for the Early period (Inguapi) but there are no dates for the styles which survived until the Colonial period and fused with African contributions to create the modern Barbacoas jewellery. In the southern highlands of Nariño the Early Period is represented by the Yacuanquer and La Cruz styles, the Middle Period by the Piartal and Capuli components and the Late Period by the North-Centre Late style.

Pasto (Carchi – Nariño) metalwork. Left – silver pendant. Right – *tumbaga* spinning discs. (M.O.)

8.1.4. Both in the upper and in the Middle Cauca Valley we can distinguish between Early and Late periods (Early from 300 b.C.E. to 500 C.E. and Late from 800 to 1500 C.E.).

8.1.5. In the Uraba Gulf metallurgy is quite early (400 to 700 C.E.). Later styles endured and gave rise to the Cuna and Embera present day metalwork. In the Caribbean lowlands the Early Zenu Group is dated between the 1st century b.C.E. and 12th century C.E. The San Jacinto Group is definitely late (15th and 16th centuries) and seems to correspond to the metallurgy found by the Spaniards in this region that, fused with African and European elements, gave rise to the current Mompox jewellery.

Early Calima (Yotoco period) metalwork. Left – gold breastplate. Right – miniature house replicas. (M.O.)

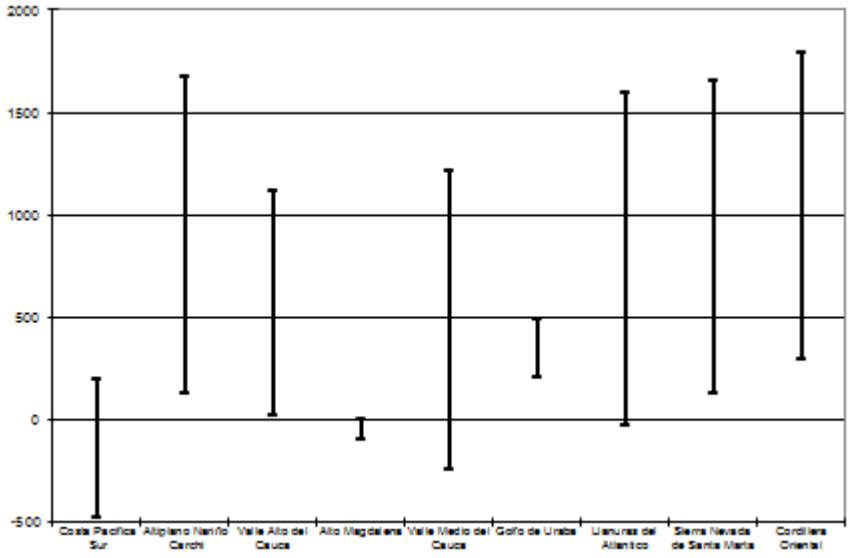
Left – Calima Yotoco gold diadem. Right – Calima Malagana gold and shell necklace. (M.O.)

8.1.6. In the Sierra Nevada of Santa Marta, it is possible to distinguish clearly an Early period, Nahuange (2^{nd} to 11^{th} centuries) and a Late period, Tairona (10^{th} to 16^{th} centuries).

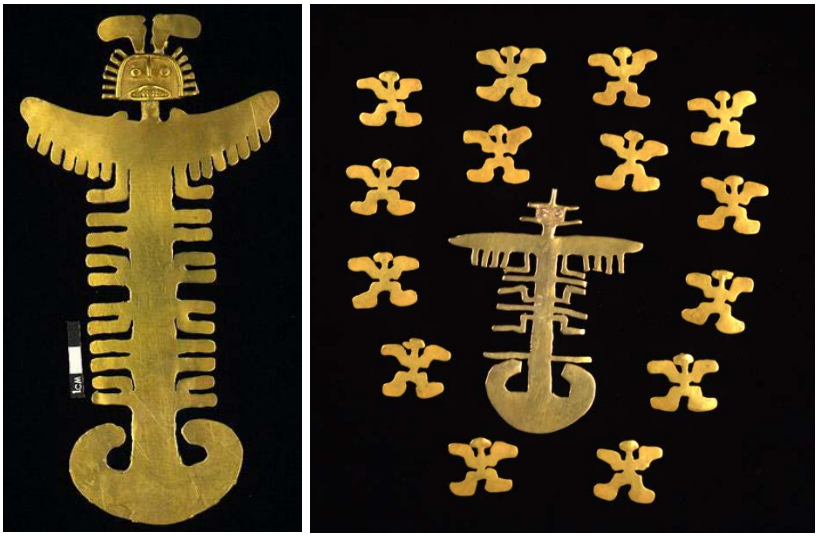
8.1.7. The panorama of the Eastern Cordillera is more complex. The three styles that make up the metallurgy of this region (Western Complex, Nuclear Muisca and Simple Hammered) seem to be contemporary. So far we have been unable to define early or late periods in the metallurgy of this region.

