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When Worlds Collide:
European-Indigenous copper production during the Contact and Early Colonial Period of Michoacán, Mexico (1521-1607)

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ABSTRACT

The Spanish conquistadors arrived in the territory of today's Mexico in 1519 and immediately entered in contact with the indigenous people that inhabited this vast territory. This encounter put the Spaniards in contact with multiple social groups and with their languages, religions, socio-political and economic organizations, world views, and also technologies. This dissertation will focus on one of those technological encounters: the Indigenous-Spanish copper metallurgy of the 16th century in the region of Michoacán and its socio-cultural, political and economic background.

During the entire colonial period, the South-Central region of Michoacán, Mexico was the main producer of copper in New Spain and one of the most important *loci* of production in the whole Spanish empire. Copper was a fundamental material for artillery, coinage and silver extraction, not to mention its importance in the manufacture of all sorts of daily life items (cauldrons, pans, knives, spoons etc.). However, when the Spaniards arrived, they had an almost complete lack of copper extraction knowledge. Spain did not have any copper mining operation at the moment nor an established copper production industry and all the copper consumed in Spain was acquired already in metallic form from production centers in Hungary and Germany, mostly through intermediaries in Flanders.

On the other hand, the South-Central region of Michoacán had a natural occurrence of rich copper ore deposits and a well-established indigenous metallurgical tradition developed during the course of at least eight centuries and based on copper and its alloys. These set of factors and an increasing world demand of copper led the Spaniards to heavily rely on native knowledge, technology and labour, hence creating a long lasting relationship of production between them and the specialized native metalworkers of Michoacán. In order for this relationship to last and succeed, a dialogue was established; techniques and ideas were exchanged, and political and economic issues negotiated.

The objective of this dissertation then is to explore the social, technological, economic and political aspects of copper production during the contact and early colonial periods of New Spain. This is done with the aim to understand how these communities of native miners, smelters, metalworkers, charcoal makers, and *tamemes* (load-bearers) adapted to a new socio-political and economic paradigm. How the encounter with the European metalworking technology (in the broader sense of the term) modified a nearly millenary tradition. And what was the role of these communities and their technology in the construction of a shared colonial world.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

ACKNOWLEDGMENTS

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CHAPTER 1: INTRODUCTION

This dissertation is a study of the socio-cultural context of copper mining and metallurgy in the south-central region of Michoacán, Mexico during the late pre-Hispanic, contact and early colonial periods of Spanish occupation. The study focuses on the social context of the mining and metallurgical communities that inhabited the region as revealed in the available historical, ethnohistorical, archaeological, and ethnographic records.

The present work is not intended to be a history of metallurgy in New Spain; neither is it focused on the technical aspects of copper production, the rates of production and consumption, nor on a typology of objects produced and their uses in the different aspects of colonial life. Other studies had already focused deeply on these matters[1]. Instead, it aims to analyse the social history of a region hallmarked by the exploitation and production of copper, and how the communities involved changed, adapted, and negotiated their place in an evolving colonial world.

To these ends, the present dissertation considers the technology as the glass through which we can see processes of technical, social, economic and political change[2]. The metallurgical technology and assemblage of socio-cultural features with which it is entangled allow us to observe typical social processes in a context of encounters such as negotiation, cooperation, adaptation and/or resistance, as well as the strategies employed. This becomes particularly relevant when framed in the Spanish colonization of the Americas and in the interaction between the indigenous societies and the Spanish colonizers because it considers the agency of native communities and their importance in the shaping of the colonial environment. In more concrete matters, the study of this technology provides an approach to issues of legal rights over territory and production activities, access to resources and markets, and technical exchange. On a regional scale, the consideration of these social dynamics can also help us understand issues related to population dynamics and the development of new settlement patterns.

Although the indigenous communities of specialized copper artisans are the main protagonists of the present study, it is not possible to address them and their changes without considering

[1] See for instance the important work of Elinore Barrett: The Mexican Colonial Copper Industry (1987).
[2] Dobres 1994, 1999, 2010; Hosler 1994; Lemonnier 1992; Pfaffenberger 1992.

other actors as well, such as the colonial authorities, colonial communities, entrepreneurial agents, slaves, and trading intermediaries.

1.1 Theoretical and Methodological Framework

1.1.1 Research Questions

As stated previously, this dissertation considers technology as a cultural phenomenon in which the tangible (availability of resources, techniques, tools, production processes, and objects) and intangible (knowledge, tradition, socio-political organization, world views) dimensions of technological practice are entangled. Therefore, the questions leading this research lie in both dimensions and also in their entanglement.

- What were the mechanisms and strategies of adaptation developed by the communities of metallurgists upon the arrival of new techniques, tools and demands for what to produce in the tangible dimension?

- And subsequently, what were their strategies regarding the intangible, e.g. the Spanish attitudes towards the technology, the material, its meaning and use?

- What was the importance of these indigenous communities and their technology in the development of the colonial copper industry in New Spain, e.g. how did this copper industry support the sustainability of other activities such as artillery making, coinage, silver extraction, and sugar production?

- How did these communities deal with the introduction of a new economic paradigm regulated by the specificities of a socio-political and legal framework dictated from Spain and continuously undergoing changes?

- Can the study of these social and technological changes, along with the associated adaptation processes help us to re-think the role of indigenous societies in the configuration of the colonial society of New Spain?

- If we acknowledge the agency of these communities on a regional scale, is it possible to visualize it on larger geographical and political scales? E.g. if we consider copper production and trade on a global scale, do these communities have a place in these dynamics?

These questions are not easy to contemplate, and the challenge will be whether this case study is suitable for addressing these questions, and if the available data can provide satisfactory answers. The case study presented in this dissertation is atypical, but it possesses the necessary contextual elements for addressing these questions and enough empirical data for providing answers. It is atypical because it takes into consideration material that has been left aside in the scholarship of Spanish colonial expansion as it shows how two different technological traditions encountered, interacted and adapted to each other.

Copper was not a very valuable metal compared to silver and gold, but its importance during the 15th to 19th centuries is undeniable. With the development of artillery-based warfare during these centuries, copper and tin (bronze) were the most important constitutive elements and became strategic materials, especially at the state level. The importance of copper was also reinforced by its use in coinage, silver extraction, and by the manufacture of all sorts of items used in different production industries of the period.

The social, historical, technical and geographical context of this case study provides an excellent opportunity to address the aforementioned questions. On one hand, the region under study is a well-defined geographical area that possesses some of the richest copper ore deposits in the whole of Mexico. These deposits formed the basis of colonial copper production, and during the pre-Hispanic period saw the development of an important indigenous metallurgical tradition based on copper and its alloys.

On the other hand, the pre-existence of a copper-based metallurgy and a natural occurrence of rich ore deposits allowed the interaction of the two technological traditions and created a causal relationship between the demands and needs of the colonial state and the technical possibilities of the native communities of metallurgists.

This metallurgical technology will be used as a methodological and empirical apparatus through which we can see the complex web of socio-cultural features that such production can create, along with the economic and political implications that it brought to the communities involved. The concept of technology is, therefore, taken as a profound cultural feature that lies far beyond the mere instrumental and material definitions. The concept of technology, as will be discussed, implies knowledge, tradition and performance, as well as symbolic codes, collective memory, identity, ideologies and rites of passage. In other words, it is a concept deeply embedded within individual and group-driven world views.

1.1.2 Hypothesis

Based on the research questions and the contextual outline of the case study, I propose a number of hypotheses that will work as a starting point.

- Technology constitutes a common place for cultural interaction, dialogue, negotiation and cooperation between groups.

- Technologies can have strong traditional and ideological loads and they can function as mechanisms of collective memory, identity and cultural resistance. Therefore, previous practical and theoretical metallurgical knowledge, held by the different actors involved stimulated certain attitudes in the encounter between cultures, and aid the processes of recognition and attempts to understand the other players.

- Metallurgical knowledge in pre-Hispanic America and Spain at the moment of encounter was different and culturally constructed, and the differences resulted from parallel and idiosyncratic technological traditions developed within specific cultural and historical contexts.

- The processes of technological hybridization can function as strategies of adaptation, in which practical and theoretical knowledge is incorporated but essential ideological and traditional knowledge can also be maintained.

- The output of these hybridization processes was a new metallurgical technology, practical and theoretical knowledge was transferred, learnt and accepted by the new colonizers, and was a key feature in the development of the 17th and 18th century Mexican copper production industry.

- Local communities of specialized metallurgists were dynamic actors in the social, economic and political configuration of the region in the 16th and early 17th centuries, and their negotiation skills and particular expertise granted them a prominent position during this particular period.

1.2 State of the Art: Theoretical-Methodological Approaches

This dissertation builds upon previous work on metallurgical practices in colonial Mexico in general, and of copper metallurgy of Michoacán in particular. However, given its socio-cultural approach to technology, and the socio-historical context in which it is developed, it considers three fundamental theoretical constructions which form the core of its interpretive framework. These are: consideration of technology as a cultural feature; the concept of indigenous negotiation; and the concept of cooperation.

1.2.1 Cultural Perspectives of Technology

In modern times it is common to make a conceptual association in which technology is conceived as the process of object-making through the application of scientific knowledge and techniques. This, however, is a very narrow definition, deeply influenced by the history of the western world of the last two centuries[3]. The historical shift produced by the industrial revolution, the rise of capitalism and the construction of the notion of progress have shaped and keep shaping our concept of technology. In a recent paper, Leo Marx called technology a *"hazardous concept"* so broad and dynamic that it needs to be constantly revisited in order to be specific[4].

This modern and instrumental perspective has continuously been scrutinized during the last three decades. It is from this perspective that I am obliged in the following paragraphs to set out a definition of what I mean when I refer to technology. It is also important to mention at this point that most of the theoretical and methodological approaches to technology-as-culture used in this dissertation have been developed within the fields of ethnography and archaeology, where material culture and its analysis are fundamental sources of data. In this sense, the interpretative frameworks they provide are a major tool for dealing with two major

[3] Pfaffenberger 1992:491-492
[4] Marx 2010

sets of data under consideration in this dissertation: the materiality of technological practice presented in the archaeological data, and the descriptions of that practice contained in the historical sources.

In 1999 Marcia-Anne Dobres and Christopher Hoffman introduced one of the most concise and complete definitions of technology yet, from the perspective of cultural studies[5].

"Technology is a pervasive and powerful complex of mutually reinforcing socio-material practices structured by self- and group-interests, expressions of agency, identity and affiliation, cultural ways of comprehending and acting on the world, practical and esoteric knowledge, symbolic representation and skill. These dynamics come together to create meaningful arenas in which humans simultaneously engage with each other and with their material world"[6].

Dobres and Hoffman mention that *"While this may be an exceptionally broad position [...] it best captures the essential nature of multiple and overlapping phenomena constituting what is too often conceptually limited to physical making and use"[7].*

By narrowing down the concept of technology to the "physical making and use" of things and by highlighting their materiality and functionality according to economic, pragmatic and rational western logic, we put aside the socio-cultural richness embedded in the processes of making and consuming those things[8]. Nonetheless, and based on the particular socio-historical context under study, I strongly believe not only that the process of production had a crucial importance but also the output of the process i.e. the things in themselves are a fundamental piece for understanding the complexities of the encounter and interaction at different levels, including technical, socio-political and economic areas. Therefore, I consider it necessary to conceptually define these "things" as material culture and hence ascribe this to its definition.

The conceptual transformation of things and objects into material culture has been a complementary advance to the cultural perspectives of technology. In the introduction to the *"Handbook of Material Culture,"* Christopher Tilley defined the conceptual framework of material culture, by stating that:

[5] Dobres and Hoffman 1999
[6] Ibid., pp.2
[7] Ibid.
[8] Ibid.

"Things are meaningful and significant not only because they are necessary to sustain life and society, to reproduce or transform social relations and mediate differential interests and values, but because they provide essential tools for thought. Material forms are vehicles for the (conscious or unconscious) self-realization of the identities of individual and groups because they provide a fundamental non-discursive mode of communication. Artefacts from such a perspective, are signs bearing meaning, signifying beyond themselves."[9]

In this definition Tilley highlights that besides their material-functional importance, artefacts serve as devices of communication and as elements for group cohesion and identity. For instance, and as we will see during the course of this dissertation, copper metallurgy and the production of copper objects were essentially indigenous activities during the whole period under study, and as such the process of production and the objects made were implicit in this identity.

Another important concept I would like to introduce is that of technological style. This concept was developed by Heather Lechtman in the 1970s, based on her extensive work on pre-Columbian Andean metallurgy. It helps to articulate the idea that if we consider technology as a cultural phenomenon then at the same time through the study of its material forms we may be able to understand the cultural imperatives underlying the human choices of what to produce and how to produce it. In other words, Lechtman's approach studies technologies in their tangible dimension, which she calls style, with the aim of understanding the cultural patterns that define a specific material configuration, hence a technological style, that is characteristic to that cultural context at a given moment of time[10].

One of Lechtman's most important contributions based on this approach is the recognition that pre-Columbian metallurgical technologies of the Andes were a product of their own cultural development and, as such, they could not be studied or understood using the same models for interpreting the development of metallurgy in the "old world"[11]. For instance, she states that while the development of metallurgy on the other side of the Atlantic had been highly influenced by specific needs in the fields of warfare and transport, Andean metallurgies were influenced by specific demands in the socio-political and religious arenas as a means to display

[9] Tilley 2006:7
[10] Lechtman 1977:3-4
[11] Lechtman 1984

ideological messages[12].

Dorothy Hosler applied Lechtman's approach to the study of Mesoamerican metallurgy and her results came to reinforce the idea that indigenous metallurgists were exploiting specific material properties of the metals with which they were working. In particular, Hosler's study found that pre-Hispanic metal workers were looking to highlight the colour and sound of the objects and hence the technical development of their metallurgy was highly influenced, just as in the case of their South American counterparts, by the display of the same type of ideological and political messages[13].

The concept of technological style can provide us with a great analytical tool for re-thinking the processes of interaction between cultures and technological traditions that define this region and chronological period. If we consider that the outcome of these processes was a new technological style that was neither indigenous nor Spanish, then through the analysis of its material forms we could be a step closer of understanding these processes.

Following these definitions and approaches, one of my working hypotheses is that beyond the economic and strategic importance of copper for colonial New Spain, the rates of production and its influence in the development of other economic activities underlie discourses of identity, social cohesion, collective memory and cultural values of the actors involved in the processes of producing copper. Furthermore, given the context of encounter and interaction, these technological processes can also reflect economic, political and social changes produced within the dynamics of the encounter, hence reflecting processes of negotiation, mutual adaptation, and collaboration between the indigenous communities and the Spanish colonizers.

1.2.2 Indigenous Negotiation

The concept of indigenous negotiation was, until recently, considered contradictory to a commonly accepted vision of native populations as dominated communities, victims of terrible regimes, condemned by their own ignorance of the law and subject to a set of fixed rules, ostracism and forgetfulness. However, in the 1960s ethnohistorical studies began to highlight

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[12] Ibid.
[13] Hosler 1994

particular aspects such as linguistic autonomy, religion and, in some cases, socio-political organization that a handful of communities managed to maintain within their territories. From this perspective, this was in a way rescuing a portion of the indigenous historical protagonism, and the active role of the native communities was acknowledged up to a given point. However, its sphere of influence was limited to the internal scenarios of their communal life without transcending a broader colonial space.

In a 2001 paper, Ethelia Ruiz Medrano provided one of the earliest definitions on the theory of indigenous negotiation and attempted to formulate its methodological implications. According to her it was clear that *“The colonial period was a phenomenon that implied force, but negotiation with the dominated society at the same time”*; therefore, *“the natives learnt to negotiate and defend their rights using the few and scarce legal spaces left by the Spanish power”*[14]. Given this, Ruiz Medrano considered it necessary to understand the motivation of the Spanish crown in offering the indigenous *vasallos* the possibility of negotiating with the representatives of royal authority, and to analyse what use those indigenous communities gave to the margin of negotiation in terms of strategies, discourses and alliances[15]. According to Ruiz Medrano this would add to understanding the processes of adaptation and resistance that indigenous societies pitted against the *“mechanisms of legal control”* during the colonial period[16]. These reflections were the results of Medrano’s studies on indigenous pictorial *codices*. She realized that they were more than mere artistic and culturally aesthetic representations, and that their appearance in a number of colonial hearings and trials where they were usually accepted as documents and legal evidence showed an active indigenous participation in the legal system of the Spanish crown[17].

In her book *“Mexico’s indigenous communities: Their lands and histories, 1500-2010”*, Ruiz Medrano expanded the work with the indigenous *codices*, focusing on the fact that most of the trials were over territory claims. She concluded that throughout the legal struggle to preserve the territorial integrity and beyond the strict purely economic factors, rests the maintenance of the indigenous community’s identity. In so doing, Ruiz Medrano took the argument of territory to the symbolic arenas of identity, affiliation and group consciousness, transcending not only colonial studies but especially current national debates.

[14] Ruiz Medrano 2001:57
[15] Ibid. Pp. 59-62
[16] Ibid. Pp. 65
[17] Ruiz Medrano and Valle 1998

In “*Negotiation within Domination: New Spain’s Indian Pueblos Confront the Spanish State”* Ruiz Medrano and Susan Kellogg compiled a series of papers in which the concept of indigenous negotiation is associated with the concept of hegemony. This association puts forward the notion that the legal actions of native communities were limited not only by the legal framework imposed by the Spanish crown, but also immersed in the systemic inequalities inherent to the colonial society. Therefore, the struggle was not between egalitarian parties, but the norm was asymmetric negotiation[18].

Hans Roskamp has analysed several case studies in which indigenous communities of Michoacán were immersed in processes of negotiation, not only against the Spanish colonizers, but also against other indigenous communities, some local and some relocated from neighbouring regions. Besides its iconographical and symbolic analysis, his book on the *Lienzo* and the *Títulos de carapan* is the story of the processes of negotiation and the struggle to legitimize indigenous rights in front of the Spanish authorities[19].

The theory of indigenous negotiation alters the place of native communities in the framework of the Spanish empire in assuming that they were active players, not only in the maintenance of their own world but also in the configuration of an original and dynamic colonial order. The research on colonial negotiation is helping to build up a context that blurs the previously fixed borders between the indigenous and the Hispanic, and between the pre-Hispanic and the colonial. At the same time, they are focusing on the processes of adaptation and creation of hybrid systems and dialogue, in which native communities actively participated.

Although the scholarly discourse of indigenous negotiation focuses mainly upon the legal sphere of colonial Spanish America, we believe that its theoretical and methodological framework can be used for approaching the socio-technical hybridization processes and political dialogue that copper production happens to evidence in 16th and 17th century Michoacán. To this end, a great portion of the data of this dissertation comes from legal procedures that directly or indirectly affected the practice of copper metallurgy in the region. For instance, the legal disputes over land and resources that involved the communities of native producers and the Spaniards has left us a rich record of data about the processes of negotiation. In the same way, setting up the mining ordinances in 1550 influenced the practice

[18] Ruiz Medrano and Kellogg 2010
[19] Roskamp 1998

of mining by incorporating a legal framework for ownership claims and mechanisms for conflict resolution. Furthermore, we will try to argue that the processes of technological adaptation in themselves created spaces for political and economic negotiation, especially between the colonial state and the native communities of producers.

1.2.3 Indigenous-Spanish Collaboration

The processes of indigenous-Spanish collaboration are an essential part of the present dissertation. Collaborative mechanisms have only very recently been taken into consideration in the study of indigenous-Spanish interactions.

As a critic of the classical euro-centric theories of imperialism Ronald Robinson argues, in his paper titled '*Non-European foundations of European imperialism: a sketch for a theory of collaboration,'* that any new theory of imperialism should have enough room for the *"…analysis of the most important mechanisms of European management of the non-European world"*, which according to him were *"the use of local collaborating groups – whether ruling elites, or landlords or merchants-as mediators between Europe and the indigenous political and economic system"*[20]. Although Robinson's sketch was conceived and applied to the study of European empires of the 19th and 20th centuries we consider that, to a certain extent, some of his hypothesises can be applied to the Spanish empire in the 16th and 17th centuries.

Robinson proposes that the notion of a collaborative mechanism has two further advantages. "*It explains why Europe was able to rule large areas of the world so cheaply and with so few troops. It also provides an explanation of the process of decolonization in terms of the growing ability of the independence movements in the colonies to disrupt the arrangements for collaboration or to use them for their own needs"*[21].

The first advantage that Robinson mentions is precisely what has helped to reformulate basic questions regarding the role of indigenous communities in the conquest and colonization processes in the colonial Americas, and their historically neglected importance in the configuration of a colonial world. A clear example of this is the ongoing research on the concept of *Indian Conquistadors* in New Spain[22]. This new perspective sheds light upon the

[20] Robinson 1972:117
[21] Ibid.
[22] Matthew and Oudijk 2007

vital importance that indigenous collaborators had in the Spanish campaigns, whether as informants, suppliers, guides, warriors, or strategists on the battlefield. Tens of thousands of these native collaborators allied with the invading forces, and the Spanish success would not have been possible without their support and direct involvement[23]. Although this phenomenon can be partly explained by coercive tactics used by the Spaniards, the ongoing research helps to clarify that the use of force was not the only way to make native communities participate in the Spanish expansionist endeavours. On the contrary, the researchers working on these topics show that the panorama was rather more complicated, and included collaboration as a result of political negotiation with the Spaniards, as well as individual and group agency seeking to ensure their own position in the colonial scheme[24].

Returning to Robinson's theory, he mentions that: *"The revised theoretical model of imperialism has to be founded on studies of the nature and working of the various arrangements for mutual collaboration, through which, the external European and internal non-European components cooperated at the point of imperial impact"[25].* In light of this and the ongoing research on indigenous collaboration in New Spain, we propose to use this approach to explore the indigenous-Spanish relationship with regard to copper production in Michoacán. Was this an example of mutual collaboration? And if so, what triggered the beginning of the relationship? And what were the basic principles that regulated it? We believe that this case study can help to widen the spectrum of studies on the topic, and place the indigenous communities and their agency within the economic and productive framework of colonial America.

1.2.4 Approaches to the Colonial Metallurgy of New Spain

The historiography of metallurgy in New Spain has permanently been influenced by the importance given to specific metals such as gold and silver, and to detailed stages of their production processes such as mining, extraction and, to a lesser extent, refining. In overall terms, the importance of these metals was defined by economic and political factors, in detriment to equally important but long forgotten metals such as iron, steel, lead, tin, and

[23] Ibid.
[24] Oudijk and Restall 2007
[25] Robinson 1972:118

copper. From this perspective, the studies on the production of silver and mercury[26] occupy a prominent place in the overall scholarly production on the metallurgy of New Spain in the last two centuries. The influence that such studies have exerted on the development of methodologies, exploration of new relevant topics and theoretical approaches is indisputable.

In 1955, Modesto Bargalló published a study entitled *"La Minería y la Metalurgia en la América Española durante la Época Colonial"*[27]. This ground-breaking work influenced most of the subsequent studies on mining and metallurgy in the Americas during the colonial period. In it, Bargalló analysed the socio-technical metallurgical production of colonial Spanish America, highlighting the social relationships of production and how they varied in function with the material, the region and the social environment. The technical and social characteristics of silver production in the viceroyalty of Peru were rather different than the exploitation of alluvial gold in the kingdom of Nueva Granada, for example[28], and these characteristics were defined by historical particularities, environmental constraints and socio-cultural contexts[29].

Following ideas proposed by Humboldt[30], de Elhuyar[31] and others, Bargalló found a common ground of causality anchored in the particular history of American and European metallurgies, which according to him, influenced the development of colonial metallurgy. To explore this common ground, Bargalló studied the pre-Hispanic and Castilian metallurgical traditions independently, defining their technical features and the specific historical contexts[32] in which these were conceived. In doing so, Bargalló created a new theoretical and methodological framework in which the boundary between the pre-Hispanic and colonial periods was permeated by the continuity of techniques, knowledge and tradition. During the early periods of contact and colonization the surviving features engaged actively with the European metallurgical tradition, which at the same time was the product of other historical developments. Although Bargalló set out his ideas on the importance of parallel developments for the output of the technical encounter he overestimated the notion of technique, thus considerably reducing the possibilities for its study. Nonetheless, his work remains an obligatory reference for any study on colonial, pre-Hispanic and pre-colonial Spanish

[26] Mercury commonly known as quicksilver or *azogue* became important by its fundamental role in the process of silver extraction through the amalgamation process.
[27] Bargalló 1955
[28] Ibid., pp.34
[29] Ibid., pp.46-47
[30] Humboldt 1966
[31] De Elhuyar 1825
[32] Ibid.

metallurgy.

Peter Bakewell's work on *Silver Mining and Society in Colonial Mexico, Zacatecas 1546-1700* is the first modern attempt to link regional history to Atlantic history using silver production and its technology as filters to address broader socio-cultural enquiries, making them interdependent but with a mutual influence on one another, and placing the debate in the framework of Atlantic history.

Daniel Brading's analysis on the role of merchant communities and trade networks in the growth of mining districts in Bourbon New Spain broadened the perspective of studies by including new actors, such as the specialized multicultural communities of merchants and itinerant miners[33] with regard to the reformation of mining laws and practices.

Lastly in this group of selected literature, is the work of Mervyng Lang and his analysis of silver production based on the mercury[34] trade, and the ferocious control the Spanish crown maintained over its monopoly of mercury production and distribution. Lang's analysis gave rise to the idea of the imperial interconnection between the colonies and Spain, and how state politics and technologies affected global scales of production and their consequences in regional and local social dynamics.

Several works have been produced in the past three decades, among which is the excellent two-volume study by Julio Sánchez Gomez on non-ferric mining and metallurgy in the Kingdom of Castille[35] prior to and during the period of overseas expansion. This work presents an insightful historiographical study that complements and greatly expands the previous work of Bargalló. Although it is not strictly and formally related to New Spain, it constitutes a centrepiece in the argumentation demanded by this dissertation, due to the fact that it clarifies the extent of metallurgical knowledge that early Spanish colonizers possessed upon their arrival, and how that set of knowledge (or the lack of it) influenced the colonial copper production in the 16th and early 17th centuries.

In a 1997 work, Sánchez Gómez translated his previous study and made it face the technical

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[33] Brading 1975
[34] Lang 1977
[35] Sánchez 1989

encounter with American metallurgical technology[36]. The result represents a refreshing analysis of the technical relationship between the metropolis and the American Spanish colonies in the 16th and 17th centuries, and even though Sánchez Gómez focuses on metallurgical techniques he still maintains a clear interest in the social and environmental factors that influenced the flourishing of a distinctive Spanish-American metallurgy and the decay of the Spanish Iberian technique.

One more approach to the metallurgy of New Spain deserving of mention is provided by the studies on the environmental and human costs of mining and extractive processes involved in the metallurgical processes. In 1971 Bakewell briefly dealt with the human cost of mercury and lead poisoning in the communities of silver smelters in the Zacatecas district[37]. Pieper explored Bakewell's reflections in the broader space of New Spain, including data from several other mining districts such as Taxco, Pachuca and San Luis Potosí, and analysed the data as a function of technological innovations that could be traced to the technical history of silver production[38].

In a recent paper, Studnicki-Gizbert and David Schecter analysed the problem of deforestation in New Spain, reconstructing and modelling the rates of destruction of forest ecosystems as a function of the expansion and contraction of mining settlements[39]. The impact of metallurgical activities on the biomass of central and northern New Spain and the degradation of ecosystems was partly produced by the demand for wood and charcoal fuel. They linked these processes with the development and expansion of pastoralism in the territories once the deforestation had taken place.

This dissertation builds upon these excellent studies and tries to include other types of less valuable material which are still of great importance in the scholarship of colonial metallurgy in New Spain. By doing so, we aim to validate the need to consider these technologies as independent but interconnected practices, i.e. silver production is not fully comparable with copper, iron, or gold, neither in its technical features nor in its socio-cultural, political and economic dimensions. By considering this we can identify the different actors involved in these technological practices and the socio-cultural, technical and political processes behind production.

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[36] Sánchez 1997
[37] Bakewell 1971:45-72
[38] Pieper 2000
[39] Studnicki-Gizbert and Schecter 2010

1.2.5 Approaches to Regional Colonial Copper Metallurgy: South-Central Michoacán

Although considerably less extensive in terms of volume when compared to the production of gold, and especially silver, the literature on regional colonial metallurgy in Michoacán is unusual in its origin. As stated above, the region under study almost completely lacks any exploitable metallic ores other than copper, and its (regionally) geological companion, arsenic. Thus, the few studies dealing with this topic can be grouped into three categories: a) formal historiographical analysis; b) ethnohistorical and ethnographical approaches; and c) archaeological approaches.

The first category prominently features the short but excellent pioneering study by Elinore Barrett, first published as an article *"The king's copper mine: Inguarán in New Spain"*[40] and then extended to a book *"The Mexican Colonial Copper Industry"*[41]. In these two essential works Barrett centred her attention on the copper production in New Spain mostly through the documents related to the mining district of San Bartolomé de Inguarán. Among the cluster of Michoacán copper deposits, Inguarán was the most important during the colonial period and one of the most important in the Spanish empire[42]. Throughout her analysis of the sources regarding the mine and the vicinity, Barrett studied the economic and administrative dynamics of the region in regard to the production of copper since its origin in the 16th century until the end of the colonial period in the early 19th century. One of her most important contribution was to highlight the importance of copper for the colonial period and that beyond silver and gold New Spain's production of utilitarian metals such as copper partly allowed the development of other important economic activities such as sugar production.

Barrett divided the history of the deposit (and by extension the history of colonial copper production) in two periods: an initial period of indigenous ownership until 1606, and a second period after this date when the crown declared its strategic importance and took possession of the main deposit[43]. Barrett recognized that the initial period was characterized by the importance of indigenous agency, the continuity until a certain extent of the indigenous copper making tradition, and the existence of a large indigenous control over the production[44]. In the process of analysing these two periods Barrett came across different phases of indigenous

[40] Barrett 1981
[41] Barrett 1987
[42] Ibid.
[43] Barrett 1981; 1987 pp.12-25
[44] Ibid.

negotiations regarding the rights over the territory and the access to mineral resources. Barrett's documental research was monumental and opened the path into the richness of the documents regarding copper production and use in New Spain.

Because of the wide chronological range of her analysis (16th – 19th century), Barrett did not focus on the 16th century material in depth but her analysis nonetheless set the foundations of the present study. In this dissertation I will build up over Barrett's work with the aim of enriching the details for the 16th and early 17th century copper production in the region of South-Central Michoacán and to further understand those one hundred years after the initial European-Indigenous contact. As it has been expressed before, I consider this a fundamental period for understanding the role of native metallurgists in the development of a colonial copper production in particular, but in more general terms the role of indigenous communities in the construction of a colonial society.

The second category of studies consists of work on ethnohistorical sources that focus on the indigenous populations inhabiting the region during the first two centuries of the colonial period. However, in these studies the production of copper, its technology and the economic and political factors are only peripheral. They are included only as documentary evidence to support arguments based on indigenous representation, colonial negotiation, ideology, syncretism and identitarian processes.

Hans Roskamp stands out as another prominent research figure. In his most influential work on the topic, entitled *La Historiografía Indígena de Michoacán, El Lienzo de Jucutácato y los Títulos de Carapan*[45]*,* Roskamp analysed a group of pictorial indigenous documents of the 16th and 17th centuries. Among them he studied the *Lienzo de Jucutácato* (*Jicalán*), an interesting pictorial document painted in the second half of the 16th century. Roskamp masterfully links the specific context in which the Lienzo was created, along with its use as a legal document presented in court, with its symbolic ideological load. This entanglement was interpreted by Roskamp as belonging somewhere between the pre-Hispanic cosmogony and symbolism associated with metallurgy, the colonial dynamics and legal framework, and the native struggle for their rights over lands and activities.

In more recent work Roskamp has further explored the relationship between the persistence of

[45] Roskamp 1998

pre-Hispanic world views or cosmogonies and the processes of change, negotiation and adaptation of 16th and 17th century indigenous communities[46]. At the same time, he has gone further in his study of the pictorial Lienzo, its symbolism and the relationship between cosmogony, tradition and metallurgy[47].

In 2013 Roskamp and Mario Rétiz published their most recent work on the topic of metallurgy, entitled *An Interdisciplinary Survey of a Copper-Smelting Site in West Mexico: The case of Jicalán el Viejo, Michoacán*[48]*.* In this study, they explore the archaeological ruins of *Jicalán el Viejo*, the town where, according to Roskamp, the Lienzo was produced, and around which the story narrated in the document comes to pass. Although the results of the study were inconclusive due to the lack of extensive excavation, the archaeological survey recognized areas where metal had been smelted, just as was described in the Lienzo story[49]. A great contribution of this work is the interdisciplinary approach to indigenous metallurgy in the 16th century Michoacán, and the use of oral history, archaeology and analysis of ethnohistorical colonial sources.

Most of the archaeological approaches to mining and metallurgy in Michoacán for the late pre-Hispanic/early colonial periods follow the same line of analysis. The inherent interdisciplinary nature of archaeology and the specific social and chronological contexts in which regional mining and metallurgy is framed in the region make the entanglement of history, archaeology and anthropology unavoidable. A general concept of the past is still very much alive in the collective memory of the region, and has an active role in the economic, political and social lives of its inhabitants.

Deeply rooted in traditions, language, music, religion and techniques, the pre-Hispanic and colonial past are permanently mixed in the daily life of the region, especially among indigenous communities. Archaeological studies on the topic are scarce. However, the work of Gringberg on the location of pre-Hispanic mining places is prominent. Along with archaeological surveys[50] she analysed 16th century sources to locate the pre-Hispanic/colonial copper deposits, following the hypothesis of the continuity of traditions and the idea that there was not a clear rupture between the late pre-Hispanic period and the 16th century on the selection of mining

[46] Roskamp 2003
[47] Roskamp 2010
[48] Roskamp and Rétiz 2013
[49] Ibid., pp.53
[50] Gringberg 2004

sites.

A few recent works have contributed substantially to the matter of regional copper production. Among them is a PhD dissertation by Blanca Maldonado[51] and her subsequent published works on the late pre-Hispanic Tarascan settlement of Itziparátzico[52]. Applying an interdisciplinary approach from archaeometallurgical studies, she surveyed, excavated and analysed slags and other debris of copper production. Although the archaeological context and the associated material culture was indicative of a late pre-Hispanic tradition, the analyses of the metallurgical slags revealed a more complex panorama, thus raising the possibility of an early colonial operation[53].

Along the same lines is the most recent work of Punzo Diaz and his group[54] on the direct dating of copper smelting slags using archaeomagnetism. This work shows how, in different archaeological settlements in the area around Santa Clara del Cobre, slags can be located in a time span that encompasses both late pre-Hispanic and early colonial periods. This is a significant piece of data since it is the first time this technique has been used to date metallic slags in Mesoamerica, especially because the dates, if correct, show continuity in the production of copper in some of the metalworking settlements in the region.

Finally on our list, is the ethnohistorical/ethnographical approach conducted by Horcasitas in her book *Una Artesanía, con Raices Prehispánicas en Santa Clara del Cobre*[55]. She departs from the ethnographical study of the modern town of Santa Clara, (a town which is famous for copper handcrafts) then continues with an ethnohistorical analysis of the settlement since its foundation. The ethnohistorical study could have been far more extensive and better documented, but a great contribution is the link Horcasitas proposes between the techniques for copper work that she documented and the pre-Hispanic metallurgical tradition. Hence, she opens a perspective via the idea of technical continuity and how the technical tradition of copper production strengthens the conceptions of a shared past, cultural resistance and group affiliation[56].

[51] Maldonado 2006a
[52] Maldonado 2006b; 2008; Maldonado and Rehren 2009
[53] This topic will be discussed further in chapters 2, 4 and 5.
[54] Punzo et al. 2015
[55] Horcasitas 2001
[56] Ibid, 172-173

The theoretical and methodological perspectives expressed by researchers working on the regional metallurgical production of Michoacán differ greatly from the general structure of colonial New Spain studies. This is undoubtedly due to the active influence of local indigenous populations in the configuration of the regional colonial world and how this is evident throughout the bulk of historical and ethnohistorical sources. However, the fact of their tangible influence in Michoacán today, as well the chosen topics of study present a challenge in which the present cannot be understood without the past. While most of the colonial ideas, legal framework, institutions and productive processes have been substituted by the republican apparatus of modern Mexico, Mexican indigenous communities are still deeply rooted in their past and maintain forms of self-organization, governance and production that help them to resist the never-ending process of acculturation.

This dissertation integrates different sets of data these researchers have used and produced so as to link them as aspects of the same story. The objective then, is to approach the socio-cultural and technical continuities and changes with regard to the regional metallurgical technology and the people involved. Furthermore, this dissertation seeks to understand these processes within the broader context of copper production and trade in the Spanish empire. We consider that the political and economic aspects of copper production and trade on a global scale during the period under study had an effect on regional dynamics, and hence considering the bigger picture can help us understand a series of causal relationships among events.

1.3 Methodological Path

The present work proposes an interdisciplinary approach that combines analysis of 16th and 17th century colonial written records, archaeological evidence, and material culture analyses of indigenous populations of the pre- and post-contact periods. This interdisciplinary approach is intended to be inter-complementary, i.e. by bridging the gap among these different data sets we can take advantage of the richness of information that each can provide, while complementing the others as well. The study of the past can be approached from one or various perspectives, and each of the disciplines mentioned above provides a unique set of evidence which can influence the dialogue among the others.

Archaeology and the study of material culture can provide evidence of everyday life and specific activities, the geographical and temporal presence or absence of materials, technologies, exchanges and inter-intra society interactions[57]. It can also provide information about mid- and long-term cultural changes in terms of ritual practices, technologies, production relationships and the consumption of goods and artefacts[58]. With respect to this study, archaeology will be used as a source of information about the technologies involved in the metallurgical processes (materials used, production techniques, and contexts of production and consumption). The corresponding findings will also be used to inform the geographical and temporal distribution of production activities and the movement of produced objects within the larger socio-cultural dynamics and their mutual relationships within local and regional scales. Critical attention will be given to the persistence and changes of the above-mentioned processes through time and space.

While no specific archaeological field work was conducted for this study, this dissertation considers the archaeological data produced by three different archaeological projects carried out in the region in the last decade. These projects are directly related with the late pre-Hispanic and early colonial copper production in the region and range from surveys and surface collection, to extensive archaeological excavations and metallographic and chemical analyses of pyrotechnological debris. Data gathered by the *Itziparátzico* archaeological project, the *El Manchón* archaeological project and the *Jicalán El Viejo* archaeological survey provides an innovative data set that can link techniques and the materiality of technological processes to sub-areas within the region of study, ethnic groups and historical and ethnohistorical descriptions.

An analysis of historical records can provide a certain degree of complementarily to limited and fragmentary archaeological records; documentary evidence can inform the discussion with detailed information of places, individuals, groups and events. Although textual sources provide a rich vision of the historical context on different spatial scales, social processes and cultural interactions, they present their own inherent limitations and biases. Therefore, it is necessary to keep in mind the general context of the narrated events as well as the specific context of the source in question.

Historical and ethnohistorical accounts of the region in the 16th and 17th century not only provide data on metallurgical themes, but more especially on social, economic and legal issues

[57] Hodder and Hutson 2003:3-4
[58] Ibid. Pp.5-6

that happen to be related with copper production, copper exploitation, settlement transformations and the communities involved in these productive processes.

The great majority of the historical documentary evidence included in this research presents a strong and potentially problematic selection bias: most texts represent the view of Spanish colonial agents, and their partial narration of events excludes almost any possibility of an indigenous view of the same events. The native perspective is almost irremediably lost or heavily distorted in most early 16th century chronicles. This project starts from the assumption that in the context of colonization, technologies such as metallurgy served as common places for establishing a dialogue, and to the need to recognize, adapt and negotiate with the other arose from the endeavour to reach the counterpart of this dialogue.

Ethnohistorical records of Mesoamerica and the indigenous colonial world provide a complementary, sometimes counter-perspective view from the colonial sources. They are composed of pictorial and/or manuscript artefacts painted and/or written by native people during the first century of the colonial period. These records provide valuable information on the topic of metallurgy and technology, but more importantly they provide evidence for different sets of cultural values and attitudes toward the materials and the materiality of technological processes.

With these elements in mind, is it possible to create an interdisciplinary dialogue for the sake of research? Is it possible to give voice to long-forgotten and excluded actors? Also, if we put aside sentiments like compassion or condolence, can we consider the indigenous peoples as active participants in a changing process that had to be negotiated? Can they be considered as active participants in a new socio-historical configuration?

Crossing sources

These datasets present a challenge as they are scarce and scattered, as well as intermittent in time and partly in space, and they represent a multi-ethnic context, not only in the Spanish-Indigenous dichotomy but also in the multi-ethnic category of “indigenous” or “Indian”. However, they are to a lesser or greater degree connected by the technology, and thus can be used to link these communities and include them in a sequence of social change and continuity, at least on a regional scale. The question remains, how to integrate these different datasets?

As mentioned above, archaeology provides a starting point that draws a picture of the use of metal and certain ideas about its production in the late pre-Hispanic period, just before the arrival of Spanish conquistadors. Archaeology provides data about the population inhabiting the three settlements, but more importantly it provides information regarding the technicalities of metalwork during the contact and very early colonial periods. This data can be contrasted with the bulk of information provided by historical sources, especially regarding metallurgical processes, not only in the region but also in central Mexico. On the other hand, historical geography and geographical information built upon the analysis of these documents can help to generate visual data on the changes which occurred in the settlement patterns of the communities along a chronological line.

At the present time, the lack of key archaeological information in terms of quantity, variability and more accurate dates for the region in the period under study limits the possibility of undertaking further exercises crossing the line between archaeological and historiographic sources, although the limited resulting information is extremely useful.

Finally, the crossing of different historical sources provides glimpses into different aspects of life and society of the metalworking communities, as well as the politics and economics involved in the processes of adaptation to a colonial environment. The three main sources considered for this dissertation (Pedro de Arellano's trail, Legajo 1204, and the Lienzo de Jicalán) are complemented by another 150 primary sources. The taxation records for different periods of the 16th century that involve the communities under study are integrated with the administrative data originating from the royal authorities, such as the *mercedes*, the *cédulas* reales and the *ordenanzas*, that regulated the political economy of copper production.

This relationship between production and administration existed within a general legal framework for the treatment of the "Indians" based on different and consecutive sets of laws applied in New Spain, such as the *leyes de Burgos* of 1517 and the *Leyes Nuevas* of 1542-1543. This production and the social aspects linked to it were not only completely regulated by the authorities, but they were contested and negotiated by the communities in the form of complaints, trials and uprisings through which the native communities defended their rights, positions and land. This dissertation takes into account several of the trials that took place in the region during the period under study, and a large percentage of those have a direct connection with the production of copper.

This complex entanglement of the political economy of production, indigenous negotiation and regional politics is directly linked with the increasing royal need for strategic materials such as copper. From this perspective, most of the processes observed at the end of the 16th and the beginning of 17th century regarding copper production obey the broader dynamics of Spanish expansion in terms of economy, geography and engagement in wars, as well as increasingly complex international politics. These broader dynamics triggered local and regional processes that are present in the sources and can be integrated into the analysis; the regional policy of *congregaciones* as well as the imposition of a royal monopoly over copper deposits are good examples of this.

Another dimension of the analysis is the local history on the adaptation of these communities, certain individuals and their metallurgical expertise in the economic life of the colonial period. Sources such the *Mercedes* show how individuals living in multi-ethnic towns or cities such as Pátzcuaro and Valladolid asked for official permits to pursue their professions, and set up small *herrerías* to attend to the increasing demand. This record is strengthened by official complaints and trials over the type of jobs in which indigenous characters are normally involved as the accused or accuser. On a communal level it is possible to trace the creation of *cofradías*[59] linked to specific activities related to copper production, such as miners, smelters, metal smiths, charcoal makers and transporters. Reference to the creation and subsequent development of these activity-driven social groups is found throughout the records of the 16th and 17th centuries. Some of these guilds survived until the 19th century, such as the *carboneros*[60] and some others such as the coppersmiths survive until today, the best example of which is the town of Santa Clara del Cobre in central Michoacán.

The historical sources available for this dissertation offer an approach to study the metalworking communities of South-Central Michoacán at local and regional levels, and to track several of the processes of adaptation, negotiation, cooperation, resistance and hybridization suffered during the first 100 years of the colonial period, as well as their conscious or unconscious role in the dynamics of New Spain and the Spanish empire.

Summing up, the envisioned interdisciplinary approach implies consideration of different datasets. Ethnohistorical and historical sources from the early colonial period of Mexico are a good example of this. Both datasets are the main study materials of disciplines such as colonial history and ethnohistory, and one of the principal sources for late pre-Hispanic and historical

[59] Guilds
[60] Charcoal makers

archaeology, ethno-archaeology and socio-cultural anthropology. The same can be said about geographic data or information coming from the material sciences.

Due to the scope of the research and the characteristics of the topic, period and region under study, this dissertation mainly takes into consideration the body of written and pictorial ethnohistorical and historical colonial sources. Unfortunately, only a handful of early colonial documents exist that can be considered as principal sources for the study of copper metallurgy, not only for the region under study but in general for all New Spain. The rest of the data is scarce, brief and scattered along a cornucopia of manuscripts and edited sources that only deal partially with the topic, the place and the people under study. Perhaps this can be indicated as a distinctive feature of the documentary body of data of the present study.

Within these limitations, this dissertation takes into consideration not only the data directly associated with the techniques and the processes of metalwork, but also any information regarding the daily life of the communities involved with this technology. Sources that document the processes of adaptation of these communities to colonial life, as well as the adoption or rejection of colonial features are especially relevant for this thesis. Equally important are the sources that attest to the struggle of native communities in defence of their territories, to resources and activities related to copper metallurgy, and to the mechanisms of negotiation and cooperation with the colonial authorities that made copper metallurgy a viable technology throughout colonial period.

As mentioned above, examples of these stories, testimonials, processes and struggles are scattered among a massive quantity of documents whose range is wide and varied. This variety extends to legal disputes and records over territory and resources, debts and rights, traveller's accounts, taxation records, natural history and writings, individual entrepreneurships and royal endeavours.

The documentary body of historical data collected for this dissertation can be divided in two large groups: 1) edited primary sources and 2) manuscripts.

1.4 Sources

1.4.1 Edited Primary Sources

This group of documents consists of well recognized colonial sources of New Spain, which have been edited numerous times and are constantly under study. Among these, three sub-groups are considered.

Chronicles: These are early accounts of the conquest and colonization of New Spain, usually written by friars, soldiers, or travellers who accompanied the military conquests and early colonization processes. This dissertation takes these early accounts as means to have glimpses into the first moments of encounter, a period that witnessed the first exchanges of goods, ideas, technologies and recognition of the other, whether that other was a native or European. Early accounts of this kind are considerable in number, but only a few are used for the present dissertation to highlight the technological dialogue implicit in the encounter, with a specific interest in metallurgy. Therefore, the accounts taken into consideration are *Historia general de las cosas de Nueva España* written by Bernardino de Sahagún[61]; *Historia de los Indios de la Nueva España* written by the friar Toribio de Benavente in the first half of the 16th century[62]; and the *Historia Verdadera de la Conquista de la Nueva España* written by Bernal Diaz del Castillo in the second half of the 16th century[63].

Relaciones: These 16th century accounts refer to groups of documents that deal with specific topics, such as a geographical area, a town, an event or an institution. This dissertation takes into consideration several *relaciones.* We have used the sources edited and published by Francisco de Paso y Troncoso in his five volumes of *Papeles de Nueva España*[64]*;* and the *Relaciones Geográficas del Siglo XVI: Michoacán* edited by Rene Acuña[65]. The *Relaciones Geográficas* of the 16th century are a compendium of historical, economic, political and

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[61] It is also known as the Florentine Codex and the original is held at the *Biblioteca Medice Florenziana*. Although for practical reasons this dissertation uses the Spanish edition of the castellan text published in 1829 (Sahagún, 1829). It is supported by the digital version of the original manuscript available online at: https://www.wdl.org/en/item/10096/view/1/1/
[62] De Benavente 1914
[63] Del Castillo 2012
[64] Paso y Troncoso 1905
[65] Acuña 1987

geographical data collected by order of King Phillip II between 1577 and 1586 and are structured as answers to a given questionnaire of 50 questions.

Taxation and tribute records: Throughout the 16th century the crown performed a number of official visitations to the indigenous communities (*pueblos de indios).* These were for counting the population and recording any features of local production, for the purpose of having a better understanding of regional economies and demographics in order to determine the payment of tribute to the colonial authorities. This dissertation works primarily with two groups of *tasaciones:* la *Suma de visitas de los pueblos de Nueva España*[66] produced between 1548-1550 and el *Libro de las tasaciones de los pueblos de la Nueva España*[67] whose taxation records include several visitations from early 1530 until 1570. These two sources show the evolution in the application of tribute to the native communities, as well as the changes in quantities and products in relation to demographic changes and settlement patterns.

New Spain's colonial laws and ordenanzas: At the time of the Spaniards arrival in the territories of New Spain in 1519, they had already conquered and colonized the Caribbean Isles for almost thirty years. In 1512 the first group of *ordenanzas* for the legal treatment of native people came into effect under the title *Ordenanzas dictadas por la reina doña Juana y el rey don Fernando, el Católico, su padre, con intervención en su elaboración de los miembros del Consejo Real, teólogos y expertos en temas de Indias, para el buen regimiento y tratamiento de los indios de la Isla Española*[68]*.* However, this group of laws is better known as *Leyes de Burgos,* and its importance lies in the fact that these were the laws that constituted the legal framework in use at the time of the first encounter and during the next two decades. A second set of laws was dictated between 1542 and 1543, under the name *Leyes y Ordenanzas echas nuevamente por su Magestad para la governacion de las Indias y buen tratamiento y conservación de los indios: que se han de guardar en el consejo y audiencias reales que en ellas residen: y por todos los otros governadores, juezes y personas particulares dellas*[69]*.* These are better known as the *Leyes Nuevas* (New Laws) and came to replace the Leyes de Burgos of

[66] Suma de Visitas de los Pueblos de Nueva España: 1548-1550, 2013
[67] Libro de las Tasaciones de los Pueblos de la Nueva España Siglo XVI, 1952
[68] Ruiz Asencio 1991
[69] España 1603; Facsimile held at the British Library. The digital version can be consulted at: http://access.bl.uk/item/viewer/ark:/81055/vdc_100026382628.0x000001#ark:/81055/vdc_100026382635.0x000002

1512 and the Leyes de Valladolid of 1513. The third major, and perhaps better known, set of laws is the *Recopilacion de leyes de los reynos de indias, 1680*[70]*,* which is the compilation of all the laws issued by the Spanish crown with regard to the West Indies up to 1680.

Sources Directly Related to Early Metallurgy in Michoacán

Although very scarce, primary sources dealing directly with native metallurgy in Michoacán exist. Among those, there are three important documents that have been studied repeatedly by ethnohistorians and archaeologists during the last 50 years. Among these, only the *Lagajo 1204* and the *Lienzo de Jicalán* deal with copper exploitation and transformation, while the trial of Pedro de Arellano has a broader scope on metallurgy and mainly deals with gold and silver.

Perhaps the most well-known of the three is the *Legajo 1204* of the *Ramo Indiferente General* of the *Archivo General de Indias* (AGI) published by Fintan Warren in 1968 under the title of *Minas de cobre de Michoacán 1533*[71]*.* Since its publication it has become a mandatory source for anyone interested in pre-Hispanic and colonial metallurgy, not only of the region but also of the entire Mesoamerica/New Spain. It is a report about copper production in Michoacán that friar Vasco de Quiroga produced for the crown in the year 1533.

The second source is the *Lienzo de Jicalán,* a pictographic document painted by the native people of Jicalán in the second half of the 16th century *"as proof of the rights that the indigenous authorities believed they held over several mineral deposits, copper sources and soil-based colorants in the tierra caliente (hotland) of Michoacán*[72]*"*. The original is held in the *Sociedad Mexicana de Geografía y Estadística* (Mexico City) and it is considered one of the most important colonial documents of indigenous tradition of New Spain. It has been extensively studied for more than a century and several interpretations have been proposed. This dissertation takes the research of Dr. Hans Roskamp and his interpretation of the Lienzo[73] as the main approach to the document, not only for being the most extensive, celebrated and critical, but also because it is the most recent study conducted on the document.

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[70] España 1681
[71] Warren 1968
[72] Roskamp 2013:29
[73] Roskamp 1998

The final edited source is a document from 1532 whose original is held in the *Archivo General de Indias* in Seville under the name *El fiscal contra don Pedro de Arellano sobre cierto oro que tomó a los indios de Mechuacan y demás cosas de que fue acusado, 1532* [74]. Like most of the sources on the topic, this one is neither focused only on the native metallurgy of the period, nor on the mineral resources of the region. It is a trial conducted against Pedro de Arellano, the governor of the province of Michoacán at that time, who was accused of stealing and melting down an indigenous treasure belonging to the sons of the last Tarascan king.

1.4.2 Archival Manuscripts

The majority of the sources considered as primary are still unedited, and they are held in four different archives, three in Mexico and another in Spain. As mentioned earlier, the available data is scattered among hundreds of documents dealing with different topics.

Mexican Archives

Archivo Municipal de Pátzcuaro (AMP)

The modern town of Pátzcuaro was the capital of the province of Michoacán from the fall of Tzintzuntzan in 1523 until 1545. During the 16th and 17th centuries the town was known as the *ciudad de Mechuacan* and was, along with the city of Valladolid (modern-day Morelia), one of the two main urban centres in the entire province. Its municipal archive holds a medium sized but very rich collection of 16th and 17th century manuscripts. The richness of the archive lies in the fact that the documents it holds deal especially with the immediate region around Pátzcuaro, which represents the centre of copper activity in the province as well. The archive is located on the second floor of the *Presidencia Municipal*[75] building. The data from the AMP is comprised of 21 documents that chronologically fall into a range between 1565 and 1669. Most of them deal mainly with copper production, the economy and local transformation of metallic copper.

Archivo General de la Nación (AGN)

This is the main historical archive in Mexico and one of the most important manuscript repositories for the study of Spanish colonial expansion in America and the Philippines (part of

[74] AGI,JUSTICIA,187,No.1,Ramo 2; Edited and published by Carrillo and Mendez, 1994
[75] City Hall

the viceroyalty of New Spain). The AGN is managed by the government of Mexico and is located in Mexico City.

This dissertation uses 226 documents of the colonial period distributed in two temporal ranges as primary sources: a) the first period encompasses the years between 1542 and 1660 which establishes the core of the research and b) the second period between 1783 and 1795 in the framework of the Bourbonic reformation. The reforms tried to give a new impetus to the copper industry with the idea of modernizing production. This was carried out by several technical missions that visited the mines and the smelting operations, and in so doing produced an interesting body of documents and technical reports. The first period comprises 123 documents in the domains of *Mercedes*, *Tierras*, *Indios, Civil, General de Parte, Cédulas Reales* and *Mapas.* The second period is composed of 103 documents, mainly in the domain of *Minería.*

Spanish Archives

Archivo General de Indias (AGI)

The AGI located in Seville, Spain holds the biggest and surely the most important collection of manuscripts, maps and illustrations related with the colonial period of the Americas and the Spanish expansion.

This dissertation takes into account 33 documents that were produced between 1537 and 1606. The documents from the AGI are correspondence between the viceroy and the king, hence the *Cédulas Reales* or orders from the king and the corresponding answers and subsequent reports from the viceroy. In this correspondence the increasing interest of the crown in the mines and production of copper in New Spain is evident, first as a local supply of raw material for the artillery production in Mexico city and the *Casa de Moneda*, and later as one of the main suppliers for the artillery factories located throughout the entire empire in places such as Barcelona, Seville, Havana and Manila.

The documents held in the AGI also mention the politics of copper production in the framework of the relationships between the crown and the major producers of Central Europe, and thus the increasing or decreasing need for applying pressure over the local production centres in the colonies, especially Michoacán and Cuba. Hence the documents held in Seville provide clues to categorize and to understanding the role of places such as central

Michoacán and its indigenous/hybrid production in the context of the global dynamics of the empire.

1.4.3 Archaeological Data

During the last fifteen years, three archaeological projects have been exploring and excavating sites with presence of metallurgical processes debris in their record. Two of them, Itziparátzico and Jicalán el Viejo are located directly within our region of study, *i.e.* Central Michoacán, in the proximity of the Pátzcuaro lake basin. The third one, El Manchón, lies some 40Km south of the Balsas River, in the southernmost portion of the *Tierra Caliente* (hot lands) region. To date, these three sites are almost the only sites ever found which show archaeological evidence of ancient metallurgical processes in Mesoamerica.

Chronologically, these three sites are located in the last period of pre-Hispanic occupation, a period known as late post-classic in the archaeology of Mesoamerica. However, the importance of these data sets resides in the fact that the chronology of metallurgical activity seems to overlap into the colonial period. This presents the possibility of evidencing a transitional phase between the late pre-Hispanic and the early colonial periods, at least regarding the technical issues and settlement patterns of the technology.

Although the research on these archaeological sites is by no means conclusive and in some cases the projects are still in process, the data they provide can help us understand the social and technological processes involved in this transitional phase with regard to the societies of native metallurgists in the region. The data collected in the three archaeological sites includes metallurgical debris and analysis of its chemical composition, settlement patterns, material culture, and geographic studies.

Amongst the data available from the archaeological research in the area, undoubtedly the most important is from the metallurgical debris recovered in the three sites, especially the by-product of copper smelting operations, known as slag. Slags are the most significant source of information for the analysis and reconstruction of ancient metallurgical technologies since they contain trapped records of temperature, atmosphere, ores, time, and almost all the general information about the smelting process. This is vital to reconstructing the technological processes from a given period of time.

The two archaeological sites located in the central area of Michoacán are directly related with some of the information found in the regional written sources. The case of *Jicalán El Viejo* is the best example of this; it was one of the two towns mentioned in the Spanish taxation records (*tasaciones*) of the mid-16th century as producers and tributaries of copper. Jicalán is also mentioned as a town of *herreros*[76] and thus the tribute paid to the crown was in the form of copper ingots and copper utensils. The importance of Jicalán to this dissertation is also that the *Lienzo de Jicalán* was painted by the people of this town, and throughout the period under study this community was permanently involved in activities related with the production and trade of copper and copper utensils. The people of Jicalán were relocated by the Spanish authorities in the early 17th century to a new site south of the modern town of Uruapan, and the old settlement fell into oblivion. From an analysis of the historical sources and the *Lienzo,* the old settlement was located, mapped, and archaeologically surveyed by Hans Roskamp[77] in 2002. Some of the collected materials, especially metallurgical slags, were studied by Blanca Maldonado[78]. The results of their analyses are considered in this dissertation in the context of the regional copper production dynamics.

Itziparátzico is located only 5km north of the town of Santa Clara del Cobre, one of the most important copper production sites during the colonial period and a living survivor of the traditional copper production technology, that even today represents a high percentage of the economy of the town. The archaeological evidence and associated dating of Itziparátzico suggest that the settlement survived only until the first years of the colonial period, and this is also indicated by its lack of mention in the colonial records. Nonetheless, it is well known that Santa Clara was founded by the Spaniards during the first half of the 16th century and it served as an early attempt of *congregación* of the dispersed native settlements around it. It is also clear that Santa Clara congregated groups of metalworkers, one of which could have been Itziparátzico. The site was surveyed and excavated by Maldonado and the data along with the results of the archaeometallurgical analyses have been recently published[79]. The data from this site is relevant in the sense that it is possible to compare the same type of data from sites within the core of the region under study in sequences that can be consecutively linked in terms of metallurgical technology.

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[76] Literally means blacksmith
[77] Roskamp and Retíz 2013
[78] Maldonado 2006
[79] Ibid.

Finally, although the archaeological site of El Manchón is located outside the core region, it is still located within the *Tierra Caliente* in an area not very far from the massive copper deposits of the Balsas River depression. The site is dated to the late pre-Hispanic (late postclassic) and early colonial periods, however, the archaeological record does not show the presence of Spanish elements in the material culture. Nonetheless, the analysed materials from the excavation show that the site was an important copper smelting settlement belonging to a local cultural tradition in terms of architecture, pottery and lithics, and intimately related to Jicalán el Viejo and Itziparátzico in metallurgy. Although the site is located slightly outside the area under study, it has also been extensively excavated, very well dated and its metallurgical remains have been analysed. In this dissertation the data from El Manchón helps to appreciate that copper production in the early colonial period could have been carried out in a region larger than previously thought, but that has been historically understudied.

In addition to the three above-mentioned sites, there is a wide-ranging archaeometallurgical dataset for the late pre-Hispanic period that includes typologies, distribution of sites and cultural information regarding the use of metal objects in pre-Hispanic times. This data provides a broad picture of metal use before the arrival of the Spaniards, and thus it generally defines a period which can serve as a starting point in the study of technological and sociocultural change in the region.

Unfortunately, there is a large gap in the data on the production of metal artefacts in Mesoamerica. The data recovered is still inconclusive and none of the sites found with metal artefacts have shown clear features of metal production. This lack of conclusive data is a limitation, since much of the knowledge regarding mining and smelting is still assumed. Mesoamerican archaeology needs to find a preserved production site with a clear context that can show the different stages of the processes of metal production in a controlled excavation that can be well dated. This lends importance to the three sites under analysis, as they represent the best opportunity so far to know what was happening before and at the same time theoretically what was happening during and after.

1.4.4 Chemical and Metallographic Data

The metallurgical remains recovered during the archaeological exploration of three sites considered for analysis have been analysed in the laboratory. The data produced give a glimpse into the technical characteristics of the metallurgy in each of the sites. The analyses provide information on the type of ore that was extracted, the temperature range reached with the furnaces, the use or not of elements to lower the melting point of copper, as well as elements to form the slag. The data can indicate whether the smelting process was conducted in a single operation or if several stages were necessary, as well as whether the high temperature of the process was produced blowing air through blowpipes as sources suggest, or if wind was used to aid smelting through bellows or other systems. The data can also show the efficiency of the operations i.e. the amount of metallic copper recovered in comparison with the amount of ore used and the amount of fuel required. In other words, the laboratory data can tell the story of copper production from a technical point of view at a given moment. This type of study is still in process and, therefore, its extent is limited. However, it is an important source of data that has to be considered side by side with the historical sources of the 16th, 17th and 18th centuries.

1.5 Chapter Overview or Structure of the Thesis

The chapter sequence of this dissertation is designed to create firstly a strong contextual background, secondly a coherent dialogue between the different sets of data and thirdly, a cause-effect analysis on the particularities of an atypical case study on the matter of the colonial encounters.

Chapter 2 Different worlds: introduces the context of macro scale, prior to and during the encounter, and analyses Spain and its colonial project. At the same time this chapter presents a contextual analysis of pre-Hispanic and early colonial Mexico, how those societies were different and how those differences marked the course of the encounter.

Chapter 3 Collision course: Contextualizing parallel developments. This chapter presents a contextual analysis of metallurgy on both sides of the Atlantic from a historical, technical and cultural perspective of the period prior to the Spanish arrival in Mexico.

Chapter 4 Impact point: Contextualizing 16th century Michoacán and the Tierra Caliente Region. This chapter analyses the historical, geographical and environmental context of the south-central region of Michoacán before and during the 16th century.

Chapter 5 Worlds colliding (1521-1550): The previous chapters are intended to contextualize this chapter and the following one. This chapter explores the period of contact between the peoples and between technologies, from the first contacts until the decade of the 1550s. Essentially it explores the encounters with 'the others' and their technology and tries to articulate a discourse around the idea of technologies as common grounds for recognition, dialogue, and negotiation.

Chapter 6: Worlds colliding (1550-1607): This chapter is a temporal continuation of the previous one and it is intended to show the dramatic changes in the second half of the 16th century, particularly post-1580 and the outcome of events, exemplified by the policy of congregations.

Conclusions: The conclusions intend to answer in a brief, systematic and integrated manner the main research questions put forward by this project and which guided the investigation and methodological path taken.

CHAPTER 2

DIFFERENT WORLDS

Contextualizing the Encounter: The Spanish colonial project in Mexico and the Mesoamerican World

With the successful conquest of the Aztec empire in 1521 the Spaniards began the construction of a new colonial system. Immediately after the fall of Tenochtitlan, the Spanish troops and their indigenous allies started a series of expansionist campaigns with the idea of annexing and colonizing new territories. However, with the increasing presence of Spanish colonizers and the control of larger territories came the need for structuring these newly acquired lands politically, socially, and economically. With almost thirty years of colonial experience in the Antilles already, the Spanish imported the model being used in the Caribbean and adapted it to early New Spain.

All the main social, political and economic institutions were implemented in New Spain following a proven successful model, to a certain degree. However, the vast territories, the cultural diversity, and the complexity of challenges faced by the early New Spain colonizers necessitated several modifications at the institutional level, especially during the 16th century.

This chapter is intended to give the reader a general understanding of the Spanish colonial system in New Spain and its evolution during the 16th century, particularly with regard to the institutions that regulated production activities in the colony and thus the life of its inhabitants. The aim of the chapter then, is to orient the reader within the institutional and legal context that regulated the practice of mining and metallurgy on one hand, and the political and economic relationships between the indigenous communities and the colonial authorities on the other. In this chapter, in conformity with the scope of this dissertation, we will highlight the importance of institutions directly related with coerced or controlled indigenous labour in the practice of mining and metallurgy such as slavery, the encomienda, the repartimiento, and the peonaje.

The institutional and legal context of the colonial system is fundamental to this dissertation, and throughout the following chapters we will explore in depth how the events under study were conditioned by this framework and by the series of changes it was subjected to during the 16th century.