8.1.8. The above seems to indicate that, once the metallurgy was introduced, it had in each of the different regions a relatively independent development; only in a very general way we might consider major stages of development common to several areas. Not only was different in each area the time of introduction of this industry, but the diversification of styles and groups and the transitions between periods operated at different times and with different durations.

8.1.9. Indian metallurgy does not disappear with the conquest and colonisation of the territory. There is indisputable evidence of its survival during the last five centuries and its fusion with metallurgical traditions from other continents. This means that, broadly speaking, it is a living cultural phenomenon that has duration of 25 centuries. It also means that we must revalue the classificatory concept of "pre-Hispanic" which we use to distinguish this tradition from historical metallurgy; between these two there are undeniable ties.



Colombia, chronology of main metallurgical traditions



Tolima metalwork. Left – bat pectoral. Right – necklace beads and pendant. (M.O.)

8.2. Geographical Distribution

When dealing with the theme of chronology it has become clear that in this region of northern South America, at least in the last fifteen centuries before the Spanish conquest, only in some areas proper metallurgical industries actually came into existence. This cultural manifestation is confined to part of the regions of the Caribbean lowlands, including the Sierra Nevada de Santa Marta, the plains of the

Pacific and the Andean zone with its inter-Andean valleys. Within this area the finds are concentrated in certain regions. The most relevant general aspects related to the distribution of metallurgy can be synthesised as follows:

8.2.1. The distribution of metallurgy is a dynamic aspect that should be seen in a temporal perspective. There were variations in the extent of the territories and internal patterns of focuses of concentration in all geographic regions.

8.2.2. The distribution of styles and metallurgical groups keeps some relation to the distribution of types and complexes of pottery, but there is not a full correlation. Even when the association of the two types of materials has been tested, we should not expect that where one appears the other should necessarily be there.

8.2.3. An important aspect refers to the relationship between areas of concentration of finds of metallurgy and the areas with deposits of metals. Even though the logic of economy of effort might as well set it, the truth is that there is not a complete correlation between the areas with an abundance of raw materials for the industry of metals and the sites where these materials were produced and used. In some areas with an abundance of deposits of gold, silver and copper few objects were actually made and used, while in areas with no resources of this type they manufactured and used many metal objects. This is evidence of the fact that other social factors were more influential in the process.

Early Quimbaya metalwork. *tumbaga* lime containers. (J.M.)

8.2.4. Within each general area patterns of distribution tend to be complex and do not seem to correspond to simple ecological or geographical logics, as could be the case with patterns of cultivated lands, to cite just one example. Obviously there were powerful factors that we do not understand very well; they must have determined where metal objects were used and deposited.

8.2.5. While there has been too much emphasis on the exchange and trading of metal objects, especially in regions like southwest Colombia, this is not an aspect that is clearly supported by the available evidence. What the maps of distribution show is that the objects of each style, group, or period tend to be confined to restricted regions and that extraterritorial finds are exceptional.

8.2.6. There seems to be no point in trying to establish general patterns of change in the spatial distribution of metallurgy in Colombia. Different areas show different trends; between one period and the other either contractions or expansions of the territory can occur. Similarly processes of concentration or de-concentration of findings can happen. We must recognise that each region had its own dynamics, relatively independent from its neighbours. This configures a very complex process, influenced by a multitude of factors and hardly reducible to simple formulas of cultural change.

Left – San Agustin metalwork, bird shaped pendant. Right – Tierradentro metalwork, miniature mask. (M.O.)

8.3. Metallurgical technology

Most geographical areas, to which we have been referring, were characterised by the, more or less similar, use of well-known and relatively simple, manufacturing and finishing techniques which were sometimes combined between them, on gold or gold-copper alloys. This configures a relatively homogeneous basis on which there are some interesting innovations:

8.3.1. On the Pacific coast, both in the south and in the north, platinum was used to produce colour plated or bi-coloured parts. This metal is handled through the process known as sintering or compenetration, involving the direct handling of a mixture (not an alloy) of granules of platinum in an matrix of gold.

8.3.2. The use of silver, so common in the Central Andes, was very limited. Despite this, there are pieces of silver in the Nariño - Carchi plateau. In other areas metallurgical analyses have revealed silver proportions exceeding 30%, which cannot be explained by the use of a natural gold alloy; it is likely that in these cases silver would have been added to obtain whitish tones on the surface of objects.

8.3.3. In the southern Pacific coast and in the upper and middle Cauca Valley the welding of small spheres of gold was employed to form relief decorations; this technique is known as granulation and involved the use of fluxes extracted from vegetable substances to reduce the melting point of the gold - copper alloy.

8.3.4. In the Nariño - Carchi plateau depletion gilding was greatly improved thus constituting the zoned scraping surface technique that allowed them to achieve different colours and textures in rotating discs and body ornaments.

8.3.5. Also in the Nariño - Carchi plateau there was an interesting, though restricted, experimentation with other alloys. Some tools were elaborated in tin and arsenical bronzes, reflecting, no doubt, the influence of the metalworking traditions of the Central Andes.

8.3.6. The extensive use of copper occurred in highland Nariño - Carchi, in the Late Quimbaya of the Middle Cauca Valley, the San Jacinto Group of the Caribbean and in the Muisca Nuclear style of the Eastern Cordillera.

8.3.7. Hollow lost wax casting with nucleus is one of the salient features of the Early Quimbaya in the Middle Cauca Valley metallurgy. Among the many

technical requirements of this process, perhaps the most critical is the control of the casting temperature.

Muisca metalwork, votive figures. Left – scene of an enclosure. Right - Miniature mask. (J.M.)

Muisca metalwork. Left – nose ornament. Right – votive figure, ceremonial raft. (J.M./M.O)

8.3.8. Another variant of the lost-wax casting is the use of stone matrices for the serial production of common motifs. The technique was used for production and decoration of ornaments and the manufacture of some votive figures in the Muisca Nuclear style of the Eastern Cordillera.

8.3.9. Complex assemblages have been reported in the Middle Cauca Valley, specifically in the Yotoco - Malagana period, as well as in the upper Magdalena and the Sierra Nevada de Santa Marta.

8.3.10. A very interesting aspect of technology that has been neglected in previous analyses is the repairing and patching of objects. Sometimes repairs were made on objects worn by use and, in others, applied to objects that came defective from the manufacturing process. Repairs were made by sheets fastened with hooks or wires and, less frequently, pressed-in studs or welding. Not all defective objects were repaired and some that could have been used without repair (votive figures, for example) were, however, patched.

8.3.11. No broad and widespread process of technology dissemination is evident in the general panorama of metallurgy. It is likely that the basic techniques of hammering and casting and the finishing technique of depletion gilding were well-known by the American goldsmiths by the moment when metallurgy appeared in this territory. As it is clear, the processes of innovation were almost all of local order. No such things as widespread communities of technological knowledge seem to have existed. The degree of isolation must have been quite acute.

Zenu metalwork. Left – *tumbaga* staff head. Centre – gold breastplate. Right – bird shaped gold staff head. (M.O.)