2.1 Legal Frame for the Colonial Enterprise

The legal framework for the colonization of the overseas territories had its origins long before the arrival of the Spaniards in Mesoamerica. It was institutionalized as soon as news of the discoveries reached Spain. At the time of Columbus' discovery of the Antilles there was dynastic unity in Spain from a political view, but not national unity. The marriage between Isabella of Castile and Ferdinand of Aragón brought together two kingdoms, each with its own political and administrative characteristics[80].

The kingdom of Castile had a homogenous legal framework, the so-called *derecho castellano,* while under the crown of Aragón several legal systems were in use i.e. aragonés, catalán, valenciano, mallorquín. These circumstances and the fact that it was Isabel who sponsored Columbus in his discovery enterprise explained why the western Indies were annexed politically to the kingdom of Castile and thus to its legal frame[81].

Nonetheless, the new territories were vast and complex in terms of natural and social characteristics. As soon as the first stages of military conquest were fulfilled, the colonization processes and the expansion to the inland territories of the "new world" demanded a legal framework which could be adapted to specific, changing and frequently unforeseen conditions. It was clear during those first years that the *derecho castellano* was insufficient for circumstances that changed with each new social group and geography the Spaniards encountered.

The crown thus decided to respect the validity of the local customs in terms of socio-political organization in so far as they were not in contradiction with the interests of the colonial state[82]. These types of initiatives added a new element, the influence of indigenous customs and agency, to the process of creating a legal frame, later known as the *derecho indiano,* which would govern the lives of the inhabitants of these territories until the advent of the independence movements of early 19th century.

Thus, the *derecho indiano* was blended with the *derecho castellano* in acknowledgement of 'others' and their customs, and the set of laws dictated by the crown or by the colonial authorities promptly addressed the specificities of a socio-political and economical organization in constant change[83]. With the advent of the *derecho indiano* and the

[80] Capdequí 1941:9
[81] Ibid.
[82] Ibid., pp.11
[83] Ibid.

promulgation of the *leyes de indias,* the *derecho castellano* had a merely supplementary role in the legal system, and its application was only considered whenever there was lack of an applicable law within the *leyes de indias* framework[84].

Although the *derecho castellano* and later, the *derecho indiano*, were the sets of rules in use during the colonization process, for the conquistadors there was another form of legal arrangement between them and the crown that came into use during the exploration and conquest of the new territories.

It is widely accepted that the main feature of the Spanish colonial enterprise was its predominantly individual and private character. This meant that the crown relied heavily on the private efforts of entrepreneurs to conduct the expansionist process. These private enterprises were legally based on the system of *capitulaciones.* A *capitulación* was the contractual bond between the crown and the owner/s of a projected enterprise. The clauses of the *capitulación* usually set out the rights of the crown over the new territories and the *mercedes* (reward or favour from the crown) which were granted to the members of the expedition[85].

The norm was that all the expenses and risks related to the enterprise were covered by the individual or group in charge of the organization and this was a convenient situation for the crown. This system was the centre piece of some of the socio-economic institutions developed in the Americas during the first years of the colonial period such as the *encomienda*, the *repartimiento* and the indigenous personal service, among others.

The *capitulaciones* had an important role in the development of the legal frame for the Spanish due to the fact that they had a particular characteristic; that is that each *capitulación* constituted the fundamental code of rules for the explored and conquered territory, and not all of them had the same reach. The *mercedes* granted to the members of the expeditions were in most cases extraordinary, and in some ways brought a distinctive lordly image to the Americas. An image that was in decline in early modern Europe was projected and reproduced in the Americas during those first years[86].

The *capitulaciones* usually granted a series of royal *mercedes* which included the title of *adelantado* (frontier governorship) to the leader of the expedition, a lifelong title that in some

[84] Ibid., pp.14
[85] Ibid., pp.15-17; Barbosa-Ramírez 1981:38
[86] Capdequi 1941:17

cases could be inherited; furthermore, the *adelantado* had the power to divide up and grant land to the other members as well as to grant natives to the colonists for personal service and other forms of exploitation[87]. Therefore, the *capitulaciones* and the *mercedes* had an important role in encouraging the Spaniards to embark on risky enterprises with prospects of land and richness that were legally established.

After the *Real Provisión*[88] of 17 November 1526, clauses for the well-being of the natives as well as the required presence of members of the clergy were included in the capitulaciones, stating that the spiritual aims of the conquest along with the political ones were the two pillars over which colonization was held[89].

2.2 Legal, Economic and Social Condition of the Indigenous People under the Colonial Regime

For the native people of New Spain the situation was quite different, and their status in the colonial regime was constantly changing in the legal and the socio-political realms. However, a series of political decisions taken by the Spanish crown were essential to defining the standing that the native communities held in the system.

These decisions were made during the first years of Spanish settlement in the Antilles, and they established the status of the natives before the law and the crown. The first proclaimed the freedom of the Indians and the second declared the advent of a relationship between the Crown and the indigenous groups known as *vasallaje* (vassalage)[90]. The two declarations were decreed just a few years after the first contact with the native populations, and largely defined their legal status before the law and the authorities, and thus it is an important matter for this dissertation.

The condition of *vasallos* (vassals) and the declaration of the liberty of the Indians were first mentioned by Queen Isabella of Castile in a Real Cédula of the 20th of June of 1500. In it she condemned the slavery activities carried out by Columbus in the Antilles, ordering that natives kept as slaves were to be set free and returned to their lands. In the same *Cédula* she first refers to the natives as *vasallos libres* of the kingdom of Castile, thus declaring the condition of

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[87] Ibid.
[88] The Real Provisión was a royal decree that lies midway between the law and the ordenanza or cédula.
[89] Ibid.
[90] Barbosa-Ramiréz 1981:45

the indigenous peoples as *vasallos* of the crown[91]. The recognition of natives with the rights and duties of *vasallos* presented an important shift in the relationship between the Spanish and the indigenous peoples of the recently conquered and colonized lands.

However, the freedom of the natives was conditioned, and in some cases slavery was acceptable for those captured in a *justa guerra* (fair war) i.e. those who had rebelled against the crown. At their arrival in the territories of Mesoamerica, the Spanish had these two prerogatives with regard to the condition of the natives. Nonetheless, the condition of slavery in New Spain during the first years had a greater dimension than in other parts of the recently acquired Spanish territories.

The possibility to make rebellious natives into slaves produced an enormous quantity of them from the very beginning of the conquest enterprise. After his defeat in Tenochtitlan during the *noche triste* (sad night) Cortés decided to enslave many indigenous allies of the Aztecs to be presented as gifts to his Tlaxcaltecans allies and thus strengthen the bond between their large armies and the Spanish forces before the siege of Tenochtitlan[92].

This same method of enslavement was used extensively throughout the conquest and pacification campaigns, producing a constant flux of slaves. Some were sold or given to the *encomenderos* and others were traded in the Antilles for provisions such as horses, weapons and tools. Some of the transaction records mention a price of 100 slaves for a horse and a few years later, 15 slaves for a horse. This can give us an idea of the numbers of natives taken as slaves during those first years[93].

This extensive system of slavery generated a moral discussion between the colonizers, the men of law and the friars. Several complaints crossed the Atlantic and the discussion carried into the court of Charles V, who finally by the royal decree of November 9, 1526 abolished the practice of taking captives to enslave them; even under the condition of *guerra justa*. The decree also mentioned that anyone who had received natives as personal servitude or by the system of *repartimiento* and *encomienda* were not allowed to treat them as slaves or brand them[94].

With the decree of August 7, 1530, the King ratified the latter orders and prohibited the trade of enslaved natives; at the same time, he ordered that anyone in possession of a slave should

[91] Barbosa-Ramiréz 1981:45
[92] Calderón 1988:152-153
[93] Ibid.
[94] Ibid., pp.155

present him in front of the hearing, where an official would study the cause of their enslavement. Those who failed to carry out the royal decree were striped of any possessions and official position[95].

In 1534, after a long series of protests by the Spanish colonizers, the decree of 1530 was repealed. Among the reasons argued by the protesters were the critical economic situation of New Spain and the misery of those whose main asset was the possession of natives. This situation continued unmodified until the proclamation of the New Laws of 1542-1543, which permanently abolished the practice of slavery. In this set of laws, the crown once again ordered that no native could be enslaved under any circumstance and all of them should be treated as vassals of the crown[96].

Because of their protectionist approach, the proclamation of the New Laws ignited uprisings among colonizers all over the overseas Spanish territories, even in places like the viceroyalty of Peru, which led to their derogation and the death of the viceroy. In New Spain, Viceroy Mendoza gradually put the New Laws into practice; however certain points such as the ones dealing with slavery were left aside, with the aim of preventing social protests by the Spaniards. In 1548 the crown ordered that all women and children under the age of 14 should be set free by the slavers, and the owners had to prove enslavement of the men in *guerra justa* before the tribunal in order to keep them. Despite this, the authorities of New Spain failed to fully comply and left the matter to the discretion of the tribunal[97].

It was not until 1551 with the arrival of Viceroy Velasco (1550-1564) that these orders started to be fulfilled[98]. Among the instructions Velasco had, were those related with the problem of slavery in New Spain, and during his rule the process to free the slaves took on a real dimension. The main orders were (as stated in the previous set of instructions of 1548) to set women and children under 14 free, and to change the slavery regime used in the mining industry of the time. Thus, the idea was to set free the native slaves working in the mines. However, fear of a decrease in mine production modified the idea of total freedom to that of compulsory paid work[99]. From 1561 on, the institution of slavery disappeared almost completely in New Spain. Nonetheless, it remained in use in the far north during the war

[95] Ibid.
[96] Ibid., pp.156; Capdequí 1941:24
[97] Calderón 1988:157
[98] Ibid.; Sarabia Viejo 1978:307
[99] Ibid., pp.307-308

against the Chichimec people (1550-1600) and underwent different modifications until it slowly disappeared completely[100].

As we saw earlier, in general terms the natives were considered to be free men and vassals of the crown. However, that freedom was also conditioned in terms of religious doctrine. Due to their supposed nature as *neófitos* (novices, new-born for Christianity) of the Catholic faith and their presumed ignorance of Spanish customs, they were declared to be in need of legal and tutelary protection. This declaration brought several institutional measures in the religious, economic and socio-political domains that deeply affected the life of individuals and communities[101]. Some of them such as the *encomienda*, the *repartimiento de indios*, the *servicio personal,* and the tributary regime were used extensively in New Spain and served as the core of the socio-economic life of the first century of the colonial regime.

The difficulty here resides in the fact that these institutions tended to intermingle closely with each other, and in general they were highly interdependent. Thus, I will try in the following paragraphs to separate them in order to explain their main characteristics and their transformations along the 16th century in order to create an explicative structure with which approach the core arguments and data of the present dissertation.

2.2.1 The Tribute System

The proclamation that natives were vassals of the crown conveyed the responsibility to serve the Spanish sovereigns the same as everybody else under Spanish rule. This included the payment of different types of tribute. In the insular territories, the *encomenderos* did not have the right to demand the payment of tribute; instead the system of *encomienda* granted them the right to benefit from the personal service of those *encomendados*[102]. In New Spain, however, it was proclaimed from the time of Cortés that the natives under the *encomiendas* should provide both personal service and the payment of tribute to their *encomenderos*[103]. The tribute included a massive variety of products: food stocks, clothing, wood, charcoal, gold dust, gold and silver bars, lead, tin, copper and in general, anything that was produced in this vast territory.

[100] Calderón 1988:159
[101] Capdequí 1941:25
[102] Miranda 1952:78 note 20
[103] Ibid.

In the first years the tribute system in New Spain was built almost entirely upon the pre-Hispanic forms of tribute that the major political entities preceding the Spanish had among their subjects. In the instructions of Charles V to Cortés dispatched on June 23, 1523 the emperor highlighted two main points regarding the tribute. The first one was the confirmation of the tributary principle:

"and because it is just and reasonable that the said Indians of the said land serve us and give us tribute in recognition of the lordship and service that as our subjects and vassals they owe us, and we are informed that they between themselves had the custom of giving to their lords and principals certain tribute"[104]

The second one dealt with the way to impose the tribute:

"and if you find that the said tribute was paid in this way, you should find the ways jointly with the said officials and come into terms with the Indians that they give and pay us each year as much tribute as they used to give and pay until now to their said lords and principals, and if you find that they did not have the custom to pay the said tribute [then] settle with them to pay us in recognition of the vassalage they owe us as their sovereign lords whatever you fairly consider they could fulfil and pay"[105]

Both points highlighted the importance of keeping the pre-Hispanic tributary dynamics with the addendum of allowing the crown officials to decide what goods and in which quantities that tribute should be given. However, by the time those instructions reached New Spain Cortés had already granted the *encomiendas* and allowed the *encomenderos* to take for themselves the tribute of the King.[106]

Charles V was notified of Cortés' actions and an important discussion took place in the court on topics regarding the *encomiendas*, the system of *repartimiento* and whether the native tributes should be paid to the king or to the *encomenderos*. It appears that the conquistador had powerful friends in the court, and the counter-arguments were more appealing than those of the accusers.[107]

The immediate solution taken by the crown was to take possession over some of the richest encomiendas and tributary provinces, including the richest mines discovered until then, all the

[104] Ibid., Pp.79 (translated by the author)
[105] Ibid. (translated by the author)
[106] Ibid. Pp.80-84
[107] Ibid. pp.86

ports, the main indigenous cities of Tenochtitlan (Aztecs) and Tzintzuntzan (Tarascans), and all the Spanish towns that existed at that moment or were to be founded in the future[108]. The rest was left in the hands of the first *Audiencia* (royal court) of New Spain (1527-1530). This recently created court was in charge of making the new *repartimientos* among the conquistadors and settlers, leaving enough land to be granted to any new colonizers venturing into the recently annexed territories. With this, the crown gave tacit permission for the *encomenderos* to obtain both their personal service and payment of the crown's tribute from the natives. The first *Audiencia* is infamously remembered for its excesses against the natives and the rampant corruption to the benefit of themselves and their friends[109].

The second *Audiencia* in 1530 brought a period in which legal guidelines were applied to the tribute the natives had to give. The natives were commanded to give the tribute directly to the king in the communities that were under direct control of the crown, and an official structure was created for this purpose. From that moment on, the natives would give the tribute to the caciques and principal indigenous figures of each community, a tribute that was then collected by the crown officials[110].

In the same way, by royal decree the *Audiencia* was in charge of setting the tribute of the natives according to the responsibilities of all the other vassals of the crown, which was the *diezmos* (tithe) to god and tribute to the King, and these were merged into the tribute. The court was in charge of revising the taxation and conducting a general moderation of the tribute based on the actual possibilities of the communities after the excesses of the first *Audiencia*. The large-scale moderation, the seizure of large *encomiendas* granted during the preceding administration and other measures taken by the court were, on the whole, highly unpopular among the encomenderos and produced several uprisings against the colonial authorities.[111]

In the instructions to Viceroy Mendoza in 1536, the crown gave a new direction concerning the tributary system. Mendoza was directed to undertake a new round of visits to the tributary towns with the aim of producing information on whether the natives could pay more than what they were currently paying, and to estimate such tributes in gold and silver. In the same way, the King ordered the viceroy to see if the worthless tribute given in goods could be commuted to be paid in gold and silver.

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[108] Ibid., pp.87
[109] Ibid., pp.87-88
[110] Ibid., pp.90-91
[111] Ibid., pp.92-110

A final instruction regarding the tribute established that if the natives were not able to do any of the latter (pay the value of the tribute in gold or silver) they could also pay with personal service, and thus the communities would give a number of people designated by the crown, regularly to work in the mines. If the latter could not be fulfilled then the communities should provide the necessary goods (food stock, clothing, wood etc.) under the system of *repartimiento* to maintain the natives or slaves working in the mines. Clearly, the instructions given to Mendoza represented a major adjustment in the tributary policy with a perspective towards producing more tangible wealth for the King, directly through his own tributaries and indirectly through the material wealth produced by the encomenderos who had to pay the royal fifth[112].

With the royal decree of May 26, 1536 the crown set the legal frame to be used in the new taxations and in future commutations of tribute, either in the form of gold and silver or personal service. It was nothing new, other than legalizing ways to proceed with the orders, and for the first time it included the legal participation of indigenous authorities in these processes as well, and their acceptance or rejection of the new tributary charges. This legal edict opened a small space for negotiation by the native communities, although in general terms the whole system was clearly abusive and to the detriment of these communities.

The proclamation of the *Leyes Nuevas* (New Laws, 1542-1543) introduced a new set of rules regarding the tribute, the most important being that the tribute had to be moderate once again, and that the natives should pay less than what they had paid in the pre-Hispanic period. The aim was that with this measure the natives would perceive, according to the text of the New Laws, the good will of the monarch towards them[113]. These laws also reinforced the mandate which ordered keeping a continuous and updated registry of the tributes and any sort of annotation, visit or commutation, which in general terms was already being done.

With the royal decree of April 10, 1546 the crown took into account for the first time the alarming decrease in the indigenous population after a series of mortal epidemics suffered by the natives during those first years. This decree ordered a temporary general moderation of the tribute in all the provinces of New Spain for the following 10 years[114].

In 1554 the new viceroy, Luis de Velasco, wrote to the King about a growing economic crisis in New Spain that had lowered the production of silver and produced a shortage of basic goods

[112] Ibid., pp. 111
[113] Ibid., pp.120-121
[114] Ibid., pp.123-128

such as food stocks, wood and charcoal in the big cities. The viceroy mentioned that this crisis was a direct consequence of the changes in the tributary policies applied to the natives[115]. The commutation of most of the products of the land into gold and silver on one hand and the forbidding of personal service on the other were the main causes identified by the viceroy as sources of the problem. As a solution for the first cause, in 1556 the crown mandated to again receive (and to force the natives to give them) certain basic products such as maize, wheat, wood and charcoal among others, and this was considered mandatory. The solution to the second problem was to create an obligatory system of labour among the natives[116]. This system was institutionalized in the practice of the *repartimiento,* which will be discussed later in this chapter.

The tribute system changed very little in the remaining years of the 16th century. It was already based on a solid structure created during the first years between the conquest of Tenochtitlan and 1563, the year in which King Philip II made new adjustments in the taxation of his own tributary provinces and towns in order to collect more money.

The tributary system evolved to become a massive bureaucratic institution under the strict vigilance of the crown. All the changes and experiments driven by moral, political or economic decisions accomplished deep transformations in the native communities. Although the system as a whole was abusive and placed the burden of maintaining the colony on the shoulders of the natives, the process itself created spaces for negotiation, political awareness, resistance, and helped to strengthen a sense of community. All of the latter were key elements in the survival of the indigenous communities under the colonial regime.

2.2.2 The *Encomienda* System

The encomienda was an institution of Castilian origin, imported during the first years of Antillean conquest and colonization and acquired particular features once it was implemented in the islands. In general terms, the *encomienda* was the institution through which groups of families with their own caciques (leaders) were subjected to the authority of a Spanish *encomendero*. This *encomendero* was obliged by law to protect the natives given to him and to ensure they were instructed in the Catholic faith by a priest[117]. At the same time, the

[115] Ibid., pp.140-141
[116] Ibid., pp.141
[117] Ibid., pp.26; Calderón 1988:167

encomendero acquired the right to benefit from the personal service of those under his *encomienda* and to claim the payment of different economic arrangements from them, such as the tribute the natives had to pay to the King according to their status as "free" vassals[118].

The natives living within an *encomienda* had to pay different forms of tribute, such as gold or silver, foodstuffs, or personal service as mentioned above. This service was usually in construction, agriculture, mining or domestic servitude. It was possible to exchange the tribute for service and vice versa, and this brought about myriads of abuse to the natives[119].

According to the law, the natives living under the *encomienda* were always considered as free men and not as slaves, thus the *encomendero* was not allowed to sell, rent or give them as part of payment under any circumstance. In the same way, the Spaniards did not have any authority to punish them. Through the King, this sort of feudal lord acquired the duty of residing in the province where the *encomienda* was located and providing military service whenever required. The *encomiendas* were granted by the King as mercedes, and were usually part of the agreements of the *capitulaciones*.

The *encomienda* was essentially a concession given and taken by the King, and therefore it was considered a possession, not a property. This put a concise timeframe in which the encomendero had the right of usufruct over the natives, and when that time expired the natives who were living under him went back to serve the King[120]. The timeframe of the concession varied during the years in which the encomienda system was in place. In the beginning they were granted for life but later it was modified in order that after the death of the original encomendero his older son or daughter, or widow (in that order) had another lifelong right of usufruct over that territory and the natives who were part of it[121].

The first encomiendas in the Americas were implemented in the Antilles during the first years of the colonization of those insular territories when the Spaniards started to realize that in order to succeed with the enterprise of settling permanent colonies they needed the aid of the natives. However, the natives had a tendency to escape from the territories where the Spaniards were expanding their control. This tendency grew exponentially after the natives were declared free men and vassals of the crown by Queen Isabella in 1500. This problematic issue motivated the Queen to decree in 1503 that the natives should be forced to live in the

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[118] Ibid.
[119] Ibid.
[120] Capdequí 1941:26
[121] Ibid.

vicinity of the Spanish settlements in order to be indoctrinated in the Catholic faith and in order to perform necessary work in agriculture, livestock farming, construction and mining. Because at that time the natives had the category of free men, this forced labour had to be paid. The main idea was that the caciques had to provide a certain number of natives for the work, and the salary was defined not by direct agreement with the employer but as was regulated by the state[122].

With the advent of the *Leyes de Burgos* of 1512-1513 the encomienda system was institutionalized and all the practices tacitly approved. Although this set of laws also included a few articles on the preservation and well-being of the natives, the system was one of exploitation. In fact, these laws began from the belief that the natives were lazy and easily tempted by vices, thus the only path to redemption lay in hard work and permanent exposure to the Spanish way of life[123].

In 1520 Charles V decreed that the *encomiendas* should cease and full freedom should be granted to the natives, but by that time the indigenous population of the Antilles was already scarce and sometime later disappeared almost completely[124].

When the decree of Charles V ending the *encomiendas* was proclaimed, Hernán Cortés had already completed one year of the Mesoamerican campaign. With the fall of the Aztec capital of Tenochtitlan, Cortés quickly proclaimed to the principal lords and caciques that they should stop paying the tribute to Montezuma and instead from that moment on they were under the service of the King of Spain. Cortés divided the recently conquered land among his troops and granted the towns located within each territory as encomiendas[125]. Nonetheless, the King reaffirmed his orders on this institution after news of Cortés' actions reached Spain. In several of his letters to the sovereigns Cortés defended his position and arrangements, claiming that it was the only way for the success of the colonial campaign and the proper form of reward to the troops[126].

The case was extensively discussed in the court, and the reasons and ideas of Cortés found audience among the highly reputed counsellors, who thought that with some modifications (some of which had already been made by Cortés himself) the terrible experience of the Antilles could be avoided. The King sent Luis Ponce de León to New Spain with (among others)

[122] Ballesteros Gaibrois 1991:28-31
[123] Calderón 1988:171
[124] Ibid., pp.173
[125] Ibid., pp.174
[126] The interested reader in the topic can approach the work of Zavala (1973).

the order of inspecting the implementation of *encomiendas* by Cortés and to report whether it was indeed the best way for the natives to serve to the interests of the crown, both in fairness and practicality. Ponce died while performing his task and his successor, Marcos de Aguilar, reported to the court that the encomienda should be perpetuated but the tributes given by the natives should be taxed according to the particularities of the lands[127].

After discussion and reports by the inspectors, the King accepted the reasons of Cortés and in 1528 delivered instructions to the first audience of New Spain, satisfying the claims of the colonizers. Thus, in the territories of New Spain the *encomienda* system took on a new shape, which included the incorporation of all the indigenous towns that were located within the boundaries of a given *encomienda*, except the main towns which would correspond to the domains of the King. It was decided that the encomienda should be perpetual and that the encomendero had a judicial jurisdiction over their *encomendados*[128]. The key point of Cortés which was conceded by the king was, contrary to the Antillean case, that in the New Spain the Spanish could benefit from the encomiendas for the rest of their lives and after death that possession would be transferred to their progeny. The only ways a Spaniard could lose the encomienda was if the person lived abroad, mistreated the natives or was punished with loss of property.

Among the measures for the *encomienda* system in New Spain, Cortés introduced a number of *ordenanzas* (orders) detailing the labour conditions for the natives with the aim of avoiding the abuses of the encomenderos (especially after the Antillean experience). These included that the natives could not be taken to serve in the mines; it was forbidden to employ the service of women and children under 12 years old; the food supply for the workers had to be fixed and provided by the Spanish; they should not be forced to work after sunset and, the period of work was limited to 20 days, after which that specific group of workers could not be sequestered again until one month later. Although the salary for the workers was institutionalized, it was merely symbolic: ½ of a peso in gold per year[129].

As happened everywhere else in the Spanish overseas territories, these orders were never fully obeyed, and the natives (as we will see in chapter IV) were forced to serve under these cyclical systems, especially in the mines due to the scarcity of workers. However, with the *ordenanzas* of Cortés and his way of promoting the *encomienda* system, a great portion of the socio-

[127] Calderón 1988:177; Zavala 1973:53-58
[128] Ibid.
[129] Ibid.

economic structure of New Spain was set in place. This was especially the case for the tax system derived from the pre-Hispanic institutions but modified by the Spanish through the encomienda system, the encomienda itself and the *repartimiento.*

During Mendoza's first years as Viceroy of New Spain, the most important element that was introduced regarding the *encomienda* was the link between it and the taxation records. In a way, this link with the crown ensured a continuing supply of money, while at the same time the colonizers were happy and to a certain degree in control due to the legal and institutionalized form of those taxes. With regard to the natives, the fact that the taxes were under heavy bureaucratic scrutiny made it more difficult for the *encomenderos* to act abusively and gave legal tools to the native communities to report them to the authorities[130].

Although the *Ordenanzas* of Cortés had made it clear that the *encomendados* could not be taken to work in the mines, the period when Mendoza was in government corresponded with the discovery of the large silver mining districts of Taxco and Zacatecas. As we saw earlier, the instructions given to Mendoza allowed the commutation of tribute for personal service in the mines. However, Mendoza forbade the free and unregulated practice of this substitution, keeping for himself the right to decide when these commutations could be done fairly.

The New Laws (Leyes Nuevas[131]) of 1542-1543 made a compilation of the entire pro and con arguments the institution had generated until that time. Nonetheless, and similar to the case of slavery, the New Laws created a very tense social environment in the colonies. The passionate ideas against the system formulated by people like Bartolomé De Las Casas and Juan Ginés de Sepúlveda exposed a system that was not only immoral, but also economically and politically in detriment to the crown and which reached deep into the court of the King. The King understood that the system as it existed was allowing the accumulation of huge amounts of power in the hands of just a few, thus creating a new feudal system. In order to begin lessening the power of the encomenderos, the King incorporated several points within the New Laws that weakened key features of the institution.

[130] Ibid., pp.45-48

[131] The full name of this set of royal orders was "Leyes y Ordenanzas hechas nuevamente por S.M. para la gobernación de las Indias y buen tratamiento y conservación de los indios: que se han de guardar en el consejo y audiencias reales que en ellas residen y por todos los otros gobernadores/jueces y personas particulares dellas" (España, 1603). However, it is widely known by the name of "Leyes Nuevas".

Some of these points brought massive opposition throughout the Americas. Among the most important ones were the prohibition of using *tamemes*[132]; the prohibition of using their encomendados in certain economic activities (such as mining); the prohibition to some officers of the crown (viceroy, governors and other high-profile officials) and religious orders from having natives as encomendados, and thus benefiting from their work and tributes. Some other critical chapters included the prohibition for colonial authorities to grant any new *encomienda*; the order extended to forbidding any personal service by the encomendados; and the institutionalization and control of the taxation by the state as the way for the natives to pay tribute as free vassals of the crown[133]. In short, these New Laws aimed to take away any direct control and power that the encomenderos could exert over the natives, while institutionalizing the bond between the natives and the King within a heavily bureaucratic operational system.

This was not the first time that these measures had been debated. They had been considered and evaluated several times since the very beginning of the institution in the Antilles. However, this was the first time in which they were declared and formally promulgated as laws of the kingdom. The backlash was enormous and social uprisings occurred throughout the colonies. This time most of the colonizers, friars and crown officials were on the same side opposing the ideas of the New Laws, largely due to the fact that the reforms touched everybody almost equally. The proclamation of the laws, as we saw earlier with slavery, received widespread rejection. Nonetheless, in New Spain the authorities mitigated the social tension by only partially implementing the orders.

The impact of the New Laws in the economic, political and social life of New Spain was not immediate, although most of the orders they contained were implemented with time. Although the encomienda system was not fully abolished until the 18th century, the promulgation of this set of laws marked a breaking point between the instability of the first years of colonial regime and the establishment of a more solid, highly bureaucratic and controlled government in which the direct control of the crown was permanently visible. At the same time, although not fully implemented, the New Laws gave the natives a higher level of autonomy and legal resources to face the abuses of the colonizers, the church and the

[132] Natives used as human bearers. Although the tamemes and their role in economic life comes from the pre-Hispanic period, the Spaniards make extensive use of them until it was fully prohibited in the second half of the 16th century.

[133] Zavala 1973:100

crown officials as well[134]. The final order issued by the King, which was intended to bury the power and abuses of the encomiendas, was given on 22 February 1549 and dealt with the complete elimination of personal service as part of the encomienda system.

2.2.3 The System of *Repartimiento*

With the elimination of personal service, the new regulations for the encomiendas and the widespread impact of several pandemics, the native work force was greatly reduced and, more than ever, regulated. Although the impacts of the latest governmental instructions and the indigenous demographic tragedy of the mid-16th century were felt everywhere in the Americas, New Spain resisted them with particular strength. During the first 30 years the economy of New Spain was built upon the forced labour of slaves and the personal service the natives were doing for free as part as their tributary duties through the encomienda system. Suddenly, the human resources that had made the New Spain economically successful became expensive, were more aware of their rights or simply non-existent.

The laws of 1551 promulgated by Luis de Velasco (second viceroy of New Spain 1550-1564) regulating native labour, ordered that they could only be employed in the types of jobs they wanted to do for a fair salary and only for as long as they wanted, and that nobody had the power to force them or detain them against their will[135]. However, the number of indigenous people who accepted these conditions was not what the authorities expected, and once again this triggered a discussion about the laziness of the natives and their natural rejection of work. The colonizers had ostensibly forgotten the constant abuse, stigmatization, cultural destruction and slavery suffered by the indigenous communities during the previous 30 years.

One way or another, the lack of a labour force brought a period of economic crisis to New Spain. With the Spanish and mestizo population on the rise and strong expansion campaigns to the north, workers and African slaves were in high demand. However, especially for the mines and the smelting facilities, the Spanish complained to the authorities that neither the Africans nor the mestizos knew anything about smelting or had the special skills needed for that type of work[136]. In order to solve the problems caused by the "excessive" freedom of the natives, the colonial authorities created what was called the repartimiento system, which adopted the

[134] Ibid., pp.102-108
[135] Calderón 1988:204
[136] Ibid., pp.235

names of *cuatequil* or *tandas* in New Spain and *mita* in Peru*.* The workers under this system were known as *tapisques* in New Spain and *mitayos* in the territories of the Viceroyalty of Peru.

The repartimiento was essentially a non-permanent institution through which forced labour was re-established under certain conditions. These conditions included the payment of a fair salary according to the region, the competence of the worker and the type of work, and which had to be paid without any delay or in any fraudulent way and the payment had to be made in money[137].

The repartimiento affected all the natives between the ages of 14 and 60 years old, as they were all obliged to present themselves to the system. Only the noble class was exempted from work, and the repartimiento judges had the ability to excuse those who were not, by disability or disease, suitable for the required work. The cuatequil included all the encomendados as well as those who were not part of encomiendas. Under this system, the natives could serve anyone who needed large numbers of workers, which included encomenderos, state officials, entrepreneurs, miners and even caciques and religious orders[138].

The *repartimiento* worked as a draft system, which meant that a given number of workers (in New Spain 1 out of each 25 men in a community) were recruited for a fixed term, which was usually for a week or up to 20 days. This particular group would then go back to their homes to attend their own *milpas*[139] and could not be called again until their next turn. The draft system was very variable and each native often had to contribute to the *repartimiento* 3 or 4 times per year. In New Spain it was customary to take natives living in neighbouring areas, thus avoiding the loss of days of travel between their place of residence and the work location.

One of the main characteristics of the *repartimiento* was to ensure a supply of labour to anyone in need of it. However, the state was in charge of the whole system, with the aim of avoiding employee abuse, thus the employers did not have any power over the workers. The system initially included specialized judges (*jueces de repartimiento*) appointed by the crown, and later the authorities also included the *corregidores*[140] and mayors (*alcaldes mayores*)

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[137] Ibid.
[138] Ibid., pp.236
[139] crops
[140] The Corregidor was the administrator of the corregimiento. The corregimiento was a political-geographical entity that included several towns located in a determined area. Regularly the corregimiento came to substitute the encomiendas as they were being absorbed by the state once the encomenderos were dying or losing them for different circumstances.

responsible for the main towns, as the those in charge of dealing with the shifts and the numbers of natives who comprised them[141].

The process for acquiring a group of natives for repartimiento was quite straight forward. It started with an application by the employer to the local authorities, an *audiencia,* or in some cases directly to the viceroy. The application had to specify the nature of the work, the general benefits resulting from it, number of natives required and the period of time. The natives, on the other hand, could protest to the local authorities or the Indian council, for instance if a given requirement was considered to be excessive or too far from their region of origin[142]. If the application was accepted the employer received a fixed number of natives for a determined period of time to conduct a defined job. The employer agreed to good treatment of the natives, suitable accommodation and food provisions for the duration of the said works.

As with all the other institutions created or implemented during the colonial period, the *repartimiento* fell into a spiral of abuse towards the natives. Several complaints were presented to the authorities, most of them protesting mistreatment by the employers, as well as violations of the agreed conditions such as suitable food, accommodation, working hours, and physical punishment. The general abuse over the long distances natives had to walk to get to the work site was a recurring complaint that was addressed several times, until it was established in 1610 that the natives could not be taken to places further than 10 leagues (42km)[143] away from their homes.

The repartimiento was created as a temporary measure to ensure the provision of labour for certain works that were of general interest to the community. The temporal specification was made with the belief that over time the natives would understand the Christian importance of work and would not have to be forced to do it. However, the institution did not fulfil its role regarding the "general interest of the community" nor was it a temporal one. First of all, the natives were used by everybody regardless of the nature of the work or whether it was of "general interest". Secondly, the system survived almost until the last years of the 17th century. This survival was especially driven by mining and agriculture due to the fact that these were the two pillars of New Spain's economy.

[141] Calderón 1988:237
[142] Ibid., pp.238
[143] Ibid., pp.239-245

The repartimiento was gradually substituted by the *peonaje*[144]. The same main condition that created the *repartimiento* i.e. lack of a labour force due to the diminishing native population meant that for those works where a certain degree of expertise was needed the qualified workers were greatly appreciated. Therefore, the employers (mostly in the mines, smelting facilities and craft works) tried to retain a skilled labour force. This brought about an increase in salaries and the improvement of working conditions. This became more acute after the deadly epidemic in 1576-1581, which further reduced the native population to levels never seen before. Although as said earlier, the repartimiento lasted until nearly the end of the 17th century, during this time several measures introduced by the state made the system more rigid and difficult to operate.

2.2.4 The *Congregaciones* de Indios

After the first military campaigns conquered the Aztec lands on the Mexican plateau, the Spanish settled and started to organize the new colony. From the moment of their arrival the conquistadors realized that the settlement pattern of Mesoamerica was highly dispersed. The largest portion of the native population lived in rural areas, and although there were hundreds of ceremonial centres they were normally only inhabited by the noble class and the rulers. Urban centres existed, but there were few of them. The bulk of the indigenous population lived near their fields and only visited the urban and ceremonial centres during market days or to attend religious and civil displays and celebrations.

Although in Mesoamerica there were different types of land classification in terms of property (communal and private lands), the people were normally organized into small political and administrative entities called *calputin,* and these were usually part of a larger entity called the *altépetl*[145]*.* The *calputin* were groups of houses occupied by families which shared certain features such as kinship, mythological origins, or protector god. The *altépetl* was what the Spaniards understood as being a proper town and could include (or not) *calputin* from different ethnic and or religious backgrounds (such as in the massive urban centres) and varied

[144] The peonaje was the freedom to engage in any kind of work. Contrary to the repartimiento, the peonaje was not forced and it did not need any sort of draft. Anyone could enter the system regardless their race (the only condition was to have the quality of free men) or background and it was more or less de-regulated by the state, giving the possibility for employers and employees to freely negotiate the conditions of employment.

[145] Gerhard 1977:348-349

considerably in size, population and territorial influence. The *Altépetl* was ruled by a dynastic figure belonging to one of the *calputin* included within[146].

With this dispersed and rather complicated settlement pattern the Spanish had considerable problems in achieving the two main aims of the colonial enterprise: to economically exploit the newly conquered people and convert them to the Catholic faith. The solution was to create a system to congregate these dispersed populations in towns. The Antillean experience had established a precedent, as we saw previously, and therefore the *reducciones*, *juntas* or *congregaciones* (different names for referring to the same practice) *de indios* were already a common practice in the Spanish colonial enterprise.

The dispersed settlement pattern was heavily exacerbated by the massive epidemics that reduced the native population of Mesoamerica by millions; many of the natives who did not die tried to seek refuge in more inaccessible lands far from the epidemics and the Spanish. The indigenous groups saw that remaining apart from the colonial process meant freedom of every type (religious, economic, political), as well as independence and health. This aversion towards the colonizers and their projects caused the process of congregaciones to become dramatic in most cases, and in some cases violent and repressive.

The native groups were forced to leave their lands and live in artificial communities created on a European pattern, which sometimes did not share any of the features which had served to associate the Mesoamerican communities for centuries. Religion, kinship, profession, language, mythical origins or any other form of association were abruptly disregarded to build a convenient urban environment from which to more easily collect personal tributes and to facilitate the process of religious conversion conducted by the mendicant orders. Thus, the colonial authorities worked very closely with the friars and religious authorities in order to enhance the results of the process. Each new congregation of *Pueblo de indios* required the construction of churches, hospitals, jails, convents and roads for the natives.

The process of *congregaciones* in New Spain had two main periods. The first one included the *reducciones* before 1570, principally those that were set between the years of 1550-1564, however, at least in the territory of central Michoacán around Pátzcuaro Lake, a previous phase started in the 1530s. The second phase in the period of 1598-1605 was much more extensive. The two main periods were preceded by large scale epidemics that decimated the indigenous population. The main objectives for the *congregaciones* policy were pragmatic and

[146] Fernandez and Urquijo 2006:147

corresponded to colonial thinking in terms of administration, control of tribute, religious conversion and economic development. The need for food stocks, mineral resources and clothing, among other things needed by the new colonial urban centres, was basically fulfilled by native workers and this work was more efficiently controlled and administrated with a concentrated settlement pattern[147].

The congregation process obeyed European logic, but it did not take indigenous practices into account, hence, it deeply affected the systems of organization and governance of the native communities, not to mention the drama of being displaced from their ancestral lands. Although the laws and orders that regulated the process itself were replete with words about the well-being of the natives and perhaps a genuine concern for not causing them any harm, if they refused to be congregated (as they usually did) they would be forced into reason by a condescending colonial regime that considered the European way the only way, and the Catholic faith the true religion[148].

2.2.5 Ownership of the Land

The ownership of the land in New Spain was always a difficult issue for the colonial regime. With the conquest and the subjugation of the native rulers and their armies in the first years of the colonization process, the next step was to divide and distribute the land among the campaign participants. However, there was the problem of native ownership over the land. As we saw earlier, from the beginning the natives were free vassals of the crown, which automatically meant that according to the Castilian and subsequent Indian laws they had property rights, just like everyone else in the kingdom.

Through conquest the king gained ownership over all the lands that had belonged to the former indigenous kings, as well as all those which were uninhabited, abandoned or simply did not have a rightful owner.

Besides the encomienda system, the crown granted land via *mercedes* to all those Spaniards who were ready to settle with their families in the new territories and actively expand the colony. All those lands were given in property, not in possession, directly by the king or by the

[147] Gerhard 1977:385-386

[148] In chapters 3 and 5 I will return to the topic of congregaciones at the regional level of Michoacàn and in the scope of this dissertation.

colonial authorities based on the social or military position of the recipient. Thus, there was a gap between the land given to the military ranks and that given to civilians.

The land for the soldiers had two categories: a) land for the chivalry (*caballerías*), and b) land for the infantry (*peonías*). The *caballerías* were 42 ha plots and included a mixed use of the soil, normally for agriculture and raising cattle. The *peonías* did not have a standard size but usually included one *solar* of 50x100 feet for the house; 100 fanegas[149] of land for grain and vegetable production, and enough land for raising 10 pigs, 20 cows, 10 sheep and 20 goats[150]. The *suertes* were granted to civilians who had decided to move and settle in the new lands and had a standard measure of 10 ha; although many of them were given as *mercedes* they could also be bought through different mechanisms, directly from the king or a previous owner. Besides these, there were the so-called *solares,* which were individual plots for the building of family houses in the towns and cities[151].

The issue of the native lands was quite complicated because the settlement patterns and organization systems differed greatly from that of the Spaniards. The indigenous land was a mix of private and communal property, which was deeply rooted in socio-cultural factors such as kinship and lineage. Beside this, the Spanish recognized two types of social categories; the noble class or *caciques*, and the peasants or *macehuales*. In order to facilitate the colonization process and to make it as peaceful as possible the Spanish established a vast system of political alliances, in particular with the noble classes. Nobles who agreed to collaborate with the Spanish expansion were rewarded with *mercedes* of land and sometimes with *indios de repartimiento.* These royal mercedes helped the caciques and noble classes to maintain their political and economic privileges, at least during the first century, and sometimes even increased their ownership over lands that did not belong to them initially[152].

For the *macehuales* the process was different. They used to live dispersed throughout the rural areas and were subjected to the process of congregaciones in its different stages. As we previously saw, one of the side effects of the congregaciones was the loss of property for those who were resettled. Nonetheless, land was granted in the *pueblos de indios* to all of those communities that were resettled, both as private *solares* and as communal lands held by the pueblos. For the people living in these settlements the tradition of having communal property

[149] The fanega was equivalent to 1.53 acres
[150] Calderón 1988:260-265
[151] Ibid.
[152] Ibid., pp.258-259

helped them to make their case to the colonial authorities that those lands had to be recognized and their ownership respected.

With the new system of spatial organization in pueblos, the colonial authorities recognized several scenarios: a) sedentary pueblos which possessed enough land from the pre-Hispanic period and whose lands and customs were protected by law and which recognized their rights of ownership. b) Sedentary pueblos which did not have enough land to meet the basic needs of their inhabitants, and who occasionally could get an increase of possessed land. c) Nomad tribes that had to be congregated and organized according to the Castilian municipal rules. d) New pueblos inhabited by native communities who were already familiar with the Spanish culture and customs and resettled in the far north, giving them new lands and respecting their traditions[153].

Although the communal lands were generally recognized and respected, native communities were under permanent pressure to defend them against the continuous expansion of the Spanish colonizers. Several disputes were taken to court by a representative of the communities or by themselves to defend their property rights; in most of these the pueblos used legally accepted documents and oral accounts (*relaciones*). These included pictorial documents and maps to prove the historical claims over the property and the extension of the territory. Another proof which was taken into consideration at the trial was the oral account, which normally included mythical-religious origins, a migration followed by the foundation of the altépetl and a genealogy of its lineage[154].

The colonial authorities recognized four classes of communal property: *fundo legal* (townsite), *propios*, *ejidos*, and *tierras de repartimiento*. The fundo legal was the territory designated to contain the town itself and included enough space for the church, town hall, main squares, streets, houses and corrales. In 1576 the viceroy determined that the fundo legal had to have a radius of 500 varas (419m or 55.15 ha) and ordered that in the future no land could be granted to any Spaniard within a distance of 1000 varas from the pueblos or houses of the natives[155].

The *propios* (also called *cajas de comunidad*) were lands granted to the pueblos to be worked communally by its inhabitants and the monetary benefits produced could be used to cover any sort of public expenses, and sometimes to mitigate excessive loads in the tributary record. The

[153] Ibid., pp.259-260
[154] Gruzinski 1991:104-111
[155] Calderon 1988:261

cajas could accumulate considerable amounts of money and thus were normally supervised by royal agents to prevent abuse by friars, encomenderos and colonial functionaries[156].

The *ejidos* were communal lands that were not worked, but whose resources in terms of wood, water, game, fruits and pasture could be used by all inhabitants of the *pueblo.* These three types of communal lands were essentially the property of the community. No one could have more rights over them than others[157]and they could not in any way be partitioned or used for personal benefit.

The *tierras de repartimiento* had their origins in the pre-Hispanic period and corresponded to the amount of land needed for the subsistence of a family, and were in essence equivalent to the calpullis. These lands were permanent due to the fact that they could not be sold, donated or mortgaged; they were inherited lands, and the only way to lose ownership over them was for a family to leave the pueblo or by the death of the proprietors without leaving any descendants. In such cases the land could be distributed among the other inhabitants of the pueblo. These were small portions of land of usually 2.25 ha, and through personal labour the person had to pay a series of tributes, first to the community and then to the king, or in some cases to the encomendero or colonial authorities[158].

2.3 The Legal Basis for Property Rights and Exploitation of Mines in New Spain

Before the arrival of the Spanish in America there was a set of orders and laws that regulated the prospecting, property, exploitation and extraction of mines and ores. This had its origins in royal dispositions which dated back to the middle ages and were applicable for the kingdom of Castile, and hence to all the territories acquired under the Spanish expansion in the late 15th and early 16th centuries.

The legislation in effect during those first years was based on the *siete partidas* compiled during the reign of Alfonso X (1252-1284), the *ordenamiento de Alcalá* of Alfonso XI (1348), and the *ordenanzas de Briviesca* dictated by Juan I in 1387[159]. All these sets of laws established the norm that all the mines were property of the crown and that individuals could exploit them with permission of the King and by paying a certain amount of royalties (*regalías*) to the

[156] Ibid., pp.262-263
[157] Ibid., pp.264
[158] Ibid.
[159] Molina Martínez 1998:1015

crown. Thus, during the expansion of the Americas it was common knowledge that all the riches found in the undersoil were by right property of the monarch, and its exploitation was only possible with the express permission of the authorities as representatives of that power, and with the subsequent payment of royalties. This was usually described and specified in the texts of the *capitulaciones*.

The amount paid by the miners tended to vary, and went from 2/3 of the production from exploitation in the peninsula to sometimes only 1/20 of it in the Americas. This disproportionate payment of mining royalties can be explained by the fact that the mining industry in the Iberian territories was almost non-existent, and therefore the monarchs could charge such high amounts. However, in the Americas the rapid discovery of greater amounts of mineral wealth pushed the crown to lower the taxes in order to stimulate the discovery and exploitation of the rich deposits[160]. The royal fifth (*quinto real*) was first introduced in *Hispaniola* (today Haiti) between 1500 and 1504, after the original 2/3 was reduced to ½, 1/3 and finally to its final version, which was the official tax transferred to the continental lands[161].

In January 1504, the Catholic Kings issued a royal decree commanding the Antillean authorities to keep written records of the quantity of gold that was being smelted, as it was rightfully theirs. Two small paragraphs can be considered the first orders dealing with the exploitation of minerals in the new territories, and in which the royal property of the subsoil was clearly stated[162].

On December 9, 1526 Charles V issued a royal decree in which he stated:

"It is by our granting and will that all persons, of any state, condition, pre-eminence, and dignity, Spanish and Indians, and our vassals, can extract gold, silver, mercury, and other metals by themselves or by their servitude and slaves in all the mines they find or elsewhere that is found, freely and without any impediments, giving notice to the governors and royal officials as it is stated in this law, because the mines of gold, silver and other metals are to be common to everybody everywhere, only avoiding to cause harm to the Indians and third parties…[163]"

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[160] Calderón 1988:348-352
[161] Ibid., pp.350
[162] Molina Martinez 1998:1
[163] Recopilación de Leyes de los Reynos de Indias 1680, Libro IV, Titulo XIX, Ley I (Translated by the autor)

Besides establishing that any vassal of the kingdom could work the mines, the law also defined those who could not, among them were the ministers, governors, corregidores, and basically anyone else working for the state, as well as the friars. The law ended by explaining how special attention had to be given to any regional ordinances ratified by the crown.

This latter portion of the law embodied one of the main characteristics of the mining legislation in the Americas, which was the regional perspective. The vast territory, socio-cultural diversity and geological variety and complexity of the recently conquered lands implied a problematic application of any standardized set of laws, especially regarding key features such as the exploitation of mines. The varied conditions for exploitation demanded legal flexibility and the possibility of adaptation to regional environments. Hence, during subsequent centuries several regional ordinances were issued with the idea of organizing the exploitation and production of metals according to local conditions in terms of social, economic, and even environmental issues[164].

In New Spain the first mining laws were compiled and promulgated by Sebastián Ramírez de Fuenleal in 1532, and subsequently revised and extended by Viceroy Antonio de Mendoza in 1539, and finally in his famous mining ordinances of 1550[165]. The ordinances of 1550 were especially designed for the particularities of New Spain, and were the main laws in use until the implementation of the *ordenanzas del nuevo cuaderno* issued in Spain in 1584, but implemented in New Spain only until 1602.

The Mendoza ordinances dealt extensively with the issues of property and mining labour. It initially gave a period of six months after the public proclamation of the ordinances for the miners to register any mine they possessed. Although not stated, according to the decree of 1526 this included any person with the right to possess a mine, both Indians and Spanish. It imposed the duty of registering the operative mines annually on the miners. It granted them provisional possession for a period of three months after the registry, a period in which the miners had to start the works in the mine in order to ensure possession. It specified how to demarcate the boundaries of the mines and the benefits to the first discoverer in case several people claimed rights over the same area. It defined actions regarding mines adjacent to one another, and regulated legal issues with regard to the possibility of working the mines as a company or group. In general terms, as Calderón states: *"…the laws sought the protection of*

[164] Studnicki-Gizbert and Schecter, 2010.
[165] Aiton, 1942

the mining capital[166]". The ordinances included mechanisms to resolve lawsuits and to revoke previously granted licenses, especially in case of abandonment, as well as clearly stating that no one could possess more than two mines[167].

With regard to the indigenous population and their labour in the mines the legislation did not consider any particular ordinances, which implied that these were general to everybody and the labour regime for the natives was then defined by other institutions, as we saw previously, such as the *encomienda*, the *repartimiento* and the *peonaje*.

Philip II issued three sets of mining laws, in 1559 (*ordenanzas*), in 1563 (*pragmática de Madrid*), and in 1584 (*ordenanzas del nuevo cuaderno*). These were all intended to operate in the kingdom of Castile and were regularly only an addition to those in the Indies; however the *ordenanzas del nuevo cuaderno* became the main set of mining laws in all the overseas territories including New Spain. Its application was not immediate after 1602. In fact, many of the ordinances issued by Mendoza in 1550 were incorporated into the new code after their proven efficiency and pragmatism.

The *ordenanzas del nuevo cuaderno* incorporated several new ideas into the already complex codes. One of the main incorporations was the extension of licenses to foreigners, who were previously forbidden to exploit any mine in the Spanish territories. Another important issue was the reincorporation of all mines to the royal patrimony, including the ones already granted in concession, although there was the possibility of a fair negotiation between the crown and the miners. The right of all vassals to work freely in the mines was endorsed, and the possibility to do so without the issuing of a license was included, narrowing the requirements to only the legal registry of the mine according to the established periods[168]. One of the underlying principles of the new code was that the mineral wealth was fundamental to the prosperity of the kingdom and thus had to be widely exploited[169].

Because the subsoil and the land surface were considered different domains, the new ordinances allowed any person to exploit the underground wealth regardless of authorization by the owner of the land, in which case a fair compensation had to be paid. The ordinances enlarged the measures of the mines, which went from 100x50 varas (1 vara is equal to 866mm

[166]Calderón 1988:351
[167] Aiton, 1942
[168] Calderón 1988:366-367
[169] Molina Martínez 1998:1018

or 32.1 inches) to 120x80 varas, which brought several problems from the start due to the lack of spatial planning of the mines and the problem of superposition of the shafts.

The ordinances demanded that any new mine had to be registered within a period of 10 working days after its discovery; the previous requirement of saving the best mineral vein for the king was eliminated, and some of New Spain's 1550 ordinances prevailed with regard to the duty of working the mine, staffing it and paying the correspondent royalties[170]. The ordinances incorporated the innovative figure of the general administrator of mines as well as the regional administrator in the case of specific places such as the *reales de minas*. This royal officer dealt only with issues regarding the mines and the extraction of minerals, and had the power to solve conflicts between miners and mediate between the miners and the crown.

[170] Ibid., pp.1020

CHAPTER 3

COLLISION COURSE

Contextualizing parallel developments

The complexity of metallurgy as a technological process supports the generally accepted idea that it was invented independently in just a few *loci* around the world. The Levant region in the Middle East, China, the Central Andes of South America and the Sub-Saharan Africa are considered to be the centres where the technology was invented then exported to other geographies and cultures[171]. Each one of the cultures that acquired the technology and the know-how, then recreated and transformed it, and developed it on the basis of their own needs, and social imperatives and prerogatives[172].

Metallurgy is a fascinating technology that involves the transformation of matter (from minerals to molten metal and then back to a solid state as objects) and its discovery and development implied a profound knowledge of the environment, the available geological resources, and the fuel sources[173]. Regardless of where an ore mineral is located the physical and chemical properties are immutable, which means that differences in technique, modes of production and manufactured items were the result of human choices. Those choices are what truly transform a technology into a sociocultural component[174]. In other words, technologies are socially driven and participate in complex culture-environmental relationships.

All over the world, societies who invented or acquired metallurgical technology mastered its production and use over the course of millennia, experimenting and innovating through trial and error systems[175]. Not only were the techniques for acquiring the raw materials or those needed to transform them improved during these long-term processes, the social relationships of production, specialization and craftsmanship and the ways in which that theoretical and practical knowledge were transmitted also evolved.

In the present chapter I intend to examine the lines of development of two technological

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[171] Hosler 1994; Wertime 1980; Wheeler and Maddin 1980
[172] Lechtman 1984
[173] Ibid., pp.3-6
[174] Ibid.
[175] Lemonnier, 1992

traditions. The aim is to explore the historical conditions, socio-cultural particularities, and technical characteristics of the metallurgical development in the Iberian Peninsula and in Mesoamerica. The focus will be placed on the state of knowledge regarding the metallurgy of copper within the two technological traditions at the moment of encounter.

3.1 The Mesoamerican Metallurgical Tradition

The first archaeological evidence of metallurgy in Mesoamerica in the region of Western Mexico can be dated back to 600-700 AD. This consists of several small copper artefacts recovered from different inland sites and along the Mexican Pacific coast, especially in the modern states of Guerrero, Michoacán, Jalisco, Colima and Nayarit (Map. 1)

It is not strange that the first appearances of metallurgy in Mesoamerica are located in the Western area. Rich and easily accessible deposits of metallic ores occur naturally all along the region, forming what Dorothy Hosler calls the West Mexican copper belt[176] (Map. 1). This massive geographical region is characterized by the concentration of metallic ore deposits, especially dominated by vast regions of copper mineralization, mixed in minor percentages with other useful metallic minerals such as silver, gold, lead, arsenic and zinc.

The copper in this region is found in the form of easy identifiable/accessible carbonate and oxide ores such as malachite/azurite and cuprite, respectively. These ores are very conveniently dispersed over the surface on the upper parts of the mineralized areas and show the strong green, blue and red colours that characterize their mineral content. In addition, the process of extracting copper from them is relatively simple[177]. For centuries, these were the main deposits exploited in Mesoamerica.

Through archaeological evidence we now know that the much harder to find and more difficult to smelt copper sulfides, such as chalcopyrite, were smelted as well throughout the pre-Hispanic period. Obtaining the sulfides was difficult; it involved reaching the deeper

[176] Hosler 1994:25

[177] Copper carbonates such as malachite and azurite are reduced in their content of carbon once they enter in contact with the decaying carbon present in the combustion charge; the carbon is mutually eliminated in the form of fumes. In the case of cuprite, the excess of oxygen is consumed during the process of charcoal combustion. (Ibid: 33-37)

mineralized zones of a given area, well below the level where carbonate and oxide occur, in addition to the complexities inherent in the process of extraction[178].

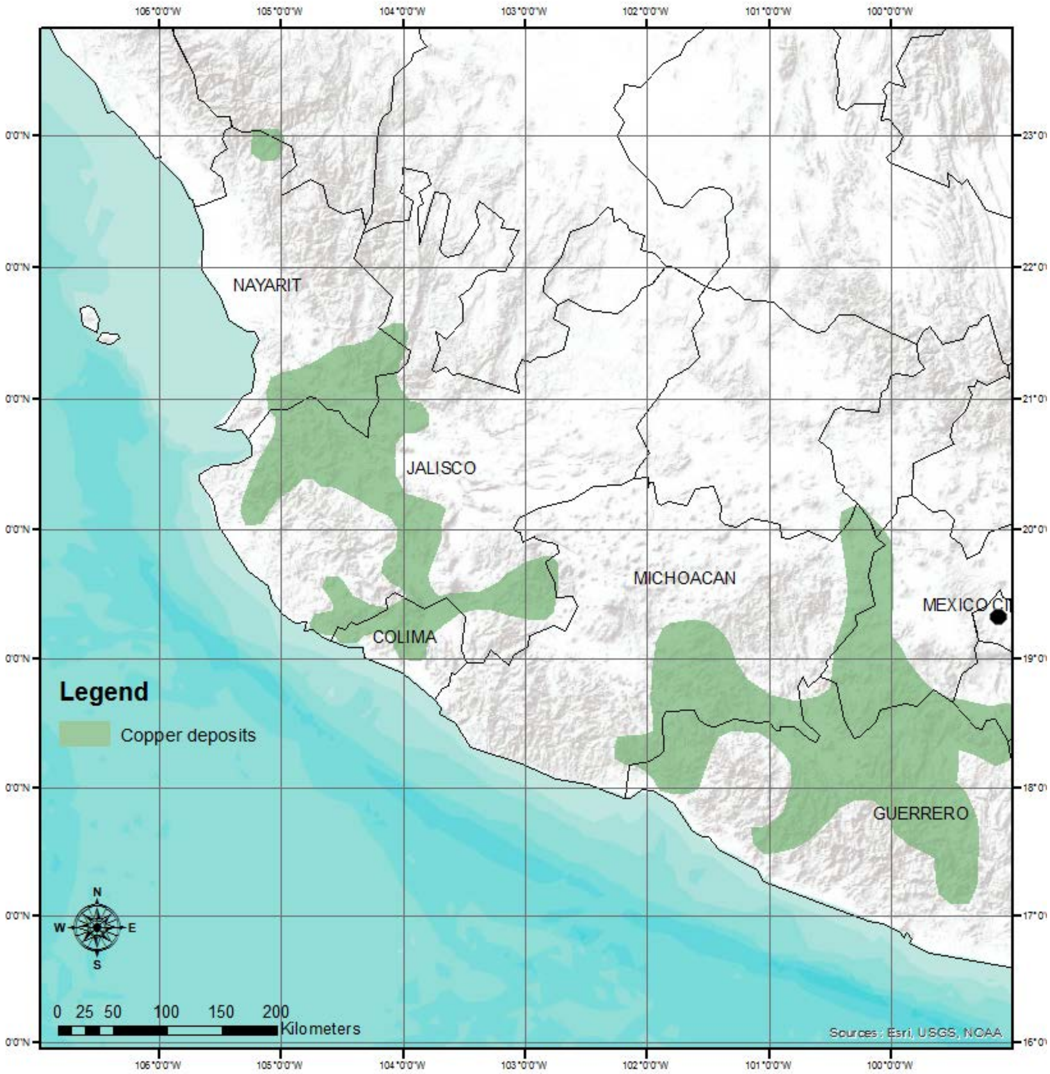
The prevalence and accessibility of these rich copper deposits in Western Mexican geology greatly conditioned the development of metallurgy in Mesoamerica as a whole, especially the technology of the regions located immediately alongside the ore deposits. Furthermore, the set of environmental constraints exerted their influence on the technological paths taken and choices made by the people working with the metallurgy.

Map 1. West Mexico and the limits of the West Mexican metalworking zone (based on Hosler 2009: figure 1)

[178] The smelting of copper out of sulfide ores implies the elimination of the sulfur. Contrary to the extraction from carbonates and oxides (direct reduction), sulfides need a long complex process of roasting the ore to release the sulfur as fumes before attempting the smelting action (Ibid: 39)

The geology of Western Mexico with its massive surface copper deposits not only influenced the emergence and development of a distinctive metallurgical technology based on copper, but at the same time the interaction of humans with nature created a series of indigenous specialized communities in the region. Over a period of about 800 years these communities developed a deep understanding of the complexities of the terrain, its geology and the mineral resources available. In the process, the peoples of Western Mexico in general, and Michoacán in particular, created and recreated the most suitable processes to turning those variables (nature, culture, technology, need) into objects, and hence into material culture.

This dynamic gave a distinctive character to the Michoacán region and to the people settled over its south-central portion (commonly known as the Tierra Caliente). When the Spanish conquistadors arrived in the Tarascan territory in 1521, sometime after the fall of Tenochtitlan, they found a region of specialized metallurgists whose technology was based on copper and whose expertise had been literally "forged" during the previous eight centuries.



Map 2. Distribution of copper deposits in the West Mexican metalworking zone (based on Hosler 2005:Fig.2.1)

3.1.1 Origins

The Central Andes of South America is one of the few areas in the world where metallurgy was invented independently. The rich mineral environment along the Andes cordillera and the coastal plains of the Pacific Ocean provided a wide range of available mineral resources. Copper, gold, silver, tin, arsenic, lead, zinc, and platinum broadly mark the spectrum of metals used during pre-Hispanic times[179].

The first evidence of metal work dates to the 2nd millennium BC in various places within a region located between southern Ecuador and northern Chile. These findings show a technology based on cold working of small nodules of native metals like gold, silver and copper[180]. Some centuries later, around 1500 BC, the metalworkers of the region started to smelt copper ores, first the more accessible carbonates and oxides, followed by the more complex sulfides. Up to that point it resembles the same unilinear early development as "old world" metallurgy, however, at the end of the second millennium that situation changed. Around 1100 BC the metalworkers in this vast region began to create copper-based alloys. Two bronzes (with arsenic and tin) were invented and used simultaneously with some others like copper-silver and copper-gold, all within a couple of centuries. During this same period, the technology slowly spread over the entire Andean region and the coastal plains along the Pacific Ocean. The societies that adopted metallurgy subsequently adapted it and developed it based on their cultural needs and environmental constraints.

As a result, two distinct technological traditions emerged from the subcontinent. The Central Andean peoples continued developing a metallurgy based on copper and copper alloys with a strong tradition of working the metal in its solid state[181]. On the other hand, metalworkers in the northern part of South America developed a metallurgy based on gold, silver, platinum, and to a lesser degree, copper. The rich copper deposits of the Central Andes were almost completely absent in the northern lands, contrasting with the presence of rich deposits of silver, and especially alluvial gold. Therefore, the technology followed a different line of technical development, with the working of metal in a liquid state as its main feature[182] and a long tradition of casting through lost wax and open mould techniques.

As in Europe, the Mediterranean basin and the Middle East where metallurgy followed lines of development largely driven by growing demand, war and transport, the South American metallurgies shared some similar influences on the direction of development.

As people move from one place to another they not only transport objects and techniques, but

[179] González 2004; Lechtman 1980, 1984; Lleras 2010
[180] Lleras 2010
[181] González 2004; Lechtman 1984; Hosler 1994
[182] Hosler 1994; González 2004

also ideas, concepts, knowledge, traditions, and symbolism[183]. Unequivocally, this applied to pre-Hispanic America as well.

Studies of metal artefacts coming from different regions and cultural areas of South America show a great scarcity of utilitarian objects when compared with much more abundant ornaments and offerings. In addition, the archaeological record suggests that there are consistent contexts in which metal artefacts are found[184]. Funerary, ritualistic and elite-domestic relics are common categories in the spatial distribution of metal objects. Supported by historical and ethnohistorical sources, these data suggest that metals in South America were of capital importance in the social and ideological spheres of pre-Hispanic societies where these objects were considered as fundamental markers of status, prestige, group affiliation and ways of communicating wealth and displaying leadership. In this sense, metals and metal objects were seated in the front row of the power and legitimacy show of chiefs and big men.

It is now widely accepted that the metallurgical technology of Western Mesoamerica had its origins in the metallurgies of South America, and that it was introduced through maritime trade networks which were active along the Pacific coast[185]. A key feature of Mesoamerican metallurgy is the fact that it includes characteristics of the two metallurgies developed in South America. The archaeological available evidence indicates that Western Mesoamerican metallurgists worked the metal using cold working and lost wax casting techniques. This implies that the introduction of the technology included elements from both the central Andes and the northern part of South America. Not only are the techniques similar but the types of objects found in Western Mesoamerica are identical in design to their South American counterparts: tweezers, needles, buttons, awls, hooks, bells, and axes are among them[186]. Based on formal and metallographic analysis, in addition to extensive ethnohistorical research, Dorothy Hosler argues that Ecuadorian maritime traders were most likely responsible for the introduction of the technology in Western Mexico[187].

During the pre-Hispanic period, Ecuadorian traders navigated along the Pacific coast to trade various types of goods, and certainly carried with them ideas, techniques and attitudes toward those materials. The ethnohistorical sources show that these traders departed from the coast

[183] Lemmonier 1992
[184] González 2004; Hosler 1994; Lechtman 1980, 1984; Lleras 2010
[185] Dewan and Hosler 2008; Hosler 1988a:832-852
[186] Ibid.
[187] Ibid.

of central Ecuador (Salango and Manta) and navigated southward until the Peruvian coast and northward to the coast of Colombia[188]. Among the goods these traders exchanged were emeralds, metal objects, clothing, shell beads, and whole Spondylus shells.