8.4. Shape and function

First of all, it is useful to establish the difference between simple and complex objects. Regardless of its function, it is clear that a large proportion of metal objects are formal and technologically simple; this category includes the nose and ear pieces of annular, semilunar and circular shapes, circular pendants and breastplates, bracelets and other kinds of small pieces, produced thanks to quick and easy manufacturing processes and with little or no decoration. The simple pieces are the most abundant in the archaeological record; found in contexts such

as not very elaborate tombs and with scarce grave goods, suggesting that they were used by ordinary people.

Complex objects are, on the contrary, much more varied in terms of their function. They do not only include the entire range of personal ornaments, but also other categories of function. Often they involve complex manufacturing techniques and profuse decoration. Even though there are small and even miniature complex objects, their average size is much greater than the simple objects. They are scarce in the archaeological record and in collections; in spite of that they have been featured and published profusely. Its "diagnostic" character has served as the basis for classifications. Available data indicate that they appear in complex archaeological contexts; tombs with rich grave goods, deposits of offerings, etc. This suggests that their use was restricted to persons who held special political, religious or social positions.

Early Tairona metalwork. Left – spinning disc. Right – breastplate. (M.O.)

Secondly, metal objects may be classified according to their general function. The popular idea that objects of gold are jewellery gave rise to the belief that all pre-Columbian metal objects were used to decorate the body. The universe of functions is actually quite broad and includes the following basic categories:

a. Personal ornaments
b. Tools and utensils
c. Votive figures

d. Objects related with the consumption of coca and hallucinogens
e. Musical instruments
f. Emblems of power and rank
g. Ornaments for constructions and statues

Left – Early Tairona pendant shaped as a woman. Right – Late Tairona pendant shaped as a man. (M.N.B. / M.O.)

Objects may be classified according to their geometric shape. Even though the universe of forms of indigenous metal objects is very well known, no statistical survey has been done which allows us to understand what the proportion of each type is in the population of each Group. Most of what we have stated for Ecuador would also apply to Colombia, so we will only point out a few characteristic traits:

a. The human figure is preferred. Patterns of representation are rigid: no movement; the presentation is frontal; the faces are expressionless or have expressions of low intensity; in the representations of the whole body the head occupies one third of the height. There is a restricted range of body positions, standing, sitting (sometimes on benches) or kneeling with four or five variations in the position of the arms. A distinctive feature is the tendency to create icons, standardised and repetitive representations of human figures.
b. Among the many species of animals that populated the territory only a few came to have importance in metallurgy. The most frequently represented animal was the bird. Birds appear in all the functional categories in varying degrees of outlining and stylisation; there are detailed and realistic

representations and others that involve only two or three simplified traits of the animal. Another important type are felines; jaguars, pumas and ocelots. Snakes acquire high degrees of stylisation, to the point of being represented simply by a forked tongue. Bats are usually represented in a very schematic way. Frogs and toads are profusely represented in necklace beads.

c. Mixed representations, anthropozoomorphic and zoo-zoomorphic, are also frequent. Among these, the most common are those of the man - bat, man - feline, man - bird, man - snake and snake - feline. In the Eastern Cordillera there are votive figures that mix deer, snake, feline and man.
d. The representations of the vegetable world are scarce; these include gourds in the Middle Cauca Valley and a few flowers here and there.

In general it can be said that the formal and functional universe is extraordinarily rich and varied; this does not imply that it reflects a great deal of individual creative freedom. On the contrary, the huge range of shapes and functions seems to respond to rigid, pre-established patterns of design and manufacture.

8.5. Iconography and symbolism; some general ideas

a. Although the shamanic theme and, more precisely, the shamanic flight are dominant in the iconography of the metallurgy of Colombia, it should not be assumed that all metal objects have a shamanic iconography. There are important groups of objects that do not participate in this symbolism.
b. The votive figures of the Eastern Cordillera form a set with a particular symbolism. A typology of more than seventy kinds of figures which, in turn, are grouped into seven major categories has been established in this area. Each type of figurine embodied a specific principle within a dual conception of the cosmos; in this way the offering constituted a way of balancing the opposing principles of the cosmos.
c. The idea of the transformation, which has an obvious shamanic source, is present in various styles and periods. This topic was sometimes managed within a single piece and also through a series of objects that represent stages in the transformative process. The most common transformation depicted is, as before stated, that of man - animal in its different variants and, likewise, the animal – animal transformation.
d. It has been proposed that in the Caribbean lowlands the conception of the cosmos as a large textile became predominant. Society and its economic activities were seen as networks, while the ridges and channels of the drainage systems were as knitting over the landscape.