The *Relación Sámano-Xerez*[189], a small chronicle written between 1525 and 1528 and whose author remains unknown, narrates an encounter that Bartolomé Ruiz (pilot under the command of Francisco Pizarro) had off the Northwest coast of Ecuador with a native vessel. The *Relación* narrates how Ruiz, after being sent by Pizarro and Almagro to further explore the recently discovered southern sea, encountered a native vessel (navío) transporting 20 men. The detailed description of the vessel contained in the chronicle has led modern researchers to re-think the navigation capabilities of pre-Hispanic Ecuadorian sailors. According to the chronicle the vessel had a capacity of 30 *toneles*, the deck was made of big balsa logs bound with ropes, had masts and lateen yards of fine wood, and cotton sails with the same appearance as the Spanish ones, as well as stone anchors. The cargo contained a variety of pieces of silver and gold for trading, and tweezers, bells, collars and mirrors. It also contained pottery items, wool and cotton clothing, emeralds, chalcedonies, rock crystals, and even a balance (similar to the roman balance according to the chronicle) to weigh the gold. All of this says the chronicle *"they bring to exchange for some fish shells, from which they make red beads like coral and white, that they had the ship almost full of them"*[190].

The same account was reproduced by Fernando Gonzalez de Oviedo in his famous *Historia General y Natural de las Indias, Islas y Tierra Firme del Mar Océano* (1535). Oviedo added a slightly better description of the cargo, the traders and their costumes. With regard to the metals he mentions that: *"They told the way how they get gold* […]. *They had a touchstone to assay the gold, and a roman* (balance) *to weigh it and the worked silver and other metals that they know very well, and they carried a quantity of all of them…*[191]*"* . With regard to the shells he mentions: "*They carried red shells in the form of chaquira, id est sartales* (beads on a string)*, like the ones from the Canary Islands that are sold to the king of Portugal for exchange in Guinea; and for these the natives give all the gold and silver and clothing they bring for exchanging*[192]*".*

[188] Hosler 2005:162
[189] Porras Barrenechea 1937:63-68
[190] Ibid., pp.65 (translated by the author)
[191] González de Oviedo 1855:Tercera parte, Tomo IV, pp.121-122 (translated by the author)
[192] Ibid., pp.122

Several other chroniclers, writers and sailors reported regular encounters with these vessels off the Ecuadorian coast and along the Northwest coastal line of South America during the 16th and early 17th centuries. Among them were Pedro Gutierrez de Santa Clara (1540-1560), Agustín de Zárate (1540-1565), Girolamo Benzoni (1540-1565), Richard Madox (1582-1583), and Joris van Spillbergen (1618-1619)[193]

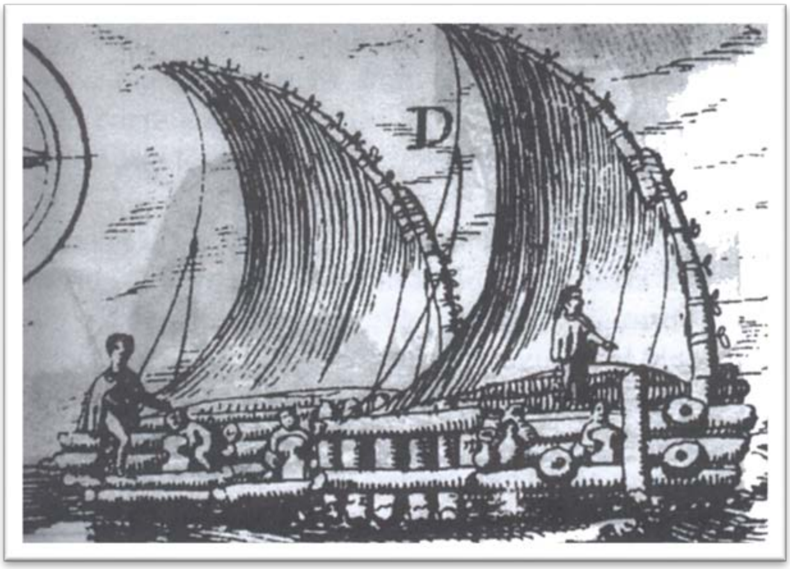


Figure 1. Illustration of an Ecuadorian native ship made by Spillbergen (from Smith and Heslett 2000:figure 2)

Returning to Ruiz's report, it is very useful to know that these traders were carrying a great variety of products, were well equipped and had considerable knowledge of metals and metallurgy. It is of interest as well that they were in pursuit of a very specific type of material, the red shells. These shells have been identified as *Spondylus*, a genus of bivalve mollusc characterized by its "thorny" aspect (figure 2), and which were very valuable in pre-Columbian South America.

[193] Smith and Heslett, 2000:Table 1

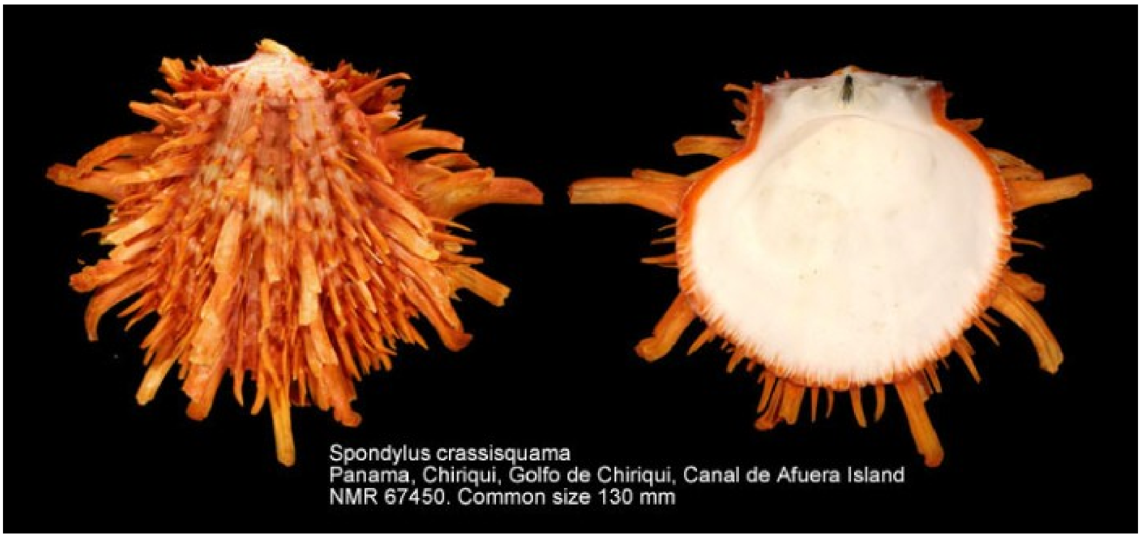


Figure 2. Spondylus shell from the Pacific Ocean (Natural History Museum Rotterdam)

Archaeological and ethnohistorical evidence suggest that spondylus shells were one of the most valuable items in the pre-Columbian world from at least 3000 BC and examples of its use are regularly found associated with ritual and elite contexts[194]. This variety of mollusc only lives in the temperate waters of the Pacific Ocean in discontinuous zones located from the Gulf of Guayaquil in the south to the Gulf of California in the north[195]. It has been argued that it was precisely the search for Spondylus that took the Ecuadorian traders to the coasts of western Mexico, which is one of its natural habitats[196].

In 1525, Rodrigo de Albornoz found himself in Zacatula, a native coastal town on the mouth of the Balsas River of West Mexico, from where he sent a letter to the king giving information about the expeditions they were carrying out. In the letter, de Albornoz tells the king how he learned from the local Indians that from time to time some southern traders used to stop on that coast to exchange their products for some local ones. This part of the letter is reproduced as follows.

[194] Elite contexts refer to the physical spaces within an archaeological site where traces of hierarchical differences are recognized; in general terms, they can be households or burials in which the associated material culture defines differences in the status of the individuals or groups represented in these spaces, in relation to the general population of the site. Hosler 2005:164

[195] Ibid.

[196] Ibid.; Hosler 1988:841-842

Letter from the royal accountant Rodrigo de Albornoz to His Majesty, reporting on the latest events in New Spain . . . [Mexico], 15 December, 1525.

". . . The two ships that were under construction in Zacatula and one brigantine are completed and could soon sail on [a voyage] of discovery for the Spice Islands, which, the pilots here say, according to reckoning and their maps, are no more than 600 to 700 leagues away; and there are reports from the Indians who say that on the way there are islands rich in pearls and precious stones, and being toward the south, there is reason to suppose that there is gold in abundance; and on being questioned how they know that there should be islands in that direction, the Indians of the Zacatula coast say that often they heard their fathers and grandfathers relate that from time to time Indians from certain islands toward the south, which they pointed to, would come to this coast in large canoes, and they brought there exquisite things which they would trade for local products; and sometimes when the sea grew rough, for there were much larger waves there than at any other part of the south [coast], those that had come would stay for five or six months until good weather returned and the sea became calm, and then they would depart; and thus it is certain that there are islands near, and there is reason [to think] that they are rich ones . . [197]*."*

It is impossible to affirm whether these southern traders were somehow related with those encountered by Bartolome Ruiz, or if they formed part of the same pacific trade network, or even if they were trading spondylus shells. However, the evidence is suggestive. If they were indeed South American traders, the 6-7 months they could spend waiting for favourable weather conditions would have allowed time for an ample exchange of ideas and technologies.

Metallurgy is not the only technology, tradition or item that has been studied as part of the exchange system between South America and Western Mesoamerica. Contacts between the two areas have been suggested through the study of clothing, mortuary practices, ceramic objects and techniques, language, and even the presence of a bird (Cyanocorax) whose ecological niches are the coastal regions of Ecuador and southern Peru, and a small mountainous territory in West Mexico[198].

The only certainty is that the metallurgy of Western Mesoamerica shares a group of characteristics with that of Ecuador and Colombia that go far beyond the merely formal

[197] AGI, PATRONATO,182, R.2, F.6v; translated by West (1961:133). Cited by Hosler 2005:164
[198] Anawalt 1992:114; Hosler 2005:165

aspects. They share the same designs and same manufacturing techniques, as well as similar materials and concentrations of alloy elements. In addition, these two areas suggest similar uses of the objects as is evidenced by the contextual similarity of the archaeological findings.

3.1.2 Development of Mesoamerican Metallurgy

In the 1980s Dorothy Hosler, one of the leading researchers on the pre-Hispanic metallurgy in Mesoamerica, studied a massive corpus of metal objects from the regional museum of Guadalajara (MRG), Mexico. She conducted metallographic and chemical analyses on hundreds of artefacts and realized that there was a correlation between the design and the chemical composition of the objects. Based on this, she identified two major taxonomical categories: a) a group of objects manufactured only in copper and b) a group that presented different types of alloys, most of them using copper as the base metal. She surmised that these two categories could represent two chronological periods in the metallurgy of western Mesoamerica. The museum objects she studied lacked information regarding their origin or any sort of contextual data, thus she extended her research to identify the same type of objects archaeologically. In so doing, she recognized a pattern which allowed her to corroborate her previous assumption that those two categories represented different chronological periods of metallurgical development. She named them period 1 and period 2[199].

Hosler assigned a time period from 600/800AD to 1200/1300AD to the early phase of metallurgical development, period 1. The period is characterized by the use of copper as the main ingredient for manufacturing metal objects, and although Hosler found that arsenic was used in low quantities, it is possible that it was a product of the natural geological presence of arsenic in west Mexican copper minerals[200]. The range of objects manufactured during this period suggests the use of casting such as the lost wax technique, which has been identified as the main practice in the manufacturing of bells. However, even the objects manufactured through cold working procedures were generally first cast in open moulds and then hammered into shape[201]. A fundamental difference with South American metallurgy is that there these processes took hundreds of years to develop, while in western Mesoamerica they appeared

[199] Hosler 1988; 2005:87-139
[200] Hosler, 2005:75-76
[201] Ibid.

fully developed from the very beginning, without any evidence of previous phases of experimentation.

The metallurgy of period 1 is found exclusively in the area of western Mexico, within the limits of the west Mexican metalworking zone defined by Hosler and is largely associated with regional cultural traditions, in particular with the Aztatlán tradition[202]. The sites in which period 1 has been identified are found along the Pacific coast and inland, following natural passes that connect the areas between the coast and the central plateau. The objects from this period include items of personal adornment such as bells, buttons, cast rings, earrings, flat plaques, and tweezers; and small tools such as needles, axes, awls and hooks[203].

At around 1250AD the metallurgy of Western Mesoamerica underwent two major changes: the metallurgists of this area started to use alloys, which implied a massive technological change, and the metallurgical technology spread to other geographical and cultural areas within and outside of the West Mexican metalworking zone. Hosler takes these major changes as the markers that define the frontier between periods 1 and 2 of Mesoamerican metallurgy. It is still not well understood why and how these changes occurred, but in the same way as metallurgy suddenly appeared centuries earlier, period 2 metallurgy made its appearance without intermediate development phases.

Recent data from the Sayula Basin, an area within the metalworking zone, suggests that this technological change and the dissemination of metallurgy had strong cultural and socio-economic components. Researchers have identified two technological periods in this area and, contrary to what was previously assumed, one is not the direct continuation of the other. Instead, both periods coexisted for at least two centuries within different cultural traditions[204]. The available archaeological evidence suggests that the two cultural groups maintained a fluid commercial interaction; however, no metal objects appear to have been traded. Period 1 objects stop appearing in the archaeological record around 1250 AD, the period that coincides with the decay and disappearance of the Aztatlán tradition and its large exchange networks. This could mean that while the former trade networks were decaying others were appearing, connecting new ascending socio-political entities which perhaps were already experimenting with new materials and techniques and had a less restrictive vision of the technology.

[202] García Zaldúa, 2016; Lister 1949; Meighan and Foote 1968; Mountjoy and Torres 1985
[203] Ibid.; as well as Hosler 2005:87-139
[204] García Zaldúa, 2016:200-202

The new Sayula Basin data suggests that the technological change and the beginning of alloys in Mesoamerica could have originated in the area of southern Jalisco and Colima, as is evidenced by the presence of some of the earliest dates for alloy objects. The discovery of a copper-arsenic (Cu-As) tweezer (1.35% of arsenic by weight) in a burial dated to 1040-1290 AD is an early testament to this technological change[205].

The only other alloyed metal object in Mesoamerica with an earlier date, comes from a sealed funerary excavated in Teotihuacan. It consists of a lost wax open-backed figurine found in a Mazapa phase burial, dated to 800-900 AD. The figurine was manufactured with a copper-arsenic (Cu-As) alloy, with the arsenic varying between 1-14% in weight[206]. This figurine is quite an unusual finding in terms of its manufacture and date and also because Teotihuacan lies outside the metalworking zone. This has led researchers to hypothesise that either the figurine was produced in lower Central America and arrived there through trade networks or that it was produced very early in western Mexico and traded until it finally arrived there[207]. No other metal object has yet been reported in Teotihuacan.

Period 2 of west Mexican metallurgy was chronologically defined by Hosler from between 1200/1300 AD to the Spanish conquest. It was characterised by the use of metallic alloys and the widespread use of metallurgical technology. From the technological perspective, the developments of this period were astonishing. Several new alloys were introduced, the majority of them with copper as the base metal. Among the new alloys are arsenical bronze (Cu-As), tin bronze (Cu-Sn), copper-arsenic-tin (Cu-As-Sn), copper-silver (Cu-Ag), copper-gold (Cu-Au; also known as tumbaga), copper-lead (Cu-Pb), copper-silver-gold (Cu-Ag-Au), and silver-gold.

The majority of objects from the preceding period continued to be produced, but the availability of new alloys allowed the metallurgists to enhance the designs and to broaden the range of objects produced. Bells were still widely produced but their shapes and sizes grew in variety, needles, rings, tweezers, and axes had similar transformations. New objects started to be manufactured, such as *coas*[208] (hoe), pectorals, elaborated pendants and discs in a long list

[205] Ibid.
[206] Hosler and Cabrera 2010:253
[207] Ibid., pp. 254-258
[208] The *coa* (hoe) was a long-handled narrow tool used for sowing seeds.

of other items for different purposes, most of them in the categories of personal adornment and ritualistic offerings[209]. Period 2 metallurgists continued the traditions from the preceding period in regard to tools and utilitarian objects, although there are a very low percentage of them in the archaeological record. Coas and axes were produced in bronze, as well as small awls, chisels and needles, but they represent only a small group in comparison to the overall bulk of objects from this period[210].

Hosler has proven how one of the main characteristics of period 2 metallurgy was the use of these new alloys to exploit other less common metallic properties such as colour and sound, which appear to have been of great importance in pre-Hispanic times. She suggests that the search for specific colours and sound capabilities led the metallurgists to experiment with specific concentrations of metals in the alloys, sometimes higher than the amount required for enhancing the mechanical properties of the objects. Such is the case of the "dirty gold" objects that the early conquistadors found on a regular basis while conducting military campaigns, and were continuously reported in the early chronicles. However, to their surprise they were usually copper objects with only a small percentage of gold, worked in a remarkable way to give the impression of being a solid gold object.

The second main characteristic of period 2 was the rapid spread of the technology to different areas of Mesoamerica and to different cultural traditions. All of them recreated the technology in minor or major ways according to their own prerogatives and social imperatives, hence creating regional styles through which they expressed complex iconography and developed particular metallurgical techniques. Such is the case of the Mixtecs and Zapotecs of Oaxaca, Puebla, Guerrero and the Isthmus of Tehuantepec. They worked extensively and masterfully in copper; however, it is their work on gold that is widely recognized, creating some of the most iconic Mesoamerican metal objects. The Aztecs are another example of this, although they worked with several metals and alloys. They used copper-lead alloys extensively to cast bells, which is an alloy rarely found in other Mesoamerican areas[211].

During this period, metallurgy was introduced into the material repertoire of the lowland and highland Mayans, the Zapotecs and Mixtecs, the early Aztecs of the central plateau, the groups settled along the coast of the Gulf of Mexico, and even as far north as the south-west

[209] Hosler 2005:257-258
[210] Ibid.
[211] Shulze 2013

territories of modern USA[212]. However, one of the most important cultural groups that introduced and reproduced the technology was from Central and Southern Michoacán.

Unfortunately, and despite all the archaeological, metallographic and chemical research conducted in the last hundred years, very little is known with regard to the mining and extractive technologies of pre-Hispanic metallurgists. Until now none unmistakably pre-Hispanic mining sites have been found, and only a handful of manufacturing sites have been archaeologically recognized, all of them belonging chronologically to the very last part of the pre-Hispanic period[213]. Nonetheless, most of these sites show an apparent transition into the early colonial period[214]. The findings are very recent, and new data will clarify long-held assumptions.

One of the most important things that we can verify is that, based on the chemical analyses of the objects and the trace elements recognized in them, modern researchers have identified the range of metals and minerals the metallurgists were using. In regard to copper, Hosler mentions that pure copper was extracted mainly from chalcopyrite (copper sulphide) or from impure copper oxides, however, there is evidence that they worked native copper and high purity copper carbonate ores.

In sum, and from the perspective of our region of study, Mesoamerican metallurgy was introduced from northern South America through maritime trade networks that functioned along the Pacific coast. It flourished from around 600 AD until the Spanish conquest in the territory of western Mexico, stimulated by the natural occurrence of rich metal ore deposits, and its development was based on the use of copper. Around 1300 AD it experienced a massive technological change as evidenced by a transition from copper-only metallurgy to the use of several alloys, most of them with copper as their base metal. Around the same period, technology that had been a primordial feature of the western area spread into several other different areas of Mesoamerica. With regard to copper, western Mexico metallurgists exploited and extracted copper from the whole range of ores available, from native copper to complex sulphide ores.

[212] Hosler 2005:331
[213] Maldonado et al. 2005; Maldonado 2006
[214] Simmons and Shugar 2013; Hosler 2014

3.2 Mining and Metallurgy in the Iberian Peninsula until the 16th Century

Archaeological evidence places the beginning of metallurgy in the Iberian Peninsula around the 3 millennium BC. However, it was not until the Phoenicians arrived in the peninsula that it became a widespread and established mining and metallurgical industry[215]. It was during the Roman period that the territory of *Hispania* started to be intensively exploited. The Romans arrived at the Peninsula around 218 BC, and by that time the richness of the subsoil was already well known, and the indigenous people were specialists in working with a broad range of metals such as copper, silver, gold, tin and iron[216].

The Romans introduced a wide range of techniques, especially in regard to mining, along with some legislation in matters of property, exploitation rights and taxation. Although Roman mining knowledge and practice are recognized as being perhaps the most advanced at the time, in the Iberian Peninsula they were limited to the most important deposits. The less profitable ones were simple operations based on the exploitation of rich surface deposits and subsequent abandonment when they exhausted and demanded a higher level of technical effort[217]. There were also massive operations which can be found in a considerable number of places throughout the territory, such as the silver and lead mines of *Centenillo* in Jaén, where hundreds of meters of galleries were excavated. Equally impressive was the exploitation of the mines of the *Mazarrón* district in Murcia with more than 1800m of underground mining infrastructure. Several such examples can be put forward for the Roman exploitation of Hispania[218].

The development of these large operations brought advanced techniques and machinery to the peninsula in response to the demands for practical solutions to common mining problems. The Romans are especially recognized for their development of drainage technology for the mines, as well as structural reinforcements for underground exploitation. Some of these methods remained in use until the 19th century[219]. Among the techniques the Romans introduced are the systems of inclined trenches for draining water in the galleries to lower valleys, or to channel water to a collection point from where it could be removed using human propelled machinery, such as hoists and buckets or the Archimedean screw (screw pump). The

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215 Sánchez Gómez 1989:41-44
216 Ibid., pp.45
217 Ibid., pp.46-50
218 Ibid., pp.50
219 Ibid.

Ctesibius pump was also a common machine of Greek origin that was introduced to Hispania by the Romans[220].

The innovations that the Romans brought to metallurgical processes were fewer, yet very important. Most of the techniques used in the processes of extractive metallurgy were already in use by the various indigenous peoples inhabiting the Peninsula prior to the Romans' arrival. Among these were the smelting of galena (lead-silver ore), copper; the separation of silver by cupellation, refining gold using salt cementation, and refining gold using sulphur[221]. The Romans introduced two important innovations: the production of mercury and its subsequent use in the extraction of gold, and the production of copper-zinc alloys, commonly known as brass[222]. Thus, as the Romans used previous mining and metallurgical knowledge they also introduced some very innovative techniques, machinery and concepts. The scale of exploitation during their occupation of Hispania had never been seen before and would not be seen again until the 18th century[223].

Regarding the supply of fuel, it is widely assumed that this greatly constrained Roman metallurgy in some areas due to the large-scale exploitation on the Peninsula and resulting scarcity of available dense forests. In fact, in some areas the deforestation caused by the use of wood for fuel in metallurgical processes became permanent, and in some cases led to abandoning mining areas[224].

Along with the introduction of new technology and a higher scale of production, the Romans introduced an administrative and legal framework regarding the exploitation, property and taxation of mining and metallurgical activities. The labour force used during this period consisted mainly of free workers (*mercenarii*) and slaves (*servi*). However, it was the *servi* that formed the vast majority of the labour force in the mines, and thus had a fundamental role within the system, at least during the first centuries of activity. With the scarcity of slaves and their increasing price in the Roman slave trading system around the 2nd century AD, mining activities in the peninsula evolved to a system of free labour. The work load left by the slaves was partially absorbed by *mercenarii,* as well as by convict labour (*damnati a metalla*) and even legionaries. This series of changes in the suitability and availability of labour force was one of

220 Luzón Nogué 1970
221 Villa Valdés 2005:205-208
222 Sánchez Gómez 1989:Pp.52
223 Ibid.
224 Ibid.

the causes for the decline of mining and metallurgical activities in the closing centuries of the Roman period[225].

Unlike the legislation of the middle ages which passed to the Americas in the 15th century, Roman law did not make a distinction between the ownership of subsoil and that of the surface. For the Romans they were one and the same, and thus the original, or first owner of a surface property was rightfully and totally the owner of the underground wealth. However, most of the land in the Roman provinces was part of the *ager publicus* (public land), hence it belonged to the *populus romanus* (people of Rome), and to the administrator, meaning the state. This important precept of the Roman law decreed that in order to conduct mining activities, individuals were concessionaries under the applicable law. The state granted a permit for mining activities in exchange for half of the mined ore.

With the advent of the imperial period, the tendency for the exploitation of the most profitable mines was to pass directly to the hands of the state, hence the emperor[226]. In the last part of the imperial phase and due to deep social and economic changes a new scheme of exploitation was introduced, which made it possible for an individual to exploit the subsoil of other people's property without the need for any sort of license or authorization, only in exchange for a fair tax on the production. This had an important impact on Middle Age and even modern legislation due to its double innovation: the separation of the subsoil and surface and the introduction of an incipient way of royalty over the production which would become the norm centuries later[227].

The Romans exploited a wide range of metallic ores throughout the Peninsula, and for some of them the Iberian mines were among the most important sources. Deposits of silver, gold and copper were extensively mined and exported to Rome in such vast quantities that the Roman chroniclers wrote often about the mineral wealth of *Hispania* and their importance to the state. The exploitation was of such magnitude that some historians refer to *Hispania* as the mineral capital of the empire. Although the Romans surveyed and exploited ores from the four corners of the peninsula, there were two zones of highlighted importance and whose fame transcended the Roman period: the mining areas along the axis of the Sierra Morena in the south and the gold and silver rich mineralized districts of the Galecian-Asturian region in the

[225] Ibid., pp.53-54
[226] Ibid., pp.54
[227] Ibid., pp.56

north. The ores mined in the Sierra Morena were of prime importance, particularly for copper. The copper from this region enjoyed a hegemonic period in which it was considered one of the best in the empire. The famous mines of Rio Tinto and Tharsis were two of the most important, as well as the mines around Córdoba where the renowned "*cobre mariánico*" had its origin[228].

The mining and metallurgical activities carried out by the Romans left an indelible mark on the Peninsula, both on the landscape due to the vast scale of exploitation and anthropogenic modification, and on the collective memory of the Spanish. The idea of the mineral richness of Spain permanently contrasted in the future with a reality of scarcity and lack of innovation.

The scale of activity conducted in Hispania and Lusitania by the Romans was of such magnitude that it practically exhausted the superficial ore deposits all along the territory. As I mentioned before, the Roman tendency was to abandon the mines after exhausting the easily mined and rich superficial veins, and moving to a new deposit. To work the abandoned mine sites would have required a higher level of technical resources and knowledge, not to mention greater financial investment[229]. The consequences of this easy exploitation model were to last until at least the 18th century, when new techniques and machinery became available and could be adapted to the challenges demanded by the mines. Nonetheless, certain Roman techniques spread and remained in use until modern times, not only in the peninsula but in the broader context of Europe. Such was the case of the amalgamation process for silver and gold extraction using mercury and described by Pliny the elder in his *Naturalis Historiae*[230]. The process and associated techniques remained in use, were passed to the alchemists, and finally were once again incorporated into the metallurgical repertoire to become one of the most important innovations of the 16th and 17th centuries[231].

After the end of the Roman period there is a lack of data on the mining and metallurgical activities in the peninsula. It is widely accepted by historians that big mining deposits such as Rio Tinto and Tharsis were abandoned at the end of this period, and remained in that state for the next several centuries. In general terms, the lack of historical data creates an image of technical involution, lack of exploitation, and the oblivion of techniques, machinery and

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228 Ibid.
229 Ibid., pp.60-61
230 De Lacerda and Salomons 1998:1-2
231 Long 2001:181

knowledge[232]. Nonetheless, in recent years archaeology has shed new light on this negative view, bringing together pieces of the puzzle and revealing that mining and metallurgy continued to be important activities in the middle ages, although on a much more minor scale.

There is very little record of mining and metallurgy during the Visigoth occupation of the peninsula (5th-8th centuries AD). The only references are contained in the *etymologiae* written by Isidore of Seville (*ca*. 560-636). In it, Isidore talks about the mineral richness of the Iberian territories and mentions the exploitation of alluvial gold in the Tagus River, as well as minor operations of silver, copper, iron, tin, lead and the mercury deposits of Almadén[233]. Archaeology has confirmed the historical sources by finding a rich production of utilitarian items, especially for warfare and agriculture[234], similar to elsewhere in Europe at the time.

The advent of the Muslim occupation in 711 AD brought an increase not only in the level of exploitation, but also in the amount of available sources for sustaining it. The Iberian Muslims mainly exploited iron and mercury, but also silver, gold, copper and tin[235]. The centre of mining activities remained, as in previous centuries, in the south-west of the peninsula with an increase in the activities towards the Portuguese Alentejo and Algarve regions, especially for tin and gold. The constant stress from war campaigns during the Muslim occupation led the constant exploitation of iron ore and the production of steel for use in warfare. The Muslims were active exporters of crafted items as well as raw materials to other parts of Europe and the Maghreb; however, they were also important intermediaries in the importation of goods from Africa, particularly gold from the sub-Saharan territories[236]. The literary sources of the time have abundant references to the type and location of the mines; however, they have a total lack of detail with regard to the technology used to conduct those exploitations and the metallurgy in the manufacture of goods. Nonetheless, the few examples we have of underground galleries indicate a series of innovative solutions in the design of their structural form to prevent collapses.

The long Muslim occupation of Al-Andalus (8th-15th centuries) saw a gradual increase in the mining and metallurgical operations, reaching its zenith during the Caliphate period (929-1030

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[232] Sánchez Gómez 1989:64
[233] Colmeiro 1863:Vol.1 pp.191
[234] Sánchez Gómez 1989:65-66
[235] Marín Civantos 1998:335-340
[236] Sánchez Gómez 1989:73-75

AD)[237]. During this period of development, the Muslims practiced cupellation of gold and silver using lead as flux, advanced the metallurgy of copper, and introduced methods to re-work and take advantage of ancient metallurgical slags. They worked the mercury deposits of Almadén intensively, and knew how to use ammoniac, and iron and copper vitriol. Equally important was the use of *aqua regia* to dissolve gold[238]. However, that period of progress subsequently decayed as the Christians advanced with the reconquest campaign. The 12th and 13th centuries were periods of recession, especially due to the advance of the Christian armies over the Sierra Morena region. The most important centre of metallurgical activities was the scene of constant battles and the Islamic troops were in retreat to the south.

In the northern part of the peninsula, throughout the middle ages the Christian kingdoms continued the exploitation of iron and participated actively in the European trading of metals, especially as importers. Iron from the Basque country, Galicia and Asturias continued to be exported in low quantities to other parts of the continent[239]. During this period, central and northern Europe became what the peninsula had been during the Roman period, this is, the major provider of metals. Germany, Hungary and England established themselves as the major producers of raw materials. Copper, tin, lead, iron and silver were traded, particularly from two well established distribution points: Venice and the Netherlands.

It was only in the 13th century, with the Reconquista, that the Christians took possession of the rich mineral deposits of Sierra Morena from the control of the Muslims, and once again began a short period of mining and metallurgical expansion. The fact that they were already participating in the dynamics of metal trade also meant participating in the flow of technology and knowledge from the mining centres of the time[240]. Nonetheless, the mining activities were restricted to certain metals such as mercury, silver and iron, all in low quantities and through small operations which barely served to satisfy the domestic demand.

It was during this period, in the 14th century that the precepts in matters of mining legislation were issued. The *Siete Partidas* of Alfonso X, the *Ordenamiento de Alcalá* and the Ley of Juan II of 1387 were proclaimed. As we saw in the previous chapter, these were the basic principles on which the mining legislation was based, and they would not change in the next 172 years until

[237] Ibid.
[238] Ibid., pp.76-77
[239] Ibid., pp.96
[240] Braudel 1976: Vol.1 pp.197

the laws of 1559 were issued by Philip II. These laws defined the three basic principles for the mining activities: the subsoil was the exclusive property of the king; with a royal permit the subjects of the crown could work those deposits; and working those deposits implied the payment of 2/3 of the profit as royalties to the monarch[241].

3.2.1 The 15th – 17th Century Period and the Explosion in the Demand for Copper

The development and introduction of firearms and the industry associated with their production produced an increase in the demand for metals that were previously considered secondary. The demand for copper and tin grew exponentially all across Europe, and the Iberian Peninsula was not exempt. By 1380 the exploitation of copper and tin in the peninsula was only anecdotal; Spain was already an importer of copper and tin from central Europe and England, and that dynamic would survive until at least the 17th century[242]. However, in terms of the manufacture of artillery, coinage and general metallic items Spain developed a well-established industry, first through specialized itinerant artisans on a small scale, and by the middle of the 15th century through permanent factories such as the artillery foundry of Burgos.

Before the 15th century, the Iberian monarchies were not important players in the demand for metals. They were like any other private consumer, with slightly above the average consumption among the other noble families in Europe. But in this century the peninsular monarchies consolidated and expanded their institutional power, partly due to more efficient tax collection, and to an increasing centralization and specialization of warfare activities.

The 15th century marked the complete triumph of firearms over the remnants of previous warfare patterns that had prevailed during the previous millennium, and a massive transformation in the ways war was conducted. At the beginning of this period the infantry was equipped with long spears and supported by heavy cavalry, while firepower had a secondary role. By the 16th century the roles had switched, and the infantry were equipped primarily with light firearms and supported by cavalry and long spears. Naval warfare experimented with similar transformations; it passed from man-to-man combat in the first phase of armed encounters to heavy long-range artillery battles. Portable firearms and artillery dominated the battleground of military conflicts, and naval power entered a phase of extraordinary

[241] Sánchez Gómez 1989:199
[242] Cipolla 1979:188

development in which artillery pieces were the centre of this improvement process. Over the next 250 years, the beginning and consolidation of European overseas expansion would exponentially increase the number of conflicts between the rising powers of the time, and thus the expansion of war apparatus[243].

As European armies grew in size and complexity there was a great increase in the demand for the primary materials in the production of weapons and gunpowder. The adoption of new warfare technology required the knowledge and diffusion of new industrial techniques, and the use of raw materials that were, in general terms, scarce. This went in juxtaposition with the better-known, better established and more abundant materials required for the bladed weapon technology that had prevailed until that time[244].

The use of artillery in the military campaigns only acquired true significance in the transitional period between the 15th and 16th centuries. In the beginning, cannons were manufactured by forging wrought iron[245], although early examples of bronze cannons can also be found from this period. Wrought Iron was an abundant and a relatively cheap material, and although the manufacturing process was simple, it involved a great deal of work and this limited its application to small pieces.

Bronze was a much more expensive material (copper and tin) but the process of melting and casting demanded less work and was already well known throughout Europe[246]. The process of casting bronze artillery allowed the manufacture of larger pieces which presented several mechanical advantages in comparison with the iron ones[247]. Furthermore, the principles of artillery casting techniques were essentially the same as those used for casting bells and statues[248]. In fact, it was not unusual for a bell maker to be employed in the manufacture of artillery during this period.

Even in later periods when artillery factories were established and fully operational, they produced artillery and bells. A long relationship between artillery and bell production was established, and lasted throughout the entire early modern period, and the spread of these

[243] Ibid., pp.299-300
[244] Braudel 1984:334-340
[245] Wrought iron is a tough malleable form of iron suitable for forging rather than casting.
[246] Braudel 1984:335-337; Cipolla 1979:300-303
[247] Sánchez Gómez 1989:124-125
[248] Ibid.

techniques to overseas territories perpetuated that relationship. For instance, the making of the bells for the cathedral of Mexico City in the 16th century included Spanish smelters, friars, artillery masters, and indigenous artisans[249].

Bronze was the favoured material for making artillery until cast iron technology was perfected and became widely available in the second half of the 16th century. This production method was not successfully introduced into the Spanish artillery until the installation of the foundry of Liérganes for the manufacture of cast-iron artillery started working in 1629[250]. For the most part, however, bronze was the preferred material for the fabrication of big artillery pieces.

In 1575 Juan Escalante de Mendoza wrote in his *Ytinerario de navegación de los mares y tierras occidentales* that:

"*It is proved that all of the iron artillery of any type, excepting the arquebuses* (*muskets*) *and versos* (breech-loading swivel gun) *is bad and harmful and it can be said that in the naos and the sea its performance is embarrassing […] the best metal that until now has been used for artillery pieces is a good copper mixed with good tin"*[251].

According to the canon of the time the bronze alloy system to produce artillery had to contain 8 parts of tin and 92 parts of copper, which meant a much greater need for copper than of tin. The problem with bronze then was not in any technical limitation but in the economic constraints that its mass production encountered[252], especially in regions like Iberia that did not have any important copper or tin deposits.

Beside the exponential increase in the demand for copper in the production of artillery, several other sectors increased their own demands for copper. The most significant was the minting of coins from different metals, particularly gold, silver and copper. In early modern Spain, the use of gold and silver coins was intensive, and copper was regularly used as a secondary alloy metal in order to change the value of coins through a change in the proportion of weight between the first and the second metal. For instance, the silver coins of the time contained a variable proportion of copper which usually did not exceed 7% (*ley de plata*). But at different moments

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[249] Nieves Molina 2010:113-117
[250] Sánchez Gómez 1989:128
[251] Escalante de Mendoza (*ca.*1575) pp.44 cited by Sánchez Gómez 1989:127 (Translated by the author).
[252] Ibid., pp.128

during the period between the 15th and 17th centuries a type of coin known as *vellon* (made of billon) was in extensive use and massively produced. The *vellon* was basically a copper coin normally alloyed with a small percentage of its weight in silver, but can also be found containing only copper[253].

During the reign of the Catholic monarchs (1474-1516) the amount of *vellon* coins in circulation was fixed to ten million maravedíes, and their purity (*ley*) to 97.57% copper and 2.43% silver. This was done with the intention of preventing an excessive circulation of *vellon* that could break the ratio of gold and silver coins in the market. Nevertheless, the high price of copper during this time and the subsequent reign of Charles V produced a wide scarcity of *vellon,* which by then was the main coin used for small transactions. This created an increase in the demand for copper and the inevitable revaluation of the *vellon* coin. These dynamics of fluctuation continued throughout the 16th and early 17th centuries, producing a constant insatiability in the procurement of copper, both at the state and private levels[254].

Other than the copper which was massively produced during the Roman period and in lesser degree during the Muslim occupation, Spain did not produce any copper before the 16th century. This means that all the copper used in the peninsular territories before this period arrived through importation from the distribution centres of the time, in particular Venice and Antwerp. During the 15th century Venice lost much of its importance as the main distribution point for the metals coming from central Europe. By the 16th century the centre of this commerce moved north to Antwerp, and Venice was then relegated to a secondary role, although during the 16th and 17th centuries Venice continued to send shipments of copper to the peninsula[255].

With Venice in a secondary role, Antwerp arose as the main trading port for metals during the late 15th and 16th centuries. Spain became one of the most important importers of copper, tin and lead metals, and with regard to copper most of it originated in the rich mines of Hungary. The route for the movement of the metal included Antwerp-Bilbao and then Bilbao-Medina del Campo, which at the time was the main redistribution centre in the kingdom[256].

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[253] Ibid., pp.139-142
[254] Ibid., pp.145
[255] Ibid., pp.278
[256] Ibid., pp.278-279

When the demand for copper increased in the 16th century the crown needed to ensure a constant supply of the metal, and thus it started a regular trading relationship with trading intermediaries in the ports. In 1542 for instance the crown commanded Sancho Pèrez, a royal official, to establish contacts with Antonio Fúcar (Fugger) in Antwerp, in order to ensure the immediate supply of 6000 quintals[257] of copper. Due to the fact that the destination of the metal was the artillery factory, the orders specified that it should be copper from Hungary, because of its high quality[258]. Considerable shipments of copper from Antwerp took place again in 1544 (2000 quintals) and 1553 (8163 quintals) under the reign of Charles V, and were delivered to the artillery factories of Burgos and Malaga[259].

The high prices of metal in addition to the cost of shipping and the dangers at sea, meant that in some periods Spain acquired the metal as finished artillery products. This could have also been due to a lack of specialized labour in some Spanish foundries. In fact, in 1552 the emperor wrote a letter from Flanders to the *consejo de hacienda* stating that:

"*given the lack of artillery in those kingdoms and its importance for many people it should be convenient to send 4000 quintals to be smelted there, this has been left undone because with the shipment and assurance of the amount would be almost 40000 ducats, and that could cover some other needs […] thus we have decided for those to be smelted here*[260]".

Apparently, the lack in the number of specialized workers was a constant problem in the Spanish foundries. In the reign of the Catholic monarchs some German craftsmen were requested in order to solve the problem of the lack of artillery in the kingdom, and in 1536 Empress Isabella of Portugal wrote to Charles V informing him that the foundry in Burgos was not working because all the smelter workers were occupied in the foundry of Málaga[261]. In 1542 the crown ordered the hiring of two smelter workers from Flanders to accompany the shipment of metal that had been acquired in order for them to do the smelting in Spain[262]. This demand for foreign skills and knowledge in the manufacture of copper was not exclusive to the peninsular territories.

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257 A quintal is a unit of weight equal to 100 pounds
258 AGS, Estado, Flandes, Leg.499, Folios 29 and 30. Cited by Sánchez Gómez 1989:278-279
259 AGS, Guerra Antigua, Leg.5, Folios 183 and 184. Cited by Sánchez Gómez 1989:279
260 AGS Consejo y Juntas de Hacienda, Leg.24, Folio 492. Cited by Sánchez Gómez 1989:281 (translated by the author)
261 Sánchez Gómez 1989:281-282
262 Ibid.

The dynamics of the first exploitations conducted in the copper mines of Cuba are quite similar. In 1540 the Flemish smelter Gaspar Lomans, a native of Leuven, began extraction operations in the mines of eastern Cuba. The mines had been discovered in the 1530s but were not successfully worked by the Spaniards until the arrival of the Flemish smelter. In 1542 the German miner Johann Tetzel joined him in the enterprise, and took several samples back to Germany to find the best way to smelt them. In 1546 the Spanish crown signed a contract with the German miner to exploit the mines after his success in finding a suitable method of extraction[263].

The problems of the scarcity of a specialized labour force in the Spanish foundries was a perennial issue, however, it was even more severe with regard to specialists in the mining and copper extraction activities in the peninsular territories. As we saw earlier, 100% of the copper used in the peninsula was brought from Hungarian mines via the trading port of Antwerp. Nonetheless, a few private enterprises tried to exploit abandoned copper deposits during the 16th century. In 1562, Juan Pérez de Mescua, councillor of the city of Guadix, started to work some copper mines using an advance of 1000 ducats granted by the *Consejo de Hacienda*[264].

The mines were reported to have been exploited in Roman times due to the discovery of coins and other items during the exploration of the underground galleries and *escoriales* (mining debris dumps). The first assays were conducted on the *escoriales,* and the furnaces for this purpose were built in the neighbouring village of Fiñana. Apparently there were no specialists in the area and thus Juan de Mescua requested officers from the mines of Guadalcanal (Northern Sierra of Seville) and the Valley of Alcudia, as well as miners from Linares and even a German specialist in the lead-silver extraction. None of them managed to get satisfactory results. After searching unsuccessfully for a copper specialist (*oficial de cobre*) the samples were sent to Madrid from where they were sent to Germany on the advice of Juan Xedler (Hans Schedler), a Fugger agent in the mines of Almadén. After a year of unsuccessful attempts and expenditure of the 1000 ducats, the works were suspended without any results[265].

In 1563 a German specialist who had previously worked in the mines of Guadalcanal bought a copper mine in Fuentes de León (Extremadura) and tried to apply his knowledge in lead-silver

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[263] Franco 1975:16-20; Wright, 1916:450-453
[264] Sánchez Gómez 1989:678-679
[265] Ibid.

production to extract metal from the copper ore. The enterprise failed completely without even achieving fusion of the mineral[266] and in fact in 1564 he reported:

"[The ore] *becomes frozen inside the furnace and it is impossible to get any melted metal, I do not know or understand the cause*[267]"

In 1570 the officers settled in Guadalcanal informed to the crown that although the copper deposits were abundant:

"…they are worthless […] for us not knowing or being able to smelt them[268]*"*

In 1574 Philip II wrote to his ambassador in the court of Vienna that the scarcity of copper in the kingdom was not due to the lack of mines because they were abundant, the problem resided in the lack of craftsmen who knew how to mine, smelt and refine the copper[269]. In the same letter, the King requested to his ambassador to find specialists in copper work and send them from Germany:

"…four or five, the best and more experienced that you can find […] I very much entrust you with finding them, taking care that they are Catholics and you can assure them that they will be well treated and that they will not regret having come here"[270]

One year later the crown started a series of surveying campaigns with the aim of accurately identifying the copper deposits available in the peninsular territories of the kingdom, all of them funded by the war council. However, it is not until the 1580s that the Italian Nicolao Cipriano conducted the first general survey of the kingdom, searching for copper, tin, lead and sulphur[271]. Given the products that Cipriano was looking it is obvious that the objective was to find vital products for the Spanish war industry. The survey was exhaustive, leaving only the Mediterranean region unexplored due to the complete expenditure of the 3000 ducats that the war council had provided to fund the expedition. In his report to the crown, Cipriano identified

[266] Ibid.
[267] AGS, Consejo y Juntas de Hacienda, Leg.47, folio 48. Cited by Sánchez Gómez 1989:680 (translated by the author)
[268] AGS, Estado, Leg.143, folio 213. Cited by Sánchez Gómez 1989:679-680 (translated by the author)
[269] Sánchez Gómez 1989:680
[270] Ibid. (translated by the author)
[271] Ibid., pp.682

29 mining deposits that could be economically viable, 10 of them in particular[272].

Cipriano himself started the exploitation of one of the identified deposits, the mines of Etayo (Navarra), at which he placed a smelter from the neighbouring royal foundry of Eugui in front of the works. Cipriano calculated that he could produce copper for a price of 5 ducats per quintal, a price considerably lower that the high prices of the metal in the foreign market. At the time, copper from Hungary bought in Flanders cost between 14 and 17 ducats per quintal. Given the promising perspectives, the crown decided to support the exploitations using funds gathered from the profits of the silver mines of Guadalcanal, but due to the fact that these silver mines were never very profitable the copper extraction operations ceased soon thereafter[273].

The increase in the price of copper in the 80s and 90s driven partially by the increased European demand and partially by the ongoing wars in Flanders produced growing concerns regarding the metal. The failure of the crown's direct exploitation of copper deposits in the peninsula motivated the administration to try a different approach to ensure the supply of metal. This was based on private initiative on open mining and extractive operations in previously recognized deposits. However, these private endeavours were not successful in the short term and Spain had to wait until the 18th century to establish a successful copper mining operation in the peninsula.

The failure of the crown to produce copper in the Peninsula compelled King Philip II to continue with the massive importations of Hungarian copper. During the last years of the 16th century the crown signed contracts with at least three different intermediaries that supplied several much-needed amounts. The most important of these was Konrad Rott, a merchant from Augsburg linked with the Fugger enterprises, who offered to supply 10000 quintals of copper at a price of 13 ducats per quintal over a period of three years (1575-1578). Other important contractors included Alonso Merlo who supplied 4000 quintals in 1582, and Simón Ruiz who supplied 5000 quintals in 1584[274].

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[272] Ibid., pp.684
[273] Ibid.
[274] Ibid.

3.3 Discussion

In the present chapter, we have tried to contextualize the development of what, following Lechtman's ideas[275], we consider to be two different metallurgical traditions. Our aim was to understand the technical level and knowledge that both traditions held at the moment of encounter with regard to copper metallurgy, and how the socio-historical context of those developments can help us to understand the dynamics of the technological encounter in 16th century in Michoacán.

On one hand, we saw how Mesoamerican people in general, and Western Mesoamerica in particular, acquired and recreated a South American technology. The outcome of that re-creation was a metallurgy based on copper and its alloys that developed regionally during the course of at least eight centuries, depending at the same time on an adequate supply of local fuel sources, fluxes, and metallic ores. Therefore, the technical features of their metallurgy were a successful adaptation to the particular natural occurrence and distribution of these elements, mediated through cultural patterns, values, attitudes towards the materials, and by the social functions that the processes and the objects produced and consumed had within the societies.

On the other hand, there was the state of the Spanish copper metallurgy and the historical particularities of its development until the 16th century. The intensive exploitation and subsequent near exhaustion of mines during the Roman and Muslim occupation periods led to their gradual abandonment, and without ores to smelt, the knowledge and technical development of that vital operation fell into oblivion. The rise in the importance of copper from the second half of the 14th and more importantly during the 15th and 16th centuries found the Spanish with a scarcity of easily exploitable deposits and of smelting knowledge. This forced the crown to procure the necessary copper on the international market, first in Venice and later in Antwerp, the two places where most of the metal trade was conducted.

With the necessary amounts of smelted and refined copper flowing from the production centres of Hungary and central Germany, the Spanish copper industry developed around this ready-to-be-worked metal. In fact it is possible that this situation was not only circumscribed to the Iberian Peninsula, but also to other parts of Western Europe.

[275] Lechtman 1980, 1984

Eric Ash describes a very similar situation for 16th century England, where he says that with the end of the Roman period and the subsequent abandonment of large scale mining and metallurgical operations some of the crucial theoretical and practical knowledge was gradually lost during the Middle Ages. Along this period, iron and steel production appeared to have kept the pace of development of the rest of Europe but the exploitation and extraction of less important metals such as copper, tin, and lead suffered a considerable contraction[276]. As a result of this gradual loss, local miners and metalworkers did not have the necessary knowledge and skills to reactivate copper production when the demand for copper increased in the 15th and 16th century. This situation was only reversed in the second half of the 16th century with the introduction of German expertise, labour and technology, provided by (among others) the Fugger[277].

It is important to say that although in Spain most of the copper extractive metallurgical knowledge had been lost, the necessary skills and knowledge to work metallic copper were maintained. Thus the principal techniques and knowledge of copper metallurgy in 16th century Spain developed around the manufacture of items, whether it was a cannon or a coin. In this sense, the technology for producing copper objects should not have been much different than that in other parts of Europe at the time.

This socio-historical and technical context represents a key piece of information that until now has not been considered in the study of colonial copper metallurgy of Michoacán. The fact that the Spanish colonizers did not possess a working knowledge of copper extraction and metallurgy at the time of the encounter in contrast to the indigenous expertise adds causality to the events and transformations in this region during the 16th century. It provides a key element for re-considering basic questions on the topic, particularly the fundamental motives for establishing a dialogue between the native communities and the Spaniards around copper production. And how did technological interaction and mutual adaptation occur.

Moreover, we must consider the historical context on a larger geographical and political scale. It was a period in which copper was rapidly gaining strategic and commercial importance as an essential element of artillery-based warfare, and in which Spain was completely dependent for its supply on external sources. The political and economic elements of these international

[276] Ash 2004:24-37
[277] Ibid., pp. 30-37

dynamics and its impact in the copper production in Michoacán are yet to be explored, but as we will see in the following chapters, they represent important elements which should be considered.

CHAPTER 4

POINT OF IMPACT

Contextualizing Michoacán and its Copper Metallurgy in the 16th Century

Immediately after the fall of Tenochtitlan and the defeat of the Aztecs in 1521, the Spanish sent emissaries to the neighbouring kingdom of Michoacán to explore the territory and its people. The conquest and colonization of the territory started right after these first encounters and was hallmarked by the dismembering of the formerly powerful Tarascan kingdom and the captivity and execution of its last king, the *Cazonci*. With the advent of Spanish power, massive encomiendas were granted, congregaciones were established and a strong colonial order was imposed. Nonetheless, native people played an important role in the negotiation of their place within this new order, despite the deep socio-political, economic and demographic changes they faced.

In the present chapter I will contextualize the region of Michoacán from three perspectives that are of central importance to this dissertation: the first is regarding Michoacán as a physical area, its particular geography, vegetation, climate, and geological features. The second is from the socio-political perspective of the encounter, focused on the transitional phase between the pre-Hispanic and the colonial period. The last is to introduce the particular regional context of Michoacán metallurgy during the encounter and the first years of the colonial period. To do this we will use archaeological and materials science data as a starting point, and gradually incorporate ethnohistorical data with the aim of associating the data sources as a prelude for the next two chapters which will deal with the core of ethnohistorical and historical written sources.

4.1 Michoacán as a Geographical Area

The Tarascan state of the early 16th century with its multi-cultural nature and geographical extension ruled in lesser or greater degree over a territory of great orographic variety. This feature allowed diverse environmental niches to occur within a multiplicity of natural resources. Before, during and after the colonial time, the Michoacán region played a key role in the procurement of raw materials, especially in terms of its rich mineral deposits and more particularly regarding the exploitation of copper.

The Michoacán region was the principal source of copper from New Spain for the Spanish crown[278], during the whole colonial period. Some of the exploitation was conducted by the Spanish using indigenous labour force via the *encomienda* system, but some was also conducted by indigenous people autonomously until at least 1604, the year in which all of the indigenous metalworking communities (autonomous, encomiendas and free workers) were displaced and congregated into large smelting and mining specialized towns.

Michoacán is located in the Central-West part of Mexico; it is possible that the name of this region comes from the Nahuatl term *michu-uah-can* (those who have fish; place of fishermen) in the language spoken by the Aztecs, to denote the peoples inhabiting the Tarascan territory[279] in reference to the abundance of fishing resources found in the lakes of the Michoacán plateau.

Michoacán is located between 100° and 103° 15' west longitude and 17° 53' and 20° 21' north latitude, its surface presents an area of 59 864 km² (map 3). It is limited to the north by the states of Jalisco and Guanajuato; to the northeast by Queretaro; to the east by the state of Mexico; to the southeast and south by Guerrero; to the West by Colima and Jalisco and to the southwest by the Pacific Ocean. Because of its location south of the tropic of Cancer it is a tropical zone; however, the altitudinal gradient implicit in its orography is the most important factor of influence regarding weather conditions, which in some cases are equivalent to those of a temperate zone[280].

[278] Barret 1987:4
[279] Trujillo 2011:19
[280] Ibid.

Map 3. Location of Michoacán

4.1.1 Physiography

The physiographic provinces are defined by their morphology, structure and geological history, hydrography and soils. The state of Michoacán is contained within two major physiographic provinces, the Transmexican Volcanic Belt (TVB), and the Sierra Madre del Sur (map 4). It presents eight clearly distinguishable physiographic sub-provinces. These are: the *Neovolcánica Tarasca*, *Chapala*, *sierras y bajios michoacanos*, *mil cumbres, escarpa limítrofe* *del sur, depresión del Balsas, depresión del tepalcatepec, cordillera costera del sur,* and *costas del sur*[281](map 5).

The Pacific coastal plains region (*costas del sur*) is located between Southern Sierra Madre (Sierra Madre del Sur-SSM) and the Pacific Ocean, and are discontinuous narrow strips of land cut by branches of the SSM at different points where it reaches the ocean. The plains are limited by the Coahuayana and Balsas river mouths, both natural borders of the states of Colima and Guerrero, respectively.

The SSM runs for over 200 km in a NW-SE direction parallel to the Pacific coast and covers an area of approximately 13,000 km². The SSM is an abrupt high-altitude sierra with almost no intermountain valleys due to its manifest ongoing tectonic activity[282]. This province has an average width of 100 km and an altitude of 2000 m above the sea level.

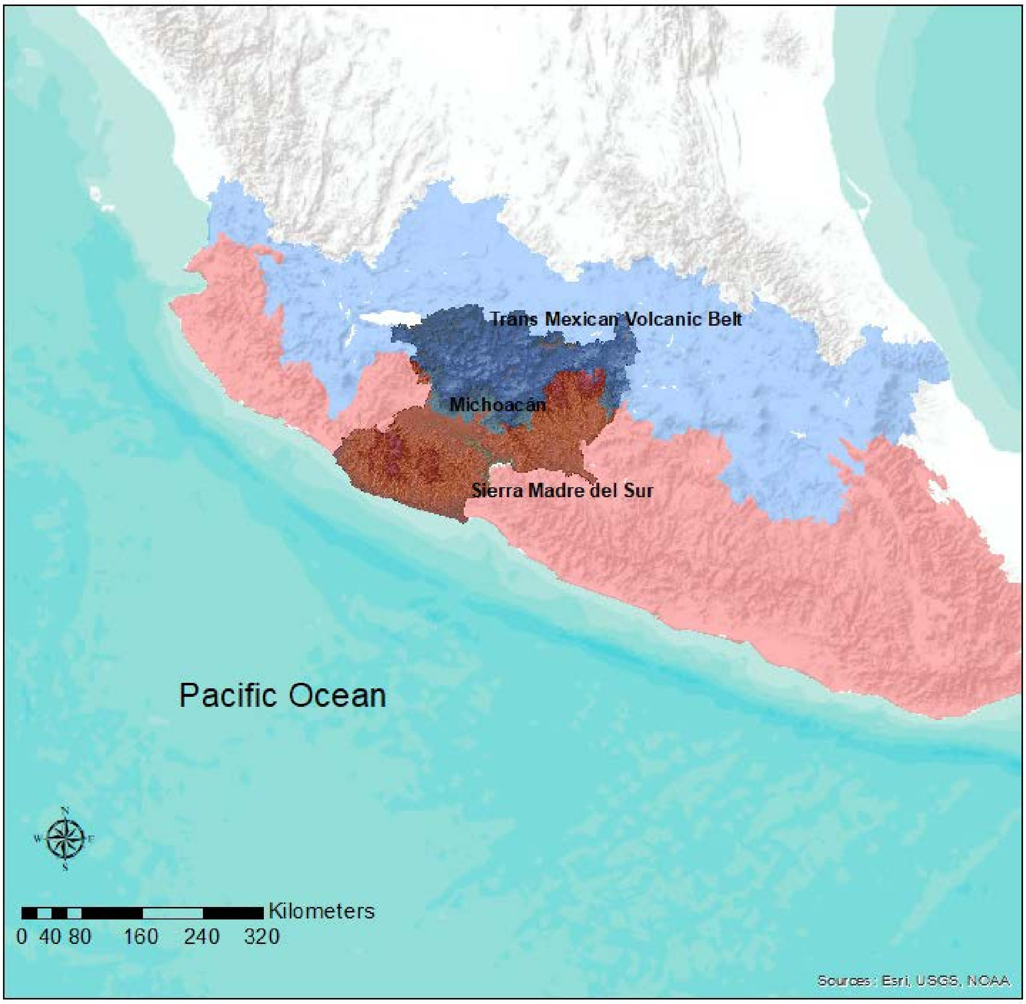
The Tepalcatepec-Balsas depression runs along the NW-SE axis for over 255 km with an average width of 30 km, it is located between the SSM and the Transmexican Volcanic Belt (TVB); it presents an average altitude of 500 m above the sea level and an area of 14,000 km². It is considered a continuation of the great depression of the Gulf of California[283]. It is a region with an undulating terrain disposition with some mountainous spots presenting characteristic sedimentary deposits in its lower areas[284].

The TVB was formed by intense volcanic activity that continuous until present times. It is located to the North of the Tepalcatepec-Balsas depression and its heights reach more than 3800m above sea level. It runs along a W-E direction for over 300 km and presents an area of 27,500 km². The intense volcanism of this region is evidenced by more than 50 volcanoes, some of them still active[285].

During its geological formation the TVB created a considerable number of endorheic watersheds, considered to be one of the most significant features of Michoacán. One of these, the Pátzcuaro lake basin was the site of the Tarascan ruling elite residence at the time of the Spanish arrival in the summer of 1522. The two other major basins (Zirahuén and Cuitzeo) were also fundamental in the development of the region, not only during pre-Hispanic times but throughout the colonial period. Until modern times, the lakes of central Michoacán have

[281] Correa Pérez 1974:179
[282] Ibid.
[283] Ibid., pp.180
[284] Trujillo 2011:20
[285] Ibid.

concentrated the bulk of the population of this area, partly because of the water resources but mostly because of the fertile volcanic soil valleys which surround them.



Map 4. Physiographic provinces of Michoacán[286]

[286] Produced with vector and raster data produced by INEGI physiographic provinces chart scale 1:1000000

4.1.2 Hydrography and Hydrology

The territory of Michoacán is drained by a number of diverse fluvial systems which can be grouped into two categories: exorheic and endorheic[287]. In the first category can be considered *a)* the Lerma basin and its Michoacán water streams covering 13,432 km², due to its geomorphologic conditions and the abundance of hydrological resources this basin represents the area of greatest agricultural performance in modern Mexico; *b)* the Balsas basin covering an area of 32,579 km² is one of the biggest in Mexico and serves as a receptacle for other major Michoacán rivers such as the Cutzamala, Carácuaro, and Tepalcatepec; the coastal fluvial system is formed of no less than 53 rivers and streams, with a common origin in the Southern Sierra Madre[288].

The endorheic basin is formed by: *a)* Cuitzeo lake, although a closed basin it is considered to be a sub basin of the Lerma river due to the network of channels that unite Cuitzeo lake with Yuriria lake and with the Lerma river; *b)* Pátzcuaro lake is a closed basin that cover a surface of 1,525 km²; *c)* Zirahuén lake is a basin of 270 km² and is one of the better preserved, however, its survivability is endanger by the slow but constant destruction of the surrounding primary forests. Finally, *d)* Chapala Lake is a massive tectonic fosse related with a series of some others located to the west. It originated in recent times (geologically speaking) in a volcanic episode parallel to the late rise of the TVB[289].

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[287] Exorheic systems can be defined as "open systems in which surface waters ultimately drain to the ocean in well-defined patterns that involve streams and rivers temporarily impounded by permanent freshwater lakes." "Endorheic regions are considered closed systems because, rather than draining to the sea, surface waters drain to inland termini whence they evaporate or seep away." *Encyclopædia Britannica Online*, s. v. "endorheic system",http://www.britannica.com/EBchecked/topic/187043/endorheic-system.
[288] Trujillo 2011:21
[289] Ibid., pp.22-23

Map 5. Physiographic Sub-provinces of Michoacán[290]

[290] Produced with vector and raster data produced by INEGI physiographic sub-provinces chart scale 1:1000000

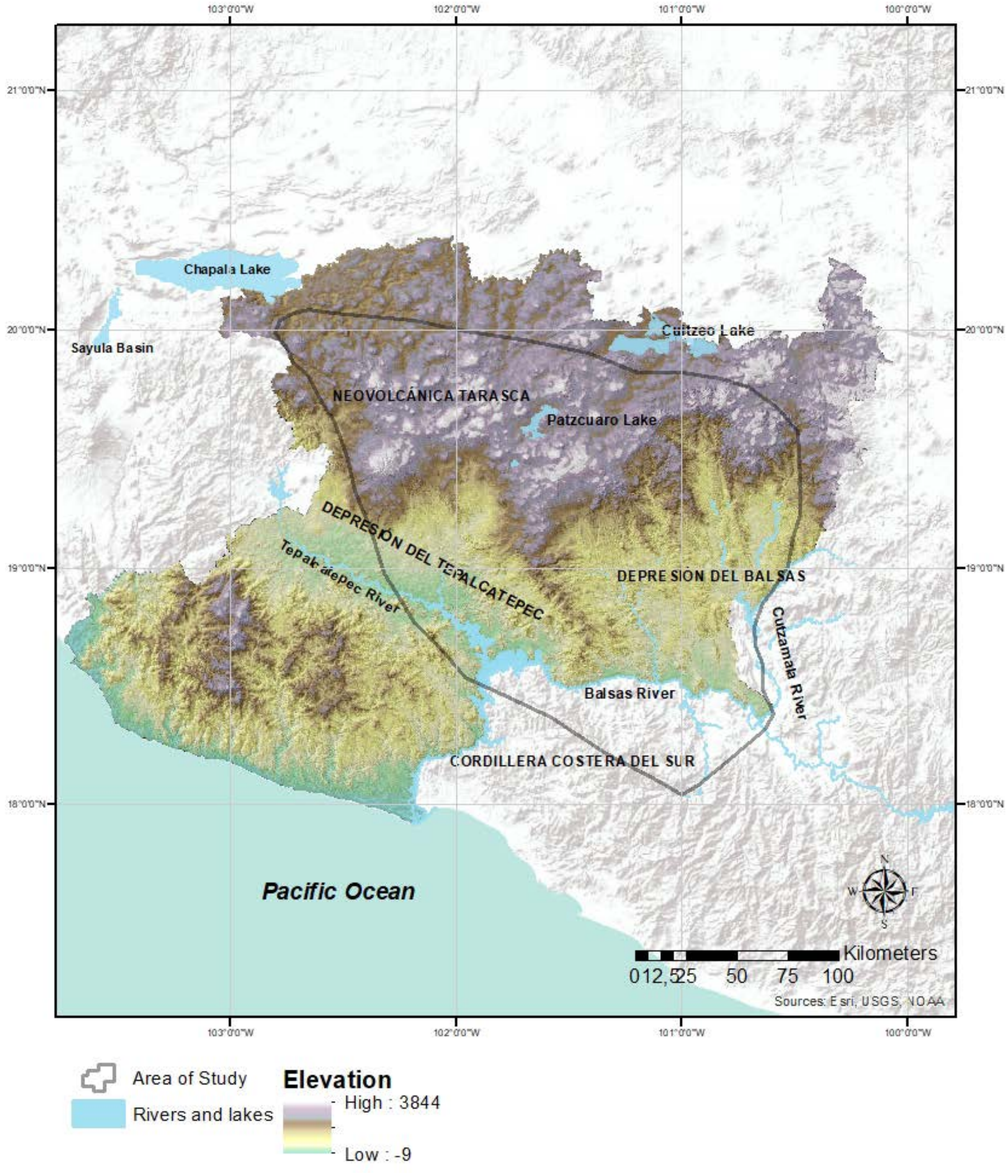
4.2 The Area of Study

Our region of study is mostly encompassed within the geographical boundaries of the modern state of Michoacán however its southern most part includes a small portion of the modern state of Guerrero (map 6). It is located between 102°42'53,694"W 19°59'31,828"N and 101°1'38"W 18°6'42"N in the North-South axis and between 102°42'53"W 19°59'31"N and 100°26'50"W 19°14'40"N in its East-West axis. It has an area of 38,112 square kilometres and it is defined on the towns, ore deposits and archaeological sites mentioned by colonial sources, and the geological charts and by the archaeological evidence related with the metallurgy of copper in pre-Hispanic and colonial times.