e. The large anthropomorphic figures of the Early Quimbaya metallurgy in the Middle Cauca Valley portray a symbolism centred on the idea of fertility and the cyclical nature of life, which is related also with the symbolism of pumpkins and gourds and, in turn, with the consumption of coca.

Uraba metalwork. Pair of *tumbaga* staffs. (M.O.)

9. Central America and the Antilles

During the first centuries C.E. the south west Circum-Caribbean littoral and the major Antilles were part of an area where cultural interchange seems to have been especially active. The area was populated by Chibcha and Arawak speaking groups that involved metals in their sacred symbolism. This favoured the expansion of metal working traditions from South America, leading eventually to the formation of local styles. In Panama, Costa Rica and southern Nicaragua this process fully evolved, both in terms of technology and iconography. In the territory of northern Nicaragua this cultural influx met the influence of the powerful Mayas and of the subsequent Meso-American cultures; this marked the north limit of the expansion of isthmic metallurgy. In the Antilles gold and *guanin* (tombac) were used by the time of the Spanish conquest. The finds are, however, very scarce and there is no museum collection or archaeological find that may allow establishing iconographic and technological trends; little is known also about geographical distribution and chronology.

Lower Central America, Nicaragua, Costa Rica and Panama. (Google Earth)

9.1. The gold of Panama

A large part of the metallurgy of Panama comes from the Conte site, a large settlement with rich graves occupied from about 450 to 900 C.E. More than 80 graves, some of them containing multiple skeletons, were dug and many objects of gold were unearthed. The grave offerings include embossed plaques, nose ornaments, gold-sheathed ear pieces, pendants, bells, and necklace beads. Decorative motifs are mainly anthropomorphic and zoomorphic; human, bats, deer, sharks, snakes, birds, turtles, crabs, insects, frogs, stingrays, armadillos, monkeys and alligators. Most motives appear also in the Cocle style pottery, well represented in the Conte graves. The gold style is thus termed as Cocle. Due to the careless methods of excavation much information was lost. The objects are now at the University of Pennsylvania, USA.

Recently some other rich graves were excavated at El Caño, another large site with many graves and an arrangement of stone columns, probably marking astronomical observations. The tombs are dated between 700 and 1000 C.E. A few isolated finds from several different places were collected by the Museo del Hombre Panameño; some of them were lost. The objects from this part of Central

America are manufactured in gold or gold-rich alloys. Most are made by lost wax casting and constitute body ornaments used by people of the elite. By the time of the European conquest there was in Panama an important gold working tradition that involved the work of artisans of high rank; priests and chiefs, who mastered the skills of craftsmanship.

Panama metalwork, objects from Conte site. Left – pendant with stone inlay. Centre – breastplate. Right – pendant.

Panama metalwork, various objects from El Caño site.