The area is dominated by deep orographic diversity, which includes a large variety of ecological niches and natural resources. In general terms, it is defined by three major regions of physiographic influence. The northern part includes the Tarascan neovolcanic region and its high plateau, the central part of the area is dominated by the Tepalcatepec-Balsas depression, and its southern-most part includes the first heights of the Southern Sierra Madre. These three well-defined regions and their geological and ecological variety provide an important basis for understanding the development of metallurgy during the pre-Hispanic period, but most importantly for the social, economic and political dynamics related with the exploitation and production of copper during the first hundred years of the colonial period.

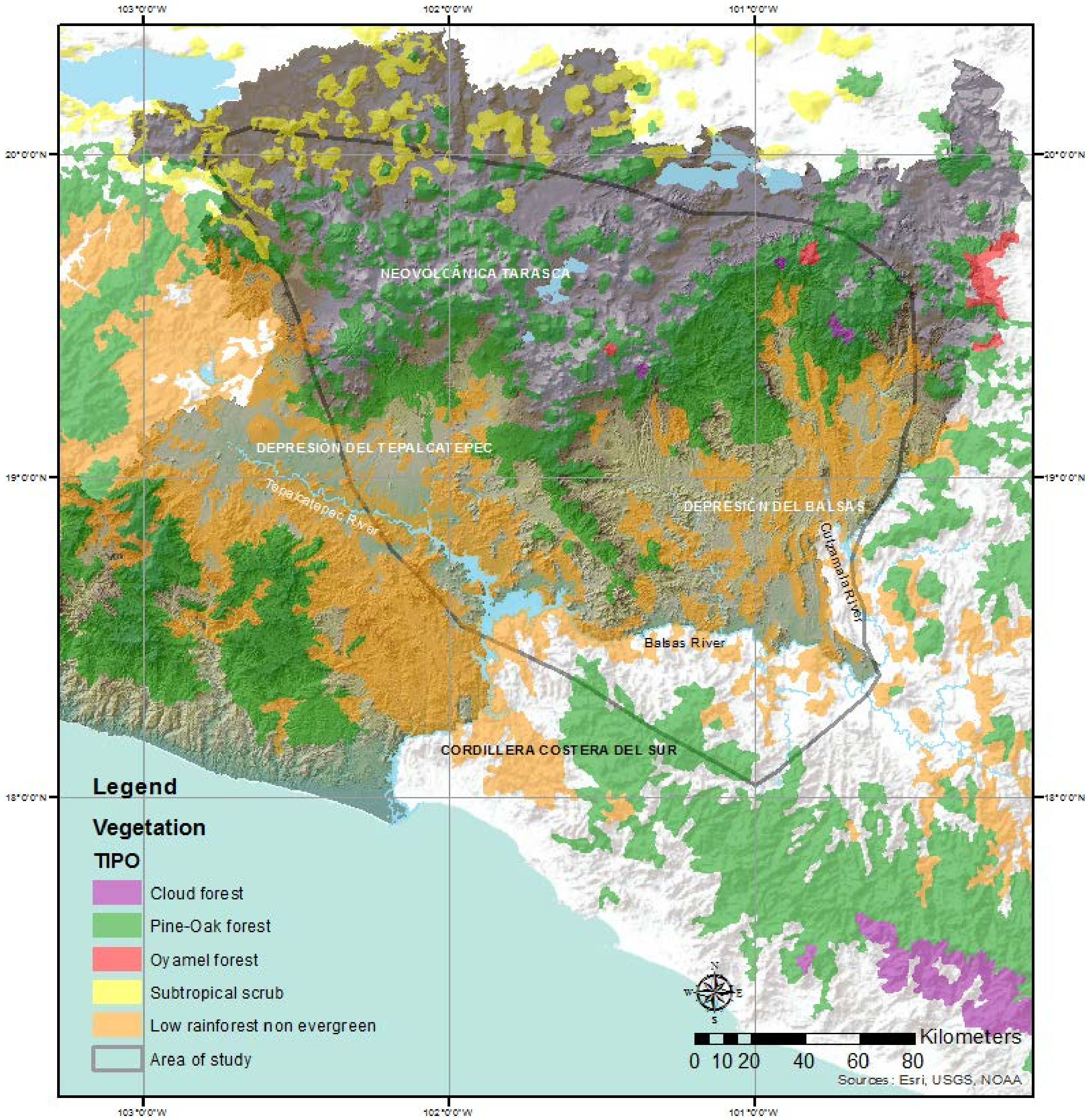
The neovolcanic region in the northern part of the area of study is defined by the high plateau and several volcanic peaks. The average elevation is between the 1800 and 2300m above sea level. This level encompasses a particular type of vegetation dominated by pine-oak and oyamel (sacred fir) forests. The plateau contains a system of lakes (Zirahuén, Pátzcuaro and Cuitzeo) surrounded by fertile soils that were highly important for human settlement during pre-Hispanic and colonial times, concentrating most part of the population, a pattern that continues today.

The Tepalcatepec-Balsas depression is located immediately south of the Tarascan neovolcanic region and is characterized by an abrupt descent in the average elevation to around 300-500m above sea level. It is crossed by the Tepalcatepec and Balsas rivers, a major fluvial system that runs in an east-west axis. This portion of the area presents high temperatures over the whole year, ranging from 25°C in winter to 40°C in summer, hence this region is better known by its colloquial name of *"tierra caliente"* (hot land). The vegetation is dominated by a low non-evergreen rainforest. The Southern Sierra Madre is located to the south of the depression. In contrast with the Tarascan neovolcanic region, the Southern Sierra Madre is a steep and difficult terrain with an almost total absence of intermountain valleys. The vegetation presents similar characteristics with the neovolcanic region and is dominated by pine-oak forests.



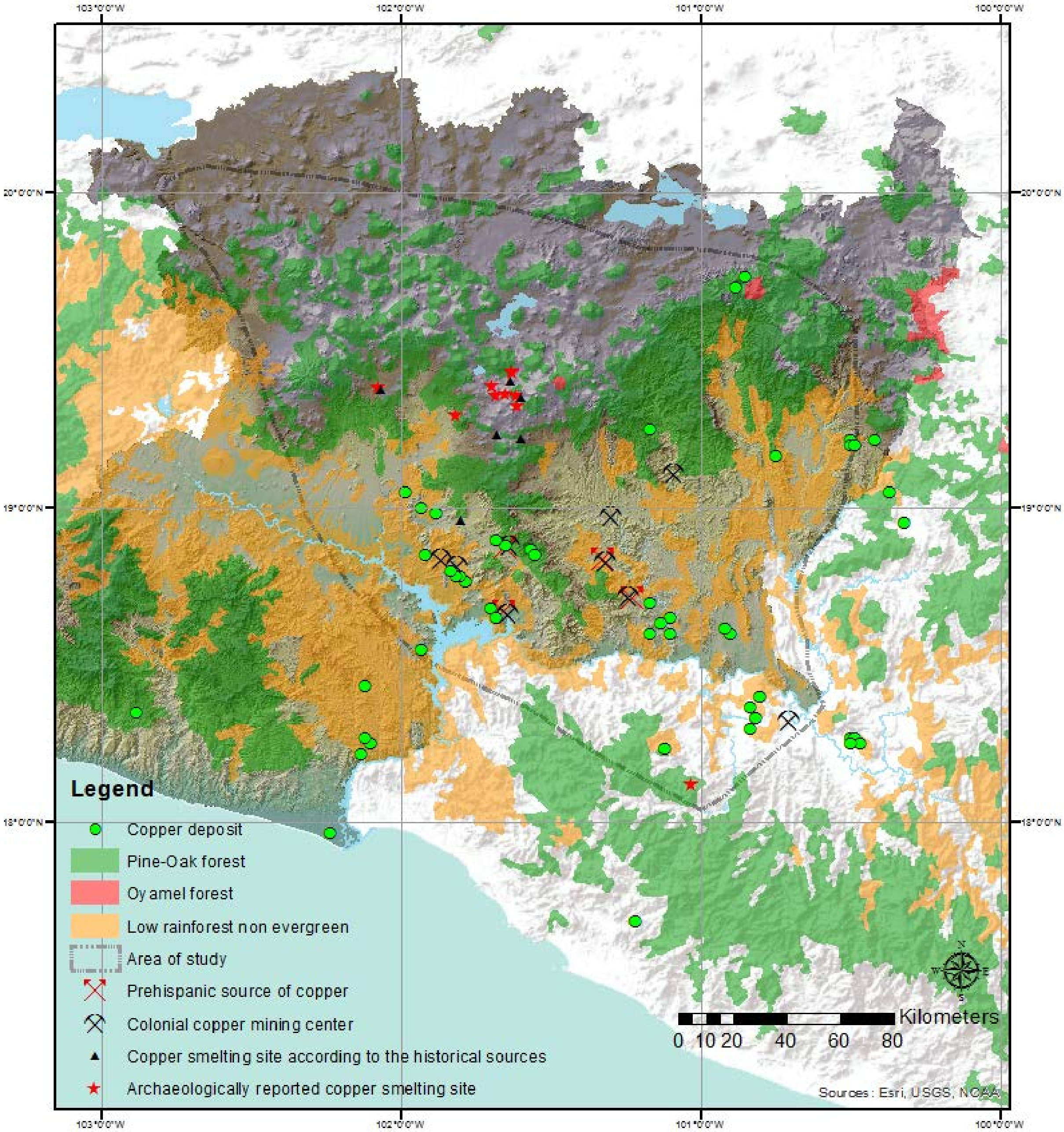
Map 6. Area of study

For the purpose of this dissertation these physiographic features and the associated vegetation are extremely important. The natural occurrence of ore deposits, especially copper, is circumscribed to the Tepalcatepec-Balsas depression, and most of the deposits are found along the slopes that run from it into the other two mountainous regions. Therefore, the mines and the mining sites which will be mentioned and discussed further in this chapter and the subsequent ones are all located within this region. However, the smelting and production sites are regularly found higher in the mountainous regions, due to the pine-oak and oyamel forests from which the charcoal was produced. The dominant vegetation around the mining areas was not suitable for producing high quality charcoal. These two factors greatly defined the dynamics of the copper production and the politics associated with it during the colonial period. Map 6 shows the relationship between activity sites, ore deposits and availability of fuel. These factors for instance, were the main ones taken into consideration by the colonial authorities for establishing the production congregations at the end of the 16th century.



Map 7. Distribution of vegetation in relation to the physiographic provinces and the area of study[291]

[291] It is important to mention that this represents the modern distribution of these ecosystems and thus it is the result of intense human action through activities such agriculture, the cattle industry and timber production. However, it supports our point in the sense that there was and still is a difference with regard to altitude between suitable and unsuitable fuel sources. The map was produced with vector and raster data produced by INEGI vegetation chart scale 1:1000000



Map 8. Relationship between ore deposits, vegetation and production sites[292]

It is important to note that although a connection among ecological niches, ore availability and technological practice was the norm during the colonial period, the pre-Hispanic period did not

[292] Produced with vector and raster data from INEGI vegetation charts scale 1:1000000 and SGM mining chart scale 1:1000000

show a marked relationship of this kind. In fact, early historical sources of the 16th century are consistent in mentioning that copper smelters were based in or around the mining areas[293]. Nonetheless, pre-Hispanic smelting was also carried out on the Tarascan plateau in sites near the sources of fuel but far from the mining areas such as Jicalán[294], Itziparátzico[295]. Smelting sites have also been recently registered by Punzo around the Zirahuén Lake[296] (map 8 and 9).

Although there is not a conclusive explanation for this dissimilarity between the colonial and late pre-Hispanic periods regarding the aforementioned relationship we can only hypothesize that it was a product of the collapse of the Tarascan state and the way goods moved under their rule. On one hand is the well-established pre-Hispanic model, controlled by the state and based on the fluid circulation of goods and services through trade and tribute networks[297]. This model would certainly allow multi-directional interaction among the areas, permitting the flow of ore from the mines to the smelting areas on the plateau or the charcoal to the smelting centres in the proximity of the mines. On the other hand, one direct consequence of the early colonial period was the collapse of the control exerted by the Tarascan state over the associated socio-economic structure.

The new model imposed by the Spaniards came with a new centre of political and economic power located in Tenochtitlan/Mexico City, and not in Michoacán. Furthermore, the tendency of the colonial copper production model was to isolate productive areas and turn them into specialized units of production thus creating mining districts and smelting towns. This dynamic is especially evident in the last decade of the 16th century with the policy of congregations; in fact the smelters around the mines started to gradually disappear until they faded away around the second half of the 17th century.

4.3 Michoacán before the Spanish Arrival: the Tarascan Kingdom

At the time of the Spanish arrival in Mesoamerica[298] (ca 1519), several socio-political entities coexisted in this geographic and cultural space. Although the European encounters with the

[293] Warren 1968:32-51; Suma de Visitas (2013), Vacana, pp.401
[294] Suma de Visitas (2013), Xicalan, pp.182. Roskamp 1998, 2013.
[295] Maldonado 2006.
[296] Punzo et al. 2015
[297] A deep discussion on the topic can be found in Maldonado 2008:287-290.
[298] The concept of Mesoamerica as a cultural area was introduced by Paul Kirchhoff in 1943.

Aztec and the Mayan societies have been the focus of extensive scholarship[299] several other cultures also came into contact with the Spaniards during their intense campaigns of conquest and colonization. Some of these cultures were organized into entities of different sizes, levels of socio-political complexity and geographical distribution. Some were even as territorially and demographically important as the well-known Aztec empire. One good example of this was the Tarascan state[300].

The Tarascan kingdom was a political entity located in West-Central Mexico. At the time of the Spanish arrival it is believed to have occupied an extension of more than 75,000 km2[301] (Map 6). Most of the former 16th century Tarascan territory consists of the state of Michoacán nowadays, one of modern Mexico's administrative divisions (Maps 1 and 6). The 16th century state was centrally administered from its capital city Tzintzuntzan located in the northern part of the Pátzcuaro basin region (Maps 4 and 6) and its power and influence were enormous, to the point of competing as equals with the neighbouring Aztec empire. In fact, during the first two decades of this century they clashed militarily on different occasions, considered each other as enemies and had established a series of military outposts along the shared frontier[302]. At the time of the encounter the Tarascan state dominated the region militarily and politically. A variety of ethnic groups inhabited the Tarascan territory, with cultural, linguistic and religious diversity[303]. In the summer of 1522, less than a year after the fall of Tenochtitlan, the Aztec capital, Cortés sent a large contingent of soldiers into Michoacán to establish a Spanish colony. At this time the territory was dominated by a large centralized political entity which the Spanish called the Tarascan kingdom, or kingdom of Mechoacan, probably as an analogy of their own political organization[304], and thus it was always described in this way in the colonial documents.

However, recent research suggests that although the territory was ruled by a central power it was organized into chiefdoms dominated by local elites, not necessarily forming a homogeneous cultural tradition[305]. In fact, archaeological finds show a discontinuous

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[299] Partially because of the abundance of historical records, partially because of the exoticism and stylistic beauty of their own history and their material culture remains.
[300] This entity has been characterized by different researchers in terms of its political organization as a: state (Pollard 1982, 1987, 1994a, 1994b 1995), kingdom (Warren 1985), and empire (Maldonado 2006; Pollard 2004).
[301] Pollard 2004:117
[302] Pollard 2004:117-120; Warren 1985:3-7
[303] Roskamp 1998:10-13.
[304] Albiez-Wieck 2011:27
[305] Roskamp 1998:3-7

heterogeneity regarding the material culture, architecture, settlement pattern and funerary practices when considering the Michoacán from a wide angle[306]. The ethnohistorical sources of the 16th century not only support the archaeological evidence but add details about the ethnicity and language of these groups[307].

By 1522 central power was wielded by one of these elite groups, the rulers of the Pátzcuaro Lake area, who were of the *uacúsecha* (eagles) linage[308]. The history of the *uacúsecha* is at the same time (partly) the history of the Tarascan state. Although archaeology provides valuable information about the Tarascan culture and its sphere of influence in Michoacán, it is mainly through a 16th century document that we came to know about the *uacúsecha* and the formation of the Tarascan state (territorially and culturally).

The *Relación de Michoacán* (from now on RM) also known as Codex Escurialense or *Relación de las ceremonias y ritos y población y gobierno de los indios de la provincial de Michoacán* is a 16th century document written or compiled around 1541 by the Friar Jeronimo de Alcalá. Although it is without doubt the most important 16th century document for the region, it is also true that it was written after the conquest with data provided by uacúsecha informants and shows only the history of their lineage, which is a partial vision of the regional history. The problem resides in the misuse of the source, and thus the history and the archaeology of the two centuries prior the Spanish conquest, which have been largely defined from the RM. This brought serious methodological problems for the historical scholarship of the region, which until very recent times suffered an RM-centric vision of Michoacán history[309]. However, the RM is still a major source of information which provides valuable data.

According to the RM the uacúsecha linage begins with the arrival of *Hireti Thicatame* and his group (along with their patron deity *Curicaueri*) to the region of Zacapu (northwest of Pátzcuaro lake), probably at the end of the 13th or the beginning of 14th century. His son Sicuirancha (ca. 1340-1360) moved from Zacapu to the neighbouring Pátzcuaro region. Several generations of chiefs ruled the settlement and started to create political alliances with the other chiefdoms inhabiting the lake shores. It was only with the advent of *Tariacuri* (ca. 1440-1460) that the *uacúsecha* started their expansionist campaigns, (according to the RM) after he

[306] Albiez-Wieck 2011:73-92
[307] Roskamp 1998:5-6
[308] Ibid., p.7
[309] Ibid., pp.7-9

was instructed by the elder priests to conquer the neighbouring regions and thus fulfil his glorious destiny[310].

From his base in Pátzcuaro, *Tariacuri* ordered the foundation of a triple alliance with the chiefdoms of Tzintzuntzan and Ihuatzio. After his death this political and military force conquered large portions of the Michoacán region and neighbouring areas[311]. The RM focuses mainly on this period, creating a sort of "golden age" in its historical narrative[312] and dedicates only brief attention to the decades before the Spanish arrival. It was during this time, however, that the bulk of conquests and territorial annexes were achieved, especially under the rule of *Zuangua* (ca. 1500-1520). It was in this period when the centre of political power moved to Tzintzuntzan[313].

Helen Pollard mentions that the hierarchical structure of the Tarascan state was comprised of the *Irecha* (head of the *uacúsecha* lineage and king or *Cazonci*), accompanied by the Angatacuri (governor); the Captain (chief military leader); the Petámuti (chief priest); the Tribute minister; the Caracha-capacha (governors of the four quarters of the state); the Achaecha (nobility members acting as advisors); the Quangariecha (captains of military units); the Ocámbecha (tribute collectors); Mayordomos (heads of units that stored and distributed tribute, and produced crafts and services within the palace); the Priests (who served in state temples); and the Angámecha (leaders of towns and villages, referred to as caciques or señores)[314].

The land-tenure system was organized in: *"(1) the patrimonial lands of the royal dynasty; (uacúsecha), (2) the fiscal lands of the state on which tributary goods were produced, (3) lands allotted to local lords; and (4) the lands of the commoners."*[315] To these categories Pollard adds the *"usufruct rights for hunting, fishing, and lumber, the control of state mines, and the control of long-distance merchants."*[316]

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310 Ibid., pp. 8-9
311 Warren 1985:4-5
312 Roskamp 1998:9
313 Warren 1985:5-6; Roskamp 1998:9
314 Pollard 2003:80-81 and table 13.1
315 Ibid., pp.81
316 Ibid.

The territory of the kingdom was organized into administrative centres, and each of these had a number of dependent communities. Each centre reported directly to the central government in Tzintzuntzan[317].

Regarding the political economy Pollard says that: *"Goods and services flowed through several institutional channels which fell into two classes: local and regional markets and state-controlled agencies. The state-controlled agencies are believed to have included the tribute network, official long-distance merchants, state agricultural lands, state forest lands, state mines, and official gift exchange."* [318]

According to Pollard the market system does not appear to have been under the control of the state and all sorts of goods and services could be found in it, including slaves. On the other hand, the tribute system, which was one of the pillars of the state, appears to have been under its total control. The tribute was collected from the regional tribute centres every 80 days. From these centres the tribute was sent to the capital or to the military borders. Goods and services flowed through the system and these included food stocks, cotton cloth and clothing, slaves, sacrificial victims, metal objects, armaments, gourds, animal skins, feathers, gold, silver, and copper.[319]

The Tarascans also participated in the long-distance trade networks which crossed and connected all of Mesoamerican territories, both as importers and exporters. Turquoise, peyote, marine shells, cacao beans, obsidian, jade, amber, pyrites, and serpentine are among those imported goods. Pollard mentions that the only documented commodities exported from the Tarascan territory were foodstuffs and manufactured metal objects, especially those of bronze and bronze alloys.[320]

This was the panorama that the Spanish encountered when they entered in Michoacán for the first time. It was a vast but recently created multicultural political entity, centrally ruled by an elite group from their capital of Tzintzuntzan, but organized into several minor chiefdoms linked to the central power by marriage, military alliances and tribute systems[321].

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[317] Ibid., pp.82
[318] Ibid.
[319] Ibid., pp.83
[320] Ibid., pp.84-85
[321] Pollard 1982; 1994a; 1994b

Although the RM highlights the cohesion (through religion and language) of the state, the truth is that this is only applicable to the territories of the lake region. Nonetheless, it is also true that some typically Tarascan chiefdoms were present in different places outside the core region, cohabiting with peoples of different ethnic and linguistic backgrounds, such as the Otomies, the Nahuas, and the Matlazincas.

From the perspective of the topic of this thesis, the political organization of Michoacán before and at the time of the Spanish arrival is fundamental on various levels. Firstly, because archaeological evidence suggests that metallurgy was present in the region as early as the 11th century. Secondly, because several chiefdoms located in the south of Michoacán were specialized in mining and metalworking activities and, according to 16th century ethnohistorical documents, paid tribute to the state in the form of ore, smelted materials and finished objects. This is especially interesting, because regardless of their cultural affiliation, they basically continued in the same manner after the shift of power under the Spanish conquest, and kept doing so throughout the 16th and early 17th centuries[322].

4.4 The Spanish Arrival, the Conquest of Tzintzuntzan and the Death of the Last Cazonci

According to Warren[323], the first notification that the Tarascan king (Cazonci) received about the presence of the Spaniards in Mexican territory came with the appearance of Aztec emissaries in Michoacán. The story is presented in the RM, and relates that the emissaries were sent to seek the aid of the Tarascan king in battle against the Spaniards. Warren mentions that according to the RM and other 16th century documents, the date of this encounter could be the summer of 1520[324]. The RM records this encounter pictorially, with the Aztec emissary men carrying and showing Spanish weapons to the Cazonci[325] (Fig. 1).

[322] Barret 1987
[323] Warren 1985:24
[324] Ibid., pp.26-27
[325] Ibid., p. 28

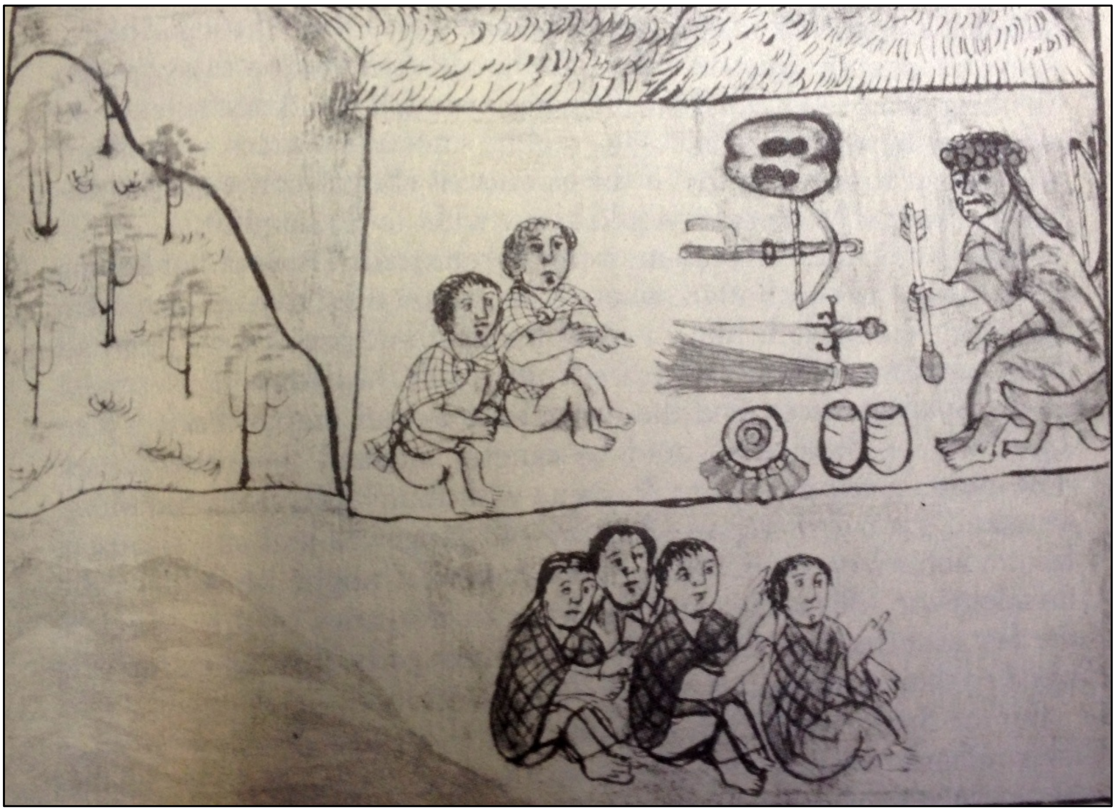

Figure 3. Aztec emissaries seeking the aid of the Cazonci according to the *Relación de Michoacán* (Reproduced from Warren 1985:27)

Several accounts mention that after the visit and because of the suspicion of trickery regarding the Aztecs (former enemies), the Cazonci (at that moment Zuangua) sent four of his Nahuatl-speaking interpreters to learn whether they were telling the truth. Apparently, they came into contact with the Aztecs and were taken to Tenochtitlan where Moctezuma tried to convince them to join forces against the invaders[326].

The Cazonci fell victim to smallpox (perhaps carried by the informants) and died in the fall of 1520. The position of Cazonci was inherited by his elder son Tzintzincha Tangaxoan, who apparently received a few more visits from the Aztecs asking for aid but he declined the request and opted for a different strategy. The first physical contact with the Spaniards occurred in the early months of 1521 when, just after the fall of Tenochtitlan, a small group of Spanish soldiers arrived at the Tarascan fortress of Taximaroa on the border with Michoacán.

[326] Ibid.

The Spanish explorers returned to Cortés with information about the new area, its metal resources[327] and two Matlazincas from the Tarascan kingdom. Cortés sent them back to Michoacán with some gifts and a message for their king. In Warren's words, quoting the chronicle of Cervantes de Salazar, the message was "*that the Spaniards were as strong in defending their friends as in fighting their enemies, and that he wished to come to their nation to show them their errors, especially in their adoration of false gods and their human sacrifices"*[328].

In his third letter of relation, Cortés wrote to the king about a newly discovered great province known as Michoacán whose lord had sent messengers to see him just after the fall of Tenochtitlan, with a message of good will and with a proposition to live in friendship with the Spanish. At least a few more visits from either side followed these first encounters; in all of them both groups exchanged gifts and mutual displays of force[329].

In July 1522 as mentioned above, Cortés sent a large group of soldiers to establish a colony deep in the Tarascan territory. The expedition was commanded by one of Cortés most important captains, Cristobal de Olid. The expedition consisted of a force of between 150 and 200 Spaniards, among them, horsemen, musketeers, crossbowmen and different other officials accompanied by a much larger force of indigenous allies numbering in the range of several thousand[330].

The sources mention that in the beginning the Cazonci Tangaxoan fortified Tzintzuntzan and prepared a large army of tens of thousands of warriors for an eventual battle that never occurred. In fact all the sources agree on the fact that the Spaniards were received in peace. There is little evidence for the motives of this welcome, but several historians mention a few assumptions[331]. The most appealing of them are: the not so completely established political position of the new Cazonci (after he killed his brothers for disloyalty) due to internal struggles among the elite groups searching for power and autonomy in a time of political instability. Another is the psychological impact of seeing their mighty enemies and their vast empire defeated in a very short period of time; along with their tactical inferiority against the Spanish warfare and deadly weaponry and cavalry power.

[327] Ibid., pp.29
[328] Ibid., pp.30
[329] Warren 1985:32-40
[330] Ibid., pp. 43
[331] Warren 1985:42-44; Albiez-Wieck 2011:521

According to the sources for the conquest of Michoacán, once Olid entered Tzintzuntzan he headed straight to the main temples and destroyed the images of the main Tarascan deity, Curicaueri, after which the Spaniards looted and collected the royal treasures[332], which must have been enormous after years of collecting it as tribute from the mining and metalworking regions. The RM mentions that once the treasure (consisting of discs and breastplates of gold and silver) was collected, Olid's men broke it apart with their swords and divided it into 360 pack-loads and sent it to Tenochtitlan with the news about their conquest of Michoacán[333].

The Cazonci himself was sent to deliver the looted treasure to Cortés under the threat of being killed. However, Cortés welcomed him properly and gathered the chiefs of Mexico for a feast in his honour. Before letting him return to Michoacán he took him to visit the imprisoned and tortured Cuauhtémoc (nephew of Moctezuma II and head of the defence against the Spaniards during the siege of Tenochtitlan) in a clear allusion to what could (and eventually would) happen to him[334].

The treasure of Michoacán was melted and cast to produce one of the gifts from Cortés to the King of Spain, consisting of an enormous gold and silver cannon which Cortés called "El Fénix" (the phoenix) which was shipped to Spain in 1524[335]. The Cazonci was summoned to Mexico many times during the 1520s, and sometimes held as captive by the captain in charge at the time, always with a ransom demand for his release.

With the assembly of a new expeditionary Spanish force going to Michoacán during the winter of 1529-1530 under the lead of Nuño de Guzmán, the situation for the Cazonci became more and more difficult. Guzmán had the mission to expand the Spanish domination to the north and northwest of Michoacán and to pacify a warrior group of natives called the Teules Chichimecas, who were in resistance against the Spanish invaders[336]. At that time the Cazonci was held captive in Mexico City, but he was released with the departure of the expedition after Guzmán demanded a portion of his treasury as ransom.

Nobody knows what obscure hatred Guzmán held against the Cazonci, but during the campaign Guzmán exhibited the Cazonci everywhere as a captive, demanding gold and silver from the Tarascans. It seems that no amount of precious metals satisfied the greed of this captain. After arriving in Tzintzuntzan the Cazonci was tortured, as the thirst of Guzman for

332 Pollard 1982:744-745; Warren 1985:54
333 Warren 1985:55
334 Ibid., pp.62
335 Ibid., pp.64
336 Ibid., pp.211-213

gold and silver grew ever greater[337]. When the moment arrived that he could not get any more precious metals from the Tarascan king or his loyal servants and *principals* Guzman arranged a trial against him, charging him with all sorts of accusations, from killing Spaniards to homosexuality and sodomy, as well as conspiracy against the crown, idolatry after being baptized and rebellion[338].

Don Francisco Tzintzincha Tangaxoan, last Cazonci of the Tarascan was found guilty of these charges and sentenced to death the 14th of February 1530. After many days of torture and already half dead, the Cazonci was burned along with the last vestiges of an era that was no more[339]. This event surely marks the shift from the pre-Hispanic times to the colonial era in Michoacán.

4.5 The Colonization of Michoacán and the Establishment of the Early Colonial Order

Less than a year after the return of Olid from Michoacán, in October 1523 Cortés sent a small expedition led by Antonio de Caravajal to survey the region and gather accurate information about the main towns and the districts subject to them. This visitation mission took less than year to complete and set the foundation for the distribution of *encomiendas* by Cortés in the early years of the Michoacán colonization[340].

The results of the Caravajal expedition were fundamental, since it was the first systematic effort to provide a list of major towns (*cabeceras*), the smaller wards which were subject to these and a census of the potential tributary population over what appears to be almost the entire territory of Michoacán. The visitation provided other types of information as well, such as the location of the towns and the native names of the main geographical features (mountains, rivers, streams, lakes). By the time Caravajal returned to Mexico City, and along the results of Olid's expedition, the Spaniards were prepared to proceed with the partition of the Tarascan kingdom into *encomiendas* and thus begin the gradual colonization of Michoacán[341].

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[337] Ibid., pp.225-229
[338] Ibid., pp.231-234
[339] Ibid., pp.235
[340] Roskamp 1998:28; Warren 1985:73
[341] Warren: 1985:78

In July 1524 Cortés started the process of granting *encomiendas,* dividing almost the entire Michoacán region among his soldiers and officials, and also to well-position and influence royal officials. He granted some to himself as well, as was the case with Tzintzuntzan, and the famous silver rich towns of Tamazula, Tuxpan and Zapotlán located on the western border of the Tarascan territory[342].

The Michoacán case was first experiment in New Spain in granting encomiendas based on systematically gathered knowledge regarding the land and the people. Although the idea remained unaltered and was clearly based on creating an economically driven colonization, the process in Michoacán did not undergo the improvisations that marked the *repartimiento* of the Aztec territories.

Another driver of the colonization process in Michoacán was undoubtedly religion, the Spanish resolve to evangelize the natives and purge them of idolatries. From the very beginning of the Michoacán campaign the destruction of idols and temples was a common practice, as Cristobal de Olid did after his entry in the Tarascan capital and during the looting campaign in the towns located along the shores of Pátzcuaro Lake.

The first missionary friars were from the Franciscan order and arrived in Michoacán in 1525. One of the first acts of their evangelization process was to convert the Cazonci Tangaxoan and his officials. He was baptized and given the Christian name Francisco[343].

The first church was built in the same year of their arrival with the help of the indigenous people in one of the barrios of Tzintzuntzan, a place in which they were welcomed and hosted by the Cazonci. The church was dedicated to Saint Ann; however, this first structure did not remain for long. The recently elected Bishop Vasco de Quiroga arrived in Tzintzuntzan in 1538, and in order to set up his diocese he asked for permission to relocate the church to the neighbouring town of Pátzcuaro at the opposite side of the lake and congregate the neighbouring dispersed towns[344]. This was perhaps one of the first congregations in New Spain, and certainly the first one in Michoacán.

During the years following the arrival of the friars, Catholic mass was given with the aid of interpreters and a series of visual aids that symbolized iconic elements of the doctrine during the mass. During the ceremony, these were pointed out using a rod to highlight specific

[342] Ibid., pp.78-79
[343] Ibid., pp.85
[344] Ibid., pp.89

moments[345]. The Franciscans oversaw educating the children of noble families, teaching them the Catholic doctrine as well as Latin and philosophy, in the same manner as they did with the Aztec nobility of Tenochtitlan in the centre of Mexico[346].

As the number of friars increased they extended the radius of the doctrine beyond the area of Pátzcuaro Lake, especially in towns located along the route to Tenochtitlan[347]. The doctrine became more focused on the suppression of the old ways of the native religion, and temples, idols, and offerings were sacrificed (one way to put it) in burning pyres to honour the name of the new Christian god. The idols and offerings made from precious metals were considered a justifiable booty, and their destiny was the crucible.

Regarding this, Warren[348] quotes and translates a portion of the accusation against a Franciscan friar in 1532:

"Father Fray Angel in the province of Michoacán told this witness that in a cu (temple) he found a quantity of gold and silver offered to the idols and that he gave it back to the natives. This witness reprimanded him for it, saying that it was bad to give it back to them so that they could go back to offer it and practice idolatry with it once more, and that it would be better not to give it back but rather to make chalices and ornaments with it so that the divine services could be celebrated, since they would just give it back to the demons to whom they had offered it. And the guardian of the said monastery (Fray Martín de Jesús) told him that it would have been better to do it that way."

The war against the native idolatry was never completed, as entire communities fled to isolated regions in order to resist the harassment of the friars, and the Spaniards in general, concerning religious issues, treasure hunting and land appropriation. Nonetheless, the friars took advantage of the recently imposed system of encomiendas that, as we saw before, had the evangelization of the natives as one of its main objectives. The friars set up missions in the *cabeceras* (main towns) of each one of the encomiendas granted by Cortés during the early years, which by 1533 was completely functional[349].

[345] Ibid., pp.90-91
[346] Gruzinski 1991:23-24
[347] Warren 1985:96
[348] Warren 1985:97-98, he takes it from "El fiscal contra Don Pedro de Arellano sobre el oro que tomó a los indios de Michoacán y demás cosas de que fue acusado, 1532" (AGI,JUSTICIA,187,N.1,R.2).
[349] Warren 1985:99-101

The Christianization of Michoacán, as in the other parts of the continent, was a painful process that led to the advent of syncretistic forms of ideology as a *"natural result of the natives' efforts to understand the new religion within the framework of their own thought and traditions."*[350]

4.5.1 The Socio-Political Organization

In terms of social and political organization, Michoacán suffered various transformations throughout the 16th century. The first and more obvious was the abrupt changes suffered upon the arrival of the Spaniards, but more especially after the execution of the last Cazonci and the subsequent collapse of the Tarascan kingdom. This not only affected the political organization but it also greatly affected the economic relationship between the political centre and the tributary provinces, as well as the internal and external trade networks. Although for a few chiefdoms this resulted in liberation from Tarascan oppression, for the majority it simply meant a change from one ruler to a different one.

After this period, and through rest of the 16th century, the indigenous elites, local governors and town chiefs played a fundamental role in organizing themselves around the vacuum of power left by the disruption of the Tarascan state and the subsequent situation of social and political uncertainty. In 1533 Vasco de Quiroga was sent to Michoacán with the mission of pacifying and organizing the region that had fallen into chaos[351]. Quiroga was successful and his achievement led the crown to appoint him as the first bishop of Michoacán, despite the fact that he was a magistrate.[352]

The secret to Quiroga's success laid in establishing political alliances with the indigenous nobility. In fact, one of his first acts was to set up several meetings (*asambleas*) with the indigenous authorities, including the indigenous governor, Don Pedro Cuiniarángari, and other *principales*. In the *asambleas* Quiroga tried to convince them of the good will of the Spanish king and his wishes to protect them and to ensure their well-being[353]. As Felipe Castro suggests this was clearly interpreted by the natives *"as a pact, and the promise of preservation of their*

[350] Ibid., pp.101
[351] Castro Gutierrez 2004:20
[352] Ibid.
[353] Ibid., pp.21

own collective privileges in exchange of their submission and the acceptance of the new religion"[354].

The outcome of these newly created alliances can be seen in the active participation of Tarascan forces in the pacification campaigns of neighbouring regions, such as the Mixton war (1540-1542) against the Caxcans, and the military conquests and subsequent colonial expansion towards the northern territories[355]. By 1550 there were already two Tarascan townships in the newly-founded and famous silver mining town of Zacatecas: San José and Tonalá Chepinque[356]. In this same period, trade caravans of goods moving from the Tarascan areas towards Zacatecas were common, despite the dangers implicit in the trip. *"The lure of high prices made the risk and the hard journey worthwhile"[357]*. This trade network, largely established by the natives, caused the viceroy to order the repairing of the road between Zitacuaro and Acámbaro (two Tarascan towns on the route to Zacatecas). Mendoza did this *"since he had been told that the inhabitants of Michoacán wished to cart supplies from the towns of Zitacuaro and Tajimaroa to Zacatecas and to bring back ores to be refined in Zitacuaro"[358].*

The Tarascan nobility of different towns used these developments to strengthen their claims over lands, resources, privileges and titles throughout the 16th and 17th centuries, claims that were regularly presented in front of the colonial administration. Their narrative revolved around how they had offered themselves freely as vassals of the king, served him well, accepted willingly the Catholic faith, and participated with their forces in the conquest of new territories for his majesty[359].

The indigenous towns and their authorities used different strategies to negotiate their role in the new system, and their technologies and productive skills were undoubtedly a part of it. In 1542 a royal *merced* (mercies) was granted by Viceroy Mendoza to the copper production natives of the city of Michoacán. The *merced* commuted part of the tribute, based on their service to the royal foundry of Mexico City[360]. That service was of course the amount of smelted and refined copper destined for the manufacture of artillery, and which would be extended that same year to supply the recently created mint house.

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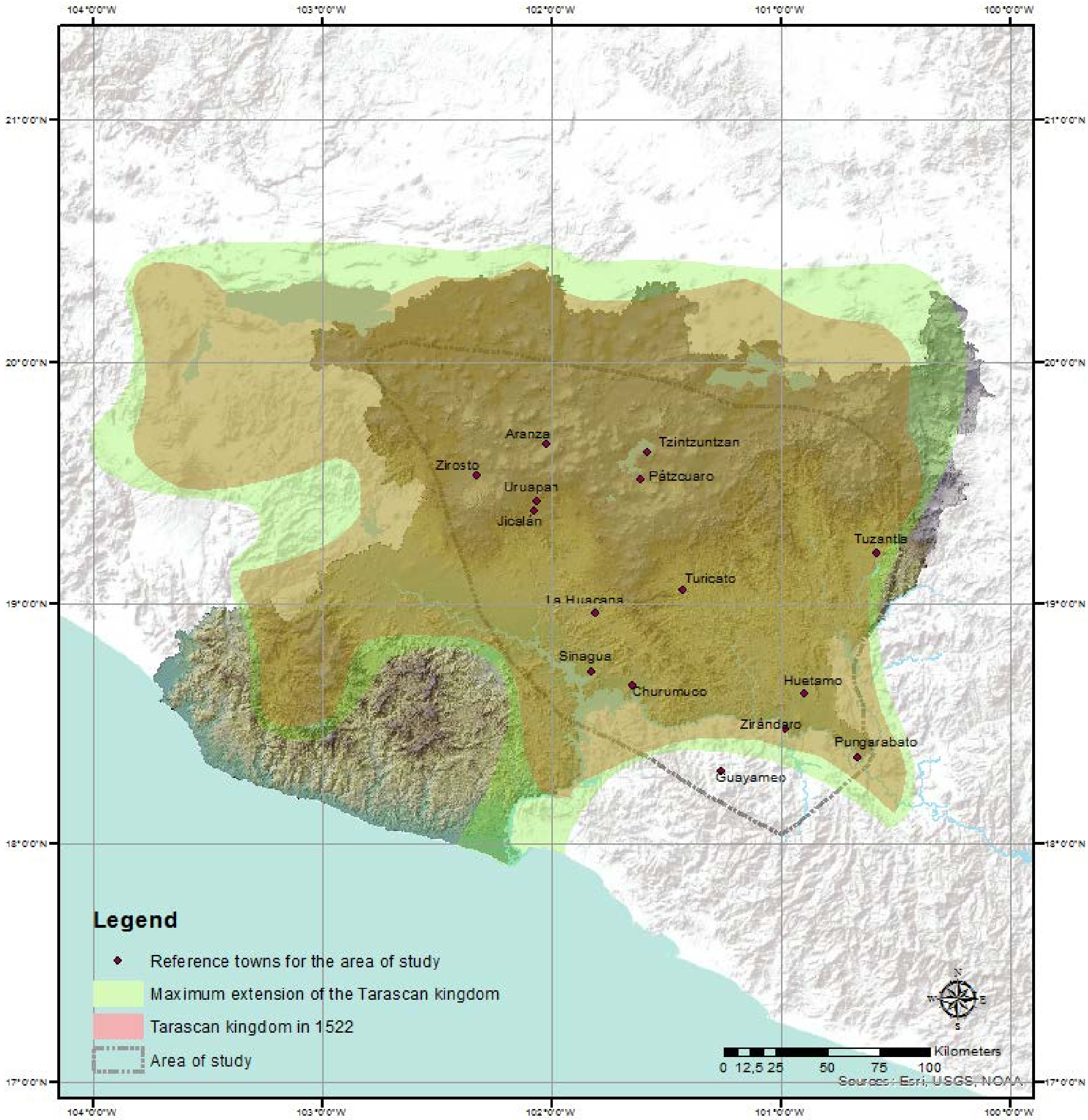
[354] Ibid. (translated by the author)
[355] Bakewell 1971:36
[356] Ibid., pp.56
[357] Ibid., pp.58
[358] Ibid.
[359] Castro Gutiérrez 2004:22
[360] AGN,Mercedes,Cont.1,Vol.1,Exp.112

The idea of indigenous societies being defenceless against the tyranny of the conquistadors, subjugated and exploited by their greed, and protected only by the moral and good conscience of the religious friars was, as Felipe Castro points out, only partially true[361].

In this regard Castro says that *"When observed carefully, it can be seen that the Tarascans were not passive subjects of their own history. On the contrary, under very harsh circumstances they tried to adapt to the new colonial reality, to defend their resources, to face the most aggressive aspects of the conquest, to look for the cracks and contradictions in the colonial order, and to build a new identity"[362].*

[361] Castro Gutiérrez 2004:19
[362] Ibid.



Map 9. The map shows the location of the area of study, the limits of present day state of Michoacán and what is believed to be the extension of the early 16th century Tarascan kingdom (Redrawn from Stone 2004:Map 1 and Pollard 2000 Figures 5.1 and 6.2)

4.6 Tarascan and Regional Metallurgy at the Moment of Contact

The Tarascan metallurgy shared almost all of the characteristics of the general framework of west Mexican metallurgy. It was a technology based mainly on copper and its alloys, but also with remarkable examples of work in silver, silver-based alloys, and gold[363]. It is interesting that one major contrast with neighbouring areas of the west Mexican metalworking zone during this period (1300-1520) is the absence of iconographical motifs as a constituent part of the metal objects.

The Tarascans had a centralized state controlled by a hereditary dynasty sustained by a vast system of tributes, formed by the chiefdoms and regions that were conquered and annexed to the state[364]. Some researchers have suggested that the Tarascan elites used metal as a distinctive feature of their identity, and that some of the expansionists campaigns from the two centuries prior to the arrival of the Spaniards were carried out with the aim of controlling areas where exploitation and production were conducted[365].

Pollard suggests that during the process of developing a Tarascan culture the groups that settled in the territory at around 1300 AD acquired their metallurgical knowledge from indigenous groups that, as we previously saw, were producing metal objects in the area centuries before their arrival. Pollard says that *"it can be currently assumed that Tarascan metallurgy was both an outgrowth of an established regional tradition and the technological expertise of non-Tarascan artisans who put themselves in the service of the State. It is also clear that, in the process of defining a Tarascan elite culture, the central dynasty encouraged the emergence of a distinctly Tarascan product"[366].*

It is possible that a Tarascan metallurgical style existed, or at least was in the process of formation. However, there is still an important lack of stylistic and technological studies that can determine whether such style existed or it was just a minor variation of a broader West Mexican style. In fact at least two sites in our area of study are clearly non-Tarascan, the town of Jicalán whose inhabitants identified themselves as Nahuas, and the site of *Barranca de las Fundiciones* where archaeologist have not found material evidence to link this settlement to the Tarascan tradition. There is only one type of object that is widely recognized to be purely Tarascan, and that is the spiral tweezer. These tweezers are normally recovered from sites

[363] Hosler 2005; Maldonado 2006; Pollard 1987
[364] Ibid., pp.102
[365] Pollard 1987:743; Maldonado 2006:102-104
[366] Pollard 1987:743

within the Tarascan territory and are associated with high status or elite burials[367]. This type of tweezer is also well represented in the RM as objects worn exclusively by high priests.

Figure 4. Fragment of a spiral tweezer recovered from a burial at the site of Atoyac, Jalisco; it was found associated with the chest area of the individual (García Zaldúa 2016:Fig.8)

The archaeological site of San Juan Atoyac provides many good examples of the interactions between the Tarascan people and metallurgy with a non-Tarascan population, who acquired metal objects from other non-Tarascan regions as well[368]. The site is located in the neighbouring Sayula basin, and is organized in a plan of activity, domestic and funerary areas, with some burials also associated with the domestic spaces. Over 200 metal objects have been found in this site and a great majority of them are directly associated with burials. The ^{14}C (radiocarbon) dates place the findings after 1400 AD, a period mentioned in the RM as one of expansion of the kingdom towards the neighbouring Chapala and Sayula regions, among others.

The archaeological and contextual analysis of the funerary spaces allowed the identification of three types of burials associated with metal objects. A) Tarascan burials, where all the associated objects had a clear Tarascan affiliation; b) Amacueca burials where all the objects belonged to a regional tradition; and c) mixed burials where typical Tarascan and Amacueca

[367] Maldonado 2006:86-88
[368] García Zaldúa 2016

objects converged in an individual burial. The spiral tweezer fragment in Figure 4 for instance was found over the chest of and individual surrounded by Amacueca pottery offerings[369]. This is significant because it sheds light on the relationship between Tarascan and non-Tarascan groups from the perspective of material culture.

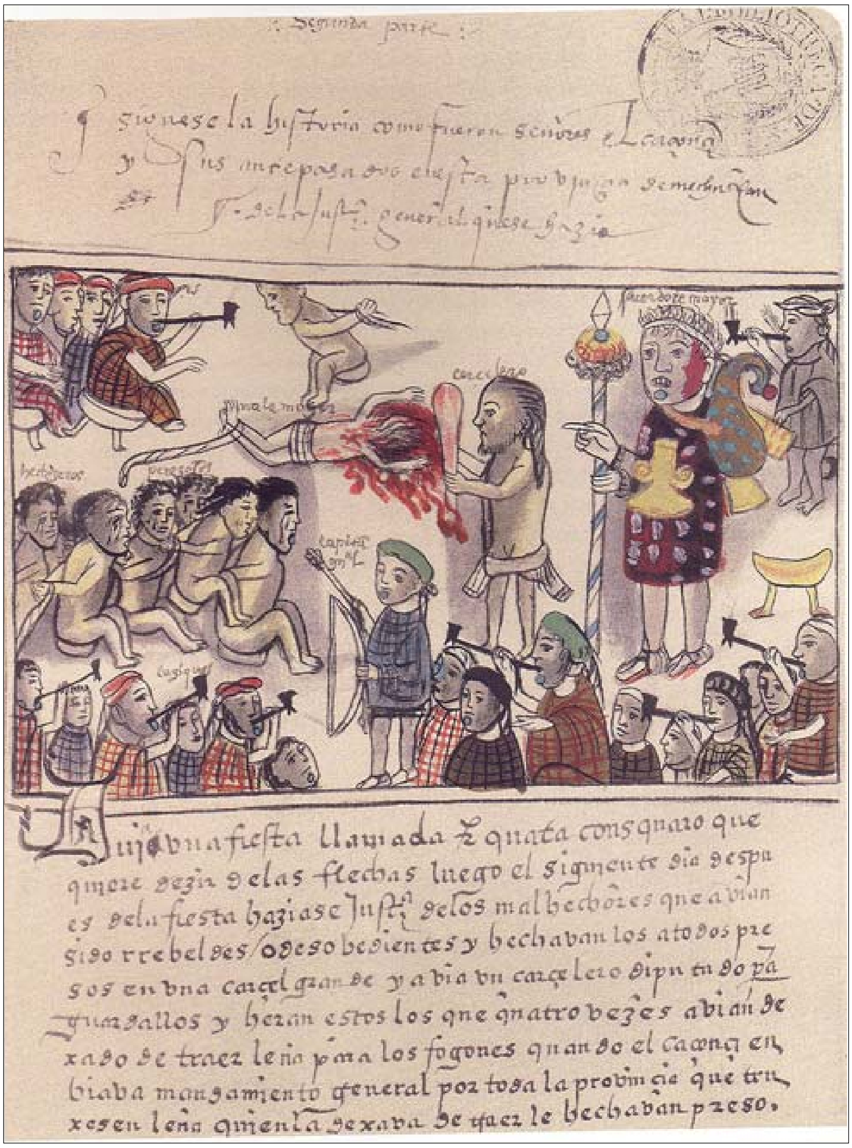


Figure 5. Scene from the RM showing the means of imparting justice, the high priest (sacerdote mayor) wears a golden spiral tweezer on his chest as a symbol of status and authority[370]

[369] Ibid., pp.197-198

[370] *Relación de las ceremonias y ritos de los indios de Mechuacán*, Lámina II. The original is held in the Real Biblioteca del Monasterio de San Lorenzo el Escorial, section of manuscripts, collection of Manuscritos Castellanos

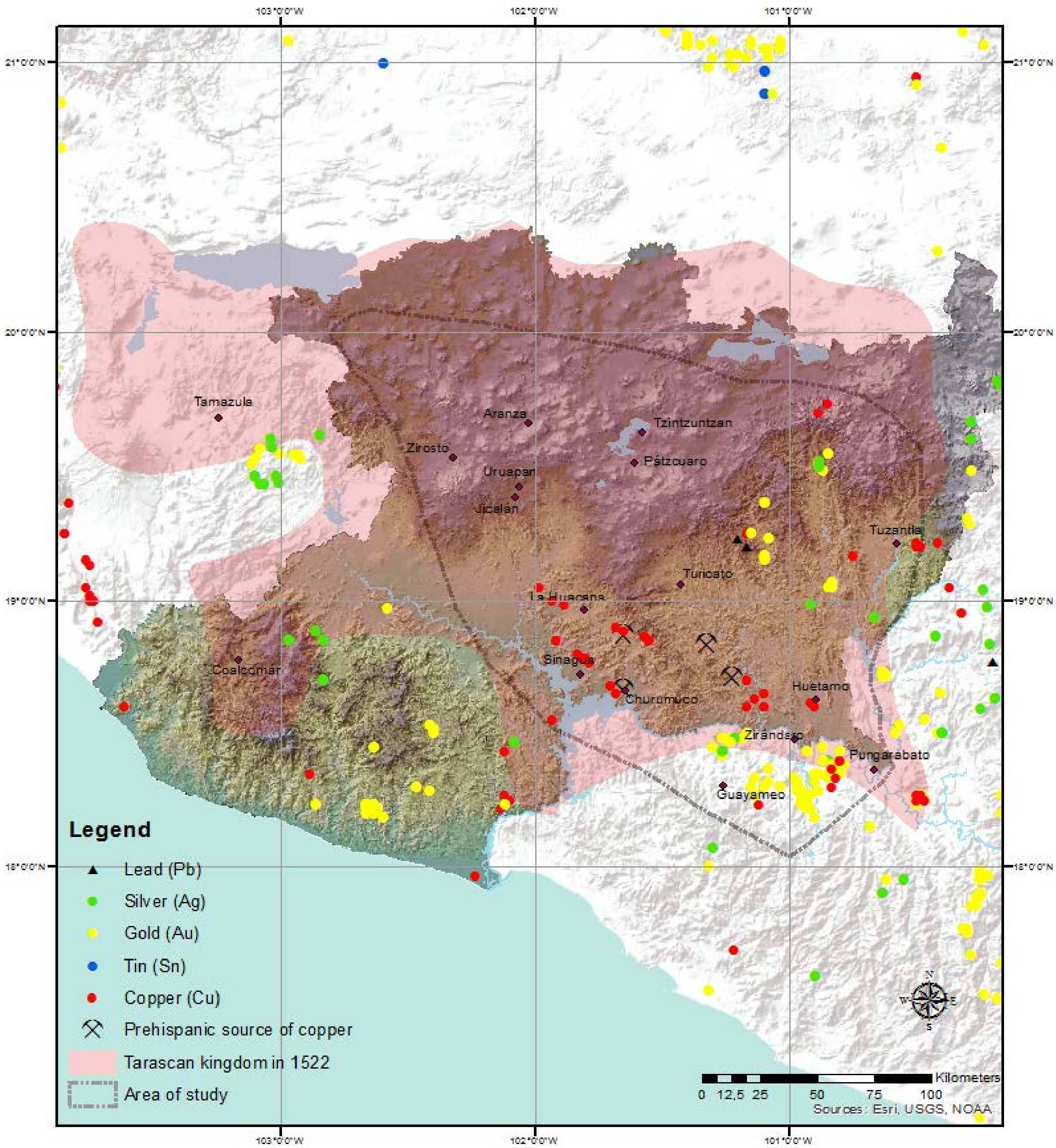
With regard to Tarascan metallurgical technology, we know that they exploited almost the whole range of available copper ores: native copper, carbonates, oxides, and sulphides. With a certain type of geology, arsenic is often found in concentrations associated with some copper ores. Tin, on the other hand, is a recurring issue in pre-Hispanic metallurgy. It was extensively used but it is not well represented in the geology of Mexico, and furthermore is almost completely absent in the region. This implies a possible foreign origin and acquisition through trade and exchange networks. The closest reference is the early colonial mention of its exploitation in the area of Taxco[371], south of Mexico City, although there are considerable deposits to the north of the Tarascan area.

From the early colonial sources we know that gold was collected from placers[372]located in the southern part of the kingdom, especially along the Balsas Depression, and that most of it arrived in Tzintzuntzan through the tribute system. The case of silver and silver objects might be similar. There are a few important deposits in the regions of Tamazula and Coalcoman, both located in the far west of the kingdom. According to the RM they were controlled by the Tarascans[373], and were heavily exploited by the Spanish during the first half of the 16th century. The area occupied by the kingdom also has some occurrence of lead, which was not a very important metal among the Tarascans. Map 10 shows the geological distribution of important ores in the Tarascan territory and neighbouring regions. It is important to mention that although the map is based on modern mining areas and therefore is influenced by economic factors involved in modern exploitation, it shows the mineralization areas of specific ores.

Tarascan metallurgy suffered the same kind of problems as the rest of Mesoamerica, and it is still poorly understood. The work of Hosler, summarized in the previous chapter, shed some light on the way that objects were produced in the west Mexican area. This includes several examples of objects recovered from Tarascan settlements. Through chemical analysis and identification of trace elements we can get an idea about the ores used to extract the metal from, and this data can be supported with different ethnohistorical sources as well. However, as was mentioned in the preceding chapter, there is a major gap in the knowledge concerning the mining and extraction stages, and the context of production in pre-Hispanic and early colonial metallurgy[374].

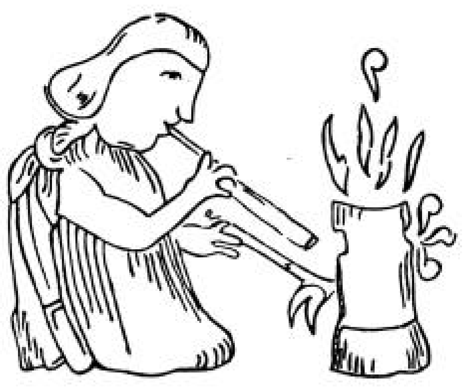
371 Hosler 2005
372 Placers are stream bed (alluvial) mineral deposits.
373 Pollard 1987:749
374 Maldonado 2006:99

Different historical sources of the early colonial period partially describe the process used by the indigenous metallurgists to "smelt" metallic ores. Most of them describe (usually graphically) metalworkers using blowpipes to insufflate air into a type of brazier, to intensify the temperature of the charcoal inside (Figure 6-8).



Map 10. Distribution of metallic ore deposits in the Tarascan and neighbouring areas[375]

[375] Produced with vector and raster data produced by SGM, mining chart scale 1:1000000



Figures 6 and 7. Pictorial representation of metalworkers, the first one on the left is a detail from the Mapa Tlotzin, an early 16th century source (reproduced from Gringberg 2004:Figure 2). The one on the right is an image from the Codex Mendoza.[376]

Figure 8. Metalworker from the Florentine codex[377]

[376]Bodleian library, Oxford University. MS.Arch.Selden.A.1, fol. 70r. In this case we know that although the figure says "platero" (a common name to refer to a gold or silversmith) the metallurgist was working with gold, given the presence of the glyph over the crucible which represents the Aztec term for gold: coztic teocuitlatl (literally, yellow divine excrement).
[377] Medicea Laurenziana library, Florentine codex, vol.3, Libro XI, f.215

Blowpipes were one of the most widespread techniques for increasing the temperature of furnaces and other pyrotechnological structures in the Americas, and several early colonial sources documented their extended use around the continent. Although no material evidence has been found in Mesoamerica, fragments of tuyeres[378]have been recovered in South American sites (Figure 9). Some South American colonial sources make a few mentions about the blowpipes. Inca Garcilaso de la Vega even mentions them as being made of copper. In his *Primera Parte de los Comentarios Reales* (1609) he wrote that:

"They smelted with the power of blowing using some cañutos of copper as long as more or less one half of a braza (1 braza=1.6m) *whether it was a big or a small smelting. The cañutos at the rear end had a small hole through which the air would come out more intense and stronger. Eight, ten and twelve* [Indians] *would gather for the smelting and they would walk around the fire blowing with the cañutos, and even today they do it because they do not want to change"*[379]

The sources from our study region refer to these tools as *canutos* or *cañutos* (literally meaning small tube) without specifying their composition; however, these two words imply the idea of a cane plant. Caña or *canna* (latin) is an indigenous plant from southern Europe that belongs to the gramineae family, furthermore the word refers especially to the stalk of the plant, which is usually long, woody and hollow[380]. So, it is possible that the blowpipes were made from an organic material similar to the European cañas.

[378] The tuyere is the distal portion of the blowpipe (nozzle); this is the tip of the tool that has contact with the furnace or brazier and it was usually made of clay

[379] Inca Garcilaso de la Vega: Primera parte de los comentarios reales, Madrid, 1829. Pp.179. (translated by the author)

[380] "Caña" entry in the online dictionary of the RAE (Real Academia Española) www.dle.rae.es

Figure 9. Fragments of tuyeres recovered from the Peruvian site of Cerro de los Cementerios, near the area of Batán Grande (Reproduced from Shimada et al. 1982:Fig. 5)

Figure 10. Moche pottery showing a group of metalworkers using blowpipes (reproduced from Donnan 1998, Figure 1)

Figure 10 shows a beautiful ceramic piece held in the Museo Nacional de Antropología, Arqueología e Historia del Perú. The vessel belongs to the Moche culture of the Northern Coast of Peru and dates to around 500AD. It is one of the very few iconographic representations of the metallurgical process in South America, and shows a group of metallurgists around a furnace using their blowpipes[381].

For our region of study, two pictorial representations of metalworking have been found and they perfectly match the features of the latter examples. The first one is from the RM and it is a representation of the officers who served the Tarascan king and their occupations. In one portion of the image a group of metalworkers can be identified, sitting in front of a brazier, using a blowpipe and producing golden items. Above the figure, one can read "plateros" (silversmiths) as their stated occupation (Figure 8). The second one is found in the codex of Jicalán. In the frame that represents the altépetl (town) of Xiuhquilan (Jicalán el viejo) one can see a pair of metalworkers using blowpipes over what appears to be a brazier, they are producing metal tools which look like coas and axes (Figure 12).

[381] Donnan 1998:9-18

Figure 11. Image from the Relación de Michoacán (*ca.* 1540), tercera parte, foja 5v (Alcalá 2013:174)

Figure 12. Detail of the Codex of Jicalán (*ca* 1565), showing in the lower middle section a pair of metalworkers producing copper tools (detail in Maldonado 2008:Figure 6)

These representations seem to have something in common; they all appear to be depicting the processes of melting metal and metalworking. In contrast with the smelting process, where the ores have to undergo a complex series of chemical reactions under reducing conditions in order to free the metal, melting is just the transition of a substance from solid to liquid. In metallurgy this process can be applied to very pure ores such as native gold, native silver or native copper. It can also be applied to already smelted ores that were previously turned into ingots or manufactured metal objects, and is also commonly used to produce alloyed objects.

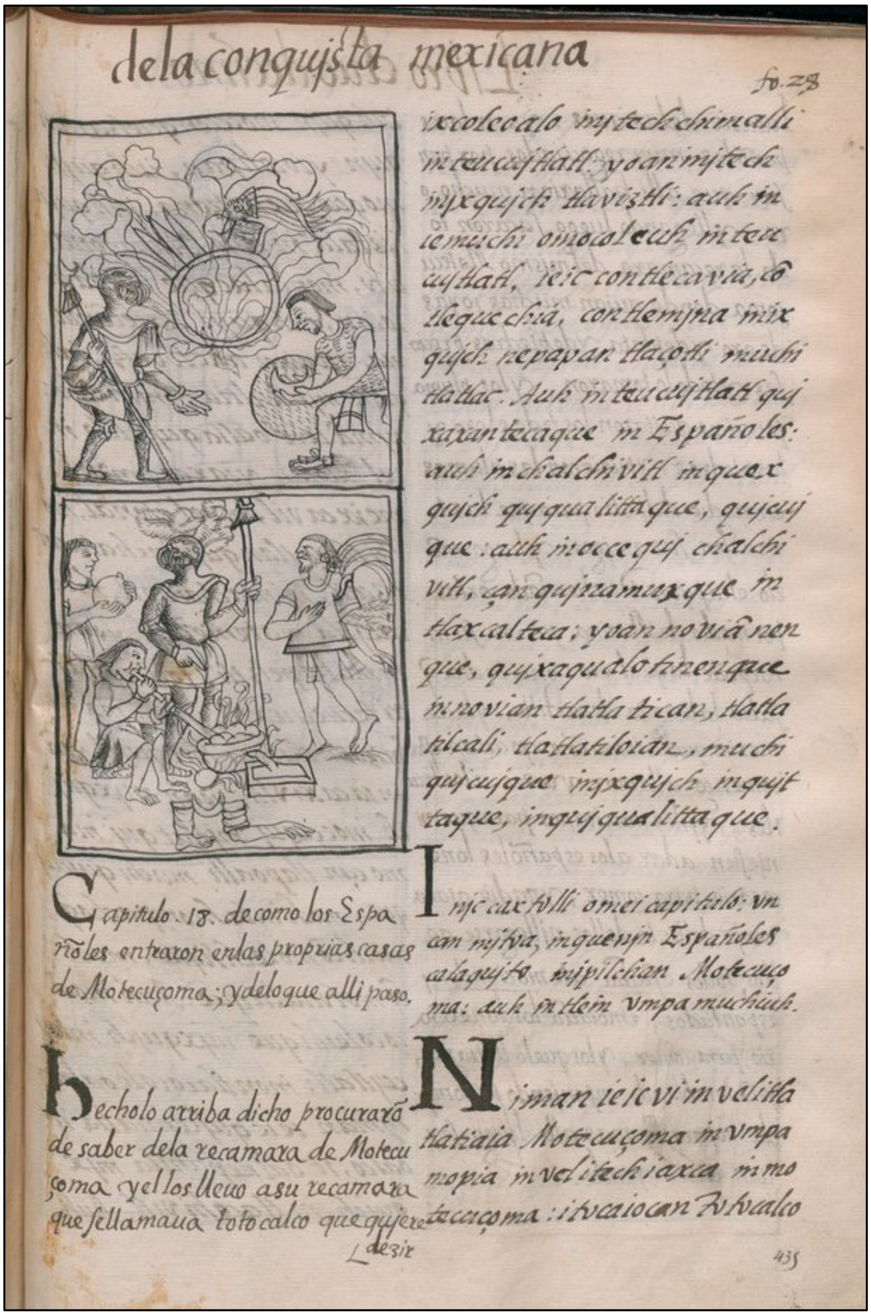
In a description from the Florentine codex for instance, after raging into the palace and demanding Moctezuma hand over his treasures, Sahagún narrates about the Spaniards:

"…and he took them to a hall named teocalco where he held all the rich plumages and other jewellery, lots of them in feathers and gold and precious stones, and after collecting them the Spanish started to rip off the gold from the plumages and the rounded shields and the ceremonial items (atavios del areyto) that were in the hall, and by ripping off the gold the Spanish destroyed all the plumages and fine jewellery, and the gold was melted to bars"[382]

The text is accompanied by the image of a native metalworker melting the looted objects using a similar type of brazier represented in most of the previously mentioned sources (Figure 4[383]).