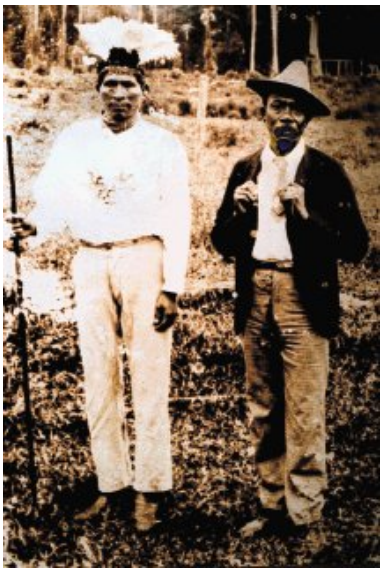
9.2. Costa Rica gold styles

Apparently the most appreciated material in the territory of Costa Rica by the beginning of the Common Era was jade, brought initially from the areas of the Olmec and Maya cultures. By around 900 C.E. the fall of the Maya culture disrupted the interchange circuits and metal soon replaced jade as the foremost material for elite use. There are, however, evidences of the use of metal objects dating back to 300 C.E. The earliest tradition is located in the central Atlantic region (300 – 800 C.E.); most objects are made of copper-rich tombacs gilded by depletion and portraying human figures. Lost-wax casting was preferred and objects were made in such a way as to maximise their size keeping down their weight. This technological innovation remained present in the subsequent styles of the Central Atlantic region, from 700 C.E. onwards.

The major gold working areas are located in the south east of the country, Diquis region, where there are also abundant alluvial gold deposits. In spite of what we just stated, most metal objects from Costa Rica tend to be rather small body ornaments; pendants, breastplates, necklace beads, ear and nose pendants. There is a rich iconography within this small-scale universe; frogs, bats, felines, alligators, shamans, musicians, alligator-men, bat-men, jaguar-men and scenes of alligators and alligator-men devouring people. Gold objects of pre-Columbian origin were used by native chiefs in Costa Rica throughout Colonial and Republican times, up to the 20th century.

Costa Rica metalwork. Left – bat shaped pendant. Right – pendant shaped as a musician.

Costa Rica metalwork. Left – bird shaped pendant. Right – pendant shaped as an alligator eating a person.



Costa Rica, chief Antonio Saldaña wearing his gold eagles, early 20th century.

10. Pre-Columbian epilogue

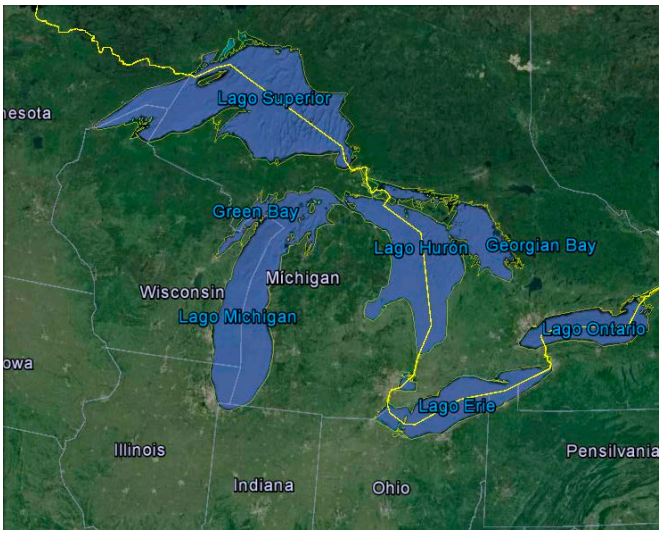
Given the level of development of Mexican cultures it is quite surprising that metallurgy had among them such little importance. There are very few Maya objects of hammered gold sheet apparently intended as textile applications. The most important find of gold objects is, undoubtedly, a set of pendants and other ornaments from the site of Monte Alban, Mixtec culture, now kept at the museum of Oaxaca. Aztec metallurgy evolved very late; just prior to the Spanish conquest a silver, gold and bronze metallurgy which combined the effort of artisans from other

specialities seemed to be very active. Most of Aztec metallurgy went into the furnaces of the Conquistadors, so very little is known about it. The other important metallurgical tradition in Mexico comes from the western Pacific coast; in the states of Jalisco, Colima, Guerrero and Nayarit flourished around 900 C.E. an important copper metallurgy. It has been established, doubtlessly, that this local phenomenon was the product of a long-distance trading connection with the Ecuadorian cultures. Mexican objects from the western coast resemble closely the Manteño-Huancavilca objects, both in shape and manufacturing patterns.

Central and southern Mexico and Guatemala. (Google Earth)

Mexican metalwork. Left – pendant from Monte Alban. Right – copper beads from the western coast.