In the case of copper extraction, however, there is a possibility that these representations are only partially showing the process of production. Given the complexity of copper ores that we know were used, the processes for their extraction were more elaborate and demanded specific infrastructure and greater amounts of effort and time. Besides the reduction conducted in the smelting operation, these processes certainly involved previous stages for roasting the ore (in the case of sulfidic ores for instance), and normally, subsequent stages of metal refining. It is very unlikely that these activities were conducted using only the type of brazier or crucible that is represented in the sources.

[382] Florentine codex, Vol. 3, Libro XII, f.27v (translated by the author)
[383] Ibid. f28


dela conquista mexicana

fo. 28

Capitulo. 18. de como los Españoles entraron en las propias casas de Motecuçoma; y de lo que alli paso.

hecholo arriba dicho procuraro de saber dela recamara de Motecuçoma y el los lleuo a su recamara que se llamaua totocalco que quiere dezir

435

Figure 13. Page from the Florentine codex showing the melting of objects from the treasure of Moctezuma using indigenous metalworkers.

One of the very few and clear examples for metalworking in Mesoamerica was found in the archaeological site of Mayapán on the Maya lowland region of the Yucatán peninsula. The findings at Mayapán include evidence for the production of copper objects by casting, especially bells. The archaeologists recovered evidence of crucibles and other similar recipients used for melting the copper; however, they could not find any structure that could be categorized as a furnace for smelting operations. An interesting issue is that the metal the smiths were melting was basically recycled metal from failed castings, broken objects, and casting sprouts[384] – a set of operations one would expect from a site that had no direct access to copper ores.

In this regard, new archaeological and laboratory data from the late pre-Hispanic/early colonial Tarascan site of Itziparátzico can, along with the early colonial historical data, shed some light on the topic of the technological characteristics of copper smelting during this period. The site is located in the vicinity of Zirahuén Lake (maps 11 and 12), at the core of our region of study, and so far it is the only copper smelting site excavated in the Tarascan territory[385].

Blanca Maldonado surveyed, excavated, and conducted metallographic and chemical analysis on the materials recovered from the site. Maldonado primarily analysed metallurgical slags, a glassy like by-product of smelting operations (Figure 14). The results of her research are extremely important because they represent one of the very few scientific analyses conducted on this type of material remains, not only in our region of study but in the whole of Mesoamerica.

Maldonado's results have unambiguously proven that the people from Itziparátzico were smelting copper and that they were using sulfidic ores, more specifically, chalcopyrite. During her research, she identified two different types of slags, which were called "lumpy" and "platy" (Figure 14) and that according to her:

"The two slag types may thus represent sequential waste products of the same continuous smelting process, possibly relating to consecutive tapping events. […] *The regular and large-scale presence of tap slag is important here, since it is typically associated with a smelting process carried out in a furnace rather than in a crucible"*[386].

[384] For more information regarding the Mayapán metalwork and associated objects, see Paris 2008:43-66
[385] Maldonado 2006; Maldonado and Rehren 2009.
[386] Maldonado and Rehren 2009:2002

Figure 14. Types of copper smelting slags identified by Maldonado: a) Lumpy, and b) Platy (Reproduced from Maldonado et al. 2005: Figure 1)

While analysing the slag samples she found the ubiquitous presence of fayalite with some occurrence of metallic copper prills. She states that this indicates a high smelting temperature of about 1100°C and a process conducted under strong reducing conditions.

"A reducing atmosphere under such high temperature is normally inconsistent with mouth-blown smelting operations. While the maximum attainable furnace temperature with blowpipes was sufficient to smelt copper, the combination of temperature and reducing atmosphere necessary for fayalite formation are unlikely to occur using this system."[387]

This is a remarkable finding, because it not only affirms the evidence that suggests native smelters used furnaces rather than crucibles to smelt the copper ore, but also because it challenges the idea that these metalworkers used only blowpipes to smelt the ore. Now the issue resides in the chronological period we are dealing with. If the slags that Maldonado found were produced in the late pre-Hispanic period we may be witnessing a previously unknown smelting technique based on natural occurring draft to feed the furnace with air, a feature that is well-known in South American pre-Hispanic metallurgy but never considered to have existed in Mesoamerica. If the slags were produced in the early colonial period we may be seeing an early adaptation of Spanish bellows into the repertoire of native metalworkers[388].

The exact moment in which bellows were incorporated into metallurgical practice by indigenous producers is still uncertain. There is documental evidence that in the last decade of

[387] Maldonado 2006:156
[388] Ibid. Pp.159

the 16th century bellows were already in use for copper production in the region. The famous hearings conducted by Vasco de Quiroga with regard to the copper mines of Michoacán of 1533 do not give any mention of the use of bellows; on the contrary, it highlights the use of blowpipes by the native smelters and the need for introducing bellows and iron tools to boost the production[389]. On the other hand, the friar Toribio de Benavente "Motolinía" in his History of the Indians of New Spain written between 1536 and 1541 dedicated a chapter to *"the mechanical arts that the natives have learnt from the Spanish and those they already knew"*[390]. In this chapter Motolinia mentions that:

"They have learnt to tan hides, to make blacksmith's bellows, and are good shoemakers, they make shoes, servillas (light shoe)*, borceguíes* (boots)*, and slippers, and women's clogs and everything else that is made in Spain; this type of work started in Michoacán because there the good deer hides are tanned"*[391].

If, as Motolinía says, the people in Michoacán were making bellows, it is not improbable to reason that it was an early adaptation to their metallurgy, especially considering that since the 1530's they had been working closely with the foundry and the mint house of Mexico City, as I will discuss in the next chapter.

Unfortunately, the dates for Itziparátzico are yet to be defined and refined. According to Maldonado the archaeological context and the associated materials recovered with the slags suggest a late pre-Hispanic period, and no colonial material has been recovered in the stratigraphic layers under study[392]. However, recent archaeomagnetic dating conducted on slags from seven smelting sites in the region, including Itziparátzico, produced an interesting chronological range.

The dating conducted on these slags shows two chronological ranges, first of 1395-1575AD and second of 1591-1691AD[393]. Although in principle any date within that range is equally probable, the suggested ranges are informative because they provide an important glimpse into the metallurgical technology in relation to time. Furthermore, the dates show that Itziparátzico was active during the transition between the late pre-Hispanic and the early

[389] Warren 1968
[390] De Benavente 1914 (1536-1541) pp.216 (Translated by the author)
[391] Ibid., pp.217 (Translated by the author)
[392] Maldonado 2006:159
[393] Punzo et al 2015:50

colonial periods. Maldonado equally analysed copper slags from the Jicalán el Viejo[394] site, obtaining very similar results with regard to the technology including the use of sulfidic ores, very efficient furnaces and high temperatures[395]. Jicalán, as I will repeatedly mention in the next chapters, was one of the main producers of copper in 16th century Michoacán.

Maldonado's research then, suggests that in the Tarascan site of Itziparátzico indigenous metallurgists were primarily smelting sulfidic copper ores with an efficient technology based on the use of furnaces. Although the furnaces were not found in the site, the analysis of metallurgical slags show they reached high temperatures under strong reducing conditions to the point that the process allowed the formation of specific mineral phases in the slag, such as fayalite. According to Maldonado, the ubiquitous presence of fayalite in combination with the temperature and the reducing atmosphere indicates the use of additional, more efficient sources of air other than mouth-blown blowpipes. Considering that the chronology has yet to be refined, she suggests that if the period happens to be pre-Hispanic then the most plausible explanation is the use of a natural occurring draft.

However, if the period happens to be early colonial then we could be witnessing a very early adaptation of bellows to the indigenous metallurgical process. The absence of metalworking evidence in the site implies that the site was mainly used for smelting operations and the product of these (ingots) was taken somewhere else for further transformation. If the period is pre-Hispanic this goes along with the way that the Tarascan tribute system worked, in which metal was channelled towards metalworking sites located inside important towns[396]. If, on the other hand, we are witnessing an early colonial production, it is also in accord with the way Spanish authorities organized their own tribute system based of the existing pre-Hispanic one. We do know, through the Spanish tax records that at least between 1533[397] and 1550[398] different towns of Michoacán were giving copper bars as part of their tribute to the colonial authorities.

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[394] This town is regularly mentioned in the colonial sources as an important copper production center in the region, and its inhabitants were the ones who produced one of the most important sources for the topic and time, the Lienzo de Jicalán, which will be discussed in the following chapter.
[395] Maldonado 2006:189
[396] Pollard 1987; Maldonado 2006
[397] Warren 1968
[398] Suma de Visitas de Pueblos de Nueva España 1548-1550 (Xicalán pp.182 and Vacana [La Huacana] pp.401)

A second team working on indigenous metalwork and led by Dr. Dorothy Hosler excavated a different smelting site in the southernmost part of our area of study; their results are very similar to those of Maldonado's, both in terms of chronology and technology, although the site did not appear to have any cultural link with the Tarascan people[399]. The site of *La Barranca de las Fundiciones* is located over the mountains of the Southern Sierra Madre, directly south of the Tepalcatepec-Balsas depression at around 1400m above sea level. The site is dominated by large accumulations of metallurgical slag and the remains of what appears to have been smelting furnaces[400].

The results from the analysis of the slags indicate several similarities with those studied by Maldonado. Hosler's team recognized two major types that they called "coarse" and "smooth"[401] (Figure 15) with the same macroscopic characteristics as the lumpy and platy Maldonado described. However, the metallurgists at the site were smelting copper oxides and carbonates such as cuprite and malachite.

According to Hosler:

"The ore originated from a weathered complex copper sulfide–iron sulfide deposit. The ore contains copper and iron oxides and, as a result, was self-fluxing. Sharp concludes that the furnaces did not have to operate at temperatures higher than 1150°C to smelt effectively. Most of the copper was consolidated within the furnace; only about 2% of the copper was retained in the slag in the form of prills […]. We are not sure how metalworkers achieved these temperatures, but Sharp speculates that the furnaces may have operated through a natural draft mechanism."[402]

Rachel Sharp studied the slags from Barranca de las Fundiciones and also mentions the strong presence of fayalite in the slags, indicating a highly efficient smelting operation with high temperatures under reducing conditions, and similar to Maldonado suggesting the use of some sort of natural draft mechanism as yet unknown.

399 Hosler 2009
400 Ibid. pp.202-203
401 Sharp 2003:76
402 Hosler 2009:203

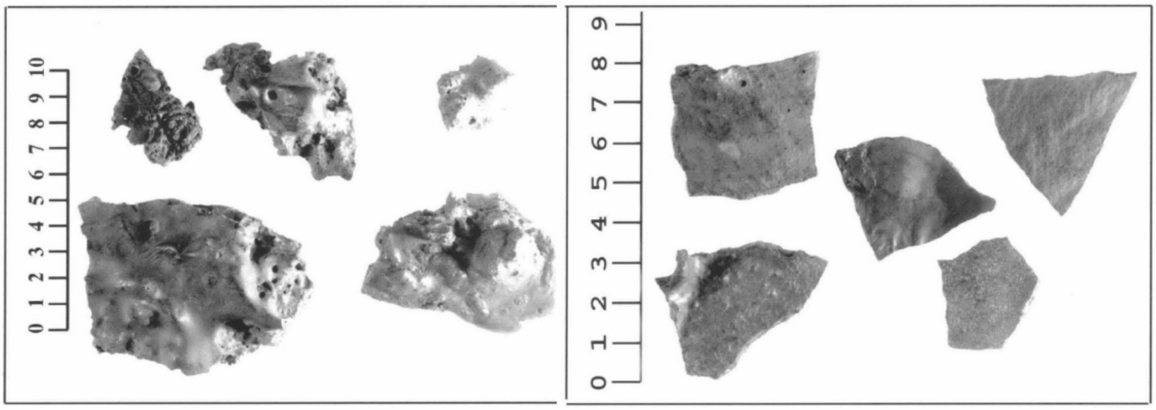


Figure 15. Types of copper slags identified by Sharp as “coarse” (left) and “smooth” (right) (Reproduced from Sharp 2003, Figures 18 and 19)

Hosler reports several calibrated radiocarbon dates for the site ranging from 1350 to 1650 AD[403] in the habitation areas, and 1250 to 1850 AD in the smelting area. Although the ranges of the dates are very broad and that the possibility of contaminated samples exists[404] the dates largely show a pattern if taken in comparison with all the other smelting sites dated in the region.

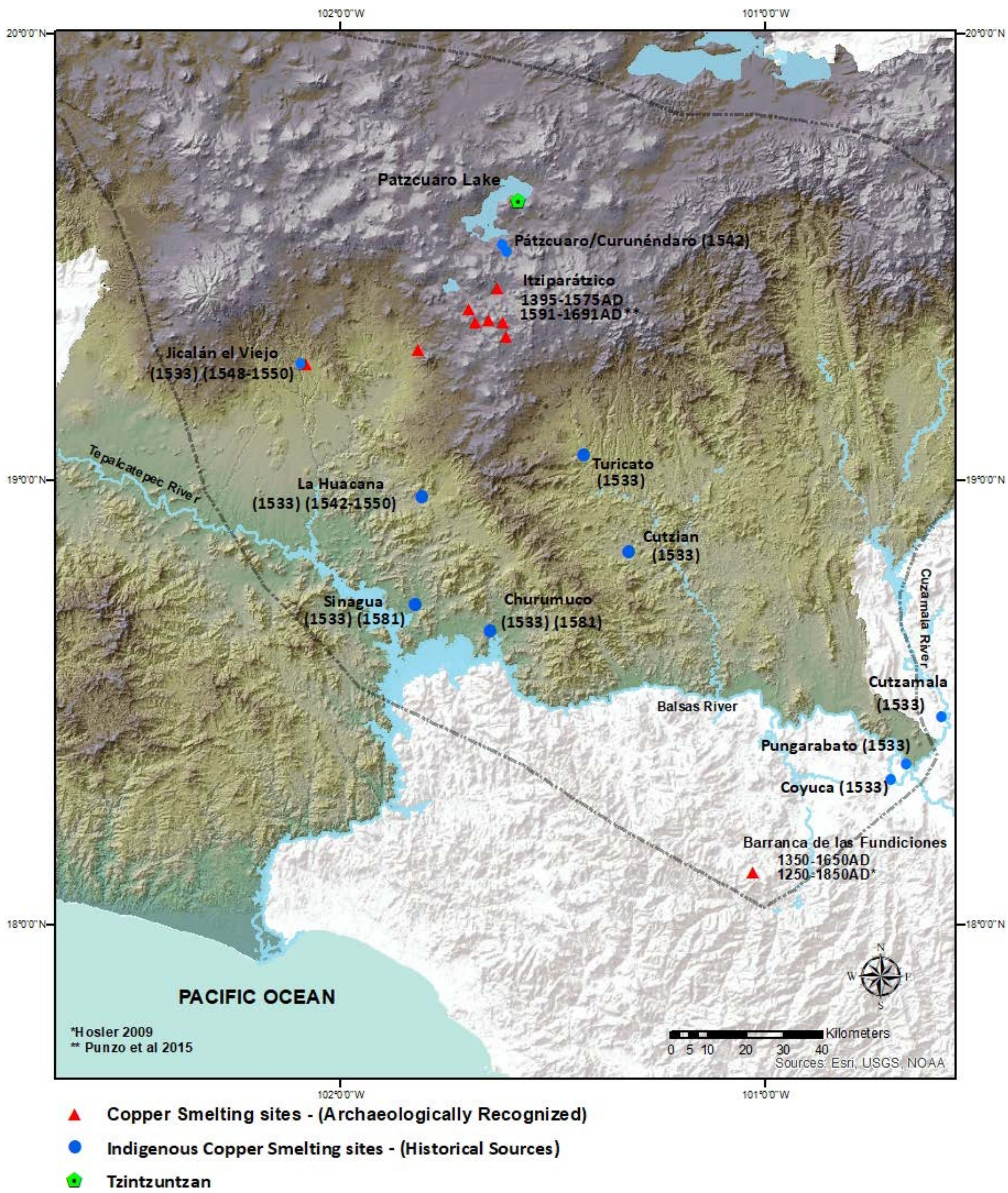
With regard to these chronological frames, the archaeomagnetic dating made by Punzo and his team also included six other archaeological sites located in the vicinity of Zirahuén Lake. Metallurgical slags from all seven sites were dated with this technique and the results show an apparent pattern in which most of the sites were probably active in the pre-Hispanic period and continued to be in operation well into the colonial period[405](Maps 11 and 12). This continuity should be a surprise; especially if we consider the question of why these communities of specialized metallurgists would stop producing copper and metal objects. In particular, we might reflect that it was a way to negotiate economically and politically with the colonial authorities, as we will see in the next chapter.

All the sites mentioned in the 16th century sources as places where copper was produced before the policy of congregations, clearly indicate the pre-Hispanic origins of the activity.

[403] Hosler 2009:203-204

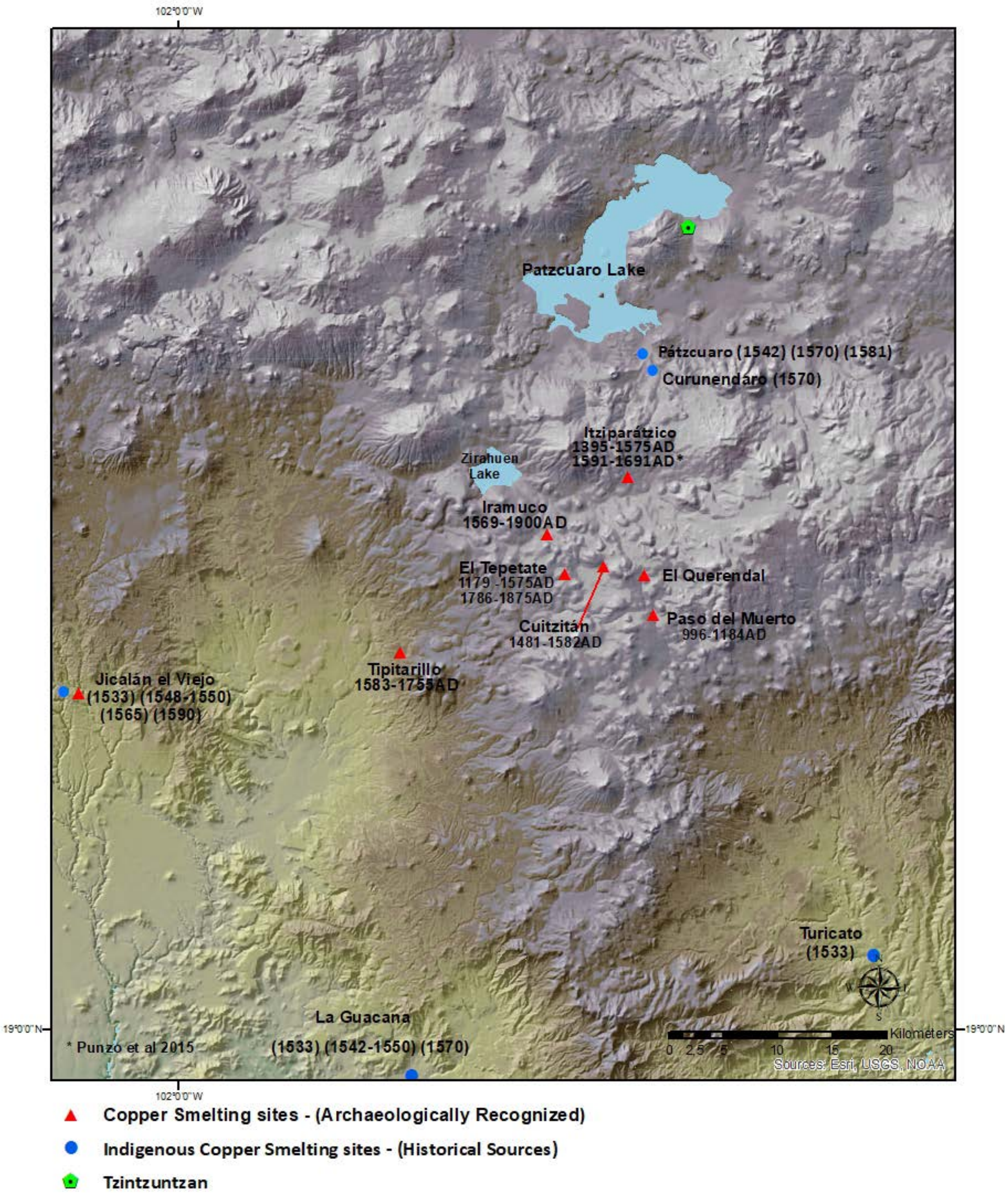
[404] Ibid.

[405] Punzo et al. 2015:46-51



Map 11. Distribution of places where indigenous smelting activities were conducted before 1550AD[406]

[406] The chronological data for Itziparátzico was taken from Punzo et al. 2015 and for La Barranca de las Fundiciones from Hosler 2009:204. The dates for the other places were taken from the early 16th century historical documents: Minas de Cobre de Michoacan 1533 (Warren 1968); Suma de Visitas de los Pueblos de Nueva España 1548-1550 (2013); and for Jicalán el Viejo (Roskamp 1998, 2013).



Map 12. Enlarged view of the places concentrated around the Zirahuén Lake and their associated chronology[407]

[407] The chronology for the archaeological recognized sites was taken from Punzo et al. 2015. The dates for Jicalán el Viejo were taken from Minas de Cobre de Michoacán 1533 (Warren 1968); Suma de Visitas de los Pueblos de la Nueva España 1548-1550 (2013:182); and Roskamp (1998, 2013).

Vital information on these matters is found in a very early and important source for our region and topic, and was produced just a few years after the arrival of the Spaniards in Michoacán. The document renamed and published by Benedict Warren as "Minas de cobre de Michoacán 1533[408]" sheds some light on different aspects of the process and broadens the perspective of late pre-Hispanic and early 16th century copper production. The manuscript contains a series of hearings conducted by the priest Vasco de Quiroga with the aim of producing a report to the king regarding the copper deposits of Michoacán, and the level and technology of production. In the next chapter I will address the document in more detail profoundly, but for the sake of this argument, a few relevant things have to be mentioned.

In the hearings Quiroga presented a group of six Spaniards and four natives as the main informants for the report. The Spaniards were either encomenderos or people who had witnessed the production of copper conducted by the natives, and among the native group there was a cacique and three smelters. They generally all agreed on certain issues, for instance the places were the mines were located, the overall difficult terrain of the mines, and the complexity and hard work involved in the processing. The Spanish who had witnessed the process (only two of them) mentioned that the natives did not have bellows, that the smelting was conducted using blowpipes (*cañutos*), and that the process had to be repeated several times (three or four) in order to get a fine metal ingot. They mention that the ingots had the shape of a brick (adobe) and were as long as a "xeme[409]", wide as the hand and thick as two fingers[410]. Unfortunately, none of them, neither the Spanish nor the natives mentioned the type of structure used for smelting; however they did mention the places where the smelting was conducted.

The native informants on the other hand mentioned two important details: a) The production in the time of the Cazonci (the Tarascan king) was much higher and b) they worked the copper only when the Cazonci demanded it, the rest of the time they work on their crops[411]. This is interesting because it shows that these people were farmers and metallurgists at the same time, a condition that would disappear with the application of colonial production policies that demanded full time specialists. Moreover, in the hearings the native informants give the tacit

[408] Warren 1968:35-52; the original is held in the AGI under the signature Ramo indiferente general, Legajo 1204
[409] The xeme was a medieval and early modern Spanish measurement unit that is defined as the distance between the tip of the thumb and the tip of the index finger (Quintanilla Raso, 1991:45).
[410] Warren 1968:44-48
[411] Ibid.

impression that all of them were equally miners and smelters, and in fact they all stated that smelting was conducted (in addition to the towns located up on the Tarascan plateau) in some towns located in the vicinity of the mines such as La Guacana, Sinagua, Turicato and Cutzian[412]. This was another condition that would change over the subsequent century when towns and productive units were divided into mining and smelting towns.

Through the historical sources of the colonial period we do know that the native copper metalworkers of Michoacán eventually incorporated the Spanish bellows technology, however with the available data it is still difficult to identify the exact moment in which this event took place. From the report of Vasco de Quiroga we know that it happened after 1533, because no bellows are mentioned in the hearings by any of the witnesses. The first document that mentions the use of bellows for smelting copper is dated to 1587 but, as will be explored in the next chapter, we think that the introduction of bellows was a fundamental part of the technical adaptation by native communities of copper producers to the colonial dynamics of production.

Nonetheless the question of the furnaces used for smelting operations remains. Later colonial sources mention in a markedly condescending tone that the natives smelted the copper ore in simple holes excavated in the ground[413]. To date, no material evidence has been found in the region regarding these structures nor any structure supposed to have been used for this purpose. The closest material reference that we can use is the findings of metallurgical activity areas in the Central Andes of South America, especially the excavations by Izumi Shimada on the northern coast of Peru, belonging to the Sicán culture.

In the last three decades Shimada has excavated and studied material remains of metallurgical activity areas located in northern Peru, dating to a period between 600 and 1532AD. In these sites Shimada has identified almost the complete *chaîne opératoire* (operational sequence) of Sicán metallurgy[414] including mining sites, smelting areas and object manufacture workshops. Shimada's results are outstanding, and his research shows, among other important things, how the metalworkers from these sites used different furnaces to conduct different stages of metal production[415]. Shimada and his team identified a small pear-shape type of furnace used almost exclusively for copper and arsenic smelting.

412 Ibid.
413 AGN,Minería,Vol. 132,Exp.1,foja 28-28v
414 Shimada et al 1982; 2007
415 Ibid.

Shimada excavated 24 of these furnaces (Figure 16) and describe them as having a morphological unity despite their chronological range of between 1200 AD and 1532 AD. Seen from above they are pear-shaped, in that the narrow end forms a primitive chimney and lies deeper than the wide end. According to Shimada the relatively small size and particular shape *"appear to have been based on the constraints of lung-powered draft, the necessity for a reducing atmosphere for smelting, efficient ventilation (including perhaps amplification of wind draft), and heat retention. The physical strain of an individual's having to blow air continuously and forcefully without the benefit of bellows underlies the difficulties associated with attaining and sustaining sufficiently high temperatures for efficient smelting (typically 1100°C to 1200°C)"*[416].

It is possible to see how these small furnaces met certain characteristics that are repeatedly mentioned throughout the available sources on the colonial period. Even for our region of study, the sources mention that these furnaces were small, economical, simple to build and to use, and above all efficient. This type of furnace appears to have been the norm for the copper smelting operations in some parts of the Spanish American territories during the colonial period. In 1640, the friar Alvaro Alonso Barba wrote his celebrated *Arte de los Metales,* arguably the most important Spanish treatise on mining and metallurgy written during the American colonial period. In it Barba mentions a type of furnace called *"de braguetilla"* which according to him is very good to smelt small quantities of metals and which he used regularly with copper. Barba describes it as a "small hole in the ground of about one *cuarta* (one quarter of a "vara"; vara = 84cm) or one *tercia* (one third) in diameter and proportional in depth" whose interior is prepared with a tight *mazacote*[417] and a pair of bellows are added to produce very high temperatures[418].

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[416] Shimada et al. 1982:217

[417] Mazacote is the mix of ground charcoal and clay or dirt which is used to prepared the bottom and inner surface of some furnaces (Barba:1817, libro 4, capítulo 1, pp.155)

[418] Barba, 1817:168-169

Figure 16. Image of the pear-shaped furnaces found by Shimada and his team at Huaca del Pueblo, Batán Grande and dated to the Middle Sicán period (AD 900-1100) (Reproduced from Shimada et al. 2013:Figure 11)

In addition to the pear-shaped furnace, Shimada and his team identified a different type of furnace on the *Huaca Sialupe* site, in which they conclude the melting, refining, alloying and annealing of metals and metal objects took place. They called these “inverted porrón furnaces” and are described as made out of inverted ceramic urns and cylindrical bodies with typical dimensions of 45-55 cm in diameter and 50-60 cm in height (Figure 18). The most important characteristic of these structures is that at the floor level they had an opening that was used to capture and funnel the natural draft[419], according to Shimada.

[419] Shimada et al. 2007:347

Figure 17. Image of a replicated smelting experiment using a well-preserved furnace found in the Cerro Huaringa site and dated to the Chimú period (AD 1375-1460/70) (Reproduced from Shimada 2013:Figure 15)

Although representing a different period and cultural context, the findings of Shimada provide an interesting perspective on how the metallurgical production was conducted in pre-Hispanic Peru and until a certain point can give us some ideas about how it might have been conducted in our region of study at the moment of the encounter with the Spaniards. The idea of introducing this data was with the intention of highlighting the fact that we still do not fully understand the metallurgical processes of either period (pre-Hispanic and colonial). The archaeological data is scarce, and the historical sources sometimes do not include fundamental details, but the laboratory analysis of smelting by-products such as slags suggests the type of structures that were necessary for successfully smelting the ores.

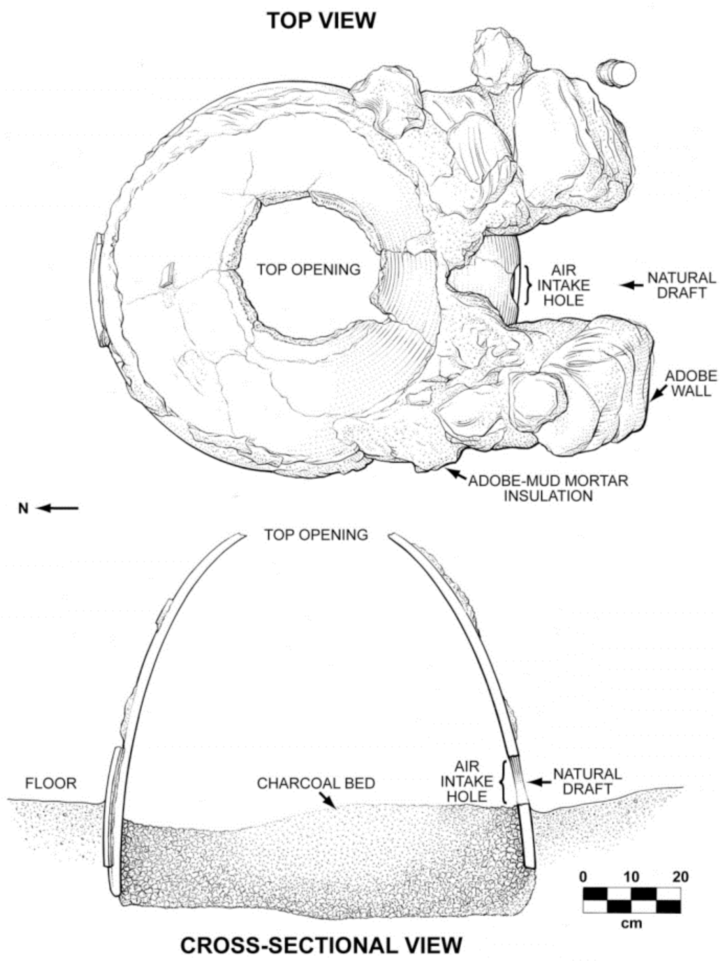

Figure 18. Drawing of an "inverted porrón furnace" (Reproduced from Shimada 2007:Figure 12)

From the combination of historical, archaeological, and material science data we know that pre-Hispanic and early colonial metallurgists and metalworkers could have used two different types of structures to smelt and melt ores and metals. One can be considered a proper furnace used for smelting and the other one, which is well represented iconographically throughout the sources, was used for melting and metalworking. We know that the copper smelting process was highly efficient, as it left very low quantities of trapped metal in the slag and characteristically used high temperatures above 1100°C and strong reducing conditions. For the researchers these particularities suggest the possibility of using natural draft if the period under study is pre-Hispanic or a very early adaptation of bellows if the period happens to be colonial.

In the next chapter we will continue this discussion and will include these data sets in the core of ethnohistorical and historical data, to see if and how they can be correlated with the series of events in the political and economic arenas as described by the written sources along a chronologically ordered sequence.

CHAPTER 5

WORLDS COLLIDING (1521-1550)

5.1 On the Importance of Copper in the Colonial Period

Copper was a fundamental metal at several levels during the colonial period, and was especially important in establishing and expanding other colonial industries. In the sugar industry for instance, it was used in the manufacture of a variety of products required by the many large and small mills that quickly appeared in New Spain and other parts of the Americas. Among the items required by the sugar industry were vats of various sizes used in reducing the cane juice, as well as grinding cylinder casings, and gear parts for the crushing mills[420].

In the silver industry copper was in great demand for making tools and utensils, and after the discovery of the patio process, as a reagent in its non-metallic form. Barrett mentions that:

"*The separation of silver from mercury was achieved by heating the amalgam under a bellshaped hood (capellina) made of beaten copper or bronze. A variation of the amalgamation process involved prior heating of the ingredients either in copper cauldrons or on revolving copper discs set up in the furnace, but this practice was not widespread in New Spain. In cases where silver was smelted rather than amalgamated, the receptacles were made of copper. Air was introduced into the furnace by means of bellows whose nozzle (cañón) was placed in a funnel (alcribís). These nozzles and funnels were made of copper or bronze, as were a variety of other utensils needed to process silver ore.*[421]"

In its non-metallic form, copper was a key element in the patio process for its use as magistrales. The magistrales were basically copper pyrites (copper sulphide) or a mix of these with iron pyrites. These were added to the charge during the silver amalgamation process to facilitate the silver to combine with mercury. After its introduction in the second half of the

[420] Ibid.
[421] Barrett 1981:75

16th century It became an essential element of the process, and was used almost everywhere regardless of the silver ore"[422]

Along with the need for everyday utilitarian, domestic, artistic, and industrial items and reagents, the greatest demand for copper throughout the colonial period was for the manufacturing of artillery and coinage. In New Spain those demands began soon after the conquest of Tenochtitlan, as can be seen in the famous pieces of artillery made by Cortés in 1521 with copper and tin bought from the natives of Taxco[423]. Although it was not until 1601 that New Spain had a proper royal artillery factory[424] (established in Acapulco, on the Pacific Coast), we know that copper was flowing towards the foundry houses established in Mexico City in the early 1530s. Those foundries were charged with manufacturing and repairing artillery and bells, in the same way that the foundries of the peninsula did at the time.

Nonetheless the bulk of copper for artillery purposes was demanded by the royal artillery factories in Spain, and shipments of metal reached the peninsula in the second half of the 16th century and continued until the end of the colonial period. Barrett mentions that in 1748 the crown's demand for copper from New Spain was of 3000qq (1qq=112 pounds) each year to be shipped to the factories of Seville and Barcelona; in 1792 that demand had increased to 7500qq[425]. Copper was never a very profitable metal, but its strategic importance for the kingdom even caused the crown to order that it had to be transported as ballast in the naos. Although most of copper exported by New Spain was shipped to the peninsula, it was also exported on a semi-regular basis to other artillery factories in the empire including Havana and Manila[426].

Copper was also used extensively for coinage. The royal mint of Mexico was established in 1535 and rapidly became a regular destination for the metal from Michoacán. Although large amounts of low denomination copper coins (4 and 2 maravedís) were made between 1542 and 1546[427], it was also necessary to add small quantities of copper to the silver coins to standardize their fineness and value. When the mint started to produce gold coins in the 18th century copper was used as well, as the main alloy metal. Although the quantities were

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[422] Bakewell 1972:143
[423] This data will be discussed further on this chapter.
[424] Gallegos Ruiz 2016:39-59
[425] Barrett 1987:43-44
[426] Barrett 1987:2
[427] Castro Gutierrez 2012:38-43

small[428] and during the first two centuries only silver coins were minted, Barrett mentions that in 1750 the demand of the mint was around 600qq per year. With the introduction of gold coins and the increase of silver coinage, by 1790 the demand was between 1500-2000qq per year[429].

In addition to the coins produced by the mint other types of coin-like items circulated extensively in New Spain. The gold *tepuzque* was the main parallel currency, and used copper as a base or major metal in the alloy. It had a concentration of copper between 75% and 30%, or in other words it had gold fineness between 6k and 16k. References to this alloy can be found all through the tax records of native towns. For instance, the 1541 tax record of the town of Xochimilco, not far from Mexico City, mentioned that every 80 days the natives had to give 50 *tejuelos* (disk-like) of gold with a fineness of 10k (41.7% of gold), and that each *tejuelo* had to weight 10 *pesos* (48grs approx.)[430][431].

These parallel currencies were freely produced by the Spaniards, but especially by the natives who used them to pay part of their tributes. The gold tepuzque started to be used as currency around 1522, and it was the result of the first metallurgical operations carried out by the Spanish while melting down the gold and golden objects that had been bought, stolen, or looted from the natives over those first years. Bernal Diaz del Castillo mentions in his *Historia Verdadera de la Conquista de la Nueva España* how the *tepuzque* was created in the first place. In his narration Del Castillo mentions that the term comes from the náhuatl (Aztec language) word *tepuztli,* meaning copper:

"*Another thing was also done; to all the gold that was melted down they added three carats more than its standard weight [that is, they debased the gold one-eighth] so as to help in the payments, and also because at that time ships and traders had come to Villa Rica, and they believed that in putting in the three carats they were helping us, [that is] the land and the conquistadores, but it did not help us in any way, on the contrary it was to our prejudice, for with the object of making a profit corresponding to the three carats, the merchants charged five carats more on the merchandise and articles they had for sale, and in this way the gold of*

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428 Castro Gutierrez mentions that the concentration of copper in the silver coins was of around 60 ounces of copper per each 100 marks of silver (2012:33). Barrett gives a similar value of 1 part copper to 180 parts of silver (1987:44).

429 Barrett 1987:43-44

430 Suchimilco, *Libro de las tasaciones de pueblos de la Nueva España siglo XVI* (1952:304)

431 Originally the term *peso de oro* was used to indicate a portion of gold weighing 96 grains (grain=0.0505gr aprox) (Pradeau 1938:21 note 2).

the three carats was current for five or six years more, and for this reason the gold of the three carats was called Tepusque which means in the language of the Indians, copper"[432]

According to the account of Del Castillo, Pradeau clearly mentions that the tepuzque gold was the creation of the Spaniards as a way to commit fraud[433]. The early Spanish settlers had the need of a convenient system of exchange given the fact that the coins they had introduced, and kept introducing, from Spain during those first years were still scarce and of high denomination. Hence, they started to produce *tejuelos* (disk-like items) to be used in small transactions. These *tejuelos* were produced with gold from different sources with different fineness and most surely with some copper alloyed as it was the custom, for instance in the tumbaga objects from the natives. During this period there was no one to control the production or to assay the metal and the only attempt to impose control came with the introduction of a mark made by Cortés indicating the weight of the *tejuelos*[434]. Without this control the gold could be easily debased by adding copper, as Cortés himself reported to the crown[435] and the narration of Del Castillo corroborates.

The tepuzque was then rapidly incorporated as a currency, years before the establishing of the royal mint of Mexico City, and remained in use until at least the end of the 17th century despite various attempts by the crown to stop its circulation. In the end the crown failed to get rid of the gold tepuzque and accepted it. In 1536 Viceroy Antonio de Mendoza ordered the standardising of its value so that 1 peso of gold tepuzque should be taken as equivalent to 272 maravedís[436][437].

The use of pesos of gold tepuzque became popular in New Spain and was one of the currencies demanded from the native communities as part of their tributes. There appears to be a

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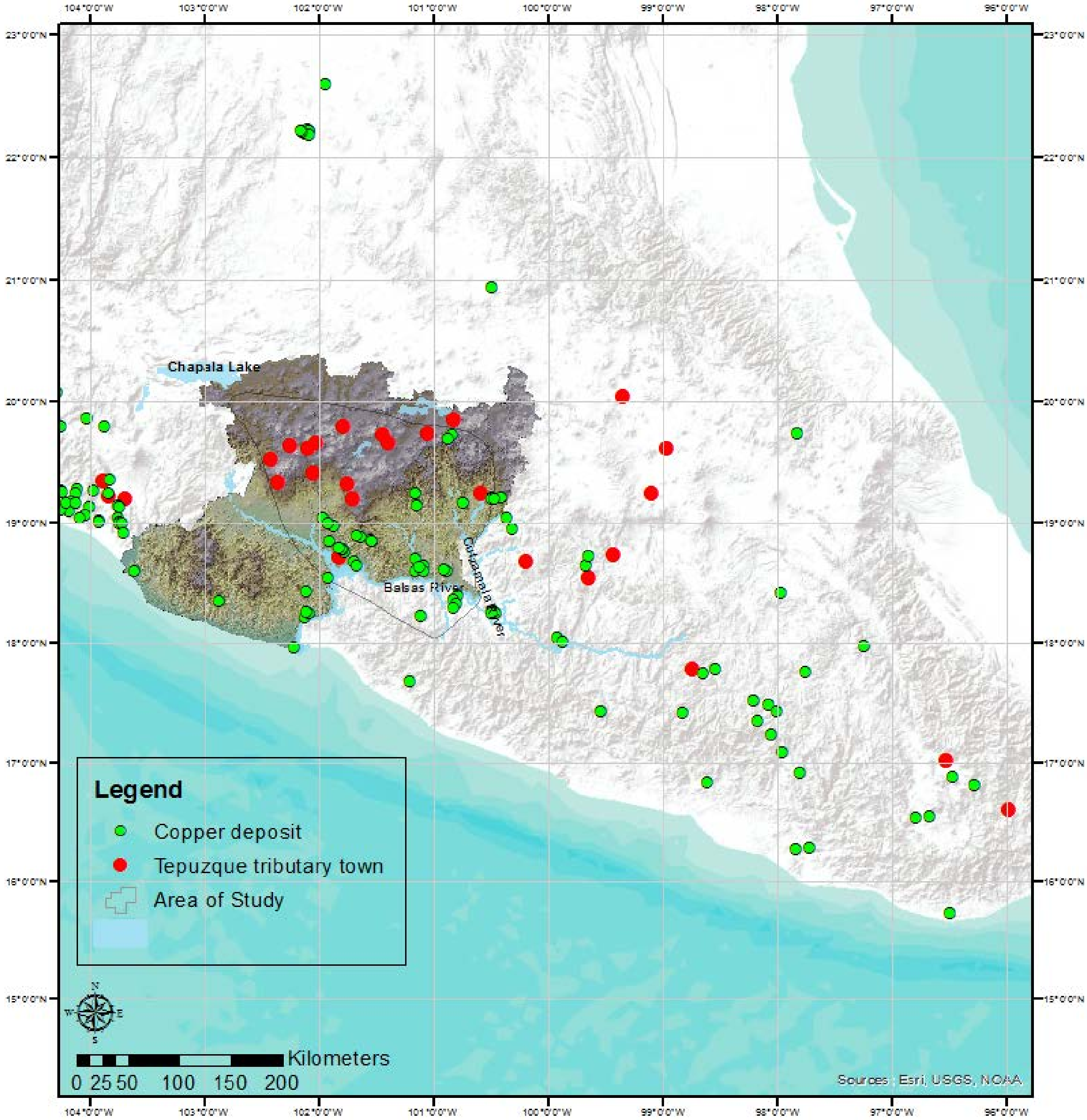
432 Diaz del Castillo 2008:316
433 Pradeau 1938:21
434 Beltrán Martínez 1952:373
435 Ibid., pp.377
436 The Maravedí was the smallest Spanish unit of account in the 16th century. As a coin it was made out of copper and it had a circulation value of 1/34th of a silver *real.* (Pradeau 1938:21 note 3).
437 In New Spain several parallel currencies were circulating simultaneously. Besides the already mentioned gold tepuzque whose value was set at 272 maravadís, there was the *peso de oro* (peso of gold=500 maravadis), *peso de oro de minas* (peso of gold of mines=450 maravadís), *peso de oro ensayado* (peso of assayed gold=414 maravadís), *peso de oro en polvo* (peso of gold dust=380 maravadís), and *peso de oro común* (peso of current gold=300 maravadís). For an in-depth discussion on the topic see Alberto Pradeau: *The Numismatic History of Mexico* (1938).

correlation between the regions where copper was available and produced, and the use of tepuzque as tribute. This is particularly indicated in the area of Michoacán and the neighbouring states of Colima, Guerrero and Mexico; all of which are areas where copper deposits are available.

This does not necessarily mean that all the towns that gave tepuzque as tribute produced their own pesos, but it suggests that some did and others perhaps acquired it from the ones that were producing tepuzque through trade. The tepuzque as a tribute eventually disappeared from the tax records around 1555-65 when a set of tributary reforms were imposed with the aim of achieving a certain level of standardization, as we saw in chapter 1. The colonial authorities, reduced the range of products to be given as tribute and demanded the tribute to be paid in *oro común* (current gold), or in the already well-established silver coinage system of New Spain. In the same way, the tribute started to be paid annually instead of the previously used period of 80 days that had been in place until that moment.



Map 13. Indigenous towns that gave pesos de tepuzque as part of their tribute loads, and the correlation between these and the copper deposits in the area[438].

[438] The data about the tributes was taken from *Suma de Visitas de los Pueblos de Nueva España (1548-1550)* and from *El Libro de las Tasaciones de los Pueblos de la Nueva España siglo XVI*.(ed.1952). The mining data was taken from geological and mining chart SGM scale 1:1000000.

5.2 Encountering Copper

The first mention of copper in New Spain is found in the early chronicles of the conquest which narrate the Spanish arrival in the territory of Mexico until the fall of Tenochtitlan. Some were not very favourable due to animadversion against copper when someone is looking for gold, but others reflect a change in the discourse when dealing with the utilitarian use of non-profitable metals such as copper.

Gonzalo Fernandez de Oviedo was what we could call a specialist; he was addressed as *regidor* for the gold smelting facilities in La Española (Haiti) and La Fernandina (Cuba) before he was given the job of first *cronista de Indias*. For this work he travelled throughout the Indies, and in 1535 wrote the massive *"Historia General y Natural de las Indias, Islas y Tierra-Firme del Mar Oceano*[439]*"*. In several passages of this account his description of metallurgy goes beyond the mere recording of events and curiosities.

When narrating the first Spanish arrival of Juan de Grijalva to the territory of Cozumel (Yucatán, Mexico) he wrote:

"*...and he made him (Julian the interpreter) ask them if they had gold and if they wanted to exchange it for some of the things our people showed them, and they said yes and brought some guanines they use in the ears, lips and noses as well as some circular plates of guanin, and they said they had no other gold but that*[440]*"*

Few lines later he says:

"Apparently this people were poor and miserable but for the readers to understand what the guanines are, from now on I say they are pieces of gilded copper, and if some gold they contain is few or none at all"[441]

Grijalva then moved to a different town on the opposite side of the peninsula of Yucatán in Campeche and finding Indians there Grijalva asked if they had some gold to exchange for Spanish goods and Oviedo wrote:

[439] Fernandez de Oviedo 1851
[440] Ibid. Pp.507
[441] Ibid.

"...and the interpreter said they had and that they were going to bring it and they came back and brought nothing but some rounded disks of gilded copper that the Christians returned saying that it was not gold, it was worthless and the Christians didn't want it, so nothing was taken but a patena of good guanin that was exchanged [for glass beads] and the one who brought it left very happy[442]*"*

Oviedo was impressed by the technique of producing guanin, he understood the process but he interpreted it according to his European logic. While he was supervising the gold smelting facilities in La Fernandina he met what appears to have been an itinerant indigenous metalworker whom Oviedo mentions was coming from somewhere in the continent. Oviedo wrote:

"...I want before the story goes on and passes to other matters to say that the indians know very well how to gild the pieces and things they produce in copper and low quality gold, and they have in this so much skill and excellence and can give such high luster to what they gild and [the objects] look so fine that they appeared to be made out of gold of 23K (carats) or even more. They do this with certain herbs and it is such a high secret that if any of the goldsmiths in Europe or somewhere elsewhere among Christians this could be known and used, that man in a very short time would become a very rich man with this way of gilding[443]*"*

Oviedo's chronicle relates that the guanines, although highly appreciated among the indigenous societies, were almost worthless objects for the Spaniards and indicated the material poverty of the natives. Although he also acknowledged the excellence and inventive skills of the gilding metalworkers he didn't understand the cultural background of the process.

A few other passages from the account of Del Castillo show the first interaction of technologies and certainly of ideologies with regard to copper metallurgy[444]. The first of these is said to have happened when Cortés was moving his forces to face the army of Pánfilo de Narvaez, a Spaniard sent by Diego Velázquez, then governor of Cuba, to capture Cortés under the charges of disobedience for carrying out the unauthorized invasion of the Mexican territories.

In the narration Cortés send a soldier, a master of pike fighting, to provide the indigenous people with a model for the type of pikes the Spaniards needed to face Pánfilo de Narvaez:

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[442] Ibid. Pp.514

[443] Ibid. Pp.189

[444] This episode on the fight with de Narvaez and the provision of copper arrow heads and pike points is narrated in nearly all the early chronicles. I chose to present only that of Del Castillo here, to give continuity to the narrative.

"As soon as Cortés heard news of the fleet that Narvaez was bringing he at once dispatched a soldier who had served in Italy and was very skilful with all arms and especially at making play with a pike, and sent him to a province called the [land of the] Chinantecs, near to where our soldiers had stayed when they went to search for mines, for the people of that province were very hostile to the Mexicans and they had accepted our friendships a few days before. They used as arms very long lances, longer than ours from Castile, with two fathoms of flint and [stone] knives, so he sent to beg them to bring him promptly, wherever he might be, three hundred of them, and to remove the knives, and, as they possessed much copper, to make for each one two metal points. The soldier took with him the model which the points should resemble, and they promptly searched for the lances and made the points, for throughout the province at that time there four or five towns, not to count many farms, [where] they collected them and fashioned the points far more perfectly than those we sent to order from them[445]."

Another passage of the Del Castillo chronicle highlights the same sort of interaction, in this case the Cortés forces were preparing to siege Tenochtitlan and he commanded his indigenous allies to supply copper arrow heads and wooden arrow shafts using Spanish samples:

"Cortes now, therefore, began to make active preparations for the siege of Mexico. He issued orders to all townships which lay in the vicinity of Tezcuco, and were in alliance with us, for each for each of them to furnish him with 8000 copper points for our arrows, to be made after the model of our Spanish ones, of which some were sent them for that purpose. They were also to furnish an equal number of arrows which were to be made from a wood particularly adapted for that use, and they received some of our Spanish arrows to work by. He allowed them eight days for the making and delivery of these; and indeed both the arrows and the copper points arrived at Tezcuco in the time specified. Our stock of these now consisted of 50000 pieces, and the arrow points made by these people were even better than those we brought from Spain."[446]

One last example of the Spanish encounter with the indigenous copper and bronze resources and technology is given by Hernán Cortés in one of his letters to the sovereigns, dated the 15th of October 1521. In this he explains the situation after the conquest of Tenochtitlan, and then he complains about the lack of artillery pieces, even though he had sent abundant silver and gold to Cuba to pay for them[447]. He continues the letter saying that fortunately he is a

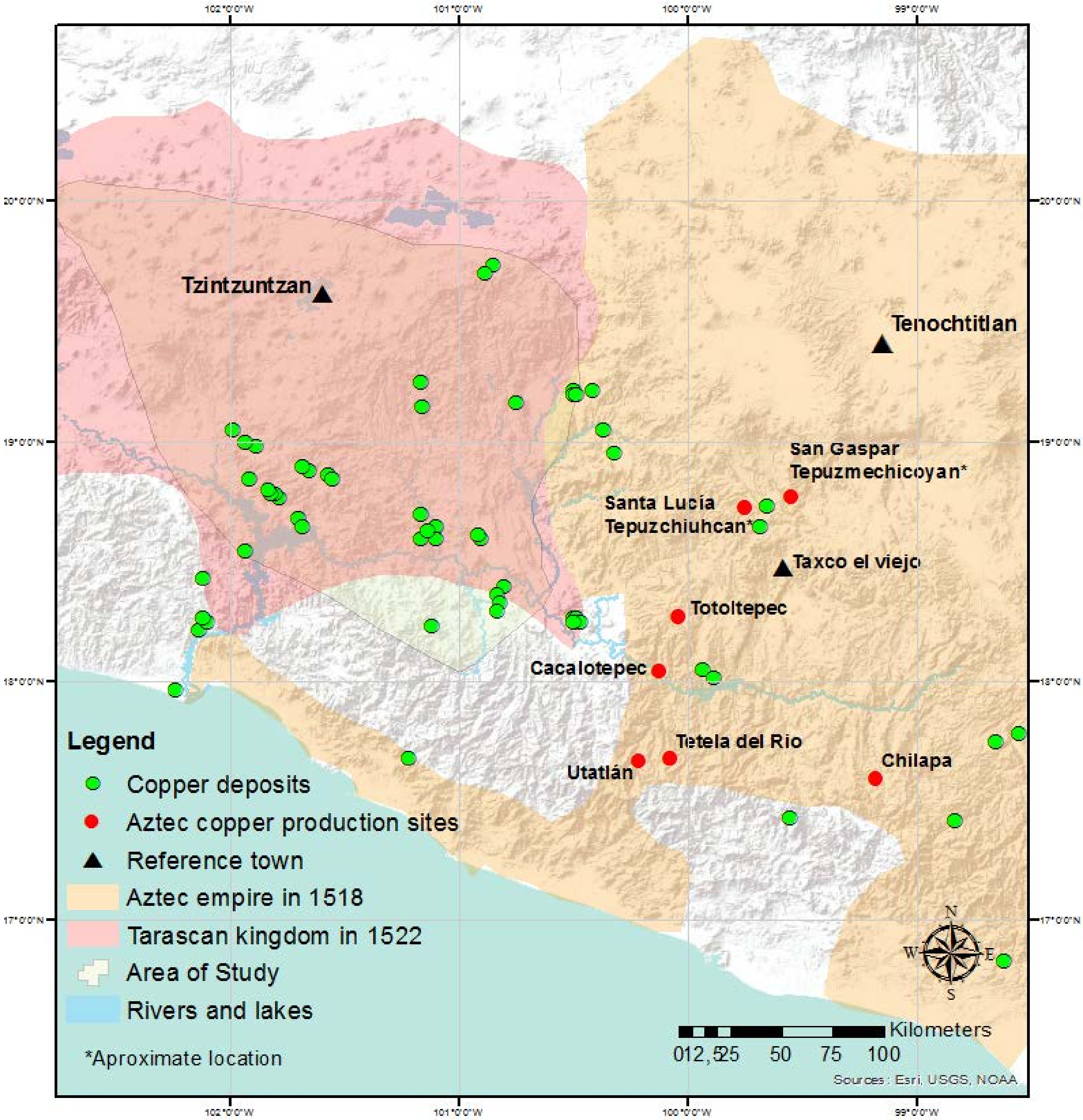
[445] Diaz del Castillo 2010:185-186
[446] Diaz del Castillo 2010:263
[447] Cortés 1806:306

resourceful man and that pushed by the need to strengthen the defences of the city in order not to lose what by much effort had been gained he decided to go in search of copper:

"I hastened therefore to find copper in the provinces, offering a good price that it might be the more quickly found; and, as soon as it was brought to me in sufficient quantity, I set a master of artillery, who was fortunately here, at making two medium-sized culverins. These came out so well that, considering their size, they could not have been better. Besides the copper, tin was required for these, as they could not be made without it, and, though with great difficulty and cost, I had procured some from people who had tin plates or other vessels; but neither dear nor cheap could much be found, so I began to enquire whether there was any in the country. Thanks to our lord who always provides speedily what is most needed, some small pieces of it were found among the natives of a province, called Tachco, in the form of very thin coins; and continuing my research I discovered that in that province and many others this was used as money; I further learned that it was mined in the province of Tachco, twenty-six leagues from this city, so I sent Spaniards with implements there and they brought me a sample of metal. From this time forward I ordered the necessary quantity to be extracted, and shall continue to work these mines, though it will be difficult[448]."

Cortés then proceeds in his report, describing artillery pieces to be produced and some others he arranged from the recently established Spanish towns on the Gulf of Mexico. Although Cortés does not mention the exact provenance of the copper he bought from the natives, it is sure that it came from the copper mining towns within the tributary network of the Aztecs[449]. According to the Aztec tribute lists the complete amount of copper consumed in Mexico was coming from the provinces located in the middle Balsas basin region to the south and east of Taxco[450] (Map 2). This region geographically belongs to the Tierra Caliente, and during the late pre-Hispanic times it was the frontier between the Aztec and the Tarascan states[451].

[448] Ibid. Pp. 306-307
[449] Barret 1987:15
[450] Ibid.
[451] Pollard 1987, 2004



Map 14. Copper production sites in the Aztec empire and reference towns[452]

[452] The historical data for the location of the Aztec copper production sites was taken from the *Relaciones Geográficas de la Diécesis de México*: *Relación de Utatlán* (1580); *Relación de Tetela del Río* (1579); *Relación de Chilapa* (1582); *Relación de Totoltepec de Guerrero* (1579); *Relación de las Minas de Tasco* (1581). All of the latter included in the *Papeles de Nueva España* Vol.5 by Francisco del Paso y Troncoso (1904). Earlier information regarding the towns of the southern provinces as copper tributaries is found in the *Matrícula de Tributos* (Tribute roll) (ca. 1522-1530), as well as in the Codex Mendoza (1541-1542). Mining data was taken from the geology and mining charts produced by SGM scale 1:1000000.

The *Relación de Michoacán* mentions a series of encounters with Tarascan copper metallurgy. In his campaign towards the pacification of the province of Xalisco and his war with the Teules-Chichimecas of the North, in 1528 Nuño de Guzman commanded the artisans and copper smiths of Tzintzuntzan to provide him with *"400 cotton breast armours, 400 bows and 200 arrows with metal heads and a great number of copper axes*[453]*"* for his forces. The latter follows the same processes narrated by Del Castillo in his story of the conquest of Mexico, which supports the idea of this already being common practice in the early years of the conquest process.

After all the pre-existing metallic wealth was exhausted the Spaniards decided to exploit the native gold and silver mines in use, and new ones yet to be discovered. Several extensive exploration campaigns were conducted with the aim of finding more mines and mineral deposits that could be exploited. During the next two centuries this was the primary driver for exploration and colonization of new areas throughout New Spain, as is exemplified in the northern campaigns which took the Spaniards as far as the southwest territories of the modern United States[454].

In the decade after the first mining operation Cortés ran, several mines began to be worked in Taxco, Zultepec and Temascaltepec. An increasing number of mines were opened, and although the main interest during the first decades of the colonial period was silver and gold, copper started to gain a place as a strategic, although not very profitable, material.

With the conquest of Michoacán and the disintegration of the Tarascan state after the death of the last Cazonci in 1530, a systematic effort for colonizing the territory began. The information gathered by Antonio de Carvajal in 1523 and 1524 regarding the territory and the available human and natural resources was fundamental for the implementation of the *encomienda* system later that year, and especially after 1530. Carvajal's reports were not only crucial for the establishment of the new socioeconomic mechanism represented by the *encomiendas* but also for realizing that the region did not possess the exuberant mineral wealth that the Spanish thought it had. In fact, just a handful of mining operations began during those initial days; silver in the regions of Coalcoman and Tamazula, and gold from placers along the Balsas River. With the patio process still undiscovered, Coalcoman and Tamazula lost their attraction only a few years after the beginning of the works, as the concentration of silver in the ore became lower and difficulties of extraction increased.

[453] Alcalá 2013:357
[454] See Bakewell 1971; Thomas 2008; West 1949.

However, the information Carvajal conveyed to the Spanish related the presence of vast copper deposits especially concentrated in the South-Central area of the region.

The first surveys made by the Spaniards in Michoacán gave accounts of rich copper deposits, and in 1533 the oidor (judge) Vasco de Quiroga prepared his famous report to the crown on the state of the copper mines in Michoacán. From this moment on the region became the principal source of copper as well as the principal producer of refined metal and copper objects. The centre of copper mining was located in the real de minas de Inguarán, a mining district in the vicinity of La Guacana (map 3). Several other locations along the region were exploited as well, turning the whole region into the main supplier of copper in the viceroyalty.

5.3 The Importance of the Copper Region of Michoacán

South-Central Michoacán and the region of Tierra Caliente[455] have the main concentrations of copper deposits in central Mexico. The vast majority of the deposits, as can be seen on Map 3, are located along the slopes that descend from the Tarascan neo-volcanic plateau in the centre of the region towards the southern and eastern Balsas-Tepalcatepec depressions (Map 3, Chapter 3). On the south bank of the Balsas River the deposits tend to concentrate around the area of Pungarabato along the slopes that ascend from the depression towards the Southern Sierra Madre.

The rich mineralization in this region is manifest in a broad range of copper ores such as sulfides (chalcopyrite), oxides (cuprite) and carbonates (malachite and azurite). These deposits tend to form in clusters, and a particularly special one is the dense cluster of deposits located in the area of La Guacana, Sinagua and Churumuco. Thus, this area was a major centre of copper mining and production during the pre-Hispanic period, and during the colonial period.

These deposits were undoubtedly the most important ones exploited throughout the colonial period, and during the 16th and part of the 17th centuries were the only ones exploited[456]. It was not until the late 17th century that colonial authorities and entrepreneurial colonists opened new fronts for the exploitation of copper. The increased search for new sources was motivated by a growing demand from the royal artillery factories of Acapulco, Veracruz,

[455] Which extends farther South and East into the neighboring modern states of Guerrero and the State of Mexico (Trujillo 2011:21-22)
[456] Barret 1987:16-17

Havana, Barcelona, Seville and Manila[457]. The increased production of the mint in Mexico City, and the exponential growth of other important industries such as silver and sugar production were drivers for new exploitations as well[458].

During the first two centuries, the deposits of Michoacán and especially the mines located in our region of study provided more than 90% of the copper consumed in New Spain. The historical sources briefly mention a few attempts to mine and produce copper outside the area of Michoacán during the late 16th and early 17th centuries. The *Relación de Nexapa,* in the region of Oaxaca, written in 1579 mentions that in the vicinity of the town there is a hill called *Chalchihuitepeque "…abundant in metals of silver and copper, and bronze which are shown through smelting and when putting them together it forms a bronze that is like steel".* The *Relación* continues, saying that when Luis de Velasco was viceroy samples of these ores were sent to him and were assayed by an official called Villasana who tested the value of the metal. It ends by explaining that the mines are not worked because the people are poor[459].

Similar examples of surveyed and identified mines appear in the tax records of native towns as well as in the descriptions of the *Relaciones Geográficas,* compiled at the end of the 16th century. None of the mines identified during those centuries were worked. The main causes for this were, according to the sources, much the same: the lack of people and lack of knowledge. It is still not clear why the other deposits of copper in New Spain were not exploited, especially those which were producing copper before and at the arrival of the Spaniards. We can only speculate about this. Perhaps in these regions there were other types of mineral deposits that absorbed the specialized labour force, such as silver and gold.

The expansion of the northern frontier of New Spain brought the Spanish into contact with the rich mineral zones of the north. News about the existence of copper and lead mines reached Spain during the second half of the 16th century. The crown ordered to be informed about them, and at least on three different occasions the sources reported that copper ores were mined and smelted[460].

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457 Ibid.
458 Ibid., pp.43-62
459 Relación de Nexapa (1579). Paso y Troncoso 1905, Vol..4.
460 In 1587 a judge of the Crown in the province of New Galicia, Doctor Guillen Chaparro, reported having found a copper mine with a high content of silver in the vicinity of the mines of Indeché. The assay conducted on the ore suggested a potential use for the minting of vellon coins, which the doctor reported. AGI.MEXICO.21.N.34. Recent excavations conducted in a Poebloan-Spanish copper smelting settlement located in New Mexico is yet another example of copper production in the early 17th century. Thomas makes an interesting connection

Nevertheless, these metallurgical operations were relatively small. Their main function was to provide the local miners and smelters with necessary reagents and copper objects needed for silver processing, among them *magistral* and different types of vessels. An interesting feature of these copper operations is that they were in the hands of the natives, as is reported by Viceroy Martín Enríquez to the king in 1573 regarding the mines of New Galicia[461].