Further north of the 23º parallel there is no proper metallurgy in pre-Columbian America. There are, however, important finds of metal objects. In the region of the Great Lakes and the upper Mississippi River native copper was mined and hammered to produce different items as early as 4000 b.C.E. No ore processes were involved and no casting techniques were used; this is the reason why this is not considered as a true metallurgical tradition. In technical terms native copper was treated as a stone, not as metallurgists would treat metals. On the other hand it is possible that annealing techniques were employed (alternation of reheating and hammering), so some doubt about whether this is or is not a metallurgical industry still remains.



The region of the North American Great Lakes. (Google Earth)

Hammered objects made from native copper in the Great Lakes region

11. The metals of the Indians after the conquest

For reasons that are not strictly scientific, American archaeo-metallurgy makes a sharp cut on the time scale of its object of study. The studies come up to the time of the conquest and avoid exploring processes and evidences of the Colony and the Republic. Afterwards, studies of metallurgy reappear to account for the industrial era in the 19th and 20th centuries. It is as if the social dynamics had frozen and then were miraculously reactivated in a different time and space. This, of course, is not more than an aberration of the scientists, not a reality. There is an interesting transition that starts at the time of the conquest and extends to the present day. There are five trends and processes that mark this particular transition between the pre-Hispanic metalwork and modern metallurgy. These processes had different expressions and rhythms in the various provinces of Spanish America:

a. The disappearance of the native gold objects and gold work - The hoarding of gold by the conquerors acted in two ways, equally devastating with respect to the production cycle. Firstly, it affected the moment of production; without enough raw material goldsmiths were paralysed. In the second place it attacked the moment of consumption since, even if they continued producing ornaments, it was increasingly difficult to use them, taking into account the prohibitions and the threat of a repetition of the looting.
b. The attempts to continue producing and using 'traditional' objects in metals other than gold and its alloys - This alternative was most natural and naive. It was obvious that the sudden availability of metals, materialised in pots, pans, tools, etc. represented an attractive source of raw material. Spaniards had them and were willing to sell them and, in principle, there was no prohibition for their possession. The problem arose when European iron, tin, copper, brass and pewter went in to shape crowns, nose rings and ear rings for the Indians; such outrage would not be tolerated.
c. The persistence in the use and manufacture of metal objects, sometimes under the protection of geographic isolation and sometimes in conditions of secrecy – There are evidences, both represented in C14 dates obtained from metal objects (13 dates for northern South America) and documents that prove that, in spite of all the difficulties, traditional objects were being produced by native communities in isolated regions until the early 19th century. On the other hand, gold remained present, though not materially, in the symbolism, mythology and oral tradition of many Indian societies.

d. The emergence of new colonial indigenous metallurgical industries in areas where, before the conquest, there were no traditions or they were incipient – Surprisingly, in areas like northern Choco in the Pacific coast of Colombia and south-central Chile where metallurgy was unimportant or altogether absent in pre-Columbian times, emerged new traditions. On the basis of new available material, i.e. silver coins, new jewellery industries emerged. No European influence is involved; the whole process is Colonial Indian.

e. The formation of mixed industries, combining American technologies and aesthetic patterns with others of European and, sometimes, African origin – When the Europeans started to settle in cities all along America they had to deal with the problem of providing articles for the daily life consumption to which they were used. European jewels and metal objects were expensive, it was difficult also to import all the qualified craftsmen needed for the workshops. This led to the incorporation of native smiths and, later on, slaves brought from gold working provinces of the west coast of Africa. In time flourishing “mestizo” jewellery traditions emerged in several places like Mompox in the Caribbean lowlands of Colombia, Barbacoas in the south Pacific coast and Santa Elena in the central coast of Ecuador.

These traditions have been crawling marginally over a long period of agony that for some of them ends with their death and for others with a transformation that perverts all its content in order to adapt it to the needs of the capitalist market and the new tastes of the commercial handicrafts.

Mestizo jewellery from Colombia. Left – silver filigree from Mompox. Right – gold pieces from Barbacoas.

Left - Mapuche jewellery from southern Chile. Right – Mapuche woman from the early 20th century wearing her silver jewels.

Present day Mapuche women with silver jewels.

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