Besides these small operations, all the copper consumed in New Spain was produced in Michoacán. The introduction of European technology during the 16th century in the form of bellows for smelting and iron tools for mining gave a boost to the industry and came to complement the indigenous metallurgical technology.

In 1603 the viceroy Count of Monterrey wrote a letter to the king mentioning that it would be convenient to exploit other copper resources in the northern frontier so the crown would not rely only on the copper from Michoacán. This came at a moment in which, according to the letter, the king of China had placed a prohibition to trade with the Spanish, and hence no more Chinese copper could be traded in the Philippines. The viceroy further clarifies that the production of Michoacán is more than enough to supply the provinces of New Spain[462].

Therefore, the copper from this region was not only supplying the necessary copper to fulfil the demands of New Spain, but also of other places in the empire. Shipments from Michoacán reached Spain, Cuba, and the Philippines as has been extensively discussed by Barrett and mentioned by Warren[463]. Furthermore, at least once in 1601 metal produced in the region arrived in Guatemala for the manufacture of bells[464].

Following the assorted news about Michoacán copper, the crown official Vasco de Quiroga produced a detailed report to the crown in 1533 about the situation of copper production in Michoacán and the possibilities that its exploitation could provide to the crown. He addressed the overall state of the copper mines and smelting operations. For this report, several *encomenderos* were called to a hearing, as well as (not surprisingly) three native master miners and smelters (*maestros mineros y fundidores).*

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between this exploitation and the presence of native people from central and western Mexico, among them, Tarascans. (Thomas 2008).

461 AGI,MEXICO,19,N.142

462 AGI,MEXICO,25.N.33

463 Ibid; Warren 285-301

464 Archivo General de Centro America (AGCA A1.15-32455-4091-2:38v) Cited in Ubico Calderón 2016:4

They were all questioned about the presence of mines and ore deposits and the level of metallurgical activities. The encomenderos allegedly denied knowing anything about the technology but did mention that it was an activity carried out by the "Indians". It is possible that the encomenderos denied knowing about the metallurgical activities within their encomiendas to avoid the royal taxation of these[465]. It is interesting that those who elucidated on the matter of metallurgical technology, exploitation and rates of production were the master smelters. After this first report about the local production, it was not until the 1540's that the colonial authorities established a productive alliance with the natives that included a regular supply of copper and that would last unaltered until the end of the century.

One of the many problems that early and later Spanish colonizers faced when attempting to mine and smelt copper was the lack of knowledge necessary to accomplish such an enterprise. Given the necessity for production the solution was to leave the copper exploitation, extraction, and manufacturing in the hands of the indigenous populations of the Central and South-Central regions of Michoacán, who as we saw were proven specialists. The colonizers limited themselves to functioning as intermediaries, buying copper from the natives in Michoacán and selling it in the cities or wherever it was needed.

Another way of acquiring copper from the natives was through the encomienda system. The encomenderos who had production towns among their encomiendas demanded copper as part of the tribute that these communities were obliged to give. Such was the case in the towns of La Guacana, Sinagua and Jicalán. According to the tax records of the years 1548-1550 the town of Xicalán was giving six small loads of copper every 80 days to Francisco de Villegas who had in encomienda the head town of Huruapa, which Xicalán was part of[466]. La Guacana on the other hand appears in the same tax records as giving 40 copper ingots every 40 days to its encomendero Juan Pantoja[467].

Although Sinagua is not mentioned as giving copper tributes neither in the *Suma de Visitas* nor in the *Libro de las Tasaciones*, it is mentioned as such in the report of 1533. According to Alonso de Escobar who at that time was the *Corregidor*[468] of Sinagua, the natives of Sinagua gave as tribute in 1531 *"40 or 50 loads of copper that he sent to his majesty to Mexico"*[469].

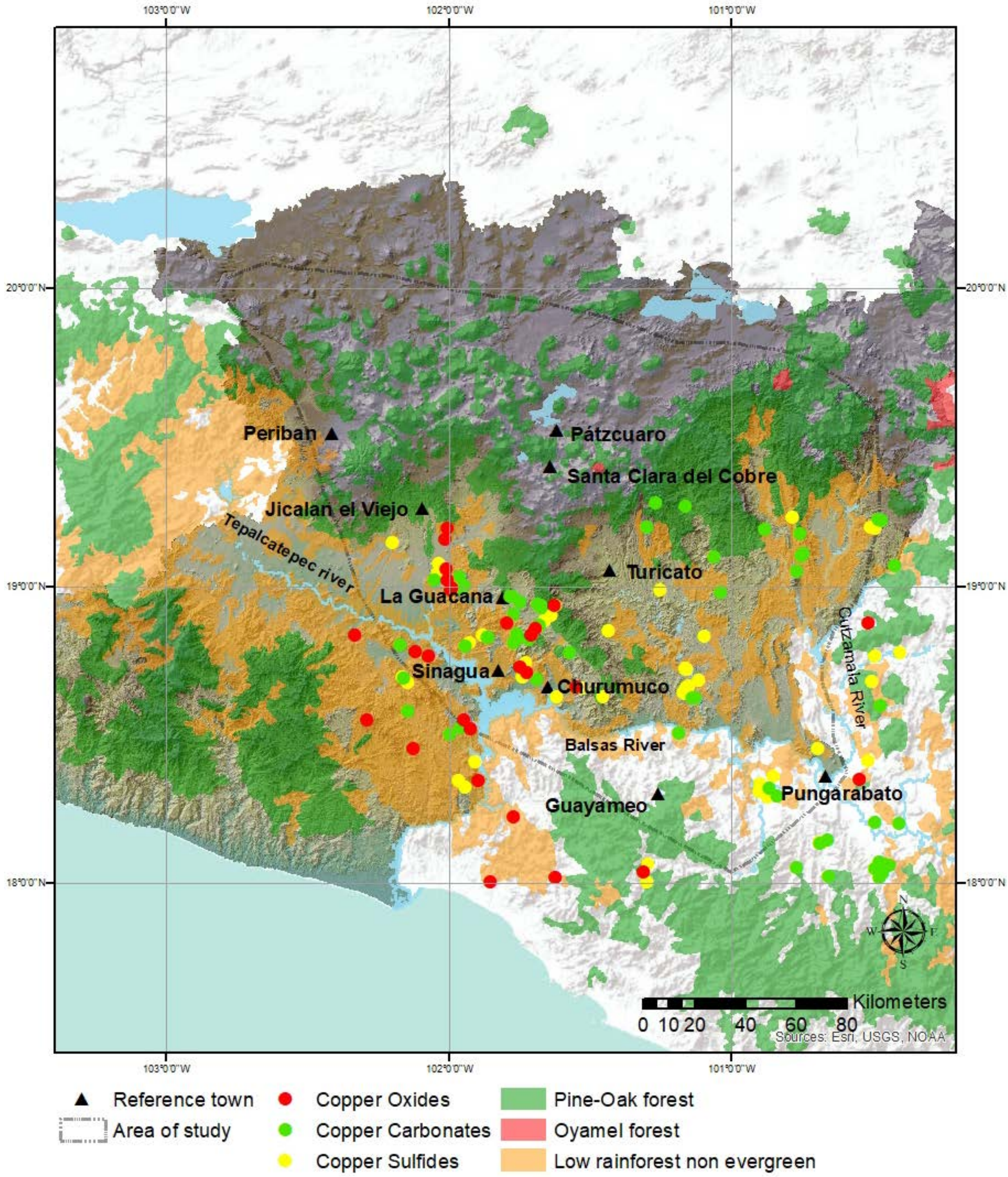
[465] Barrett: 1987:12-17
[466] Suma de Visitas de Pueblos de la Nueva España (1548-1550), Huruapa (287).
[467] Ibid., Vacana (788)
[468] Crown official appointed by the king to act as a governor in the native towns that were not yet granted as encomiendas or that were under the encomienda of the king.
[469] Warren 1968:36

Alonso de Escobar states that the tribute was sent to his majesty although Sinagua is not mentioned in the tax records as a king's encomienda until 1540[470]. By the 1550s copper had disappeared from the tax records as a tribute item, and had been replaced with maize and cotton cloth[471].

With the decrease in the native population after several epidemics that hit New Spain between 1522 and 1576, the copper region of Michoacán fell into a particularly harsh period of depopulation. During the period of 1595-1605 the colonial authorities implemented an extended policy of congregaciones in the territories. In Michoacán this policy used several mechanisms to ensure the continuation of copper production. The outcome of these policies was the creation of three congregations that were focused in the mining of copper ore (La Guacana and Churumuco), and the smelting of that ore (Santa Clara del Cobre). In the following sections I will address the main sources that deal with the indigenous role in the colonial dynamics around the production of copper.

In the late 18th century Fausto de Elhuyar, a Spanish metallurgist educated in Germany, was sent by the Crown to visit and suggest solutions to increasing the performance of the mining industry and metal production in the American territories. In 1790 he visited the copper mines of Michoacan and the royal smelting facilities. His report mentions that the technology was the same as had been used by the Indians since the beginning of the colonial period[472].

[470] Barrett 1973:table 1
[471] Barrett 1987
[472] Ibid. Pp.71-75



Map 15. Distribution of copper deposits according to the type of ore[473]

[473] The data for copper deposits was taken from the geology and mining charts produced by the SGM (Servicio Geológico Mexicano) scale 1:250000.

5.4 1530-1550: The Forgotten Exchanges

5.4.1 The Pedro de Arellano's Lawsuit

After the death of the last Cazonci, the Spanish settled in what had been the capital city of the Tarascan kingdom. It is from there that the first mention of metalworkers in Michoacán is found. In November 1531, a native from Michoacán identified by the Christian name of Francisco presented a legal complaint to the colonial authorities in Mexico City against Don Pedro de Arellano, who at that time was the appointed governor of Michoacán. Francisco represented the interests of Don Francisco, son of the last Cazonci and who at that time was only 10 years old[474].

The accusation relates that Arellano went to an island of Pátzcuaro Lake and tortured three natives who were keeping a treasure that the last Cazonci had left as inheritance to his sons. Arellano had tortured them with the intention of making the natives reveal the place in which the said treasure was hidden. The accuser gave a description of the treasure and presented one of the torture victims, a native called Cuancho, who showed signs of having been burnt.

This was the beginning of a very long legal process in which several political and economic interests were involved and the process itself had important consequences for the region, the most important of these was the arrival of Judge Vasco de Quiroga, who was sent in 1533 to take part in this process and others related with the same topic[475].

Arellano was found guilty, condemned and sent back to Spain, and his properties in New Spain were confiscated. However, the accusation of stealing from the natives was not the most serious one he faced, perhaps the most important accusation was that he had lied about the quantity of gold melted and thus he had committed fraud against the king of Spain for not having paid the corresponding royal fifth on that treasure.

Arellano's defence against the charge of stealing was based on the claim that he had the right to take that gold because it was in a temple and thus used by the indigenous for idolatry

[474] The original document of the process is held in the Archivo General de Indias under the signature AGI,JUSTICIA,187,N.1,Ramo 2. The document has the name of *"El fiscal contra don Pedro de Arellano,sobre cierto oro que tomo a los indios de Michoacán y demás cosas de que fue acusado, 1532".* Warren (1994) translated and edited the document along with a brief introduction.
[475] Warren 1994:335-336

purposes. Besides the importance of the process in the social history of the period, the dynamics of power involved had a great influence in the following decades. For instance, the royal court of Mexico appointed Juan Infante to conduct an investigation on the accusations. Infante used that position to expand his political power and at the same time expand his personal encomienda in Michoacán; such actions led him into a constant and long political dispute with the crown and with Vasco de Quiroga when he was appointed as the first bishop of Michoacán[476].

Besides the political, social and economic components of the trial, it is an important source of information for this dissertation given the material proceedings of Arellano's actions over the stolen treasure.

The treasure was reported to consist of "*nine ears of gold, 10 big silver xicales (cups), 6400 grains of gold the size of maize grains which were stored in a silver jar of 1 ½ handspan in height, 60 gold bracelets, 80 earrings of fine gold, 40 necklaces of fine gold, 40 necklaces of silver, and 200 tejuelos of silver*"[477].

After having seized the treasure Arellano took it to his house in Tzintzuntzan where almost all of it was melted down into bars. To do this he hired around 10 native plateros (silver and gold smiths) and among them at least one copper smelter. Although the information regarding the way in which the metallurgical operations were conducted is peripheral and repetitive, a few pieces of important data can be extracted.

The hearings at the trial included the testimony of the said native metal smiths. They stated they had been hired by Arellano and testified to having produced 16 gold bars, each weighing approximately 500 pesos, during a period of three days inside his house. The metalworkers made the furnace and prepared the necessary moulds for casting the bars. The testimony of the natives was to the detriment of Arellano, due to the fact that he had reported to having produced only two bars which had been sent, along with some other gold objects to the foundry house of Mexico City, as was the legal requirement for paying the royal fifth.

According to the document, Arellano tried to bribe the natives to say that they had produced only the two gold bars he had declared. He offered some coarse cloths and money, but when they refused he threatened to kill them once he was set free. There was an obvious political agenda behind the whole trial, and even the defence of Arellano argued that it was all a set up

476 Ibid.
477 Ibid., pp.363

to remove him from power. His defence was based on trying to present the native witnesses as liars, false Christians and as part of an organized plot under the command of the inherited Cazonci authority to which they were still, according to Arellano, loyal servants.

Besides the interesting developments of the trial, all the groups involved were well aware of the power struggle behind it, including the natives. The document provides a glimpse into a period when Spanish were actively entering into contact with the metallurgical technology of the natives, who were hired and paid for doing specialized works. This was not a new thing of course, as we saw in previous sections of this dissertation. The hearings of the lawsuit mention that this work had been required before in the region, without any inconvenience.

We know from the letters of 15 and 19 of May 1522 written by Cortés to the crown, that Cortés had hired native metal smiths to help him with melting down the war booty acquired in the conquest of Tenochtitlan. Cortés had started the works in the foundry house located in Coyoacan on the 25th of September 1521, and had hired silversmiths from the towns of Azcapotzalco and Xiquipilco[478]. The payment to these workers according to Cortés was 166 pesos, 6 tomines and 2 grains of gold, as well as 173 pesos of fine gold that were collected from the *escobilla* and *relaves*[479].

Similar information can be found a few years later when Sebastian Ramírez de Fuenleal, bishop of Santo Domingo and president of the first royal court of Mexico, visited the house in 1532. In his visit he refers to *"finding a big mess in it because there are not crucibles, and also there are not any bellows and the gold is melted down by Indians blowing through canes…and they don't have any ordenanzas (instructions) on how to do the melting*". He even suggested lifting the ban on having bellows outside the foundry house because there was no point, due to the fact that the melting is done by the natives in the referred way[480].

5.4.2 Vasco de Quiroga's Report on the Copper of Michoacán

[478] With the establishment of the mint in Mexico City in 1535, the town of Xiquipilco was granted as encomienda to the house and the native metalworkers of this town were among the first ones to work there (Beltran Martínez 1952).
[479] Ibid., pp.378. The "escobilla" was the product of gold dust that had fallen on the ground in the melting operations; the "relaves" were particles of metal that were left in the mud when washing and cherry-picking the metal. By Spanish custom the smelters and some other workers had the right to keep these secondary metals.
[480] AGI,PATRONATO,184,R.21. It is cited as well by Beltrán Martínez 1952:386

As it was mentioned earlier, one of the consequences of Pedro de Arellano's trail was the arrival of the crown official Vasco de Quiroga, who had initially been sent to investigate reports of abuses in the area associated with two similar lawsuits. These had been committed by Arellano and Juan Alvarez de Castañeda, both of whom were accused of stealing treasures from the Tarascan nobility[481]. According to Benedict Warren, Quiroga arrived in June or July of 1533[482] with instructions to participate in these legal hearings but more importantly, to help organize the then chaotic conditions in the territory left by the death of the last Cazonci, and the subsequent vacuum of power.

Context

Quiroga only spent a few months in Michoacán, and in January 1534 he went back to Mexico City to participate in yet another trial, this time concerning the encomiendas of Juan Infante. Vasco de Quiroga would not return to the region until 1538 when he was appointed as the first bishop of Michoacán. It was during the fall of 1533 on his first visit to the province, that Quiroga gathered the information for writing his report. The document was sent to Francisco Ceynos, then oidor of the crown in Mexico City, who in turn submitted it to the *Consejo de Indias* (Counsel of Indias) in Spain. It is not very clear why Quiroga produced the report but it is framed within a time in the 1530s in which the crown was avidly looking to find raw materials to produce artillery in the Indies.

In 1530 the rich copper mines of Santiago de Cuba were discovered, and samples of the ore were sent to Seville in 1531 to be smelted and assayed[483]. In September 1532, the queen expressed her great pleasure that such mines had been discovered and a royal *merced* was granted to the residents of the city for exploiting the ores[484]. The residents implored the crown to send one master smelter with bellows and tools to begin the works[485], but apparently that did not happen. In 1534 by a royal decree Charles V granted a license to the silversmith Luis de Espinoza to establish a smelting house near the mines, in a private endeavour to smelt all the copper that the residents could provide. The enterprise did not succeed, as can be deduced from the consequent relief in the payment of royalties over the works, from a fifth in 1533 to a fifteenth in 1536[486] and finally to a twentieth in 1540[487].

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[481] Warren 2004:121
[482] Ibid.
[483] AGI,SANTO_DOMINGO,1121,L.1,F.67R-68V
[484] AGI,SANTO_DOMINGO,1121,L.1,F.112V-113V
[485] Ibid.
[486] AGI,SANTO_DOMINGO,1121,L.2,F.61V

While this was happening in Cuba, similar events regarding New Spain were progressing in Spain. In December 1532, the Queen summoned Luis Fernandez to the court to deal with artillery to be made in New Spain. In her letter the Queen expressed that "*she has been told that in the New Spain there is great aparejo*[488] *for making artillery"* and commanded Fernandez to make the arrangements necessary to travel there and start the works[489]. Apparently this plan with Fernandez did not come about, and again in 1533 the court summoned another expert, Rodrigo Martinez, an artilleryman who had been involved in the manufacturing of the artillery for the *especieria* fleet under the command of Simon de Alcazaba. He had made some other pieces as well, for the city of La Coruña[490]. According to the documents of this period, Martínez was also a former resident of Mexico City[491]. Martinez was called to the court in February 1533 to discuss the artillery of New Spain[492], and apparently the crown and Martinez made an agreement and signed a contract to manufacture artillery in New Spain[493]. Unfortunately, Martinez was part of the expedition of Simon de Alcazaba which departed in 1534 towards Cape Horn and he died somewhere in Patagonia.

This was the context in which Vasco de Quiroga made his report, a moment in which the crown was seeking to find and locally exploit the raw materials to produce a much-needed provision of artillery and other necessary copper objects for the expanding colonies. Perhaps this report was ordered with the idea of the imminent arrival of the necessary experts that were to set up a proper foundry house in Mexico City. In contrast with the information regarding Cuba where the crown was trying to set up an infrastructure to start mining and smelting copper, in New Spain that infrastructure already existed and the crown had general information about the availability of copper, tin and sulphur. In fact, New Spain was the only place outside Europe where artillery and gunpowder had been already made by the Spanish.

This source is one of the most important for the study of early technological interactions between indigenous communities and Spanish colonizers, not only at the regional level of

[487] AGI,SANTO_DOMINGO,1121,L.2,F.173V

[488] Spanish word that defines a set of certain things that is necessary to make something.

[489] AGI,INDIFERENTE,422,L.15,F.111V

[490] AGI,INDIFERENTE,422,L.15,F.151V-152R; AGI,INDIFERENTE,422,L.15,F.110V

[491] AGI,MEXICO,1088,L.2,F.101V-102R. It is possible that this Rodrigo Martinez was the same Rodrigo Martín who was the captain of artillery in the fleet of Pánfilo de Narvaez, and who was bribed by Cortés to join his forces before the conquest of Tenochtitlan (Diaz del Castillo (ca.1576) 1862:528). If he is the same person then it is possible that he was the one in charge of making the artillery pieces that Cortés made with the copper and tin he found and bought from the natives of Tenochtitlan and Taxco in 1522 after the fall of the city.

[492] AGI,INDIFERENTE,422,L.15,F.217R

[493] AGI,INDIFERENTE,422,L.15,F.227R

Michoacán or New Spain, but perhaps at an American level. As we will see in the next chapter, this document clearly shows some of the elements that we have been mentioning in this dissertation, specifically the establishment of a dialogue in which technology, in this case copper metallurgy, is the common ground of understanding and where all of the participants have a voice. Furthermore, the document presents the first stages of a technological interaction in which the two cultures recognized each other, identified their technical capabilities, and explored the mechanisms for future interaction, mutual adaptation, and collaboration.

In the next section we will fully or partially reproduce some of the sworn statements given by both the indigenous and Spanish witnesses, with the aim of showing the reader the richness of information that this document provides at different levels.

Vasco de Quiroga's Report on the copper mines of Michoacán[494]

The report by Quiroga included testimony from two distinguishable groups of informants.

The first was composed of Spanish colonizers and colonial authorities. Among them we find Antonio de Oliver who at the time was the encomendero of half of the town of Turicato; Antonio Godoy who for a short period had been the encomendero of Sinagua; Juan Pantoja encomendero of La Guacana; Alonso Lucas, a miner who had come to Michoacán to work in the mines with the slaves of Hernán Rodríguez; Suero Asturiano who was the constable of Uchichila (Tzintzuntzan); and finally, Juan Alvarado who was the encomendero of Tiripitío[495].

The second group of informants was composed of indigenous authorities, native copper miners and smelters. Among them was Don Pedro Cuinierángari, the indigenous governor of Michoacán and highest native authority at the time. Don Pedro presented four native informants, all of whom were specialized miners and/or smelters. They were Juan, resident of

[494] The original of the document is held in the Archivo General de Indias (AGI) under the signature INDIFERENTE,1204 and was first translated and publish by Benedict J. Warren in 1968 with the name of "*Minas de Cobre de Michoacán 1533"* Since then it had been considered the main source of information regarding the topic and the region in the fields of archaeology and history. In this section I work with the 2004 edition of the document by Warren, in both English and Spanish and entitled: *Información del licenciado Vasco de Quiroga sobre el cobre de Michoacan, 1533* (Investigation by the licenciate Vasco de Quiroga: Concerning the Copper of Michoacán 1533), (Warren 2004:118-153)
[495] Warren 2004:123

Tzintzuntzan; Don Juan who at the time was the cacique of Cocian (Cutzian); and Juan and Tapa, residents of La Guacana and specialized miners and smelters[496].

The questions contained in the inquiry which were given to the informants were:

"for an inquiry concerning the copper mines that exist in this province of Michoacán and in what regions and towns they are, and what towns are near to them, and what quantity might be produced each year, and what quantity of it the neighbouring towns could pay in tribute each year, and how near carts can arrive to those mines (in order to take it to Mexico City)*"*[497]

First group: Spanish witnesses

The first informant to provide testimony was Antonio de Oliver who answered:

"He said that what he knows is that he has heard the Indians of Turicato, which he holds in encomienda, say that eight leagues from the head town of Turicato there are some copper mines that are outside of the limits of Turicato and that in ancient times they used to mine copper there. And this witness asked the said Indians to get some of that copper and bring it to him; and the Indians told him that the Indians of Guayameo, which is the encomienda of Gil Gonzalez de Benavides, protected it so that they could not get it or bring it out; and that the copper that was taken out from there was not smelt it by itself alone but with a certain earthen ore which was brought from the town of La Guacana, which is the encomienda of Juan Pantoja, which according to the mind of this witness may be more or less six leagues from the said mines; and that the metal and the earth that they put in to make the copper, so that it can be smelted, they bring by purchase and commerce from the said town of La Guacana; and that the said mines, according to the reports that this witness has heard, fall within the borders and lands of the said Guayameo, which may be more or less twenty leagues from this city to Uchichila; and that from Mexico carts can come to this city, if the roads are improved, and they can easily be improved.

And this witness has heard a report that in a town called Cinagua, which belongs to His majesty, of which Alonso de Escobar is corregidor, which is eighteen or twenty leagues from this city of Uchichila, there are other copper mines, according to what this witness has heard from Antonio de Godoy and Juan Pantoja and from Indians of this province of Michoacán, and

[496] Ibid.
[497] Ibid., pp.130

this witness has heard it said that from there a great amount of copper has been produced and is still produced, from where the greater part of this province is supplied, because the natives work the land with it and they consider it a very useful metal for making their tools for cutting and working their fields.

And regarding how much can be produced from these mines, this witness does not know, because he has not seen it excavated or even smelted, nor has he even seen the mines, but he has only heard it said. And this witness has heard many Spaniards, whose names he does not remember, say that there are other copper mines in this province of Michoacán from where a great amount of copper is produced, but this witness has not seen them, nor does he know anything more than he has said, nor how many leagues are involved, nor whether carts can get them." [498]

Among the Spanish informants, Antonio de Oliver (Turicato) along with Juan Pantoja (La Guacana) present two very particular testimonies. At the time they were in possession of two large *encomiendas* which included within their limits the bulk of exploitable copper deposits, and most of the towns and hence the people specialized in copper production. The interesting part of their statements is that they deliberately omitted mentioning the mines and copper production within their own encomiendas. Instead, they gave information about the other's mines, or mines outside their own territories. Barrett has suggested that they were trying to down play these facts in order to avoid any further official inspection, perhaps with the aim of impeding a possible confiscation of the mines, or the imposition of a royal taxation over the production and thus a loss in the benefits they were receiving from it[499]. Copper was never taxed in New Spain, although several inquiries on the possibility of taxation were made by the crown during the 16th and 17th centuries.

The second witness summoned by Quiroga was Antonio de Godoy, and as his testimony provides vital information we reproduce it almost entirely; Godoy said:

"that what he knows is that in Cinagua, which belongs to His majesty, there is a mountain range through the middle of which a vein of copper runs, from where the Indians take out copper, and this witness has seen it, and it is in the area of a small town called Choromoco, subject to the town of Cinagua, and it is a very good mine. And it seems to this witness that if they had a forge there to smelt the metal, they would produce a great amount [between lines – *because the Indians, since they do not have bellows nor good equipment, produce it with a*

[498] Ibid., pp.130-132
[499] Barrett 1981:6

great amount of work and do not produce a great amount, and if they had a forge they would produce it] *in quantity, and that every day, with four or five Indians it would be possible to produce a quintal* [between lines – *with some bellows and with more equipment of forges, they would produce it according to the equipment that was available and depending on the master craftsmen who were there and knew how to produce it; and there is a great deal of charcoal available there*]*; and this town is fifteen leagues from this city of Uchichila."*

And if they open a road (and it would be easy to do so), carts could come from the City of Mexico to Urapa, which is the encomienda of Diego Rodriguez de Valladolid, and it seems to this witness that from where the cart could go it would be another six and a half leagues to the mine. And near to the town of Cinagua is the town of La Guacana, which is the encomienda of Juan Pantoja, which is five leagues on this side of the mines, ten leagues from this city of Uchichila, and the carts will be able to go within three leagues, or four, from this said town. And this witness has heard its owner Juan Pantoja say that in the said town of La Guacana there are copper mines, and he has seen the copper that the Indians give him as tribute; and he has heard it said that they would produce a great deal of copper if they had the equipment, because they produce it in one of the villages of that town. And this town is twelve leagues, or eleven, from this city by the route that he has already mentioned that can be prepared for the use of carts.

This witness also said that he has heard a Spaniard who is in Turicato and Antonio de Oliver, who has it as his encomienda, say than in a village called Cucian, which is subject to Turicato, there are other copper mines which they say are rich in rich copper. The town of Turicato is eleven leagues from this city, and the village is five leagues further on in hotter country, between Guayameo and Turicato, and it seems to this witness that it may be eight leagues from Guayameo. And the said Oliver told this witness that he wanted to put twenty slaves in there and that he thought that they would be better used there than getting out gold in a slave gang. And Juan Baeza, servant of the said Oliver, said the same thing to this witness.

But this witness has not seen any mine except that of Cinagua which he has mentioned, but he has heard it said that all of the towns of the hot country, such as Guayameo and Cuyceo, and Pungarabato and Coyuca and villages of Tanxitaro, which border on the hot country, and other villages of Antón Caicedo which are subject to Perivan, in all of this towns there are copper mines, and he has heard this commonly from both Indians and Spaniards. And in Tepalcatepeque, which is on the way to the mines of Los Angeles, which would be twenty-five *leagues from this city, he has heard that there are also copper mines but he does not know how good they are nor has he seen them."*[500]

He concludes his testimony by making observations about the possibility of bringing carts near the mines and the best routes to do it.[501]

The testimony of Godoy is perhaps the most important among the Spanish witnesses, firstly because he stated that he *"has seen the land"*, as well as the processes and the mines. Secondly, he firmly and clearly suggested what technology should be introduced in order to enhance the production.

The fifth witness, Suero Asturiano, said that:

"what he knows is that in Coyuca, which is in the area of the mines where they collect gold, which is the town which is called by the name of Coyuca, and belongs to Guillén de la Loa, five leagues from this town, near to the gold mines and where the gold mines are, there are other mines of copper where they used to produce copper. And this witness has seen the stones and he knows the metal from it, and the Indians say that they produce copper there. And to this witness it seems that there is a great quantity there, because there are some rocks that are big, and others small, and plenty of them.

And in the region of these mines is the town of Pungaravato, which belongs to Bazán, and the town of Cucamala, which is the encomienda of Juan de Burgos, and the town of Cuycio, which belongs to His Majesty, and the town of Guayameo, which is the encomienda of Gil Gonzalez de Benavides, and the town of Asuchitlán, which belongs to His majesty, and these towns are at a distance of five and six leagues and nine leagues, and others seven leagues, and he does not know of other copper mines."[502]

Asturiano ends his testimony mentioning the possible routes for the carts, and that *"he does not know what amount of copper could be produced in the space of a year, nor does he know how it is smelted, nor does he know how much tribute of the said copper the towns near the said mines could give, nor anything else of that type"*[503]

Asturiano's testimony is interesting because he very accurately described an area outside the core region where the other witnesses focused, which was an important copper production

[500] Ibid., pp.132-134
[501] Ibid.
[502] Ibid.
[503] Ibid., pp.140

area in the pre-Hispanic period. It was an area with important ore deposits, but somehow no information regarding copper exploitation in this region has yet been found in the sources. Paradoxically, although no sources mention this region as an important copper producer, the archaeological survey project conducted by Dorothy Hosler across the area of the middle Balsas River managed to locate 32 copper smelting sites[504]. Among these she decided to excavate the one that appeared to have the most promise as being pre-Hispanic; *La Barranca de las Fundiciones de El Manchón*. Among the 32 identified sites, she extrapolated 3 as possibly being pre-Hispanic; the others were discarded based on their colonial features[505].

Continuing with the document; the next Spanish witness called was Juan de Alvarado who said that he did not know anything related with the copper, neither the mines nor the smelting and only gave information regarding the distances between towns. He finishes by saying that *"He has not seen nor does he know how it is produced or smelted, except that they smelt it by blowing through hollow tubes as they do for gold"*[506]

The last Spanish witness was Alonso de Escobar, *Corregidor* of the Town of Cinagua, who apparently gave his testimony at a different moment than the rest of the witnesses; he said that:

"What he knows is that this witness has been serving as corregidor in Cinagua, which is a province eighteen leagues from this city of Uchichila along the road that goes to Çacatula, which is part of this province of Michoacán, and four leagues on beyond Çinagua, in a village that is called Cholomoco there are three copper mines in which this witness has seen that two of them are closed and stopped up with a great amount of stone and dirt. And the Indians say that in the times of the Cazonci they produced a great amount of copper there, and he has not known what amount they produced except to say that it was a lot of copper.

And nearby there in the same ravine, more or less a crossbow shot away from the closed mines, there is a mine made in a fissure of the living rock and there are twenty paces of trench open, and there are two veins of copper and they are four estados deep. And from there, because there is at the foot of a very high hill, all of rock, it is more than eight and ten estados, and the one vein crosses and cuts through the middle of the hill where they do not work anymore nor can they work. And the other vein goes below, and they follow it and get copper out of it. And the one that cuts through the mountain would have a width of three palms and the other is

[504] Hosler 2009:203-204
[505] Ibid.
[506] Ibid.

also a good quantity, and this witness has seen them take a good amount of copper from there. And from there they have taken forty or fifty loads that he has sent to His Majesty in Mexico which they have given as tribute, and besides that, this witness believes that in the past two years they have produced at least an equal amount for themselves.

And this witness knows that in the said two years twelve Indians have produced all of this copper. In a day they dig out and collect enough for a half celemin[507] *of ore each indian, because it is very hard to collect, and afterward it takes each one of them two or three days to blow on and melt that half a celemin. And they smelt it and produce from it a piece of copper as long as a hand or two fingers longer and the thickness of two fingers, and the same width as a hand, and the form is like that of a clog*[508]*.*

And if there were a greater number of Indians and if they had forges there would be a much greater quantity. And if there were two or three hundred men and if they had forges, they could produce as much as they wanted.

[…] And it is necessary that they be master craftsmen and that they know how to produce it. The Indians do not commonly know how to blow on it or make it, but it is the master craftsmen who know how to produce it, and in every town where there are mines there are twelve or fifteen men who know how to do the smelting.

The testimony of Escobar is interesting because he mentions that he had already sent copper to His Majesty in Mexico City; although he does not specify the year of this consignment he implies that it was at least two years before, hence around 1531. It is an interesting piece of data because this date concurs with the summoning of Luis Fernandez to the court in December 1532 to discuss the making of artillery in New Spain.

This copper had been given as tribute by the natives of the town of Cinagua, which at this moment was already directly under the jurisdiction of the crown. According to Escobar's testimony the amount of copper sent to the City of Mexico was considerable. He claims to have sent 40 to 50 *cargas* (loads) of metal*;* the problem here is that the *carga* was a Spanish measurement of volume not weight. Further on in the document the native smelters clarify that the load is composed by 20-30 ingots. But, what was the weight of an ingot?

[507] The celemin was an ancient Spanish volume measurement that was equal to 4.6 dm^3 (liters). www.rae.es entry: Celemín.
[508] Warren translate it as clog, however the Spanish word is "adobe" which can also be translated as brick, hence a brick-shaped ingot.

Helen Pollard calculated that, according to the document, an ingot of copper with the dimensions described by the different witnesses would weigh between 1.6 and 2.4kg[509]. Pollard arrives at this number by considering the dimensions given of one *xeme* (aprox. 18cm) in length, by one hand (aprox. 10cm) in width, and 1 finger thick (1.5-2cm). She arrives at a volume of 180-270cm^3, and considering that the density of copper is 8.96g/cm^3 then the result is the aforementioned weight[510].

A *carga* then, would weigh between 32-48kg, however if we consider that mules were not yet extensively used in this period, and the primary way to move products was with the use of human bearers called *tamemes,* then we should consider 32kg as a better approximation to its real weight. The tax record of the town of Coyuca[511] in 1542 says that every 20 days one of the tributes of this town was to give 20 tamemes for carrying the copper of Mexico. The taxation specifies that these bearers should not carry more than two *arrobas* of copper each. One arroba was ¼ of a quintal or 25 pounds (11.5kg), hence according to the Spanish *ordenanzas* (although only proclaimed after 1540), the *tamemes* should carry no more than 25kg.

Accordingly, if Escobar sent 40-50 loads of copper it means that the whole shipment would have weighed somewhere between 1280kg and 1600kg, or 28-36 quintals of metal. This is a considerable amount that certainly would not have passed unnoticed for the authorities, especially coming from a town under the administration of the crown. Perhaps this shipment of metal produced the information that the Empress claimed to have received from New Spain in December 1532, and hence would have been the trigger for demanding a detailed report on the copper deposits, technology, rates of production, and possible routes for the carts. Escobar completes this information saying that this shipment was the product of two years of work by the natives of Churumuco.

Second group: Indigenous witnesses

The indigenous testimonies were provided through the translation of Francisco Castilleja, an interpreter of the Tarascan language, and all the statements are signed by him.

The first native witness was Don Pedro, governor and noble-man of the city of Uchichila. He stated that in the time of the Cazonci when there was need for copper he commanded the people from Turicato and Churumuco to produce the copper. When asked about the

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509 Pollard 1987:748

510 Ibid.

511 El Libro de las Tasaciones de Pueblos 1952:146-147

particularities of the activities and the amounts that could be produced he said that he did not know anything about it and that is why he had brought with him the specialists[512].

The second witness was Juan; an Indian native of Michoacán said the following:

"that the copper mines that this witness knows that there are in this province of Michoacán are the following: [*Guacana, the best* – in the margin] *in the town of La Guacana, which belongs to Juan Pantoja, there is a copper mine, and another in Cholomoco, and another in the town of Cocian, and this town of Cocian is subject to Toricato, which is Oliver's encomienda.*

And he does not know of any other mines except these, where this witness has been a smelter of copper. And the Indians went there by command of the Cazonci the get copper out, and they had their fields nearby there.

And when they commanded them to produce copper, every Indian produced one piece a day a jeme in length and about a hand in width, because he has been smelting it for a long time, and in a day each Indian could not produce more than a small plate of this size. And Juan Pantoja produces much copper of this kind in his town, and he will tell how he produces it, because he produces it in quantity, and the witness does not know what method he has for producing it, because he has not seen how Spaniards produce it.

And the Indians smelt it by blowing through hollow tubes, and he has seen the Indians of Pantoja's town called La Guacana producing it, and there is a great amount there. And this is what he knows.

And it seems to this witness that the town of La Guacana could give fifteen loads in tribute and that each load would have thirty ingots of the size he has said that each Indian produces in a day, because it is hard work to produce it, because it is rock, and one breaks the stone, and afterward it is smelted with much work, and thus this witness has produced and smelted it. And if the Indians were commanded that they give copper and nothing else, they would bring it in great quantity. And in the town of Cocian in a year they would make ten piles and in each pile there would be four hundred ingots, and this town is subject to Turicato. And in the town of Cholomoco, subject to Cinagua, if the Indians did not give any other tribute, they would produce in a year twenty piles of four hundred ingots each, and the people of the said town or

[512] Ibid., pp.140-142

village of Cholomoco would do it, because in the rest of Cinagua they do not know how to do it, nor are the craftsmen in this matter, and they would produce this much if they hurried."[513]

The testimony of this native miner and smelter is important for the detailed description regarding certain aspects of production. For instance, the rate and amount of copper that indigenous technology could provide as well as the shape of the ingots, which are important data to postulate the production capacity of the time, and which the following testimonies complemented. Juan mentioned two other important pieces of information, first about the *encomenderos*; he affirmed that in fact (although all along the hearings the *encomenderos* denied it) at least Juan Pantoja was producing copper in his town. This supports the hypothesis that these people were trying to hide the production of copper from the colonial authorities perhaps, as Barrett says, to avoid paying royalties to the crown. The second deals with the principles of negotiation between natives and colonial authorities that would be established a decade later and focused on the tributary loads. Juan mentioned that if the Indians were only required to produce copper and nothing else they could produce greater quantities of metal, a request that would be granted in the next decade to the native of Pátzcuaro.

The third native witness, Don Juan, was the cacique of the town of Cocian and he said he was a speaker of Nahuatl[514] and a smelter of copper, which he produced in the mine of Cocian. About the questions he said:

"that this witness is a smelter of copper, as he has said, and that for a long time he has been producing copper in the said copper mine which is in the said town of Cocian. And this witness with four other Indians in the space of three months has produced twenty pieces of copper [*each one*] a *jeme in length, a hand in width, and two fingers thick. And now recently few Indians have gone to produce it, while before they produced a great amount. And a year ago there were fifty Indians in the said mine producing copper, and that forty Indians, some of them getting out the earth and metal, and the others smelting, in a year produced two hundred ingots like those that he mentioned, and the said two hundred ingots make up ten loads of copper. And they cannot produce a greater amount because it is hard work to produce it.*

If more Indians were to go to produce it, they would produce it in proportion to the number of people, because there is a great deal of ore. And if a Spaniard went with the Indians to produce

[513] Ibid., pp.142-144
[514] In Warren's translation, foot note 6 he clarifies that the Spanish word used in the document "naguatato" could mean either that he was a native speaker of the Nahuatl language or that he was an interpreter of it (2004: foot note 6)

the said copper, it seems to this witness that taking along Castilian tools they could break up some boulders from which they could produce a much greater quantity, because this witness has produced it, as he said, with a great deal of work, because they do not have tools with which to break up some of the big green rocks from which much copper is produced, and because they cannot break them, the Indians get it from just the ground, and that is what they smelt.

[…]Asked what quantity of copper the common people of Cocian could give as tribute, he said that they could give twenty pieces of the thickness and size that he mentioned above, and no more, because there are few workers. There are no more than five smelters, and the women dig out the earth, and this is the amount that they give as tribute to Oliver, their boss."[515]

The testimony of Don Juan goes along with what the other indigenous testimonies present, a very hard job with a shrinking production due to the lack of specialists, in contrast with the production of the pre-Hispanic period. He also mentions that they produce a certain amount of copper that is given to the encomendero as tribute, the same type of production the *encomenderos* tried to hide. The cacique mentions one piece of data that is very relevant for this dissertation and is the mention of the Castilian tools and his acknowledgement as mechanically superior and better suited for the mining works. Not only that, he also suggests that with the introduction of these, the miners could perform better and reach rich mineralized areas in the mine that were difficult to access with their own tools.

This can give us a bit of perspective with regard to the openness of the natives to incorporate Castilian tools and techniques to their own repertoire of mining and metallurgical activities; something that happened in the following years and that certainly also included bellows.

The fourth witness Tapa, a Tarascan Indian and native of La Guacana said that he is a smelter of copper and regarding the questions he said that:

"He knows some copper mines in the town of Guaraxo, subject to La Guacana where they used to produce copper for the Cazonci, and they used to produce a lot, and now they produce very little because the mines are stopped up and they do not find so much metal. And in a month there are three or four Indians, and in the end they produce only a little copper. Twenty Indians would produce five loads for bearers. And their month is twenty days long[516] *, and in those*

[515] Warren 2004:144-146

[516] The Mesoamerican solar pre-Hispanic calendar was divided in 18 months of 20 days plus 5 "nameless" days.

twenty days they produce this amount that he has mentioned, because they are rocks and they smelt it and it is very hard work to produce it.

Asked if he knows of any other mines, he said that in Cholomocoyo subject to Cinagua, there are some mines with a great deal of copper. This witness has seen them and been in them, and there is a great quantity. Twenty Indians could produce two loads of smelted copper in two days, and according to the number of workers, they would produce that much because there is a great amount. And in the first mines that he talked about, if there were many Indians, so that a hundred Indians would clear and clean the earth and get out the ore, in twenty days they could produce ten loads. And these mines, both the one and the other, are large and very long lasting, and they will not play out for a long time.

And this witness has also seen other mines in a town called Cocian, subject to Turicato. And the richest mines of all are those of Choromocoyo, which is subject to Cinagua, and they could produce however much they would want, if they had the workers, as he has said. And the said Cholomocoyo is a corregimiento. And this witness says that a great deal of copper was produced there in the days of the Cazonci and this is the truth by the oath that he took."[517]

The last native witness Juan, native of La Guacana, Christian and smelter of copper said that:

"In the town of Guaraxo, subject to La Guacana he has seen that there are some copper mines where in the time of the Cazonci this witness saw that forty Indians produced ten loads of copper in ten days. And in those days this witness was a boy and he did not know how to smelt. And this mine caved in and it fell and collapsed. It is so full of earth that they cannot get ore from it as they used to do, and now five Indians produce in a day an ingot as wide as a medium-size plate and as thick as a finger. And this they do by searching for it there above, and they do not go into the mine. And if they went into the mine they would get out a great deal, and forty Indians would produce ten loads of copper in forty days. And it would take those forty Indians two months to clean out the mine.

[…] And this witness was further asked what amount of the said copper the Indians of La Guacana could give in tribute, they said that from the said town of Cholomoco, which is subject [*to Cinagua* – between lines] *to La Guacana they could give ten loads every eighty days. He said that in La Guacana there could be ten Indians who know how to smelt and no more, and that every eighty days they could give five loads and no more.*

[517] Warren 2004:146

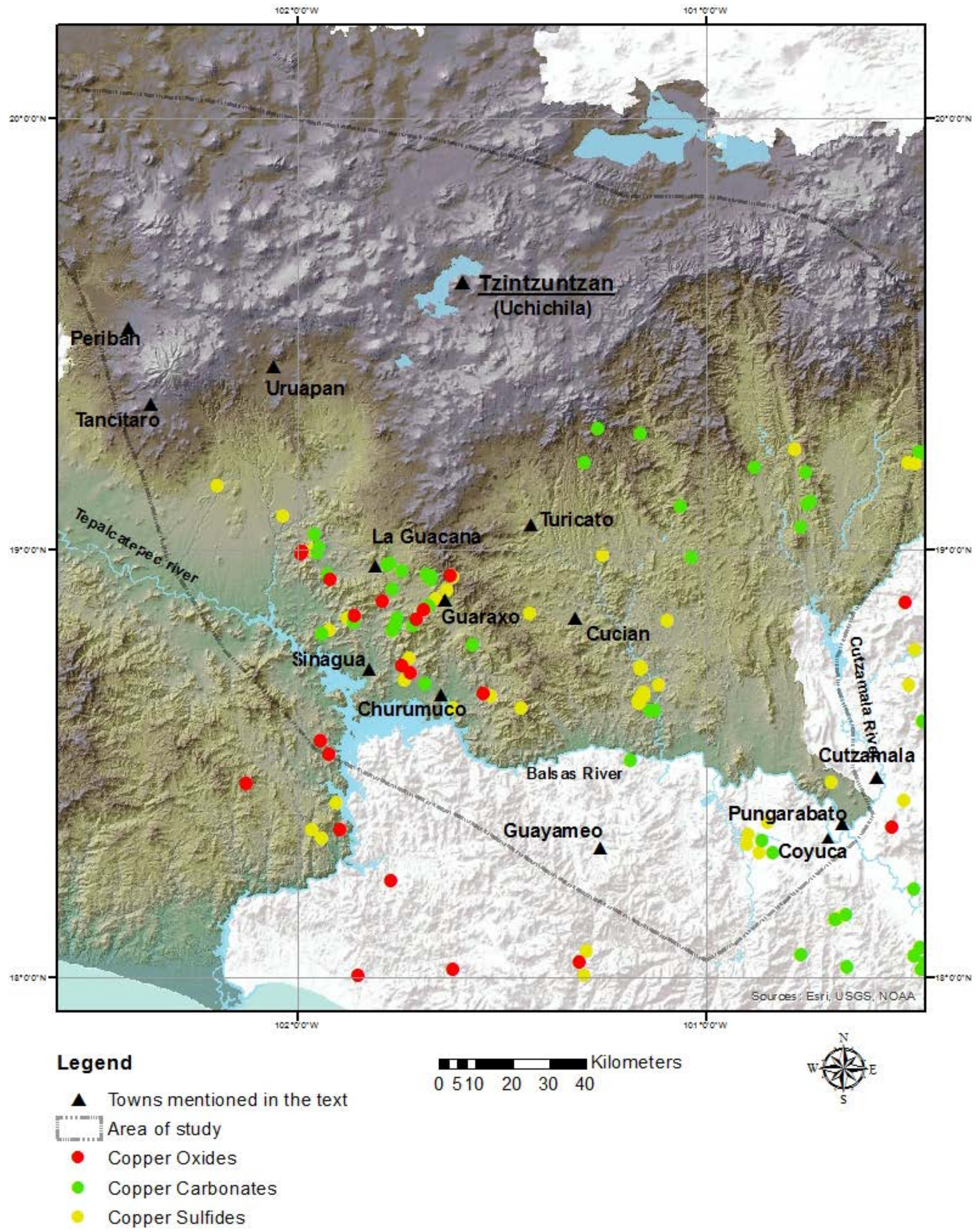
The statements of the native miners and smelters are fundamental here. They demonstrate expertise in their opinions and estimates, especially regarding the quantities that were produced at the time and previously, and what could potentially be produced with higher numbers of people, and time. Their testimonies were assertive and less speculative than those of the Spaniards. They also stated that with the introduction of Castilian tools production would increase, although they did not mention bellows or the forge, perhaps because they were yet not familiar with them. Another important point is their opinion that more copper could be produced if they did not have to provide any other type of tribute, a suggestion that would be negotiated in the *Merced* of 1542, as we will see. Equally important is the mention of the town of Guaraxo, near La Guacana, a place that most researchers associate with Inguarán, and which would become the most important copper mine throughout the colonial period[518].

In summary, Vasco de Quiroga's report provides a detailed account of the state of copper production in the Michoacán region, as well as the places, technology and people involved. The report also raises the question of why, if copper was mined and worked in several places of Mesoamerica, it was precisely focused in this region. It is possible that not only the availability of important copper deposits was the key factor that attracted the Spaniards, but perhaps also the fame of its skilled craftsmen and the refined quality of the metal. In fact, along the colonial period these were the three main features that characterized the copper from Michoacán sometimes even favouring it over other important production places like Eastern Cuba.

Quiroga's report certainly is a unique document, and although the information it provides regarding the practicalities of copper production is of vital importance for anyone interested in pre-Hispanic and colonial mining and metallurgy; its value goes far beyond these issues. It is above all a document that shows the dialogue between two cultures around the topic of metal production. One of the main characteristics of this initial dialogue is that each part had its own voice, concerns and solutions about how to act within this specific context. Hence its historical importance resides in the fact that this initial dialogue will configure the future of the technology in the region and the economic and political role of the groups involved. Furthermore the document itself shows how individual and groups were pushing their own agendas; *encomenderos* trying to protect their profit by hiding the production, crown officers fulfilling their role of finding a very needed metal; and natives (like the people of Cocian) looking for a way to negotiate tribute exemptions based on the production.

[518] Barrett 1981:2; Hosler 1994:38

The documents, as far as we know, was never mentioned again, but given the future events in the region with regard to copper it appeared that it was used to structure the production, the role of the people in it, the technology and even the way in which the region was connected by roads.



Map 16. Distribution of places and towns mentioned in the report of Vasco de Quiroga

5.4.3 The Royal Quest for Copper (1535-1538)

As we saw previously, attempts to establish an artillery foundry in New Spain did not succeed, nonetheless, Vasco de Quiroga made his investigation and sent his report to the court in Spain. In April 17 of 1535 the first viceroy of New Spain, Antonio de Mendoza, was appointed, and among his instructions was an order to establish a mint in Mexico City, which would be the first one in the Americas[519].

The mint was authorized by the royal decree of May 11 of 1535 and with it the crown gave ample powers to the viceroy for its installation, as well as for the appointment of the personnel working there[520]. This mint would become one of the main consumers of copper and metallurgical services from the specialized communities of Michoacán, as we will see in the following sections.

Besides establishing the mint, we know from other documents of the period that Mendoza started to make the necessary arrangements to set up a functional artillery foundry house in Mexico City. Unfortunately, I have found only peripheral data regarding this, and no sources dealing with its creation are available at this point. It is true that among the various instructions given to Mendoza by the crown there are none that deal with a foundry house. However, it is possible that they conveyed tacitly sometime after his arrival. Apparently, Mendoza had repeatedly remarked on the need for artillery in New Spain.

In 1537, Queen Isabella of Portugal was the regent of Spain, and she wrote to the viceroy:

"About the artillery that you request for the port of San Joan de Ulua and the city of Mexico, you already know the need of it we have here and because I have been told that in those lands there is abundance of copper, if over there are masters who know how to make it you would arrange to make the quantity of it which is necessary, otherwise you will inform me if it has to be sent from here."[521]

Mendoza replied in a subsequent letter to the empress. In point 10 of his letter Mendoza says:

"Your majesty commands that because you have been informed that in this land are good resources to make artillery (you) order me to make it and to send to the casa de la contratación in Seville some quantity of it. I already had said to your majesty that there are many mines

[519] Pradeau 1953:28
[520] Ibid.
[521] AGI,MEXICO,1088,L.3,F.75-77 (translated by the author)

from where much metal can be extracted for making all the pieces you want and because of a lack of officers to mine it and to smelt it and a master to command the works we don't do it or take advantage of it, and because of this cause little copper is produced and the quintal (of copper) *brought from Spain (costs) ten and twelve pesos. Because that is the price that a little of copper that I ordered to buy for repairing some pieces of artillery which were broken cost. Your majesty (must) command that the said officers and master that I have requested are sent because if they come much could be done."*[522]

The viceroy's position is quite clear; at that moment (1537-1538) there was still no fully functional artillery foundry in Mexico City. Only repair operations were done, and the amount of copper required for those was still not available from the province of Michoacán, which also implies that the natives were not yet involved in supplying these works. Mendoza still asks the empress to send the necessary officers and a knowledgeable master to mine and smelt the ore. This is a situation that was about to change, perhaps because of the denial for the requested specialists, who as we have seen, did not exist or were very scarce in Spain at this time.

In the same letter Mendoza provides the first acknowledgement of the skilfulness of indigenous metal smiths.

In the point 26 of this same letter Mendoza says:

"I have already mentioned to your majesty how I was afraid that because of the nature and inventiveness of the natives they could forge the (silver) coins. Some 15 or 20 days ago two false "tostones de a cuatro" were brought to me that had been made by the natives. I ordered all the silversmiths from Mexico to be captured, and summoned all the others from the region to know who were the persons responsible, but it was impossible to know for sure anything about it and it is not possible to know about any similar thing that is made among them or how is made. They had also forged coins that run among them and that one has been reproduced and it looks just the same in the good and the bad way as the others made from the first false ones." [523]

That was the situation in 1538; but interesting changes regarding copper production were about to take place during the next four years.

[522] AGI,PATRONATO,184,R.27 (translated by the author)
[523] Ibid. (translated by the author)

5.4.4 Spanish Crown-Native Producers: A Long Lasting Relationship is established (1538-1542)

This period appears to have been extremely important for the relationship between the copper smiths of Michoacán and the colonial authorities, and it coincides precisely with the arrival of Vasco de Quiroga. In 1538 Quiroga went back to Michoacán for the first time since his report on copper production. This time Quiroga arrived as a very prominent figure, having been appointed as the first bishop of the province.

I posit that the arrival of Vasco de Quiroga was a vitally important fulcrum in regard to copper production in the region. First of all, he had produced a detailed report on the state of copper production and resources less than 5 years earlier. Secondly, from the correspondence between the viceroy and the empress we know that New Spain was in need of artillery and the crown was unable to send the specialists requested by the viceroy. We can deduce the latter because none of the requested specialists arrived in New Spain or in Cuba, despite several requests made by the Viceroy Mendoza in New Spain and by the inhabitants of Santiago in Cuba, where the mines were located.

Until now we have not found any source material that directly link Vasco de Quiroga with the development of the Michoacán copper activities. However, indirect evidence suggests that it is possible that the new bishop arrived with instructions regarding the production of copper, gravitating toward using the indigenous knowledge, technology and labour force to start its supply to Mexico City[524]. It is possible as well that, during the period between his arrival and 1542, the Spaniards had introduced European technology such as bellows and iron tools in order to enhance the production.

With his arrival in Michoacán, Vasco de Quiroga transferred the capital of the province from Tzintzuntzan to Pátzcuaro (that was going to be known as the city of Michoacán), making it one of the first exercises for congregations in New Spain. He congregated a number of towns that were located around Pátzcuaro Lake into the newly established capital, and he began the creation of the famous *"pueblos hospital"* based on the utopian ideas of Thomas More, and which functioned as examples for other regional congregations.

The importance of Vasco de Quiroga in the region was immense; he established a system of alliances with the indigenous elites that help to pacify Michoacán, and his influence in the

[524] Horcasitas 2001:171; Brody Esser 2004:179

development of the native arts within the colonial context has been noted by several scholars[525].

In the oral history of the town of Santa Clara del Cobre, which is the only town that maintains the traditional way of producing copper objects in Mexico, the notion persists that it was "tata" Vasco (colloquial name of Vasco de Quiroga in the region) who taught them how to work with copper. In the main square of the modern town there is a plaque which reads *"To Vasco de Quiroga, founder of Santa Clara and giver of its industry".* We know that this is not entirely true as first of all Santa Clara was not founded by him and secondly, he did not teach them how to work with copper. Nevertheless, perhaps it is not entirely untrue either.

It is possible that during this period, and based on his idea of organizing the towns and enhancing unique productive activities in the region, Quiroga had introduced (or help to) the necessary European technology. We cannot forget that during these years the Viceroy Mendoza was also in the region leading the military campaign against the Chichimecas, thus we have two predominant figures with strong interests on copper. One of the major concerns of the time, as we saw, was to produce greater amounts of copper to supply the demand in Mexico City, both in the mint and the artillery factory.

In addition to this, in the following decades Michoacán became an important supplier of finished objects demanded in the colony for specific needs. The most significant were a variety of cauldrons and pans. The shapes of these objects and their uses were not part of the repertoire of pre-Hispanic metallurgists. Hence, there was also an influence on what type of objects should be manufactured, and the teaching and development of the necessary techniques to do it. All of this allowed the native metal smiths to become actively integrated in the economic dynamics of New Spain, as suppliers of specific materials and products within a growing market.

In the following paragraphs as well as in the next chapter I will address this topic, taking some specific sources into consideration.

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[525] Ibid.

5.4.5 The *Merced* of 1542

The next news we have about the activities in Michoacán native copper production comes via an official *merced* (authorization or permission) granted by Antonio de Mendoza to the natives of the city of Michoacán (Pátzcuaro) in May 1542[526].

As we saw, at that moment the capital city of Michoacán was Pátzcuaro. According to the *merced*, the natives of the city of Michoacán provided 53 quintals of copper to the artillery foundry in Mexico City. Given the considerable amount of metal, the viceroy granted the *merced* and ordered the officials to receive the metal from the natives as payment of their tribute. The 53 quintals were taken as equivalent to 500 cotton clothing (mantas). The text of the *merced* continues, mentioning that for the future shipments that have been arranged this should be the price to pay to them.

Since the *merced* had to be preceded by a formal request, this implies that the native smiths were already negotiating with the authorities based on their production, and it is here where come to mind the testimonies of the native informants of Quiroga in his report.

Secondly the amount of copper delivered is considerable. 53 quintals was around 5300 pounds or slightly over 2500kg. This shows a boost in the productive capabilities of the native copper smiths. This is especially interesting with regard to an area that it is not mentioned in Quiroga's 1533 report as a production zone. However, the archaeological research made by Blanca Maldonado and the survey and dating conducted by Jose Luis Punzo suggest there were several copper smelting sites just a few kilometres to the south of Pátzcuaro. Could these smelting sites be early colonial obeying to a reconfiguration of regional production activities? Once again at this moment is impossible to be certain, and perhaps only further archaeological research and more radiocarbon dates can shed light on this topic.

The amount of copper sent to Mexico in 1542 is only comparable with the amount reported by Alonso Escobar in his testimony of 1533. This increase would be explained if between 1538 and 1542 a hybridization of the technology took place in Pátzcuaro or the vicinity, after the process of congregation. This could have come about from the introduction and adaptation of forges and bellows, and the use of iron tools for mining, just as had been suggested in the report of 1533. It would not be surprising an early introduction of this technology. Bellows (and forge) were in use in Mexico City since the decade of 1520s and given the need for

[526] AGN,MERCEDES,VOL.1, EXP.112,F.56V

producing copper to supply the colony a logic step from the colonial authorities (and the natives) would have been to integrate them with the indigenous technology.

It is pertinent to note here the information provided by the friar Toribio de Benavente (Motolinía), who between 1536 and 1542 wrote his famous *History of the Indians of New Spain*. As I referred to ealier, in his chapter dedicated to the mechanical arts that the natives knew and the ones they learnt from the Spaniards, he mentioned the manufacture of blacksmith's bellows (*fuelles de herreros*) by the natives of Michoacán *"where there is a great deal of work with deer hides"*.[527]

However, the foundry house of Mexico City was not the only colonial office establishing a productive alliance with the copper smiths of Michoacán. The mint required the products and services of the natives as well, and here we find a direct mention about the transfer of technology.

5.4.6 Information of Francisco Tello de Sandoval on the Mexico City Mint (1545)[528]

In 1544 the royal inspector Francisco Tello de Sandoval arrived in New Spain. He was a prominent figure of the court, inquisitor of Toledo, canon of the Cathedral of Seville, and member of the supreme council of Indies[529]. He had been sent by the crown to accomplish two main tasks: the first was to inspect and report how and in which way Antonio de Mendoza and the royal court of Mexico (Segunda Audiencia) were preforming their duties; and the second one was to proclaim the enactment of the New Laws of 1542-1543.

The visit of this inspector had major importance, and the results of his inspection of the colony and its administration produced an important series of events that included a direct confrontation with the viceroy, other colonial authorities and the major encomenderos of New Spain.

During his inspection Sandoval produced a detailed report on the functioning of the Mexico City mint, which contains important pieces of information for this dissertation because it

[527] De Benavente 1914:216-217

[528] The original of the document is held in the Archivo General de Indias (AGI) under the signature JUSTICIA, 277. It has been published entirely by Pradeau in his book *Don Antonio de Mendoza y la Casa de Moneda de Mexico en 1543* (1953).

[529] Pradeau 1953:9

addresses the supply of copper and services provided to the mint by the native communities of Michoacán.

The report of his visit to the mint is dated the 27th of May 1545. Tello de Sandoval conducted several hearings and summoned all the different officers of the mint to provide their testimony. One of the questions he asked was for information about the coins that were made in the mint. At that moment two types of coins were produced: silver coins and copper coins. The silver coins were silver *reales* with denominations of four, two, one, and half a real. The copper coins (Figure 19) on the other hand were made with denominations of four and two maravedís. These coins were produced from 1542 until 1551-1552. And their production stopped due to the widespread lack of acceptance by the natives, these coins were finally taken out of circulation by a royal order in 1556[530].

According to the testimonies of the officers the copper coinage proved to be rather difficult. In the beginning the mint workers tried to use the copper provided by the natives of Michoacán, but the blanks produced in the mint ended up being too brittle and hence unsuitable for being struck. A practical solution for this problem was provided by the coppersmiths of Michoacán. Through the intervention of the viceroy, the blanks were going to be cut and produced in Michoacán by the same natives in charge of smelting, who afterwards would send them to the mint ready to be stamped.

To do this, natives of Michoacán visited the mint and were instructed and given the specifications demanded for the job. This solution appears to have been successful, as Tello de Sandoval's detailed report does not include any complaint about the copper coins.

One of the witnesses was Juan Gutierrez, an assayer at the mint, who after being asked about the copper coins declared:

"Copper coins have been made and are made now in fourths of four maravedís and two maravedís and nowadays are being worked, and that in the said house they have made fourths but now those are brought already worked from Michoacán and the only thing we do is to check and refine the weight and if they are fine we coin them, which we do in this house. And it is been more or less two years that this is done in this way; and this is done by the Indians of Michoacán who were taught in this house, from the copper of Michoacán."[531]

[530] Nesmith 1955:41-43
[531] Pradeau 1953:41

The assayer added that these coins contained only copper and no silver, according to orders given by the viceroy. He added this piece of information because at that time a type of coin called vellon was produced in the peninsula, which had a small percentage of silver that regulated their value.[532]

On the 5th of June, the die-sinker Francisco del Rincon was summoned to give his testimony, and in response to the same question he stated that:

"And because the copper with which the said coins were made was from the province of Michoacán and was bad and sour, and did not go well with the hammer, and because the officials of the mint were not able to work with it, and the Indians of Michoacán who were bringing it to this house managed to work with it, and because of that, and because your Majesty could be better served, the viceroy ordered that the said Indians should bring it already worked from Michoacán, so in this house we only coin them."[533]

These are only two small extracts from the hearings, and other officers of the mint referred to the same arrangement.

The copper coins were produced approximately until 1551-1552, but the production stopped because, according to the sources, the copper coin was not well accepted among the native population. Most of the sources referred to episodes of natives accumulating the coins and throwing them into the lake of Mexico.

The history of copper coinage in New Spain was summarised by Juan Suarez de Peralta in a small passage of his *Tratado del Descubrimiento de las Indias y su Conquista* written in 1589, in which he says:

"For a long time, at least up to 1579 when I left New Spain,… the smallest and most ordinary coin given [as alms] *to the Spaniards is the half real of silver because there have not been any* [copper] *cuartos, and the natives do not know what they would like. Thus, when I arrived in Spain… and saw cuartos and learned of their circulating value, I was amazed and could not help ask, is it possible that this coin has a value and that one may purchase food with it?*

I remember hearing it said that Viceroy Mendoza had a large quantity of cuartos coined, which he ordered accepted, and they circulated; and this coinage must have been the grossest stupidity of the land, since the Indians never wished to receive them, and had no remedy.

[532] Ibid.
[533] Ibid.

Instead of accepting the coins, the Indians secretly gathered them and dumped them into the lake, until they put an end to them, and none were seen. When they realized this, no more were ever made."[534]

Figure 19. Front and back of a "cuarto" or copper coin of four maravedís (Reproduced from Sánchez Vázquez and Mena Cruz 2004:72-75)

5.4.7 Copper as Tribute (1542-1550)

In the 1533 report, copper was mentioned as being demanded and given as tribute. The towns of Cinagua, La Guacana and Turicato were said to be supplying copper as part of their tributary loads, although these do not appear in the tax records until 1540-42 and 1550.

In the first official taxation of the towns of Michoacán made by the Bachiller Ortega in 1528, copper is not mentioned at all as part of the tribute of any of the towns, although Cinagua, La Guacana and Turicato are listed in the records[535].

Two main sources contain the information about the tributes of the native towns in New Spain; *El libro de las Tasaciones de Pueblos de la Nueva España* and the *Suma de Visitas de*

[534] Nesmith 1955:42-43 citing Juan Suarez de Peralta's book.
[535] Warren 1985:Appendix B

Pueblos de la Nueva España. The first one contains information that spans a broader period of time, from the decade of the 1530s until the 17th century, while the second one only deals with the period of 1548-1550, and thus both sources can be seen as complementary. All the previously referred towns are mentioned in one or both of the sources, however, only two towns in the region are mentioned in the tax records as tributaries of copper: La Guacana and Jicalán.

The "*Libro de las Tasaciones"* contains the first taxation of the town of La Guacana. It notes that the natives are taxed to give 40 bricks (*adobes*) of copper and one peso de tepuzque (among other products like cotton cloths and corn) each 40 days to their encomendero, Juan Pantoja. Although it does not specify the date of this taxation, a subsequent commutation of this tribute dated August 25, 1543 suggests an earlier date, between 1538 and 1543 due to the fact that the record says that the taxation was made by the bishop of Michoacán (Vasco de Quiroga), who we know only arrived in 1538 for a few months, went back to Mexico and came back again in 1540[536].

Similar information with regard to copper is presented in the *Suma de Visitas* (1548-1550). In this record, it says that every 40 days the *herreros* (literally blacksmiths) from La Guacana give 40 *planchas* of copper[537]. This is interesting because it is the first time that the terms *plancha* and *herreros* are used, at least in this context. In the succeeding years *plancha* would become the reference term for the copper ingot (as we will see in the next chapter), an ingot that according to the sources was morphologically different that the previous brick-like one. The future *plancha* (of the 17th and 18th centuries) would be a big circular disk-like ingot in which one of the faces was convex, following the shape of the bottom of the furnace (*cendrada*), and of a much greater weight (50-70lbs) than the brick-like one described between 1533 and 1543.

According to this, is it possible that between 1540-43 and 1548 the production in La Guacana passed from brick-like ingots to planchas? It is impossible to say with the available data, and perhaps only through archaeology we can answer that question. Nonetheless, we could be seeing an important transformation of the metallurgical technology that included the adaptation of indigenous furnaces to the use of European bellows. Perhaps this is why they were called *herreros* (blacksmiths) in this tax record, which at the time defined a profession (that had to be proven) characterized by the use of a forge, and bellows. In addition there is

[536] El libro de las tasaciones 1952:187-188 (La Guacana)
[537] Suma de Visitas 2013:401-402 (788-Vacana)

the possibility that an intermediate ingot existed in-between the small brick-like ingots of the first half of the 16th century and the massive *planchas* of the 17th[538].

In 1556 a new taxation was imposed on the tribute of La Guacana, and at this time copper disappeared as part of the tributary obligations of its inhabitants.[539]

Although Xicalan is not mentioned in the *Libro de las Tasaciones* it is listed in the *Suma de Visitas* of 1548-1550 as a subject of the head town of Uruapan. It says that its inhabitants give every 80 days 6 small cargas of copper, which would make 24 cargas per year, which according to our calculations is around 950kg of metal, a similar number to what Escobar reported for Cinagua in 1533. Although Xicalán is not specifically listed in the report of 1533, the Spaniard witnesses mentioned Uruapan as a town where copper is produced, so perhaps they were referring to Xicalán. Xicalán became a recurrent historical reference for copper, and its inhabitants produced one of the most important sources of information on the topic, the *Lienzo de Jicalán* (ca. 1565), which is now one of the most famous ethnohistorical accounts of the entire colonial period of Mexico.

Although not a copper producer, the tax records mention the town of Coyuca as a participant in copper tribute. The two sources describe the town of Coyuca as a provider of human bearers (*tamemes*) to carry copper. The taxation of 1542 contained in the Libro de Tasaciones says *"that every 30 days they are obliged to give 20 tamemes to come carrying the copper until this city each one carrying up to two arrobas* (50 pounds) *and no more"*[540]*.* However, the record does not specify the place of origin or the delivery destination. Given the location of Coyuca (map 4), the origin could have been any of the mines in the region or a number of them. The destination could have been either Mexico City or the city of Michoacán (Pátzcuaro). However, considering the distances and the dynamics of copper during these years it is more probable that the destination was Pátzcuaro. If so, then it is possible that the tamemes of Coyuca were carrying the ore that would be smelted in Pátzcuaro or its surroundings.

The date of this taxation is interesting as well. When we look at the big picture, we can see that something very important was happening on a regional level with regard to the copper

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[538] This will be further discussed in the next chapter section 6.4.2

[539] El libro pp.188

[540] Ibid., pp.146 (Coyuca)

production during the first years of the 1540s. The records on Coyuca include a previous taxation dated to 1537, in which this tribute is not present.[541]

The taxation reports of 1548-1550 contained in the Suma de Visitas gives similar information; but now the town had to provide 20 *tamemes* every 20 days[542], which is significantly more, and thus may be expressing increasing demand. This report also says that the tamemes carry the copper "of Mexico," although in the 2013 edition the editors changed it to "to Mexico." They explain that the decision for changing it was based on a better redaction. Nonetheless, it is possible that the tamemes were indeed carrying the "copper of Mexico," alluding to a chain of production that had Mexico City as the final destination, but perhaps included Pátzcuaro and its surroundings as the places smelting it.

On top of that the *ordenanzas* that regulated the use of tamemes included a weight limit (no more than two arrobas) and a maximum distance of 20 leagues (around 100km). Mexico City was clearly beyond that distance, but Pátzcuaro was within the permitted range. Moreover, Antonio de Mendoza had ordered the improvement of the road between Mexico and Tzintzuntzan in 1539 so that products could be transported by beasts of burden and carts[543]. In the subsequent taxations of Coyuca after 1553 the tribute of tamemes disappeared.

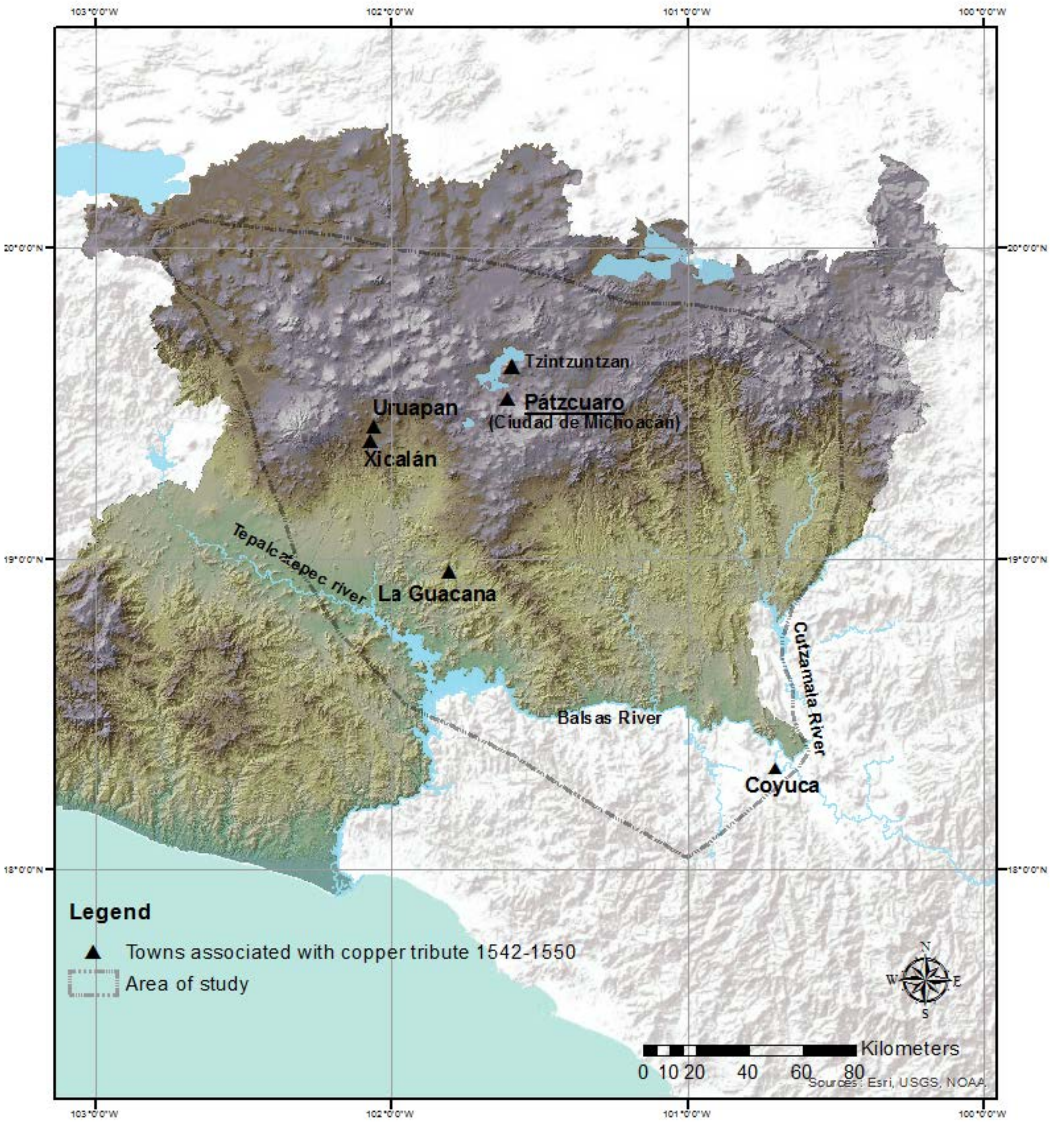
5.5 Discussion

This first part of "worlds colliding" had the intention to show the first encounters with each other's copper technology, as well as to highlight the importance copper had during the colonial period, especially during the 16th century. In this sense this initial part is directly linked with the final part of Chapter 2 because the importance of copper was not only circumscribed to the New Spain. As a strategic material, the metal occupied an important place within the priorities of the Spanish crown and as such it is impossible to understand the events regarding the production of copper in Michoacán without considering the importance of copper and copper trade within the context of Spain and its needs as a rising world power.

The period from 1533 to 1550 shows the establishing of a dialogue in the first place and a subsequent relationship based in the collaboration between the copper producers of Michoacán and the Spanish crown. This relationship was set initially through the direct tribute

[541] Ibid.
[542] Suma de Visitas pp.127 (164 – Coyuca)
[543] García Rodríguez 2014:22-26

between the natives of the city of Pátzcuaro and the Spanish crown by which the natives would provide all the copper to the artillery factory in Mexico City. The relationship was eventually extended to further metallurgical services for the mint of Mexico with a clear example of an exchange of metallurgical knowledge evidenced through the visit of native smelters and copper smiths to the mint around 1543. The intention of the visit was to instruct the natives on the requirements for producing the blanks for the copper coins.



Map 17. Towns associated with the tribute of copper between 1542 and 1550 according to the historical sources

Between 1542 and 1550 three towns in our area of study (Xicalán, Pátzcuaro and La Guacana) appeared as suppliers of copper in the form of tribute, nevertheless, Pátzcuaro is not in the tribute records and we only know about it through the *merced* of 1542. One more town involved with copper as tribute was Coyuca which supplied *tamemes* to carry copper ore from the mines to what we believe is the city of Pátzcuaro. If this is the case then a production chain was structured around copper to ensure a continuous supply of metal to Mexico. This chain would include mining in the rich mineral zones of the hot lands; transport of ore from the mines to the smelter in Pátzcuaro; smelting of ore, and finally, the transport of metal to Mexico through the newly repaired road (ordered by Mendoza). If indeed this big chain of production and distribution was set in place as we think, then it certainly would include indigenous and Spanish agents.

At the end of this period copper disappeared from the tribute records. Barrett has suggested that this was motivated by copper production becoming a commercial activity. The historical sources of the following years show that indeed this could have been the reason and at least until 1580 the whole activity will be in the hands of the natives. Furthermore, the crown will forbid the Spanish entrepreneurs to trade with copper, thus allowing only a direct channel between the native producers and the colonial authorities.

CHAPTER 6

WORLDS COLLIDING (1550-1607)

The decade of 1550 began with two important events that would have an important effect on the production of copper at a regional level. The first was a shift of power in New Spain. The confrontation between Francisco Tello de Sandoval and Viceroy Antonio de Mendoza after the inspector's visit between 1545 and 1548, ended with the removal of de Mendoza from his appointment. After several charges were filed against the viceroy and presented in court, the crown decided to send de Mendoza to the viceroyalty of Peru in 1550.

In his place the crown appointed Luis de Velasco as the viceroy of New Spain, a position that he held from 1550 until 1564. As we pointed out in the first chapter when discussing the evolution of indigenous tribute, the new viceroy had among his instructions a royal order for optimizing the tributary dynamics of the colony. Part of the strategy was to restructure the tributes and to demand payment from the native communities of bigger portions of their tribute in gold and silver. In Michoacán this had an important impact on copper production, and it is precisely during this period that copper disappeared from the tribute lists and starts appearing in the document as a product widely traded by the natives. The trading of copper grew to the point that in 1570 the colonial authorities issued an order to regulate the way in which copper ore and metal were traded.

The second important event of the decade was the proclamation of the mining ordinances of 1550. Before leaving the position, Antonio de Mendoza proclaimed his famous mining ordinances for the mines of New Spain. As I discussed previously in Chapter 1, the ordinances of Mendoza dealt extensively with issues of discovery, property, and rights over mines in the territory of New Spain. The text also includes mechanisms for solving disputes with regard to these issues. The ordinances of 1550 were the main set of mining laws from 1550 until 1602 and their practical application proved to be successful enough to influence subsequent sets of laws with regard to mining in the Spanish territories.

To what extent did these ordinances influence the exploitation of copper in Michoacán? It is hard to say but as we will see we will see in the following section, it is after this moment that an increasing number of mines started to be registered by Spaniards in the region, especially copper and tin deposits. The new set of mining laws certainly had a regional impact and it is in fact within this frame that a legal dispute arose in 1565 between the natives of Xicalán (Jicalán) against the natives of Urecho. The resulting legal process shows that the dispute was related to certain copper, matiz, and limestone mines and the associated areas of activity.

6.1 Jicalán Enters the Scene

The first mention of Jicalán appears in the report written by Antonio de Carvajal in 1524. After the Spaniards entered the Michoacán territory in 1522 led by Cristobal de Olid, Cortés asked for information about the towns, inhabitants and natural resources of the new territories. Antonio de Carvajal was appointed as the captain of this expedition, which explored the Tarascan lands between 1523 and 1524. His report was the first colonial account of Michoacán, and as such functioned as the base for granting and distributing the first *encomiendas*[544]. Upon visiting the town of Uruapan, Carvajal reported the existence of a town called Chicaya, a subject of Uruapan[545] that consisted of 60 houses and was located at a distance of four leagues from the head town. Modern researchers have associated this town with the old settlement of Jicalán[546] (map 18). In 1609 its inhabitants were relocated some 10 km northward, where it still exists today[547].

As previously said, Jicalán is not mentioned in the report made by Vasco de Quiroga in 1533; however, two of the Spanish witnesses testified that they had heard that in Uruapan (Juan Pantoja) or in a town subject to Uruapan (Juan Alvarez) there were natives who worked with copper and that, by extension, copper mines should be located there or in the vicinity. It is most likely that these informants were talking about Jicalán.

Jicalán appears again in the tax records of 1548-1550, and this time it is stated that they gave six small loads of copper every 80 days to their *encomendero* as part of their tributary obligations.

Between 1550 and 1565 we lose track of any information related to copper or its production in Michoacán until Jicalán and its inhabitants reappear in the record. This is the period of the government of Viceroy Luis de Velasco. Despite the lack of specific data, this period is very

[544] Warren 1963
[545] Ibid., pp.411
[546] Roskamp 2010
[547] Ibid.

important due to the changes in the tributary practices of the native towns and the introduction of the *repartimiento* system of forced labour which, particularly in the case of copper production, would have an important role in the years to follow.

6.1.1 Lawsuit between the Natives of Jicalán and Urecho (1565)

In 1565 the natives of Jicalán, Urecho and Uruapan were involved in a lawsuit against each other over the possession and rights to exploit certain mines[548]. On the 8th August that year, the natives of Jicalán brought a complaint in front of the colonial authorities in Pátzcuaro against the natives of Urecho (map 18). In it the people from Jicalán stated:

"by ourselves and in the name of the other natives of the said town we say that us having as we have within our territory some lands that are in a hill where we collect and take advantage of certain matiz with which we paint the gourds that we make in our said town, it can be fifteen days more or less that the natives of the town of Hurecho had disturbed us and continue to disturb the collecting of the said matiz saying that is theirs, which they cannot do in accordance with the justice, because on top of the fact that is in our lands and territory it has been [like this for] *many years, so many that the people have no memory of it that we are in possession and take advantage of the said matiz"*[549].

A week later the same natives presented a new complaint in front of the authorities in which they accused the people from Urecho of being road robbers. According to the accusation they were coming out of the hill and the natives of Urecho robbed them, taking their matiz, a blanket, and a hat. The natives of Jicalán demanded the justice to imprison them under charges of road robbing.[550]

Later that month on the 21st August, the accused stood in front of the authorities and denied the charges entirely. Instead, they accused the natives of Jicalán of entering the territory of Urecho without their consent and stealing the said matiz. The natives of Urecho denied that the people from Jicalán had any rights over the disputed territory and, as such, demanded punishment for the trespassers.

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[548] The original of the document is held in the Archivo Municipal de Pátzcuaro (AMP) under signature: Sección Indios, Siglo XVI, Caja 131, Legajo 3. The document was extensively studied by Hans Roskamp (1998) and I will be working with his palaeographic version of it.
[549] Roskamp 1998:164 (translated by the author)
[550] Ibid., pp.164-165

According to the natives of Urecho, the real owners of the disputed lands were the caciques of the uacúsecha elite (Tarascan rulers) and their colonial successors[551]. The defence and subsequent accusation from the Urecho side was based on the argument that before the arrival of the Spaniards all the lands and mines were the property of the Cazonci (as it has been discussed in Chapter 3) and hence the only right they could have was a licence of exploitation.

In short, the natives of Urecho said that it was impossible, as the people from Jicalán claimed that those lands and mines were their property since time immemorial. They added that in any case the rightful owners were the successors of the Cazonci, Don Antonio Huitzimengari and Don Pablo Huitzimengari. Additionally, they said that the disputed lands and mines were within their territory anyhow, and not in the territory of Uruapan which was located (according to them) more than twelve and thirteen leagues away from the disputed hill[552]. They finished their testimony by saying that if the authorities allowed the actions of Jicalán without any punishment, this would cause more claims and harm to the properties of the Tarascan nobility.[553]

In this regard it is important to mention here that Urecho was culturally a Tarascan town and in the document we can see how they still kept the alliance to the authority of the Uacúsecha lineage, represented by Don Antonio and Don Pablo Huitzimengari. However, Jicalán was a Nahua town and by this process and the *Lienzo* (next section) we can assume that they were only looking after their own interests without much consideration of the current indigenous authorities.

On the 29th August the authorities of Jicalán gave power of attorney to the Spaniard Miguel Angel Medina for the purpose of representing them in court. Through the representation of Medina, the natives of Jicalán presented a first version of the complaint in front of the colonial authorities in Pátzcuaro against Urecho. On the 6th September they enlarged their complaint by adding other mines of copper and limestone to the already mentioned mines of matiz:

"Don Joan and Don Domingo and the rest of the natives of Xicalan subject of Oruapa say that having and possessing us a hill that is located within our territory, certain copper mines and another hill and some others mines of matiz with which we paint our gourds and jointly with some caleras (limestone mines) *from where we take out limestone all of which we discovered*

[551] Ibid.
[552] Ibid., pp.166-167
[553] Ibid.

and possessed since many years to this day and now the natives of Urecho have disturbed and keep disturbing us in the possession that we have of them, entering in our mines and taking by force the said metals and matiz and limestone, and the natives of Oruapa in past days understanding that is within our territory asked before your grace a writ of protection of all the said matiz which your grace heard, and this is the copy that we present and now to our right convene that we get writ of protection over the said matiz as well as over the mines of copper and limestone. Therefore to your grace we ask the protection in the said possession by ordering the concession of the said writ of protection, and if those from Urecho have to ask or to demand for forgiveness to your justice they can do as they wish, because in agreement to the law we cannot be dispossessed from the possession without firstly being defeated lawfully"[554].

Unfortunately the document is incomplete and we do not know the outcome of the process or if any proof, other than the testimonies, was presented. However, it is interesting to observe the knowledge of the laws and the colonial legal system shown by the natives of Jicalán. Their use of a Spanish attorney (*procurador de causas*) to legally represent their claims in front of the authorities, and the way they presented their arguments based on a remote past that even preceded the late pre-Hispanic Tarascan rule, shows an advanced level of legal knowledge.

This level of political awareness is manifest in the creation of the *Lienzo de Jicalán* which, although we do not know for sure whether it was used in the process against Urecho, was certainly created with the purpose of being presented in court as proof of their ancient (and sacred) ownership over several copper, matiz, and limestone deposits.

6.1.2 The Lienzo de Jicalán (*ca.* 1565) [555]

In addition to the *Relación de Michoacán* (1539-1541), perhaps the most extensively studied colonial ethnohistorical document from Michoacán is the *Lienzo de Jicalán* (Figure 20). The *Lienzo* is a pictographic document which was used and elaborated upon in the second half of the sixteen century, as proof of the rights that the indigenous authorities of Jicalán believed

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[554] Ibid., pp.168 (translated by the author)

[555] This lienzo has been called "de Jucutácato" since it was reported to be found in the town of Jucutácato, south of Uruapan, in the mid-19th century. It has been called by this name though the events it claims to narrate do not correspond in any way to the history of that settlement and how the document ended up there is still unclear. For the purpose of this research, I will use the description and interpretation given by Hans Roskamp (1998, 2010, 2013) on his profound study of the document, and therefore his suggestion to call it Lienzo "de Jicalán" instead of "de Jucutácato" will be considered as well.

they held over several mineral deposits, copper sources, and soil-based colorants in the *Tierra Caliente* of Michoacán. The *Lienzo* is several things at the same time: it is a map, it is a chronicle that tells the story and foundation of the town and its people, but above all it is a political document created to be used in legal disputes over lands and mineral deposits.

The *Lienzo* is divided into 38 frames forming a series of scenes connected by a red/orange[556] line. This line indicates the order and the direction of the reading and therefore is an essential part of the document. In iconographic terms, the document represents five different portions or scenes of one story[557]. They are: the creation of men by the god Tezcatlipoca, their migration in remote times from a place in the east of Mesoamerica into this region of Michoacán, the foundation of the town of Jicalán, the procurement of copper ore and matiz, and the production of copper objects and painted gourds[558].

The *Lienzo* is an extraordinary document that is presented as a fundamental source for this dissertation in three main ways. The first is the context in which it was produced and the specific function it was created for.

As we saw in the previous section, the natives of Jicalán had a difficult legal confrontation with the neighbouring town of Urecho, and although we do not know how the proceedings ended, we can observe the tension over the ownership and possession of land and resources. It is even possible, as Roskamp says; that the conflict against Urecho was not the only one that Jicalán had to face during those years.

In 1566, only one year later, the Spaniard Francisco Alemán registered a few mines in the vicinity of Contenparo in the name of Pedro Vasquez. This Contenparo is the Condémbaro mentioned in the *Lienzo* as the final destination of one of the routes shown on the document[559] (Route C – Map 18). In addition to declaring to the authorities that the mines were deserted, as part of the registry process, Alemán indicated the location of his mines in relation to those of other Spaniards such as Joan Fernandez, Mateo Gutierrez, and Juan Pantoja. This further suggests that the area was being claimed as an area of exploitation by both natives and Spaniards and, as such, Jicalán regarded these claims as threatening.

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[556] This same color has been used in the Lienzo for other elements which might be related or not, among them, the clothes of the main characters, copper objects and copper mineral deposits (Roskamp 1998:109; 2010).
[557] Roskamp 1998:109
[558] Ibid. Pp.105-120
[559] Ibid., pp.192

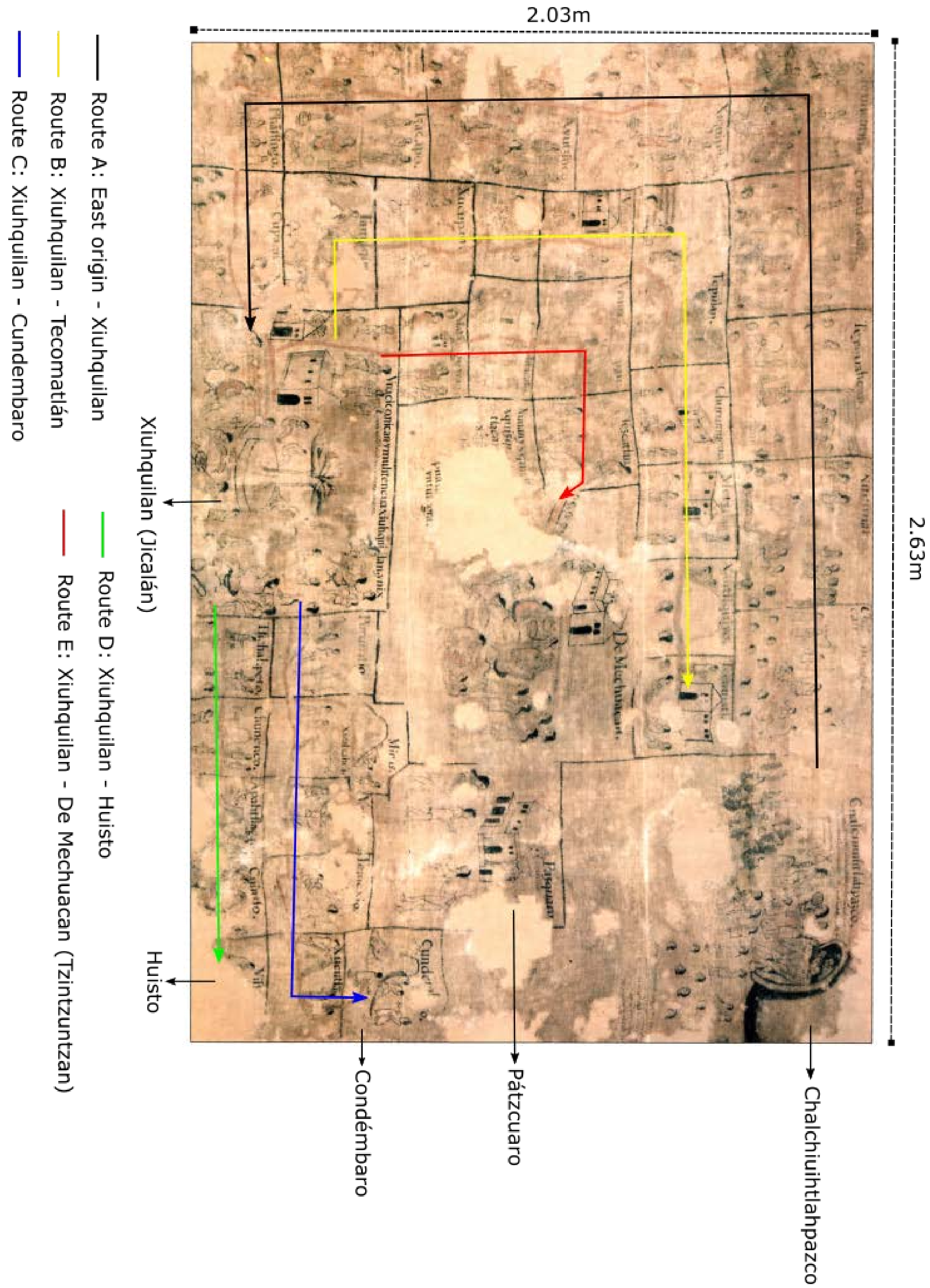

Figure 20. The Lienzo de Jicalán (Modified from Roskamp 2004:fig.1 and 2)

In 1568 Mateo Gutierrez registered two mines, one for copper and one for tin, in the vicinity of Huisto in the name of Juan Fernandez Madaleno and the *licenciado* Pedro de Villafranca. Once again, this is an area located along the mining routes described in the *Lienzo*[560]. In this case Huisto was the town mentioned as the final destination on the south-western route (Route D – Map 18).

Considering that Mendoza's ordinances of 1550 established a well-defined body of mining laws which dealt extensively with issues of property, exploitation rights and discoveries, it is not surprising that a document such as the *Lienzo* was produced. In this context, the document was conceived as a tool for political action to be used in legal disputes with the aim of legitimizing the rights of the Jicalán people over the mineral deposits. In this case, as Roskamp mentions, the *Lienzo* functioned as a mining title[561].

The second aspect of the *Lienzo*'s importance for this dissertation is the way in which the story is told, and how the narrative is structured to highlight certain key elements of the legal discourse of the time regarding indigenous ownership.

According to the *Lienzo*, the ancestors who founded this town in remote times were Náhuatl-speaking Toltecs[562] who venerated the god Tezcatlipoca. They had at some moment set out on an arduous migration towards Western Mexico that eventually brought them to the area south of the modern city of Uruapan. It was here that they established the *cacicazgo* (chieftainship) of Jicalán and initiated their main economic activities: copper work and the elaboration of painted gourds[563].

The *Lienzo* begins with the creation of mankind by the god Tezcatlipoca inside the *chalchiuihtlahpazco* or "bowl of precious green stone" (Figure 20 and 21). The glosses indicate that men were created out of ashes or blood, and from this creation seven groups came out of the bowl[564]. There were those made of ashes, those belonging to the house of arrows, the

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[560] Ibid. (AMP,Sección Registro de Minas, Siglo XVI, Caja 131, Legajo 3, Año 1568)
[561] Roskamp 1998:192
[562]The Toltecs were a social group that populated regions of what nowadays is the central plateau of Mexico during the late classic-early postclassical period of Mesoamerica (800-1200AD), characterized and recognized as the epithet of high culture. All the civilizations that came after them tried to link the lineage of their rulers to the Toltec tradition in a process of legitimization of elites. This practice was in use until the late 17th century and was practiced by different Mexican populations.
[563] Roskamp 2013:302
[564] Roskamp 2010:71

Toltecs, the Nahuas, those who guard the quetzal feathers, the inaugurators, and those who put lime in their hair[565].

After leaving the bowl, the people were guided by Tezcatlipoca in his *nahual* form (companion animal) along a mythical migration across the center of Mexico and towards the west. Once they arrived at the territory of Michoacán, Tezcatlipoca ordered them to found the *altépetl* (settlement) of Xiuhquilan. According to the analysis by Roskamp, it was the same deity who told them to start working copper and painting gourds, helping them to find the necessary resources as well, and perhaps teaching them the technical knowledge.[566]

Figure 21. Detail of the chalchiuihtlahpazco or "bowl of precious green stone", origin of the people of Xiuhquilan (modified from Roskamp 2004: Figure 1)

The story narrated by the *Lienzo* has three interesting components; first it shows that the realm of metallurgical technology was still anchored in native cosmogony and tradition: the creation of mankind, the intervention of the gods, the mythical migration, and the sacred nature of the technology and metallurgical knowledge. Second is the use of that cosmogony

[565] Ibid.
[566] Ibid., pp.72

and mythical past to structure a discourse on the legitimacy of their rights within a colonial context: this is ours because it has always been, and was given to us by divine intervention before the Spaniards and even before the Tarascan rulers conquered the region.

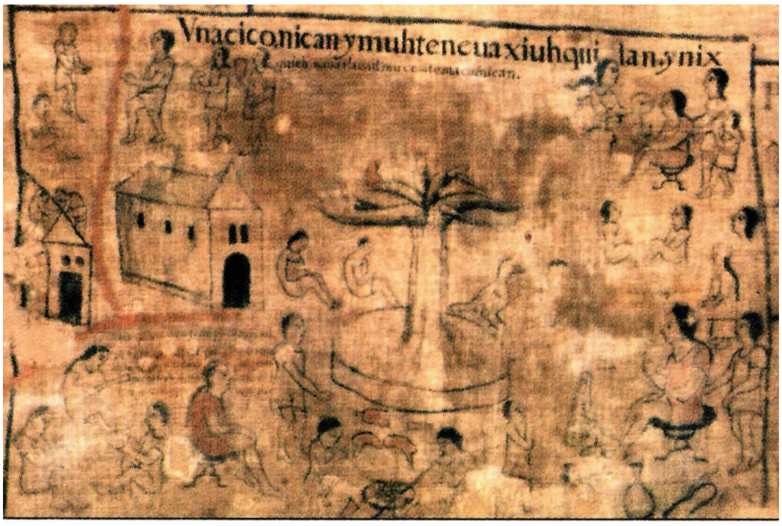


Figure 22. Detail of the foundation of Xiuhquihlan (modified from Roskamp 2004: Figure 1)

The third and perhaps more “practical” aspect of the *Lienzo*’s importance for this dissertation is the actual copper mining and geographical information that it contains.

As the story of the peregrination ends with the founding of Xiuhquilan, four other routes depart from the town and go across a determined number of places and towns (Figure 20). Roskamp has managed to identify some of the places and hence has been able to map out these possible routes.

Three of these routes (B, C, and D) appear to have been closely related to the exploration, discovery and exploitation of mineral resources in the region, whether copper, mineral-based colorants (matiz) or limestone.

The *Lienzo* reveals that the inhabitants of Jicalán exploited copper mines located along three routes leading to different areas within the region (Map 18). While not all the places mentioned in the document have been identified, Roskamp made the exercise of mapping the four routes based on the few identifiable places; in Map 18 we have superimposed a layer of copper ore deposits to Roskamp's map with the intention of highlighting the relationship between the *Lienzo* and the copper deposits region[567].

In the *Relación de Michoacán* the *Tierra Caliente* region appears and is described almost exclusively as an extraction zone for valuable natural resources that were exploited by the Tarascan rulers at Tzintzuntzan. In contrast, the *Lienzo de Jicalán* emphasizes the antiquity of the area's occupation by Náhuatl speakers, who claimed to be masters of Arts belonging to the Toltec tradition. It is clear from the *Lienzo* that this people had their own worldview and religion and were absorbed into the Tarascan kingdom just a short time before the arrival of the Spaniards.

6.1.3 The Old Town of Jicalán and the Archaeological Evidence

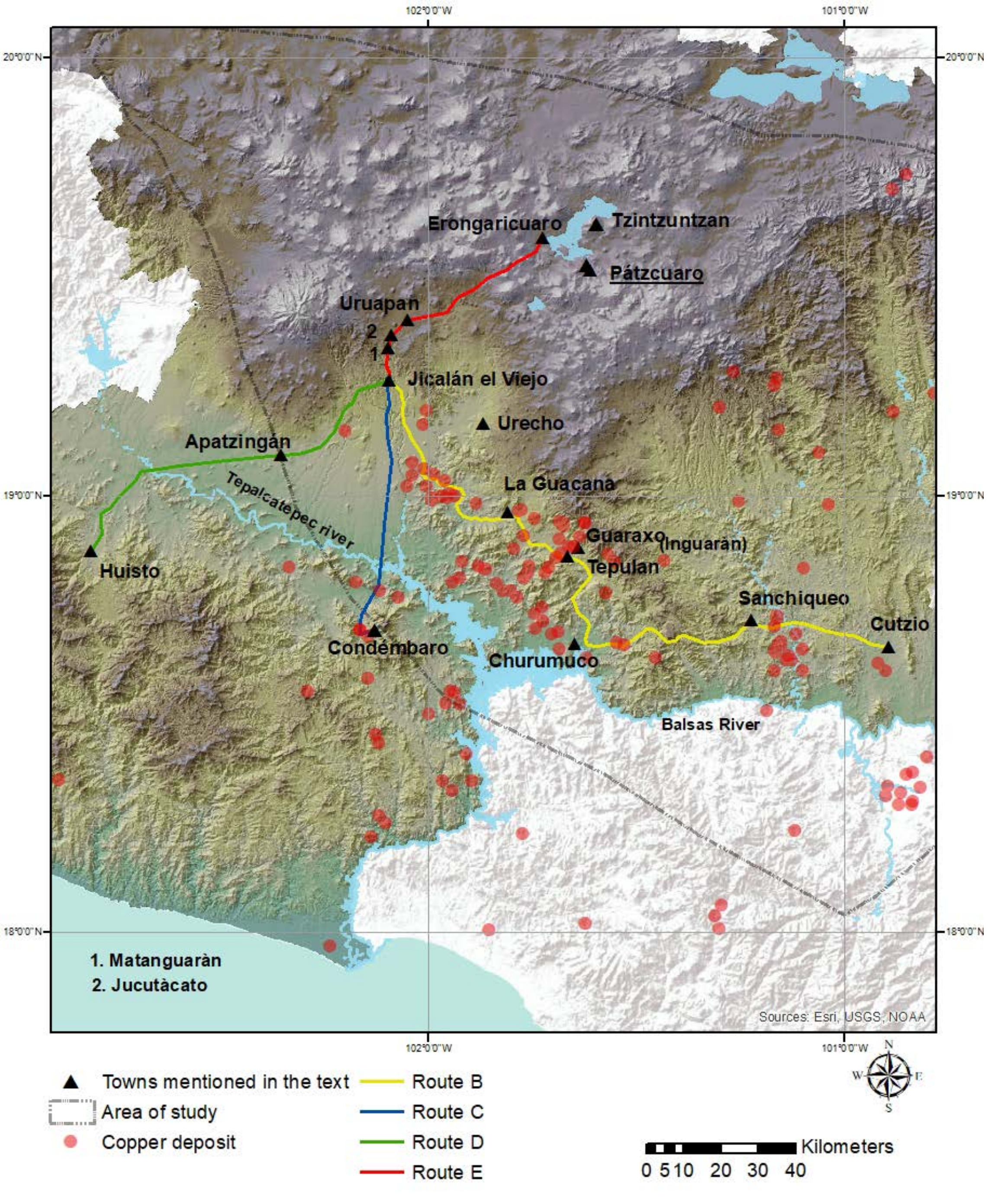
Jicalán el Viejo is located on a small, flat mountain top (mesa) that measures approximately 500 square meters, and is located 12 km south of the modern city of Uruapan. The site has suffered a vast and constant deterioration since its abandonment due to extensive agricultural and pastoral activities. In addition, over the years it has undergone massive illegal looting activities encouraged by local stories about the presence of large quantities of gold hidden underground.

The brief archaeological recognition of the Jicalán el Viejo site conducted by Dora Gringberg in the 1980s was a first glimpse into the evidence produced when applying an interdisciplinary analysis. She recognized different areas of activity based on the material present on the surface[568]. Gringberg recognized several concentrations of metallic slag dispersed over the terrain, collected them and analysed them[569]. The results stated that *"[the analyses] confirmed that the slag was antique and neither Spanish nor modern, because of the quantity of metal prills[570] trapped in them. In some of them the prills are pure copper, but in some others they are copper-arsenic. It was possible to observe small amounts of copper sulfides as well, which indicate that they were reducing sulphurous minerals[571]".*

The former was a good first attempt at interdisciplinary analysis whereby Gringberg departed from the assumption of an ideal smelting operation represented by the European or modern

[567] Roskamp 2004:Figure 3; 2010:Figure 5 and 2013:Figure 2.2
[568] No archaeological excavation was conducted.
[569] Gringberg 2004a 68-69
[570] Prills are small drops of metal usually trapped in the viscosity of the flowing slag.
[571] Ibid. Pp.69

metallurgical tradition. The evidence of "less efficient" operations were (according to Gringberg) a clear indicator of native technology belonging chronologically to the pre-Hispanic era.



Map 18. The map shows the routes mentioned in the Lienzo which were used by the people of Jicalán to access the resources needed for the manufacturing of metal objects (copper) and the "matiz" used for the painted gourds. (Based on Roskamp 1998 and 2013:Fig.5)

In 2003 Hans Roskamp carried out a second attempt to archaeologically identify the old settlement of Jicalán. After an extensive and detailed iconographic and contextual analysis of the *Lienzo*, he conducted topographical mapping to spatially characterize the site. His research was then focused on systematic surface collection and the excavation of three test pits[572].

Roskamp reports on various architectural features, among the most important of which are a small, square, stepped pre-Hispanic pyramidal basement that measures 22x22 meters with a height of 5 meters[573], and three heavily damaged U-shaped structures that appear to form a complex with the pyramid itself[574]. Around this complex, *"accumulations of pottery, broken stone slabs and bone fragments were found and could suggest the presence of a burial area*[575]*"* within the site. Clearly these materials had been strewn on the surface from looting in recent times.

Roskamp also reports on a small structure some 175 meters to the north of the main complex, which he identified as an early colonial chapel based on the façade features of carved limestone and the presence of an atrium[576]. The religious building was erected at the very center of the settlement, on the elevated area that corresponds to the pre-Hispanic site, following the Spanish tradition of building their temples over the indigenous ones as an avocation of conquest and religious domination[577]. Roskamp identified accumulations of slag located in and outside of what he believes is a cluster of domestic unities and habitation terraces.[578] The prospecting work done throughout the site also revealed the presence of numerous petroglyphs[579].

In 2006 Blanca Maldonado analysed fragments of slag from the collection made by Roskamp. The metallurgical and metallographic analyses were made with the idea of comparing them with another set of metallurgical debris from an archaeological site reported to be contemporaneous, called Itziparátzico, located near the modern town of Santa Clara del Cobre[580].

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572 Roskamp and Retíz 2013:40-49
573 Ibid. Pp.42
574 Ibid.
575 Ibid.
576 Ibid. Pp.43
577 Gruzinski 1991:220
578 Roskamp 2013: 46
579 Roskamp and Retiz 2013:46-47
580 Maldonado 2006:55

Maldonado reports that *"Slag samples from Jicalán were subjected to the same analyses as the samples from Itziparátzico, producing similar results: evidence of a smelting technology that used sulfidic ores and very efficient furnaces[581]".* Contrary to what Gringberg reported some years before, Maldonado mentions the efficiency of the smelting processes that produced the debris in question. The results from the analyses of the two sets of metallurgical evidence (according to Maldonado) show a very efficient smelting technology that was not only processing complex ores (sulfides) but was also reaching temperatures above 1100ºC. This temperature is much higher than what archaeologists believe could have been reached in pre-Hispanic times.

Although the two sites have not been dated with absolute techniques, the materials associated with the slag excavated suggest a relative age that falls within the late pre-Hispanic period. In interpreting the technology, Maldonado arrived at a dilemma: if the slag is pre-Hispanic, we are seeing a previously unknown technology that included the use of some kind of draft air furnace; if the slag is early colonial then we are seeing a Spanish smelting facility that clearly indicates the early use of bellows[582].

It is evident that archaeological research on the topic of transitional pre-Hispanic/colonial metallurgy has been reliant on a preconceived idea of finding one technology (indigenous-pre-Hispanic) or the other (Spanish). Such a view overlooks the possibilities of mixed processes and hybrid forms which are very common in transitional phases[583].

Some of the early Spanish chronicles and most of the 16th, 17th and 18th century documents used for this research suggest the early use of hybrid copper metallurgy. This refers to native metallurgists using and adapting Spanish techniques and tools, and Spanish colonizers learning how to mine and smelt copper.

6.2 Establishing the Copper Market, Northern Exploitation, and the Decrease of Native Population (1570-1590)

The next two decades would see a marked dynamism around copper in the region. The ore and the metal began to be traded extensively by native traders and merchants, and slowly but steadily the Spanish traders and producers found their way into this scenario. This period

[581] Ibid. Pp.189
[582] Ibid. Pp.189-196
[583] Hosler 1994:67-69

would see the appearance of new smelting centres located on the intermediate zones between the mines and the high plateau region, near the rich oak-pine forests which were essential for making high quality charcoal. This is remarkable because it shows that the settlement pattern related to copper production changed continuously during the century, relocating the smelting sites closer to the fuel sources, major centres of population and colonial activity, and main roads, in a clear attempt to connect the production of copper to the centres of higher demand, in this case Pátzcuaro and ultimately Mexico City.

There are two other important developments in this period. The first development was the beginning of copper exploitation outside of Michoacán in mines located in the northern regions associated with the exploitation of silver mines. According to the documents the exploitation of these copper deposits was a fundamental part of silver extraction within the context of the northern expansion. The second, and perhaps the most important change, was the dramatic decrease in the native population. Several epidemics with high mortality rates hit the region (and New Spain on the whole) after the arrival of the Spaniards; however, the epidemic of 1576 proved to be devastating, killing around half of the native population.

6.2.1 Mapping a Moment: the Copper Market in 1570

In 1570 the main authority of Pátzcuaro (Ciudad de Michoacán), García Manuel Pimentel, produced a brief but very important document with regard to the copper trade[584]. In it Pimentel orders the regulation and standardization of weights and balances used to weigh the mineral and metal in copper contracts. The warrant mentions the towns where copper is smelted and/or traded, and hence gives us an indication of the places involved in copper production and trade at the time. The warrant says:

"I Garcia Manuel Pimentel mayor of this city issue this warrant equally by his Majesty. Inasmuch I am informed that [among] *the native people of this city and the towns of curunendaro, pucuandaro, tzatzeo, opopeo, aramutaro, cutzaro, yrapeo, pi(.), quareo la guacana where copper is traded and smelted, sold and bought among the native traders that deal with it and work with it there is great damage and opprobrium, because the said merchants have as a habit that for receiving the said copper from whom they buy it they have some weights and buy the said copper by reason of thirty pounds by arroba and sell it by*

[584] AMP,Pesas y Medidas, Siglo XVI, Caja 131, Legajo 4, Año 1570, 2fs. (translated by the author)

reason of twenty five pounds, and for doing this they have made stone weights (…) defrauding in this city and in the said towns (…) and for providing (a solution) and remedying by this warrant in the name of his majesty I order the said merchants and traders of this city and in the other towns (…) to buy and sell from this moment on with a price by weight and measurement by reason of the quintal of 100 pounds and the arroba of twenty five pounds and no more nor less. The weights for this purpose have to be those with which the Spanish merchants are accustomed to weigh that are approved and weigh with branded weights and with the brand of this city and the said weights have to be made of iron or copper as it is said, otherwise a fine of twenty pesos of gold will be given as punishment (…)"

Although this is a short document, it gives us two important pieces of information; the first is the fact that at that moment copper had a very dynamic market that had to be regulated to avoid abuses and excesses in the transactions. The order was issued to the native merchants, traders and perhaps producers (which could be the same) of a small number of towns where copper was smelted and traded. This is a fundamental piece of data because it strengthens the previous and later information about copper trade being in the hands of the natives and, furthermore, it lists the towns where copper is produced and traded. These data can be viewed in comparison with previous and later sources that gave similar geographic information, to see whether something had changed or would subsequently change.

Some of these towns were well known and had consistently been mentioned in different sources; such is the case for La Guacana (in the report of 1533) and Pátzcuaro (in 1542). However, all the other places mentioned in the document appear for the first time, at least in relation to copper, it is also interesting that Jicalán is not mentioned. Most of these places developed an increasing level of importance on a regional scale during the following years, such as Satzeo in which the first royal smelter was set in the early 1600s, but that according to this document was already functioning as a place for copper production since at least 1570. Map 2 shows the distribution of the towns mentioned in this document. We can observe important pattern changes in comparison to the information from the previous 30 years, as production sites moved to the highlands near the plateau where fuel was abundant.

As I briefly discussed in Chapter 3, this was due to the fact that the smelting operations demanded a much greater quantity of charcoal than of copper ore, in a ratio of 1:3. From this perspective, the relocation of smelting sites corresponded to practical efficiency, and although the mining sites remained the same or varied little over the years, the pattern of distribution of production sites changed completely.

It is important to note that the document itself clearly specifies that the warrant is intended for those towns were copper is smelted (*beneficiado*) and traded (*tratado*), without any reference to places where copper was mined. Unfortunately, the document does not include the location of the towns, and most of them have disappeared over time. The location and identification of these towns presented in map 19 are based on different sources from the period from which we were able to track some of their approximate locations.

La Guacana, Pátzcuaro (*Ciudad de Michoacán*) Opopeo, Satzeo and Aramútaro are towns or small settlements that still exist and they were located using geographical charts produced by INEGI[585]. Irapeo and Pucúndaro are mentioned in the *Relación de los Obispados de Tlaxcala, Michoacán and Oaxaca*[586] (1571) as subjects of Tacámbaro. Although their names have disappeared, the source says that they were located *"one long league"* (Irapeo[587]), and *"a league and a half"* (Pucundaro[588]) away from the head town. The town of Curunendaro is mentioned in different sources[589] as being one of the native neighbourhoods (*barrios*) of Pátzcuaro, resulting from the process of congregation carried out in the relocation of the episcopal capital from Tzintzuntzan to Pátzcuaro between 1538 and 1542.

The case of Cútzaro is more complicated since at least three towns of the same name (or very similar) existed in the region during this period. One Cútzaro was on the northern shore of Pátzcuaro Lake as a subject of Comanja[590]. There was another Cutzaro[591] in the region of Tacámbaro, whose location fits well with that of Irapeo and Pucundaro. The other possibility is the town of Cutzaro located to the south, not far from Churumuco, and a subject of Sinagua. Although it is not mentioned in the *Relación de los Obispados*, this Cutzaro is mentioned in the *Relación de Sinagua* (1581) as one of the subject towns of Sinagua, along with Churumuco and Ayangüitlan[592], and again in 1605 it is mentioned in the *Relación de La Guacana* as one of the native towns to be congregated in Churumuco. Therefore, we believe that the Cutzaro of the document is the one of Churumuco.

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585 INEGI carta geográfica Morelia escala 1:250000
586 García Pimentel 1904
587 Ibid., pp.123-124
588 Ibid.
589 Carta de los principales de Pátzcuaro al obispo Vasco de Quiroga. 10 de Marzo 1549 (Warren and Monzón 2004:192); Relación de los Obispados (García Pimentel 1904:33)
590 Relaciones de los Obispados 1904:36
591 Ibid., pp.41
592 Relaciones Geográficas del Siglo XVI: Michoacán, Relación de Sinagua (Acuña 1987:253)

The decision to include the Cutzaro of Churumuco is not only because it is located in this important mining region but also because of the information contained in the *Relación de Sinagua,* written in 1581 in the context of the *Relaciones Geográficas*.

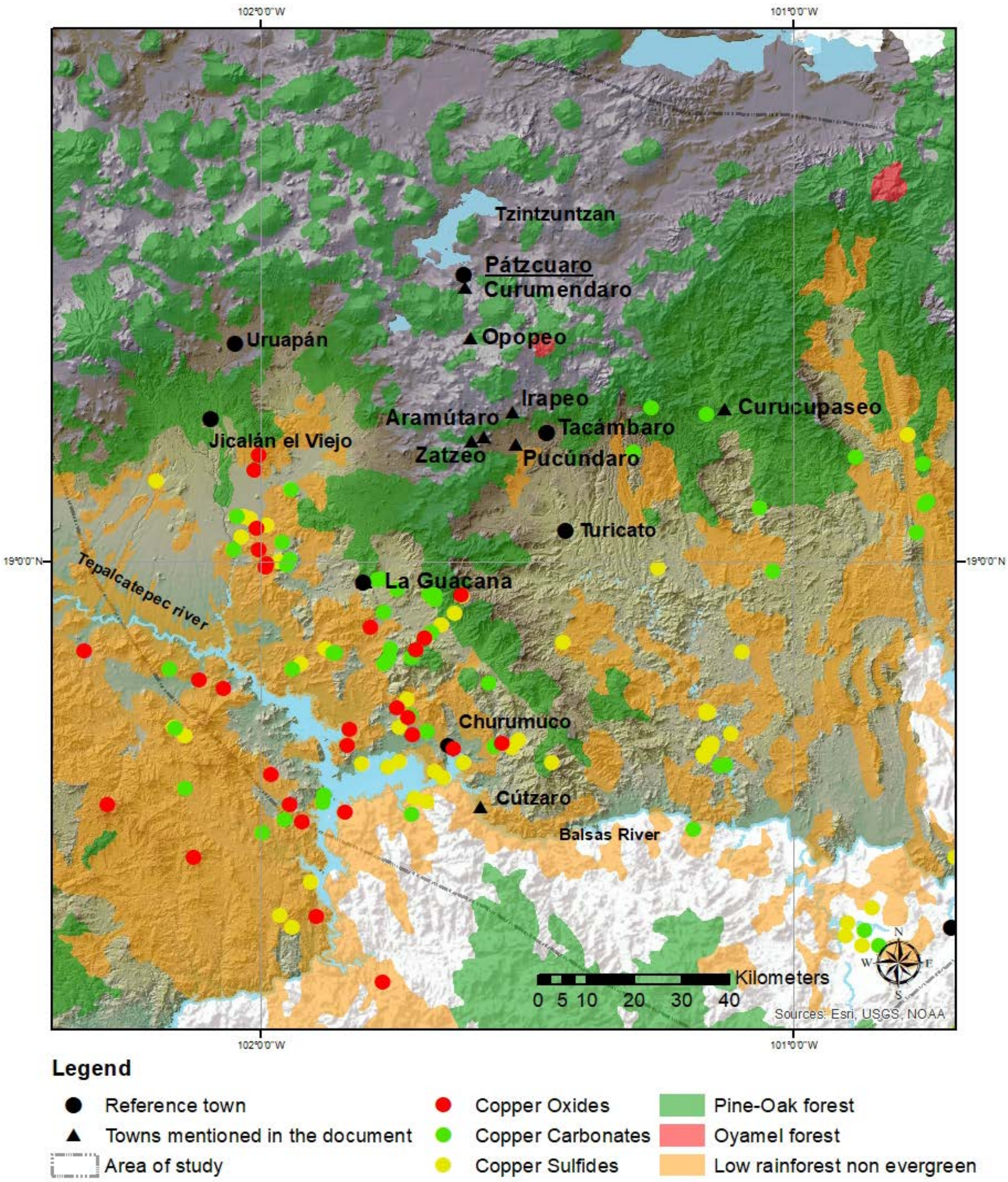
First the document mentions how Cusaro is one of the subjects of Sinagua, but then in one of the answers to the questionnaire it says:

"There are not any cattle in this territory, nor any silver mines. There is, in the region, one copper mine, which belongs to the natives, from which much copper has been and keeps being mined and that serves for their tools, like the iron, with which they work and cultivate the land"[593].

Important pieces of relevant data can be taken from this passage. The first is the mention of a copper mine that has produced and keeps producing much copper. The second is that the document states that the mine belongs to the natives. The third is that this copper is worked in the town(s) to produce copper tools.

The map included the town of Curucupaseo as well which, although it is not mentioned in the document, shows strategic importance within this context. One of the last orders of Antonio de Mendoza as viceroy was to enhance the roadways to allow the transit of beasts of burden and carts. We have seen that he ordered a series of improvements to the road that connected Michoacán with the city of Mexico; however, before leaving his position he also ordered a road to be built between the town of Curucupaseo and the city of Michoacán with the aim of connecting the mining districts of *Tierra Caliente* with the main urban centers. This order was completed by his successor Luis de Velasco in 1551, and apparently connected this important intermountain passage with Tacámbaro[594]. This road was one of the suggestions given by the Spanish witnesses in 1533 as a possible way to bring carts to transport the mineral from the copper mines to Mexico.

[593] Ibid., pp.254 (translated by the author)
[594] Espejel 2009:393-398; García Rodríguez 2014:38-40



Map 19. Location of the copper smelting and trading towns mentioned in the document of 1570

6.2.2 Copper and the Expansion of the Northern Frontier (1570-1600)

On the 23rd October 1574, Viceroy Martín Enriquez wrote an extensive letter[595] to the king dealing with the administration of the colony and answering several questions on various topics. In point 19, the viceroy responds to an inquiry from the king regarding certain information received in the court about the royal fifth on lead and copper not being collected in the mines of the New Galicia. The viceroy replied:

"In chapter 64 your majesty deals with the mines of lead and copper because you were informed by the officials that the fifth is not collected. (…) and what results from these mines is used in the smelting of the silver mines, with regard to the ones of lead which is a low metal this is turned into "greta" and "cendrada" which serves in the smelting of the silver for the fifth which is the one that is taken out by the Indians and blacks from what the miners allow them (…) and your majesty understands the high importance of this. And the copper is very low quantity and most of it is taken out by the Indians and this as well is used in the smelting of the silver by lots of vessels that are necessary there. I will see if there is a way in which the Real Hacienda (tax office) can somehow be served. Although I understand that favouring the mines is of the higher importance."

This is perhaps the first information about copper mines being worked outside the area of Michoacán, and it is interesting that the natives are the ones who are working the copper. According to the document, they mine the ore and in the settlement they work it into all sorts of vessels that are used in silver smelting operations. The viceroy is clear in his suggestion that it should not be taxed because is of little value in the quantity produced, but has great importance in the demands of the silver industry. A similar case is that of lead, which was used in the preparation of the furnaces for silver refining (*cendrada*) or as a flux (*greta*) in the smelting operations[596].

This is not the only document that reports on the presence and exploitation of copper in the far north. In 1587 Joan Antonio Velazquez, priest of the village of San Miguel de los Chichimecas (today San Miguel de Allende), wrote to the king reporting to have found rich copper mines in the province of the New Viscaya[597]. These mines had the peculiarity, according to Velazquez, of bearing a high concentration of silver. In his letter the priest claims to have found a new method to smelt that ore, which could be used to produce bullion coins without

[595] AGI,MEXICO,19,N.142 (translated by the author)
[596] Bakewell 1971:147
[597] AGI,MEXICO,21,N.31

the need to spend any silver, because what was necessary was already contained within the ore.

The priest was perhaps talking about the copper-silver mines around Indehé and Santa Barbara. These mines were discovered in 1567 but not worked until the early 1630s, when the mines of Parral brought a new silver bonanza[598] to the region. In fact, in a letter written by the king in 1602 to the court of New Galicia he mentions that he was told about some copper mines next to Indehé, New Viscaya which had a high concentration of silver and would be convenient for making bullion coins[599], precisely because it was too hard for the miners to separate the silver from the copper.

We do not have any other information with regard to copper mining from these mines, but as the northern expansion continued, especially driven by the search for new silver deposits, small copper mining and smelting operations were opened alongside the new silver ore exploitations, even as far north as the modern territory of New Mexico (USA). Noah Thomas archaeologically excavated and studied a Spanish-Indigenous colonial metallurgical facility associated with the mission of San Pedro in the Puebloan settlement of Paa-Ko, New Mexico. The site is located in the vicinity of the modern city of Santa Fe and dates to the early years of the 17th century[600].

According to Thomas *"…the production practices at the facility are quite varied and include evidence for copper smelting and copper sheet metal production, the smelting of lead ores and production of lead metal, and the recovery of precious metals through cupellation and other refinement technologies"*[601]. This archaeological evidence represents a piece of information that fits with what the document from 1574 stated: the use of lead and copper metallurgy to aid in silver extraction operations[602].

Thomas mentions that the facility is associated with a Puebloan settlement, and according to him the work was most probably conducted by indigenous specialists brought from western and central Mexico working alongside the Spaniards, just as the documents mention occur in

598 Bakewell 1971:30
599 AGI,GUADALAJARA,230,L.2
600 Lycett and Thomas
601 Thomas 2008:17
602 Two more early colonial smelting facilities have been archaeologically reported in the nearby region: San Marcos Pueblo, and San Francisco del Tuerto, in all of which copper appear to have played a fundamental role (Thomas 2008:236).

Zacatecas[603] and Parral[604]. In this sense it is important to remember that west Mexican natives (Tarascans and other ethnic groups from within the west Mexican metalworking area) were a common presence in the far north; they were free workers and, according to the documents, had a pivotal role in the development of mining and metallurgical practices, not only as prospectors and miners, but also as suppliers of essential reagents and finished objects demanded by silver production. It is hard to imagine any northern mining enterprise without the ubiquitous presence of these groups of native specialists.

Information regarding the presence of Tarascan specialists in different mining operations in the far north also includes the silver mines of Fresnillo (1570-1609), Cuencamé (1601-1652), Mapimí (1589-1617), Parras y Saltillo (1600s), Real del Oro-Indehé (1567-1573; 1581-1630), Santa Bárbara (1567-1604)[605], and Zacatecas (1546-1700)[606]. It is not a surprise that native specialists from Michoacán and other regions followed the northern expansion; they were skilled free workers, wage labourers exempted from tribute, personal services to Spaniards or any other coercive colonial structure such as the *encomienda* or the forced labour draft (*repartimiento)*. These skilled labourers held an ambiguous social position in the northern frontier in that the mobility made possible by the wage labour gave them a status of semi-autonomy. This in turn encouraged the continuous mobility of groups and individuals looking for higher wages, carrying with them essential knowledge (and labour force) for the success of various mining operations.

The exploration and expansion of the northern frontier of New Spain was above all a private enterprise driven by the aim of finding more and better quality sources of mineral wealth, in particular silver. As such it was regularly funded and carried out by individuals and wealthy families of New Spain's nobility with support and encouragement from the colonial government. Most of these families were in possession of large *encomiendas* along central and western Mexico and participated in a diversified myriad of economic activities. Such is the case of the Oñate family, whose recent wealth, power and influence was based in the slave trade, sugar production, silver mining, and the possession of vast *encomiendas* like the ones of Culuacán, nearby Mexico City, and Tacámbaro in Michoacán (Map 19) which they acquired from the beginning of the Spanish colonization campaigns in the late 1520s.

[603] Bakewell 1971
[604] West 1949
[605] Thomas 2008:Table 5.1
[606] Bakewell 1971:36-56

The Oñate family not only had this large *encomienda* in the core of the copper production area of Michoacán but were also among the first Spaniards to follow up the initial waves of the northern expansion, accompanying the military campaigns of Nuno de Guzmán and Antonio de Mendoza against the northern Chichimeca tribes. They are also considered to be part of the founding groups in the cities of Guadalajara (1542) and Zacatecas (1546). It is precisely in Zacatecas where they became mining pioneers, opening and working several silver mines and smelting facilities (*casas de beneficio*). The Oñate made Zacatecas their headquarters, a place from where they not only benefited from the silver bonanza, but also expanded their influence towards the far north exploration[607]. It is necessary here to ask why the Oñate and other similar wealthy families are important in this discussion.

During the 16th century this family had a powerful influence in the silver production of New Spain. Before the Zacatecas mining bonanza, they were already consolidated silver producers and the possession of these two large *encomiendas* gave them plenty of access to unskilled and skilled native labour force. They were certainly a key factor in the mobilization of these labourers from Michoacán and central Mexico northwards and into their own mining settlements. Furthermore, they were not only in need of skilled and unskilled labourers, but also in need of settlers for peopling the newly explored and distant lands. As previously mentioned, by 1550 entire neighbourhoods in Zacatecas were inhabited by Tarascans and other ethnic groups from the valley of Mexico[608].

Perhaps the influence of the Oñate family was not simply restricted to the northern expansion, or their relationship with the people of Michoacán limited to sending labourers to the northern frontier. Tacámbaro was the natural pass to the hot lowlands (*tierra caliente*) and as such it was located on the main roadway that connected the copper mines of Sinagua, La Guacana, and Cocian with the high plateau[609]. This roadway had been rehabilitated by the viceroy Mendoza in 1550 with the purpose of connecting these two regions. The document of 1570 mentions various copper smelting towns in the vicinity of Tacámbaro (Map 19) and we have already seen the vital importance of copper products and reagents for the silver and sugar production industries. Although we do not have documental evidence, it is possible that the Oñate family were promoting both the mobility of skilled labourers northwards and the

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[607] Ibid., pp.6-15
[608] Ibid., pp.36
[609] Espejel Carbajal 2009:393-396

development of the regional copper industry jointly with the natives. If this was the case, they certainly did it because it was highly convenient for their own interests. A functioning copper market within the limits of the *encomienda* would help to ensure the payment of the native tribute, produce vital copper goods for their more lucrative business (silver and sugar production), and prepare additional skilled labourers.

Juan de Oñate y Salazar, one of the sons of Cristobal de Oñate (the patriarch of the family), is our last link in the Oñate chain. After being main inspector of the silver mining district of San Luis Potosi, he was commissioned by the viceroy to advance the northern frontier forward by exploring and establishing a colony deep in the far north. He completed this task in 1598, founding the kingdom of New Mexico and establishing the colony of Santa Fé. He was appointed with the titles of *adelantado* and governor between 1598 and 1606. This is the period in which the copper smelting facilities studied by Thomas are framed[610]. In 1606 Juan de Oñate was dismissed from the position and accused by the crown with criminal charges and incompetence. He was found guilty and condemned to the loss of titles and perpetual exile from New Mexico. The fate of Juan de Oñate y Salazar, although tragic, is of much importance for this dissertation.

In 1621 Juan de Oñate travelled to the court in Spain to try to solve his legal issues and clear his name; in both respects he was only partially successful. In 1624 the crown asked him to accept the position of chief mine inspector (*visitador general de las minas y escoriales de España*) and prepare a status report of the mines and the smelting and refining facilities of Spain[611]. Oñate accepted with the condition of taking six native smelters and refiners from the Indies with him, a petition that was granted by the king[612]. Were these native metalworkers from Michoacán? We do not have enough documental evidence to affirm it but, regardless of their origin, this is a remarkable piece of information that in a way comes to partially close the circle of this dissertation.

The king's appointment of Oñate and the granting of his request represent a tacit acceptance by the crown and its advisors that, at this moment, American mining and metallurgical expertise had advanced to the point where it could improve the technology of Spain. In fact, according to Milford, this event *"… is a turning point in the history of mining, when the flow of*

[610] Thomas 2008:15-20

[611] Milford et al 1998:8-11

[612] AGI,INDIFERENTE,451,L.A8,F.145-145v

technology reversed directions across the Atlantic Ocean for the first time[613]*"*. This event shows as well that the relationship of collaboration between native and Spanish specialists during the 16th and early 17th century was an essential part of this technological development[614], and that the position of native specialists as experts was fully recognized. Apparently Juan de Oñate died in 1626 near to Guadalcanal when a mine shaft collapsed[615]. We do not have more information about the fate of the six native smelters and refiners, and it is not clear even if they finally crossed the Atlantic.

6.2.3 Diversifying Native Metalwork in Michoacán (1576, 1581, 1600)

As I have mentioned before, the period of 1570-1600 is shown to be a very dynamic period in which copper became an important trading product at a regional level, and where the natives played a pivotal role in this dynamism. During this period the natives also started to be mentioned frequently as specialists in different jobs associated with metalwork. During this time they were not only recognized as miners and smelters, but also as coppersmiths, blacksmiths and a series of other jobs related to metal.

In November 1576, the mayor of the city of Michoacán opened an investigation against three native blacksmiths resident in the city, accused of helping in the escape of Juan del Vado, a Spaniard who was in the city jail accused of sodomy. The testimony of two of the jailers, Francisco Garcia and Juan de Arteaga states that "*they had found the cotter pin of his shackles broken, and after searching further they found two knives, one metal file, and three handmade keys, one for the door of the jail, one for the shackles, and one for the cell"*[616]. The three natives were accused of "*having made all the said items as officers and craftsmen of metal, which they are".*[617]

This is not the only reference about natives doing different jobs associated with metalwork in the city of Pátzcuaro at this time. According to the *Relación de la Ciudad de Pátzcuaro* written in 1581 (in the context of the *Relaciones Geográficas*) the natives of the city are:

"(…) some of them merchants and traders, and others, skilled craftsmen, blacksmiths and caldereros (coppersmiths – makers of copper vessels)*, campaneros* (bell makers)*, turners, and*

[613] Milford et al. 1998:11
[614] Thomas 2008:258
[615] Hillerkuss 2011:17
[616] AMP, Siglo XVI, Caja 131, Año 1576, 2fs
[617] Ibid.

die makers, and, principally, painters and feather workers, and of some other professions, with which they make a living. They are rich and diligent, and they are charitable people and more compassionate than the Mexicans. Among them there are many musicians of all sorts of genres and singers"[618]

This small passage of the *Relación* shows how the natives are not only associated with copper work as a profession but also with a broad spectrum of other specializations closely related to metalwork. This, once again, further strengthens the information that show how the native metalworkers were integrated into the economy life of the colony. A similar situation is mentioned in a lawsuit process of 1600 when a royal officer was accused of trading with copper at a time when it was strictly forbidden. The officer Roque de Olibera was accused of having over three quintals of copper objects hidden in the town of Tunácuaro. In his defence he said that the pieces had been made by the local native smelters and coppersmiths with whom he had been working for quite some time prior to his appointment as a royal officer[619].

6.2.4 Disease and Depopulation, an Inflexion Point in the Relationship (1576-1580)

The arrival of the Spaniards also brought a set of diseases for which native populations had no immunity and, as a result, devastated the territory of New Spain producing a demographic catastrophe in the 16th century. Smallpox, typhus, measles and mumps were just a few of the newly-introduced diseases that produced different outbreaks throughout the century. These outbreaks led to several major periods of depopulation in 1520, 1531, 1545 and 1576-1578[620] accompanied by numerous minor outbreaks. Although it is impossible to establish the true number, several researchers have estimated that the native population in 1519 was about 15-30 million[621]; however, eighty years later when more reliable sources exist the estimation is only over 2 million[622].

It is widely accepted that the deadliest and most widespread epidemics during the 16th century were those of 1545 and 1576-1578 which devastated the whole of New Spain, in some areas

[618] Relaciones Geográficas del siglo XVI: Michoacán; Relación de la Ciudad de Pátzcuaro (Acuña 1987:202) (translated by the author).
[619] AMP,Caja 132,Exp.4,1599-1600
[620] Enfield 1997:101
[621] Acuna-Soto et al. 2004; Enfield 1997:100-102
[622] Ibid.

killing between one and two thirds of the native population[623]. These two massive epidemic episodes were known locally as *cocolixtles*[624]. The disease responsible is still a matter of controversy but new research has identified the symptoms as a type of haemorrhagic fever that was unknown to indigenous and Spanish physicians prior to 1545. The disease affected the native population to a much greater degree than the Spanish population[625]. Several alternatives have been proposed as the disease responsible for the epidemics, among them yellow fever, malaria, plague, leptospirosis, hepatitis, and dengue[626]. In a recent study using tree-ring chronologies from central Mexico, Acuna-Soto identified that there was a connection between climate and the epidemics[627] whereby both the 1545 and 1576 outbreaks occurred during years of abundant rain in the midst of the worst drought of the 16th century[628].

The 1576 epidemic was first registered in the valleys of central Mexico in April and by September of that year, coinciding with the peak of the rainy season, the epidemic evolved as an expansive wave that within a few weeks extended as far as Sonora in the north and Guatemala in the south[629]. According to the sources cited by Acuna-Soto, the highest death rate occurred from September 1576 to March 1577; by October 1577 the number of deaths was considerably lower, and the end of the outbreak was declared in October 1578[630]. However, the demographic devastation to the native population was of such magnitude that it would take more than a century to recover[631].

Fortunately for the historiography of the event, the 1576 outbreak occurred in between two nationwide censuses that help to estimate the demographic impact of the epidemic, the first census in 1570 and the second in 1579-1580. Contemporaneous sources from the period mention that half of the population died as a result of the epidemics, estimating that of the 4 million natives alive before the outbreak, only 2 million had survived. Although not arriving at precisely the same numbers, Acuna-Soto analysed the censuses of 157 communities, concluding that of the slightly over 2 million people living in those communities in 1570, only

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623 Ibid; Malvido and Viesca 1985
624 Cocoliztli is the náhuatl word for pest (Malvido and Viesca 1985).
625 Acuna-Soto et al. 2004:2
626 Ibid., pp.6
627 Ibid., pp.4
628 Acuna-Soto et al. 2002
629 Ibid.
630 Acuna-Soto et al. 2004:3
631 Enfield 1997:102-103

1.077.902 were registered in the same communities in 1580[632]. This confirms that, at least in those areas, the loss of population was indeed around 50%.

In the region of Michoacán the situation appears to have been very similar. According to Felipe Castro, citing the work of Nicole Percheron, between the arrival of the Spaniards in 1522 and 1580 there was an average decrease in the native population of 86.5% in the *Tierra Caliente*, and 77% on the plateau[633]. Enfield gives more pessimistic figures, and she suggests as well that the population loss on the plateau and around the Pátzcuaro Lake was considerably lower than the dramatic situation of the *Tierra Caliente* region. For the highland region, Enfield mentions a decrease in population of around 88% between 1542 and 1630, from an estimate of 248.648 to 29.400. In contrast, the *Tierra Caliente* (where our mines are located) suffered a population loss of about 94% during the same period of time, falling from 140.051 to only 8.351[634].

The *Relación of Sinagua* of 1581 exemplifies this dramatic decrease. The account mentions that "(…) *of 300 men that used to be, no more than 120 survived, and all of them died because of the pestilence which keeps killing them*"[635].

6.3 The Spanish Entrepreneurs enter the Scene

Given this dramatic decrease in the native population, it is not surprising that major economic and political changes occurred during the following years. In fact, if we focus on our corpus of historical sources we can distinguish, at least with regard to copper production, two moments: one before, and one after the epidemics. In the period before the epidemics the presence of Spaniards (with the exception of the crown and its officers) in the documents dealing with copper production is marginal, with the exception of the report of 1533. However, after 1578 their presence (and that of the crown) increased exponentially, with some working in collaboration with the natives and others working their own mines and smelters directly.

Spanish individuals start to be involved in all aspects of copper production, including mining, transport, smelting, and charcoal making. In the final years of the 1580s we have some information regarding both the rise of Spanish copper traders and merchants, and the first

[632] Soto et al. 2004:3
[633] Castro Gutiérrez 2004:51
[634] Enfield 1997:102-103
[635] Relación de Sinagua (Acosta 1987:254)

royal commissions sent by the crown to buy copper metal and copper ore in the region with the idea to increase colonial control over production.

A document of 1589 has perhaps the first record of colonial agents acting upon royal orders in the region, with the specific commission of buying and procuring copper from the producers, traders and merchants. The document is a complaint presented by Francisco de Ayala, a resident of Pátzcuaro, to the authorities demanding the correct and fair payment for the copper he sold to the crown. Ayala argued that the price which was originally set by the agent was lower than the price he had paid for it. Ayala demanded that Diego de Herrera (the agent) consider a revised taxation that apparently better agreed with the price demanded by Ayala. The document includes what seems to be the revised taxation of Diego de Herrera, and its content, although brief, has some relevant information. Herrera reports that:

"By virtue of your Excellency's commission to take the metals and copper in plancha and other materials hold by the persons that trade and work in the smelting of the said copper paying it at the expense of your Majesty. From Ayala were taken in the town of çaçeo (Satzeo) where the smelter (foundry) is located one hundred and seventy-three cargas of metal and your Excellency being served this can be paid to one and half pesos per carga. The cost for your Majesty for each carga is one peso at the foot of the mine and half a peso for the costas[636]*, and the cost for carrying the copper up from the mine to the said town of çaçeo is ten tomines and more because the said 163 cargas taken in çaçeo at this price sum four hundred and seventy-five pesos and ten tomines_____________475*

Some other seventy cargas of metal were taken from him in the town of enguaran and these can be paid to one peso and a half because the carriage to take them up to the smelter in çaçeo is paid at the expense of your Majesty, and as such were paid over there all the things taken from the said Spaniard and sum 95 pesos

It seems to me that your Excellency being served, these five hundred and five pesos and six tomines can be paid for the two hundred and thirty-three cargas of metal taken from him, with regard to the hundred and seventy-three from the mine to çaçeo and what he says that the Indians owe him it will be necessary to make an inquiry there and (take) a declaration from them. In order to be in conformity with this he can be paid at the expenses of your Majesty and afterward we can get paid little by little by the natives

[636] In this context "costas" might refer to the cost of intermediation and handling provided by Ayala. He was buying copper ore in the mines from the natives, and transporting it to the smelter up on the highlands where he paid another group of natives to smelt it.

Diego de Herrera 8 of October 1589"[637]

According to the document the events had happened one year before, and unfortunately it does not include the initial taxation (and perhaps the detailed report) made by Diego de Herrera and the subsequent complaint of Ayala demanding its revision. This leaves us with a lack of information about the role of the natives in this particular transaction. They are mentioned to be a part of it and as such Ayala says they owed him a certain amount of money, which Herrera says will be covered at the expenses of the crown.

In 1592 Francisco de Ayala, the protagonist of the document of 1589, created a company with Francisco de Bernal to set up their own smelter in the town of Satzeo[638]. The official minute for the foundation of the company says that Ayala was in charge of setting up and supervising the facilities for the smelting and the charcoal making (*carboneras*), as well as providing the necessary native smelters to work in the facilities. Francisco de Bernal was in charge of supplying the smelter with ore from the mines, initially providing 600 horses[639] of copper (ore) that the natives of Inguarán owed him. He was also in charge of making the arrangements to transport the ore from the mines to Satzeo, for which he added 20 mules of his property to the company.

The company committed to supply 130 quintals of copper at a price of 12 pesos each, although we do not know if this was on an annual basis or over an established period of time, but 600 horses of ore would imply some 1500 quintals of ore. Later documents mention that for each quintal of ore (100 pounds) the smelter only recovers 20 pounds of metal[640], which would place the production of this company on around 300 quintals of metal. Apparently the partnership did not go well, and six years later Francisco Bernal accused Francisco de Ayala in front of the authorities of having sold all the copper produced without delivering the 130 quintals to the royal officials.

The fact that the company did not deliver the copper created a number of problems for the making of artillery. In 1601 the crown was still feeling the effects of the failure of Ayala's company. That year they had to buy all the copper they could find to supply two artillery

[637] AGN,Indiferente Virreinal,Caja 4371,Exp.027 (translated by the author)
[638] AMP, Siglo XVI, Caja 131, Legajo 6, años 1592-1598
[639] Barrett mentions that 1 horse of ore was equivalent to one carga of 10 arrobas, or 250 Castilian pounds of ore (1987:116 Chapter 2, note 20)
[640] In a later document (1601) detailing the instructions for the new copper administrator, the authorities highlight that for each quintal (100 pounds) of ore given to the native smelters the officer should expect in return 20 pounds of metal (AGN,General de Parte,Vol.5,Exp.1428,f.325)

foundries, at that time the first was located in the forest of Chapultepec nearby Mexico City, and the second newly established in the port of Acapulco. The sources of the metal included not only the natives of Michoacán but also diverse Spanish intermediaries and tradesmen. Between August and October of that year the crown bought 35 quintals of copper *planchas* from Gerónimo de la Cueva, a local tradesman, paying a price of 30 pesos each, which was almost three times the original price agreed with the company of Ayala[641].

6.3.1 Roque de Olibera's Lawsuit (1599-1600)

One final example of private Spanish interests in copper exploitation comes from Roque de Olibera, a recurrent figure in the copper industry of that period. In the spring of 1599 he assisted the Captain Garcia Rodriguez de Valdés who was visiting the copper mines and smelters in the region. Captain García conducted a series of hearings with the aim of getting information about the particularities of copper mining and smelting, and Olibera was called upon to provide his testimony. In it he is mentioned to have been a copper miner and that for two years he exploited a mine in the proximity of Inguarán that he rented from the native owners of the hill. Apparently he worked the mine employing a gang of eight native silver miners, and during the time of exploitation he produced a great amount of ore[642].

In the spring of 1600 Roque de Olibera was accused of trading with copper for his own interest while working as an assistant officer in the copper smelter of Jicalán. According to the documentation, in July 1599, after assisting Captain Garcia, he was appointed by Diego Sanchez Caballero[643] to supervise the smelting works in Jicalán that had started to produce copper for the crown, by order of the viceroy. In other words, he was holding a royal commission and according to the instructions of the position it was strictly forbidden for any royal officer to deal or trade with copper, regardless of the quantity. Olibera was accused of having three quintals, one arroba and seven pounds of copper objects (*cobre labrado*) hidden in the town of Tunácuaro[644].

He pleaded guilty, accepting that he had infringed the royal order that forbade buying or selling copper ore or metal from/to any Spanish or native. However, he defended himself, arguing that the metal objects found in Tunácuaro were made by the native coppersmiths of

[641] AGN,Real Hacienda,Caja 3027,Exp.004
[642] AGI,MEXICO,258,N.12
[643] Copper administrator between *ca.* 1591 and 1601
[644] AMP,Caja 132,Exp.4,1599-1600

that town using Olibera's own copper brought from Inguarán and other copper that they already possessed, thus they were free to work it because it did not belong to the crown. He was categorical in his defence asserting that in no way did the copper used to make those objects came from the smelter in Jicalán under his supervision and thus property of the king. Apparently if proven, this would have had serious repercussions for him.

To support his claim he presented three witnesses: Pedro Pantoja *encomendero* of La Guacana, and two native smelters and coppersmiths from Tunácuaro, Bonifacio Respa and Juan Coxo. The three witnesses provided similar testimonies; Pedro Pantoja stated that before the king was smelting his copper in Jicalán he knew that the accused had plenty of copper of his property in the mines of Inguarán and some more in Tunácuaro. He said that he saw him smelting this copper with the natives, giving them some to be turned into objects, and that he knew that for about a year prior to the accusation, Olibera had bought objects from the coppersmiths.

Bonifacio Respa declared that a long time before the king had interests in the smelter (Jicalán) Roque de Olibera had given him 50 pesos to make copper objects. Since then he had provided Olibera with pots and braziers, in the same way that other coppersmiths had made copper pieces for the accused with metal bought from traders and not from the smelter of Jicalán. For his part, Juan Coxo declared that before the king was smelting his metals (in Jicalán) Olibera gave him 17 pesos to make copper objects in the same way that he gave money to others, and that for six months he had been paying those pesos in pieces made from recycled metal and metal bought from traders.

Apparently Olibera's strategy worked and he was only condemned for having disobeyed the ordinances but not for committing fraud against the crown, which was the more serious charge. He was condemned to pay as a fine of one third of the metal he was accused of using (1 quintal and 10 pounds); however, it seems that the main punishment for that fault (the loss of position and being forbidden from occupying any official commission for six years) was only partially applied because in 1605 he was working as *teniente de corregidor* in the town of La Guacana.

The document of the lawsuit against Roque de Olibera is full of important information and also small but transcendent details. The document shows the mobility of a figure like Olibera along the chain of production, the relationships with other producers, natives and Spanish, and with regional authorities. In addition, it shows a high level of dynamism in the relations of production among all of the different participants in this particular industry (Spanish, native, and colonial authorities). Furthermore the document also shows how the natives were still the pivotal point, not only for the crown's production plans, but also for any private Spanish endeavour.

The document provides one particular interesting detail that deserves to be mentioned: the fact that the natives of Jicalán were smelting copper, during a determined period of time, exclusively for the crown and this was happening immediately after the visit of the Captain Garcia, at a time when Satzeo was also producing copper under royal supervision. I will come back to this point in the following sections with the aim of situating this data within a much broader context.

The presence of Spanish miners, smelters, and intermediaries who bought ore from the mines in the lowlands, transported it to the smelter, paid for the smelting, and traded with the final product is meaningful. Their presence, which continued to grow in the following years until becoming ubiquitous, could be understood as part of a natural movement towards filling up gaps in the production chain that were previously occupied by native producers and traders. This would not be a surprising event if we take into consideration, on the one hand, the disastrous aftermath of the epidemics of 1576-78, and on the other hand, the increasing demand of copper, especially from the crown.

6.4 The Crown Takes Over (1588 – 1607)

With the native population diminished, the interest, involvement, and influence of Spanish individuals in the copper production and trade grew exponentially in the last decade of the century. During the same period, the demand for copper and copper goods continued to increase in the colony. However, this urge reached a critical point when New Spain's steady need was suddenly accelerated by external circumstances, occurring at the imperial scale. This applied extra pressure to production and triggered, or at least deeply influenced, all subsequent copper-related events in this region.

Intense foreign attacks on the Pacific and Atlantic coasts raised the alert for the need to enhance the defensive capabilities in all ports of the overseas territories. The ports of New Spain, Manila, Havana, Portobelo, Cartagena, Lima, and the Windward isles were under permanent threat, not only from attacks of Dutch and English forces, but also from corsair fleets that were very active in both oceans. Given the importance of the task, the crown began different actions towards equipping and renewing the defensive structures and capabilities of the ports.

This effort required a major investment in heavy artillery and thus in the necessary materials and facilities to produce it. For this reason, the crown ordered the creation of three more royal artillery foundries in Manila (1581-1588[645]), Havana (1597), and Acapulco (1601)[646]. This royal endeavour implied a tight control over the strategic materials needed to produce the artillery, particularly copper and tin, but also saltpetre, sulphur and lead for gunpowder and ammunition.

With regard to copper, we know that the factory of Havana was being supplied with local metal mined and smelted around the city of Santiago[647], while according to the documents, it is suggested that Manila, after having failed in mining and smelting local ores, was obtaining its metal through trade with China and Japan[648]. For its part, New Spain had to equip and maintain two of the main Spanish ports in the overseas territories (Acapulco and Veracruz) and all the copper used for artillery was still mined, smelted, and partially refined in Michoacán[649].

Certainly these sets of internal (the diminished native population) and external (the sudden increase in the crown's need for copper to produce artillery) circumstances helped to modify the crown's passive attitude towards copper production in Michoacán, which had been characteristic of the previous years. This change of attitude included four main measures that were implemented gradually in the region. Chronologically they were: (1) allowing an

[645] The documents mention that already in 1574 during the attack of the Chinese corsair Limahon to Manila, a master blacksmith, Juan Rodriguez Carrillo had repaired pieces of artillery in the city. In his *probanza* Carrillo mentions to have made in 1581 *"all the arrangements for setting up an artillery foundry in Manila"* (AGI,FILIPINAS,34,N.51), and apparently some pieces were made that year (AGI,FILIPINAS,339,L.1,F.206v-207r). However, it is not until 1588 that the foundry appears to be fully functional and staffed with adequate personnel (AGI,FILIPINAS,34,N.79). Nonetheless, in 1602 the newly appointed governor for the Philippines Juan de Acuña stopped by in Acapulco to pick up, among other things, 17 pieces of artillery made in that foundry and destined for the defence of the port of Manila (AGI,LIMA,217,N.8).

[646] Gallegos Ruíz 2016:43-46

[647] Wright 1916; AGI,SANTO_DOMINGO,16,N.21-3 recto

[648] During the 1580s and 90s the authorities of Manila claimed to have found copper mines with high quality ore that could be used for artillery making; however, the different attempts made to smelt the ores failed due to the inability and lack of skill of the settlers (AGI,FILIPINAS,18A,R.3,N.15; AGI,FILIPINAS,18A,R.5,N.31; AGI,FILIPINAS,34,N.79). For these reasons in 1588 the governor suggested that copper could be purchased from the Portuguese in Macau who in turn acquired it from China (FILIPINAS,34,79). Apparently by 1603 copper was already being traded extensively and directly from China (AGI,MEXICO,25,N.33).

[649] AGN,General de Parte,Vol.5, Exp.1427

increasing presence of Spanish miners, smelters and tradesmen (1580s); (2) strengthening the control over all aspects of copper production (1589); (3) enhancing the production (1599); and (4) getting directly involved by setting up a royal smelter (1605-1606)[650] and its own mining operation (1607-1616).

In addition to allowing and encouraging the presence of Spanish entrepreneurs, the crown introduced a series of modifications that came to affect the socio-political and economic dynamics of regional production. Chronologically the next in line was the introduction of the office of copper administrator (*juez administrador de cobres*). This officer was in charge of ensuring an adequate supply of metal to the artillery foundry, buying copper from native and Spanish private enterprises, ensuring a well-functioning regional production. He was specifically in charge of supervising the smelters of Satzeo and also Jicalán for a time, as well as the mines of Inguarán. These were all places where the crown was acquiring and producing copper in a regime of exclusivity. Between 1606 and 1620, the administrator was in charge of managing the recently established royal mines and smelter.

6.4.1 The Copper Administrator (1588-1620)

We do not know the exact date when this office was introduced to the regional dynamics, but the position was created within the frame of the new mining code proclaimed in Spain in 1584 (*ordenanzas del nuevo cuaderno*[651]), which would gradually substitute the ordinances of 1550.

However, we do know that the first copper administrator was Diego de Herrera who, in 1589, held a royal commission to buy copper *planchas* from Francisco Ayala in a business operation that included the native smelters of Satzeo. The document mentions that the event had occurred one year and a half previously, during the firsts months of 1588. In 1587 Herrera was still the chief constable (*alguacil mayor*) of Michoacán[652] which could imply that he should have taken the position between 1587 and early 1588; nonetheless, it is possible that he held the position while being the *alguacil mayor* and by 1591 he was finishing his commission[653].

[650] I will argue in the following paragraphs that although the crown did eventually establish its own mining and smelting operations, this only happened after the process of congregation of 1606.
[651] Chapter 2.3
[652] AGN,Tierras,Vol.2974,Exp.103
[653] AGN,General de Parte,Vol.4,Exp.314

In 1590 the natives of Zirosto (maps 20 and 23) had to provide 65 draft labourers per week who were divided among the silver mines of Guanajuato, the city of Valladolid and the copper mines[654]. Given that the people of Zirosto were recognized as excellent charcoal makers, it is possible that their work was not to be used in copper mining but in making charcoal for the smelters. The interesting issue here is the fact that this is the first time that the draft labour system appears in the documents associated with copper production and this coincides precisely with the appointment of this officer.

This could mean that, as in the years that followed, the position of copper judge/administrator also implied the legal authority of using the draft labour system to drag people into specific stages of copper production. The importance of this information does not reside on the fact that it is the first time it appears in the historical records, but that it happens at a time of restructuring when the figure of the administrator and its judicial faculties were an essential part of a series of actions that deeply affected native communities in the region.

Possibly the second person holding the position was Diego Sanchez Caballero, at the moment we have not found information on when he was appointed nor if there was any other person in between him and Diego de Herrera, so it is probable that the period of his commission began around 1591. During this time he was mentioned in the reports produced by Captain García after his visit of 1599 and in the legal process against Roque de Olibera. In 1601 he was finishing his commission when the viceroy of New Spain Gaspar de Zuñiga appointed a new copper administrator named Alonso Delgado Guzman[655].

Although I could not track down the documents of the commission of Diego de Herrera or Diego Sanchez Caballero, in the research process I found the commission of Alonso Delgado Guzmán. In fact, it is in this document that I identified a vein of data regarding the royal need for copper, the responsibilities of the administrator, and the relationship of production between the natives and the crown.

In the initial part of the document the viceroy confirms that this was a critical moment for Spain. Artillery was urgently needed in most of the seaports, and copper, as an essential part of artillery making, played a strategic role, and as such it was considered a high-priority material. In the document the viceroy highlights the crucial importance of the appointment and urges the officer to be extra diligent in a moment of great need, mentioning that:

[654] AGN,Indios,Vol.4,Exp.322
[655] AGN,General de Parte,Vol.5, Exp.1427

"On the making of the artillery pieces for the necessary seaports to be more efficient and fast I thought convenient to take and extract all the copper metals from the province of Michoacán, from the mines of La Guacana from where since many years and until today metal has been brought to the artillery house in this city where now the need for enhancing the foundry has increased, in order to make more and bigger pieces of artillery that consume and require larger quantities of copper, for this reason and because this is of great importance we have accorded to take all the metal mined in these mines and have appointed Diego Sanchez Caballero to buy and send to Mexico all this metal, task that he has fulfilled and now that his appointment has ended is convenient to appoint a new trustworthy person in his place"[656]

In this part of the document the viceroy appears to be referring to the initial time of the commission of Sanchez Caballero (*ca*. 1591) explaining briefly the context and why the position of copper administrator was created. In this passage the viceroy highlights one piece of data that is important for understanding future events, including the visit of Captain Garcia Rodriguez de Valdés. This is the importance of copper and the need to increase artillery production in Mexico in order to produce more and bigger pieces, a statement that will be further discussed in the following sections.

Through the commission to the new administrator we can also take a closer look at the responsibilities of the post and the still close relationship between the crown and the native producers in the region. The document includes a series of eight instructions given to the officer with regard to his duties and the agreements established with the producers:

1. The administrator has to report to the mines where he will receive the metal and the other particulars of the appointment from the previous administrator Diego Sanchez Caballero and he has to be diligent and careful with the business, trying to acquire all the copper he can *"without disturbing or bringing any grievances to the natives"*
2. He has to pay three pesos in silver reales to each of the native smelters for every copper ore quintal and one for the charcoal used which is the agreed price for their work. For every two *cargas* (1 carga=3 quintals) of ore he should receive 120 pounds of metal from the smelters.
3. The payment for the charcoal makers has to be done on hand, keeping a record of each of the transactions and the name of the suppliers.

[656] Ibid., f.324 (translated by the author)

4. In order to ensure the constant supply of ore from the mines to the smelter in Satzeo, he has the authority to appoint an experienced and trustworthy person to supervise the mining, with a salary of 200 pesos.
5. For each carga of ore he has to pay two pesos of *oro común*, which is the price asked by the native miners to those who buy it and use it for different businesses. He has to keep a record of the ore bought each day and the name of the suppliers in case of fraud.
6. He has to pay one peso of *oro común* in silver to each of the natives transporting the ore from the mines to the smelter in Satzeo. This is the price agreed with them and this payment, jointly with that of the smelters and the charcoal makers, has to be made in reales, not in clothes or any other thing, with a great penalty if this is not conducted properly.
7. All the metal from Satzeo has to be sent to the captain of artillery and ammunition of his majesty in Mexico, the transport is done by the natives and the price is two pesos for each quintal. This price must be paid punctually, taking good care not to show any poor treatment.
8. The administrator cannot deal or take part in any trade with copper for his own benefit regardless of the quantity, under penalty of suspension of any royal appointment for six years and a fine of 200 pesos[657].

From the document, we can assume that the whole chain of production of copper for the crown was still conducted by the natives, which by itself is a valuable piece of information, especially in a period where Spanish individuals were starting to position themselves as producers and intermediaries. Mining, mid- and long-distance transport, charcoal making, and smelting, were still all performed by native specialists and this reflects that the relationship between the natives and crown established sixty years earlier was still fully functional and reliable in 1601. Moreover, the level of attention demanded by the instructions over keeping a respectful and fair business relationship with the producers and transporters leads us to think that the crown was interested in maintaining the best possible rapport with this key group of people.

The second important piece of information provided by the commission is that, with regard to mining, it is not clear that the crown had set up its own operation. Although there is an officer supervising the mines, his function appears to be focused on ensuring a steady supply of good

[657] AGN,General de Parte,Vol.5,Exp.1428 (translated by the author)

quality ore to the smelters, guarding the works, keeping records to avoid fraud, and paying the natives fairly.

A similar situation appears to be occurring with smelting. From the document it is possible to deduce that native smelters were not yet wage labourers working for the crown in a royal facility[658]. Instead, they were represented as independent specialists working on demand, exclusively for the crown but managing their own smelter, which as we know was functioning in Satzeo from at least 1570. In fact it is only in 1599, with the visit of the captain Garcia Rodriguez de Valdez (discussed in the following section), that we find the first mention of implementing a royal smelter in Satzeo, when he suggests that the crown acquire *"50 pair of bellows on behalf of his majesty for setting up a proper smelter"*[659]. Furthermore, it is only in 1605 that we find the expression "royal smelter" in the documents, uttered by Baltazar Dorantes and referring to the smelter of Satzeo within the context of the process of congregations[660].

Alonso Delgado de Guzmán did not last too long in the post and by 1606 he had been replaced by Juan de Espinosa Mondragon who was appointed as copper administrator for, besides his other duties, carrying out the congregation of the natives and the relocation of the royal smelter in the town of Santa Clara. Apparently, Espinosa Mondragon had been the judge of congregation for the town of Chilapa[661] until 1603, a region not far from the port of Acapulco, and it is possible that based on this previous appointment he was considered an ideal person for the post of copper administrator during this particular period.

After the congregation was established and the smelter relocated, the crown appointed Alonso Pacho de Guevara as the new copper administrator in April 1607[662]. The document of his commission is almost an exact copy of the commission of Alonso Delgado Guzmán issued in 1601 with the difference that it includes an extra set of instructions where the salaries of the labourers are mentioned and defined for the first time[663]. We are not certain how long Pacho

[658] This situation was going to change with the implementation of congregations five years later
[659] AGI,MEXICO,258 (translated by the author)
[660] Lemoine 1962:692-693
[661] AGN,Congregaciones,Vol.1,Exp.50
[662] AGN,Reales Cedulas Duplicadas,Vol.5,Exp.660
[663] AGN,Reales Cedulas Duplicadas,Vol.5,Exp.663

de Guevara held his commission for but in 1612 he was working as *alcalde mayor* in the silver mines of Ixmiquilpan, some 150 km to the east[664].

The last royal officer who held the position appears to have been Fernando Moreno Alvarez de Toledo. We do not know if he was appointed immediately after Pacho de Guevara left the position around 1612 but in 1616 he was working as the administrator when, according to the documents, he requested draft labourers from the towns of Aranza, Sivina, and Turicato for working in the mines and the royal smelter[665]. Alvarez de Toledo would be a figure permanently linked with copper production in the region, first as a royal officer and then from 1620 as the first concessionaire of the royal mines and smelters. That year (1620) the crown decided to give the administration of the mines and the royal smelter in concession, and for this reason the position was put out to tender. Alvarez de Toledo ended up celebrating a contract (*asiento*) with the crown for their exploitation until 1630.

6.4.2 Visit of Captain García Rodríguez de Valdes and the Copper Smelting Technology (1599)

As part of the quest for enhancing and increasing the production of copper and artillery in New Spain, the viceroy Gaspar de Zuñiga (count of Monterrey) commissioned Captain Garcia Rodriguez de Valdes to conduct a visit to the mines of Inguarán and the smelting facilities of Satzeo in the spring of 1599. The aim of the commission was to produce a detailed report on the state of copper mining, quality and quantity of ores, smelting, and general costs of production. The captain was also commissioned to indicate what actions could be taken to increase the scale of production.

However, the available documentation reveals that the viceroy's decision to bring Captain Garcia to Michoacán followed a much more ambitious plan that involved enlarging and enhancing the artillery foundry of the forest of Chapultepec, near Mexico City, to a size with the capacity to produce the artillery for all the ports in the Indies, including the Philippines. It seems that the viceroy's plan was not a completely original idea; rather it was framed within the crown's general plan for establishing a big foundry in the port of Havana, arrangements for which had already started in 1597, but by 1599 was not yet operational. In a letter sent to the king on 4th October 1599, the Count of Monterrey says:

[664] AGN,Real Hacienda,Vol.1414,Exp.151
[665] AGN,Indios,Vol.7,Exp.76; AGN,Indios,Vol.7,Exp.61

"Great importance would be to have in the Indies a fine artillery foundry so that the ports on these seas can be provided promptly and easily, and apparently this has been understood in the council (of the Indies) because it has been agreed that with the high wages paid and other necessary things the foundry could be set in Havana. I had news that the blacks had not arrived yet and that the salaries are being paid in vain. I have also got reports about the state of the copper in those lands and that it has to be transported by sea from Santiago de Cuba with all the risks that operation has, specially the English corsair's attacks, and because I thought everything was going slow, and presented some difficulties and high costs I made arrangements to know if it would be easier and cheaper to do it here. During my mandate some (artillery) pieces have been made here as I have reported and now we have just finished and tested two more culebrinas of 80 quintals each and we are getting ready to cast one more of around 60 quintals and all of them would be placed in the fortress of San Juan de Ulúa. And after having seen how easy this was with the service of the Indians and the (local) costs of the quintal de artillería[666]*I was only holding the doubt on the abundance of copper, and regarding this topic I came across with confusing reports about huge quantities of copper being traded in the province of Michoacán, besides the amounts that are regularly brought to this city, and all of it is smelted and mined by hand of Indians who have this as their voluntary profession. I wanted to certify all this and the perpetuity and abundance of metal as I was told about existed in certain hills of those lands. And I sent a person who I thought was appropriate and trustworthy to see everything with his own eyes, which he did and I attach to this letter the report he produced for your consideration. I beg your lord to command me if something should be done with regard to this matters*[667]*".*

According to the document, the crown's original plan was to set up a foundry in Havana with the capacity to produce artillery for all the ports in the Indies, taking advantage of the availability of copper on the island. However, by 1599 this endeavour had not yet been completed. We know that in 1596 the council of the Indies took the decision of aborting the original idea of bringing all the copper produced in Cuba to Spain for manufacturing artillery for the Indies in the royal factory of Seville. Instead the council opted for building a big factory

[666] The *quintal de artillería* was the name given to a bronze (copper-tin) quintal, in which the copper has passed through different stages of refining and has been alloyed with tin, hence it was considered to be a metal ready to be cast into the mould. In one of the documents that form part of the letter under discussion (AGI,MEXICO,24,N.25) the viceroy added a sworn declaration by the *armero* mayor of New Spain explaining step-by-step the costs involved in each of the necessary stages to produce a *quintal de artillería*, thus explaining the whole process of production.

[667] AGI,MEXICO,24,N.25 (translated by the author)

in Havana[668]; for that purpose the king named and sent Francisco Sanchez de Moya as captain of artillery in Havana.

The crown also sent an important group of specialists to accompany Sanchez de Moya, comprising one *sobrestante* (foreman), two artillery casters, four assistant casters, one master blacksmith, one master carpenter, one bellow maker, one master turner, one gunpowder maker, and one cannonball caster, all of who travelled to Havana in 1597 with families and servants[669]. At a time when specialists of this type were scarce in Spain, mobilizing this labour force implied a very important effort, and this is perhaps why almost half of the specialists were brought from Portugal[670]. In addition to the personnel, the crown sent 30804 pesos and three tomines to pay for the costs of the foundry.

The viceroy of New Spain was well informed about the details of the crown's plan due to the first-hand information provided by Captain Garcia who had been employed by the viceroy as captain of the infantry of New Spain in 1598. The captain was extremely well-informed about these matters; between 1593 and 1594 he held the position of general administrator of the copper mines in Cuba where, following a royal commission, he tested the quality and quantity of the ores. In 1594 he was first appointed as lieutenant to the general captain and in 1595 as captain of the infantry of the island, where he repelled the corsair attacks for three years.

Based on the information provided by the captain, the viceroy knew that the plan to set up a foundry in Havana was facing significant problems. For instance, there was a lack of labour force in the copper mines and smelter of Santiago which were primarily worked by African slaves at that time. The copper ore mined in Santiago represented an additional problem because, although it was abundant, its quality was not ideal and needed several stages of refining with the consequent rise in the costs of production. Furthermore, copper had to be transported to Havana by sea at a time of frequent corsair and privateering actions. On top of all of this, there was the high cost of production that represented the Cuban operation.

From this perspective, the viceroy's plan followed a well-structured logic. The foundry of Mexico was the earliest, and had been the only semi-permanent artillery foundry in the Indies. The supply of copper from Michoacán was continuous, and the strategic position of New Spain would make it possible to send artillery to the ports and/or to equip the ships on both oceans.

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[668] AGI,INDIFERENTE,744,N.55

[669] AGI,CONTRATACION,5254,N.2,R.1

[670] Among them: Ambrosio Golbin, assistant caster from Lisbon; Gonzalo de la Rocha, master carpenter from Braga; Pedro Alvarez, master blacksmith from Guimaraes; and Salvador Gonzalez, cannonball caster from Lisbon. AGI,CONTRATACION,5254,N.2,(R.5,R.10,R.14,R.16).

Additionally, its location inland would make a foreign attack almost impossible. The quality of metal from Michoacán had proven through the years to be reliable, the relationship with the native producers was fluid, and there was a safe and well-maintained royal road between the smelter and the foundry. However, according to the viceroy, the real deal was that the cost of production of artillery in New Spain was far lower than any operation in Havana.

After a few years of activity, the artillery foundry in Havana proved to be unsuccessful and expensive, thus in 1607 the crown decided to ship everything back to Spain, including part of the personnel, copper produced, and any money that was left unspent from the *libranza* of almost 31000 pesos[671]. In a similar way, the viceroy's plan for a massive artillery factory in Mexico was not implemented, at least not completely. Instead the crown decided to establish a second foundry in New Spain that would help to produce artillery for the ports on the Pacific, including the Philippines and especially for equipping the *naos de China*. The new artillery foundry was built by the Captain García Rodríguez de Valdés in the port of Acapulco in 1601 and by 1602 it had already cast 17 pieces of 20-40 quintals that were taken to Manila[672].

However, it appears that the viceroy did not completely abandon the idea of a great artillery foundry in New Spain. In 1603 he wrote a letter to the king with news about some copper mines in the northern frontier, mentioning the need to exploit some other sources in order to reduce the copper dependency on Michoacán, *"mainly in times in which copper is not coming from the Philippines because of the ban imposed by the king of China that impedes bringing it from there"*[673]. The viceroy added that although it would be good to exploit other sources, the copper from Michoacán was still more than enough for the artillery demanded by the province. He suggested again that with the enhancement of the artillery factory in Mexico, New Spain could provide all of the artillery needed in Cartagena (Colombia), Portobelo (Panama) and the Windward Islands.

Captain Rodriguez de Valdez was an experienced military man who had served in Cuba and Puerto Rico. He was not what one would regard as an expert in metallurgy or artillery making, but perhaps his experience using artillery in the army would have provided him with some knowledge of copper, bronze production and casting – skills that he would demonstrate during his years in New Spain. In addition, his experience as general administrator of the copper

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[671] AGI,SANTO_DOMINGO,869,L.5,F.150R-150V. Nonetheless the crown left Francisco Sanchez de Moya in charge of the copper mines and smelters of Santiago with the order to send all the copper produced in Cuba directly to Spain.
[672] AGI,LIMA,217,N.8,F.22v-23
[673] Ibid (translated by the author)

mines of Santiago would have given some first-hand knowledge on copper mining, smelting and refining. We do not know about his previous experience besides the military, but given that he was appointed as administrator in the gold and copper mines of Bayamo and Santiago with the special commission of testing the quality of copper ores, this leads us to think that he possessed some proven experience on the matter.

During his time in Michoacán, Captain García visited the mines of Inguarán and the town of Satzeo where the crown was conducting the smelting of the ores purchased in the mines around Inguarán. The captain produced an extensive report about the situation of copper mining and smelting that included a few important insights on ore quality, extension of the deposits, extractive technology, and the general costs of production of good quality metal for artillery purposes[674]. However, major part of the report is dedicated to his suggestions for enhancing the production of ore and metal, a situation that, according to him, was not related to technological factors but to an extensive lack of specialized labour force. From this perspective, García proposed a plan to resettle native people who lived in towns and dispersed villages around the mining and smelting regions into two specialized congregations, one that would be dedicated exclusively to mining and a second one to smelting. This part of his report will be discussed in the next section.

With regard to the first part of his report, we know that when attending to his commission Captain García visited the mines located in the vicinity of the town of Inguarán, in a hill that was called "hill of the three kings" (*cerro de los tres reyes*) where, according to him, most of the running mines were located. He was accompanied by an official scribe and an interpreter of Tarascan from Pátzcuaro. In the mines he was joined by two Spaniards, Roque de Olibera, Gerardo Velasquez, and one mestizo, Juan Alonso. All of them were involved in activities related to copper mining, smelting and trading.

In previous sections I have already discussed the activities of Roque de Olibera. Gerardo Velasquez was the person appointed by Diego Sanchez Caballero to supervise the copper mines of Inguarán, and his responsibilities were being the *sobrestante* (foreman) of the mine, buying ore from the native miners and transporting it to the smelter in Satzeo. Juan Alonso was a miner and apparently also a smelter who had arrived at the mines looking for a job twelve years before, when the viceroy Alvaro Manríquez de Zuñiga (1585-1590) ordered the first royal intervention in the copper mines (according to his testimony). This is interesting

[674] The fallowing discussion is based on AGI,MEXICO,258,N.12 unless stated.

because it coincides with my proposed date for the first appointment of a copper administrator in the region around 1588.

During his time in the mines, the captain conducted hearings and took testimonies from his three companions in the mines. The questions asked were about the situation of the mines, how much ore a native miner could mine each day, whether increasing the number of workers would produce more ore, and whether they knew of any other mines in the region. The three witnesses provided very similar answers; all of them agreed that the ore deposits were so massive that increasing the number of native workers would increase the amount of ore without ever exhausting the deposits. All of them also agreed that there were more mines but their state and accessibility were so bad that it was worthless to try, or very expensive to make them workable. The witnesses declared as well that a native miner produced around half a *carga* (150 pounds) of ore per day (six hours) and that after smelted, this amount of ore would produce around 30 pounds of metal, more-or-less the same quantity reported in the documents of commission for the administrators.

Captain Garcia took ore samples (*catas*) from four different shafts, three that were being currently worked and one that had been recently opened. His aim was to smelt the ores to have a clear idea about their quality and quantity. It is at this point that the scribe provides us with a small piece of information of great importance. According to him, the process of smelting those ores was so particular that the captain had failed when conducting the tests he knew and had seen in other places (Cuba). Since these ores could only be smelted following the process used by the natives in Satzeo, he commanded Gerardo Velazquez to send the samples there so he could test the quality of the ores using their procedure.

At this point it is pertinent to mention that Captain García had first-hand experience in the technology of copper production used in Cuba, acquired during his time as administrator of the mines of Santiago. However, this technology was based on German technology first introduced by the Flemish Gaspar Lomans in 1540 and later by the German Johan Tetzel in 1547. This could explain why Captain García found the technology in Michoacán to be so particular, especially if we consider, as I have argued throughout this dissertation, that this technology was the hybrid result of indigenous and Spanish technologies interacting with each other.

The document unfortunately does not explain the features that the Captain considered admirable and particular about the smelting process conducted in Satzeo. Nonetheless it does contain a summarized step-by-step description of the process, which allows us to make a few assumptions and shed light upon the elusive smelting technology of that time. According to the scribe, the captain ordered the smelting of two out of the four samples he brought from the mines, after which he proceeded to refine the metal produced in order to see how much metal would be lost in the process and thus have an idea of the total costs of production.

The scribe recounted that the captain weighed a sack of ore from the first sample, which had a total weight of 106 pounds. After weighing it, they removed one quarter of it using a *jícara* (small bowl, gourd) used by the natives for measuring the quantity of ore, which apparently represented a standard measurement. The jícara with the ore weighed 26 ½ pounds. The captain then ordered Melchor, one of the native smelters, to smelt it, which he did by placing the ore over 8 pounds of a material called *añinir*, or *ninir* (which appears with different names along the document). The scribe continuous his account saying that the 26 ½ pounds of ore produced 5 pounds and 2 ounces of clean copper and that the *liga* lost 3 pounds and 4 ounces in the process, all of which was weighed with a roman balance.

For the smelting of the second sample, the scribe says that the captain weighed a sack of ore from the second *cata* which weighed 110 pounds. From it they took 27 ½ pounds which corresponded to a quarter using a *jícara* to measure the ore. The captain commanded that Nicolao, a native smelter, did the smelting, which he did by placing the ore over 8 pounds and 14 ounces of *ninir* which serves as *liga*. From the operation they recovered 7 pounds of clean copper, and the *liga* (*ninir*) lost 4 pounds and 8 ounces, everything being weighed with the same roman balance. It is not certain what the scribe means by *ninir* but it is obvious that it was an essential part of the smelting process as it is present during two different operations, and its quantity was modified according to the quantity of ore.

The scribe mentions that it is a material that works as a *liga*, and though *liga* regularly refers to another metal as part of an alloy (in fact, in Spanish it is a synonym), it can also be understood as something that gets combined with a metal, sometimes as an aid in the processes of extraction; for example, the use of lead and mercury in the extraction of silver and gold. One important piece of information provided by the document is the fact that metal and *ninir* were weighed after the process which means that metallic copper and *ninir* could be recovered separately at the end of the smelting process. The question of what it is remains; I believe it could be a Tarascan word, but this can only be clarified by an expert in the Tarascan language. Nonetheless some preliminary research gives a few hints.

The *Diccionario de la Lengua Tarasca o de Michoacán* written by the Franciscan friar and linguist Maturino Gilberti in 1559 translates *ninini* as the verb "to cook or to ripen" (cocer o madurar) and *niniri* as "a thing cooked or ripe"[675]. For instance, he mentions that the phrase "bread cooked in the oven (horno=furnace)" is translated as *curinda niniri,* curinda being the word for bread[676]. In the same way the expression *medio crudo* (half raw) is translated by Gilberti as *ça no niniti*, an interesting concept, as we will see. Thus, if the word *ninir* is indeed of Tarascan origin, it seems to have its root in the action of cooking, a pyrotechnology with more than a few common points with metallurgy, both metaphorically and literally.

Almost two centuries later in 1789, the crown commissioned the German mineralogist Francisco Fischer to visit the mines and smelters of Michoacán in yet another effort to increase production. During his visit Fischer produced a very similar description of the smelting process. He mentions that the smelting is done in holes dug in the floor, the roasted ore is placed over a certain amount of *planchas de crudíos* (from *crudo* = raw)[677] from previous smelting operations, and this is then covered in charcoal and smelted. After one and a half hours this charge is smelted, and without cleaning the furnace, the same operation is repeated three, four or five times depending on the grade of the ores[678].

The result of these successive operations is a layer of slag which is removed after solidification. Underneath this are new *crudíos* which are removed as they solidify, taking the shape of thin *planchas*, and are kept for use in later operations. At the bottom of the furnace, beneath the slag and the *crudíos,* a *régulo* of copper is left, weighing between 50-70 pounds. This difference, Fischer adds, must come from the content of copper in the *crudíos* used. Fischer

[675] Gilberti 1901:74
[676] Ibid., pp.427
[677] The original report of Fischer was written in German and then translated into Spanish by Fausto De Elhuyar who was the director of the school of mining in New Spain. In his report Fischer uses the term *lech,* which Elhuyar translates as *crudío.* According to the German-English Dictionary of Metallurgy (Timor 1945:153) *lech* can be translated as regulus or matte. Regulus according to the Collins dictionary online is an impure metal forming beneath the slag during the smelting of ores (https://www.collinsdictionary.com/dictionary/english/regulus). For its part, matte is a common product in the smelting process of sulfidic copper ores such as chalcopyrite ($CuFeS_2$) and consists of a mix of copper and iron sulphides (Cu_2S - FeS) with a high but variable content of copper (50-70%). Matte and slag form an immiscible phase enabling its separation with the lighter slag floating above the matte (Seetharaman 2005:17). I am not necessarily saying that *ninir* is what is called matte in modern metallurgy (that can only be established after further archaeological and laboratory data are available), but according to the sources of the period, it definitely refers to an impure metal with an apparently high content of copper that is recovered in an intermediate space between the slag and the metal.
[678] Tavera Alfaro 2001:196

mentions that he strongly believes that during the process the *crudíos* are roasted, freeing the copper they contain while the mineral added gets transformed in new *crudíos*[679].

If we assume that the technology of smelting did not present other variations between the late 16th and 18th centuries, then Fischer's report may well be describing the same or a very similar process to the one described by Captain García. This could suggest that the *ninir* used by the native smelters in 1599 is the same material, called *crudíos* two centuries later. The question now is to determine what exactly this material is. According to 17th century authors such as Álvaro Alonso Barba and Bernabé Cobo, the *crudíos* were the impure result of the first smelting operations and were recovered beneath the slag.

Barba says that the *crudíos* are (in Oruro, Bolivia) a mix of lead, copper, sulphur and other impurities that resulted from the first smelting[680]. The smelters used to smelt these *panes* (bread) several times with strong fire until all the lead and the other impurities were consumed and perfect copper is left. Barba adds that he refined great amounts of this material to obtain clean copper or, when it contained silver, to separate the copper from the silver; in these operations he regularly operated a small furnace used in Oruro that was a hole dug in the floor which was very convenient for smelting small quantities[681].

Six years before Fischer's visit to Michoacán, another specialist, the chemist Joseph Coquette, visited the mines and the smelters. In his report of 1783 he stated that one of the problems that regional copper mining and smelting had was *"…up to now having worked without art, following blindly the method established by the ancient ones without ever considering the advantages of the land"*[682]. Coquette was referring to the labyrinth of disorganized shafts that composed the mining district of Inguarán and that was, according to him, a very inefficient smelting technology which in Santa Clara consisted of six *cendradas*[683], each with two bellows operated manually.

Continuing with Captain Garcia's report, the scribe wrote that the day after the smelting was done the Captain proceeded to refine the metal produced with the aim of checking the amount of copper that could be lost in the process and hence calculating the overall cost of

[679] Ibid.
[680] Barba 1729:208
[681] Ibid. Pp.168-169
[682] AGN,Mineria,132,Exp.1
[683] He adds in parenthesis *"if one can call that to holes dug in the soil capable of receiving one load or twelve arroba of mineral and two imperfect circular bellows which moving vertically over its axis smelt by force of arms"* (translated by the author) Ibid.

production (one of his main tasks). *"The Captain asked Diego Sanchez Caballero to provide him with four copper planchas in the way they come out of the smelting and are delivered by the native smelters; the four weighed 62 pounds. These planchas were put into a new cendrada that the captain commanded to make to Bonifacio, a native smelter. After having smelted the said four planchas a big plancha that weighed 60 pounds was recovered, which means that 2 pounds were lost in the refining"*[684]. This part of the account is interesting because it seems to describe a modification to the morphology of the furnaces used until this point.

In the smelting of the two samples, the scribe mentions that for each operation the smelters added 26 ½ and 27 ½ pounds of ore measured by the *jícara* as well as 8 pounds and 8 pounds 14 ounces of *ninir*. The result was 5 pounds and 2 ounces of metal for the first sample, and 7 pounds for the second. During the refining process the Captain requested four *planchas* in the way that they are delivered by the native smelters which weighed 62 pounds; roughly (and ideally) 15 ½ pounds each. If we consider that smelting (as all the sources from 16th to 18th century say) was a series of consecutive operations then is possible that each *plancha* was the result of perhaps three to four controlled operations. If we add to this that the native smelters smelted a quarter of the quintal of ore each time, then each *plancha* could be the result of smelting one quintal of ore in four operations[685].

The interesting part here is that if 26-28 pounds of ore and 8-9 pounds of *ninir,* plus the charcoal and perhaps some fluxes represent a standard charge that produces 5-7 pounds of metal, then we possess important data that can help to determine the furnace and its size. Even more revealing is that the document continues by saying that the captain commanded one of the smelters to make a "new" *cendrada* that received the four *planchas* and produced one *plancha* of 60 pounds of weight. This could indicate the introduction of a change in the dimensions of the furnaces used until that moment.

We do not have enough information about the weight of the *planchas* before this document (1599) but we do have abundant information for the following years. Available data from the mid-18th century shows that the weight of the *planchas* was always within a range of between

[684] AGI,MEXICO,258,N.12 (translated by the author)
[685] All of this is just an exercise of interpretation and it is not intended to be precise; surely the weight of these *planchas* (if we are correct) would have been variable within a certain range. For instance, copper *planchas* of New Spain in the 18th century had a weight of between 50 and 90 lbs. Let us not forget that the instructions given to the administrator of copper stated that 2 *cargas* (6 quintals) of ore were expected to produce 120 lbs of metal without specifying a number of *planchas*.

50 to 90 pounds each[686]. This weight coincides with the *planchas* described by Fischer in 1789 (50-70 lbs) and that were a product of a furnace dug in the soil, with a mouth of between three *cuartas* (63 cm) and one *vara* (83.59 cm) in diameter that decreases towards the bottom in a cone-shape. Fischer also added that this furnace could receive two to three arrobas of *crudíos*, and a half, three-quarters or one full quintal of ore plus the charcoal. This is four times the capacity of the furnace used by the native smelters according to the captain's description, but closer to the new *cendrada* he commanded to be made.

In the book *Pirometalia Absoluta o Arte de Fundidores* written by Joseph Diaz Infante in 1740, the author gives us information about the shapes in which copper arrived to Spain from America. Diaz Infante says that copper from America arrived in two main shapes: rounded *planchas* and *granalla*[687] (Figure 23). According to the scale in his illustration the *planchas* had a diameter of around 30 cm. If we consider that a *plancha* was recovered from the bottom of a cone-shaped furnace then we can expect a similar shape to the one illustrated by Díaz Infante. In fact, in the modern town of Santa Clara del Cobre where the traditional techniques are still in use, the furnace is called *cendrada*[688] (Figure 25), has a very similar shape and dimensions to the one described by Fischer, and produces a *plancha* of similar dimensions and weight.

What I am suggesting here is that before the visit of Captain García to the smelter of Satzeo, the furnaces used by the native smelters were smaller in size and capacity, and thus produced smaller *planchas*. Perhaps through the intervention of the captain, a new type of larger furnace (*cendrada*) started to be used and eventually helped to standardize the regional production of smelted copper in the type of *planchas* that we recognize as the norm during the 18th century and that still survive today in the copper work tradition of Santa Clara del Cobre. It is important to mention at this point that in 1605-1606 a brand new royal smelting facility was built in the town of Santa Clara as part of the process of *congregaciones*, a process that was heavily influenced by the report of Captain García. It is possible that his influence went beyond the relocation of specialized labour force but also included some technological changes like the introduction of these new and larger *cendradas*.

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686 AGN,Indiferente_Virreinal,(Caja 5270,Exp.046; Caja 5549,Exp.020; Caja 4757,Exp.002). It appears that there is a difference in the weight of the *planchas* from Michoacán (around 50-70 lbs) and the weight of the *planchas* coming from Zitácuaro (80-90 lbs), a different production area that started its operation in the early 18th century.

687 Diaz Infante 1740:85-86

688 In the mid-20th century the coppersmiths of Santa Clara stopped smelting copper ore and started to recycle and melt copper scrap from different sources. For this reason the dimensions of the *cendrada* were slightly reduced. Nowadays the average *cendrada* is around 50-60 cm in diameter.

One last piece of information that supports my suggestion is given by Captain García himself. During his trial of residence of 1606 celebrated in Lima, he is mentioned to have served the viceroy of New Spain by visiting the mines and smelters of Michoacán. Part of the result of his commission was the casting of 47 pieces of artillery in the royal foundry located in the forest of Chapultepec, pieces that were destined to the fortress of San Juan de Ulúa. During his visit, he adds, he also taught the Indians of Michoacán to "remake" (*reformar*[689]) the copper at a very low cost[690]. This could be a reference to the introduction of the new furnace previously discussed.

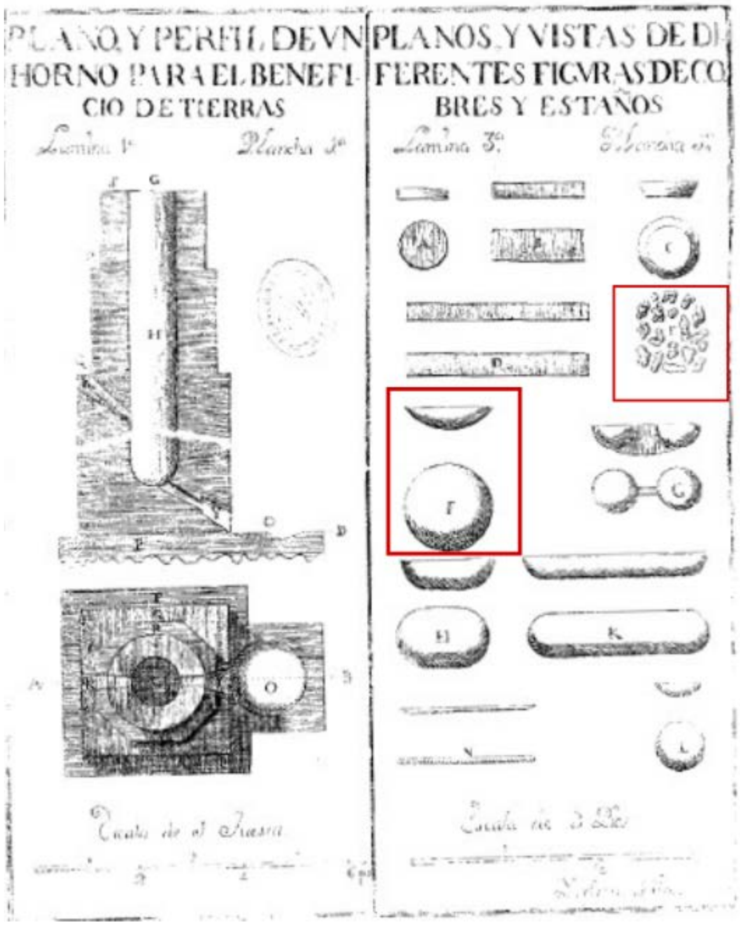

Figure 23. Figure from the 1740's book *Pirometalia Absoluta o Arte de Fundidores* showing the two ways in which copper is brought from America: *planchas* on the left and *granalla* on the right. The scale (in feet) at the bottom of the page shows that the *plancha* is 1 ft in diameter (Diaz Infante 1740:Lámina 3a).

[689] He uses the word *reformar* which according to the RAE could mean redo or reshape something; or to modify something, generally with the idea of improvement (http://dle.rae.es/?id=VeG42ZB entry reformar)

[690] AGI,LIMA,217,N.8,f.2v

But what about the smaller furnaces described in the process of smelting and used by the native smelters? This is a much more difficult topic because there is an almost absolute lack of material evidence from archaeology, and very few data contained in the historical sources. From the report of Captain García we can extract information about the capacity of the furnace and the weight of the resulting ingot (*plancha*). However, the report does not say anything about the shape or its size; we only know, based on the smelting load, that they were considerably smaller, perhaps a quarter or a third of the one introduced by Captain García. The report does not mention anything about bellows, but by this time we should regard them as being fully incorporated into the smelting technology.

The only reference that I could find with regard to a type of furnace with similar characteristics, operated with bellows and used for copper production, comes from the most important Spanish treaty on metallurgy, *Arte de los Metales,* written by Alvaro Alonso Barba in 1637 and printed in Madrid in 1640. In his book Barba says that in Oruro (Bolivia) he worked extensively with a small furnace called *braguetilla* (Figure 24) which was very convenient to smelt small quantities. He used this furnace mostly to refine copper when it was in the form of *crudíos,* and to separate the silver from the copper[691].

This furnace was essentially a circular hole dug in the floor of one *cuarta* (20.9 cm) or one *tercia* (27.86 cm) in diameter and with proportional depth. It was prepared by using a very compact *mazacote*[692]; the side where the nozzle of the bellows enters the furnace was left open while the rest of the circle was enclosed with *adobes* (mud bricks). The furnace was filled with charcoal and once it had reached the proper high temperature, the *crudíos* were placed on top until all the impurities were consumed and the molten metal ran through the charcoal to the bottom of the furnace. He repeated the operation, adding more *crudíos* and charcoal until the furnace was full of metallic copper. Just as it is described by Captain García and Francisco Fischer, the results of the operation are layers of slag, *crudíos*, and clean metal at the bottom of the furnace.

If this furnace was similar to the ones used by the native smelters of Satzeo before the introduction of the modifications made by Captain García then the development of a hybrid

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[691] Barba 1729:168-169

[692] Barba mentions that in this context (furnace making) "*mazacotes are the bottoms or sole-pieces of furnaces, but also the receptacles in which the melted metal is tapped. These furnace parts can be made with clay used for crucible making or with a mix of selected earth with charcoal powder"* (1729:155-156). In other words it refers to a part of the furnace but also to the plaster used to make these particular parts.

copper smelting technology could be better explained. In the report of 1533, it is stated that the native metalworkers smelted small quantities of ore using only blowpipes to blow air into the furnace. We do not know the shape or size of the furnaces but we do know that they produced a small brick-like ingot weighing 5-7 pounds. In 1538-1542, the native smelters of La Guacana paid 40 of these brick-like ingots (*adobes*) as tribute every 40 days. In the taxation of 1548-1550, the same group of people was giving 40 *planchas* as tribute in the same period of time, and they were called *herreros* (blacksmiths).

I support the idea that in between these two periods (1538-42 and 1548-50) a major technological transformation took place that implied the adaptation of Castilian bellows to the indigenous copper smelting technology. If I am correct in my assessment then the change in the ingots' morphology, from the small brick-like ones to these small *planchas,* is better explained than a straight development from small brick-like ingots to the massive *planchas* of about ten times their weight that started to be produced in 1599. This could indicate that the small furnaces the captain found were the result of an initial hybridization process of indigenous and Spanish metallurgical technologies.

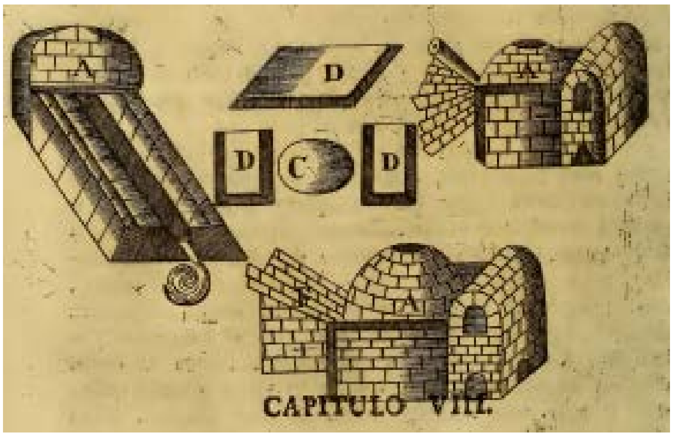

Figure 24. The *Braguetilla* furnace according to Barba, in the image the C represents the hole in the ground while the Ds are the *adobes* encircling it, leaving one side open for the entrance of the nozzles (Barba 1729:170).

Why is Barba's description a relevant source here when his book, although the most important Spanish metallurgical treaty of the early modern period, deals only with metallurgical techniques practiced in Bolivia and Peru in the early 17th century? The answer to this question lies in the assumption that it is possible that these furnaces and the techniques associated with their functioning in New Spain and Bolivia could be related. The smelting process, the sequential steps in the construction of the furnace and the morphology of the furnace itself are far too similar to ignore, and although it is impossible with the current data to affirm that these techniques were indeed related, at least I can suggest it as an area for future and further research. It is important to ask, how is it possible for these techniques to be related? It could be a product of chance, or the result of a similar technological development, or even a product of technological exchange between interconnected mining areas.

In the whole continent, only Mesoamerica (New Spain) and the Central Andes of South America had the mix of rich copper deposits and a pre-Hispanic metallurgical tradition based on copper and its alloys. Therefore it would not be strange to find a similar hybrid technology, a product of incorporating Castilian bellows into native technology. A second possibility could be a technical exchange between the colonial metallurgies of New Spain and the Central Andes. We do know that this happened several times; for instance, in the silver industry with the mercury amalgamation, and the patio process. Thus, if we consider that this same technology for copper production was being used in the silver mines in northern New Spain as we saw earlier in this chapter, it is possible for these techniques to have found their way to the Andes. There is also the possibility that Captain García himself could have introduced the technology to the Andes during his time in Lima around 1606, a technology that he had seen and up to a certain point enhanced. This is a very suggestive range of possibilities.

It is impossible not to see the similarities between the furnaces described by Barba, Fischer and Coquette, and the traditional *cendradas* still used today by the coppersmiths of Santa Clara del Cobre. This not only includes their formal aspects, but also the sequential steps followed in the building of the furnace. In Santa Clara the *cendrada* is partially destroyed during its operation and thus it requires a re-formation every time a new smelting takes place. This is done by cleaning up the debris from the previous one, plastering the bottom of the furnace with a special mix of earth and stones and bordering the edge of the furnace with "fire stones" specially selected for their thermic resistance, leaving one side opened for the entrance of the bellow's nozzles (Figure 25).

The visit of Captain García to the mines and smelters of Michoacán had a deep impact on the technology of copper production, but an even deeper one on the social organization of the native labour force. Although it is not included in the document, we can assume that one of his immediate suggestions for increasing the production of copper was to incorporate the town of Jicalán el Viejo and its specialized native smelters into the production of copper for the crown, as we saw earlier in the process of Roque de Olibera. This can explain how Jicalán started to smelt copper ore exclusively for the crown only a few months after his visit, under the supervision of Roque de Olibera.

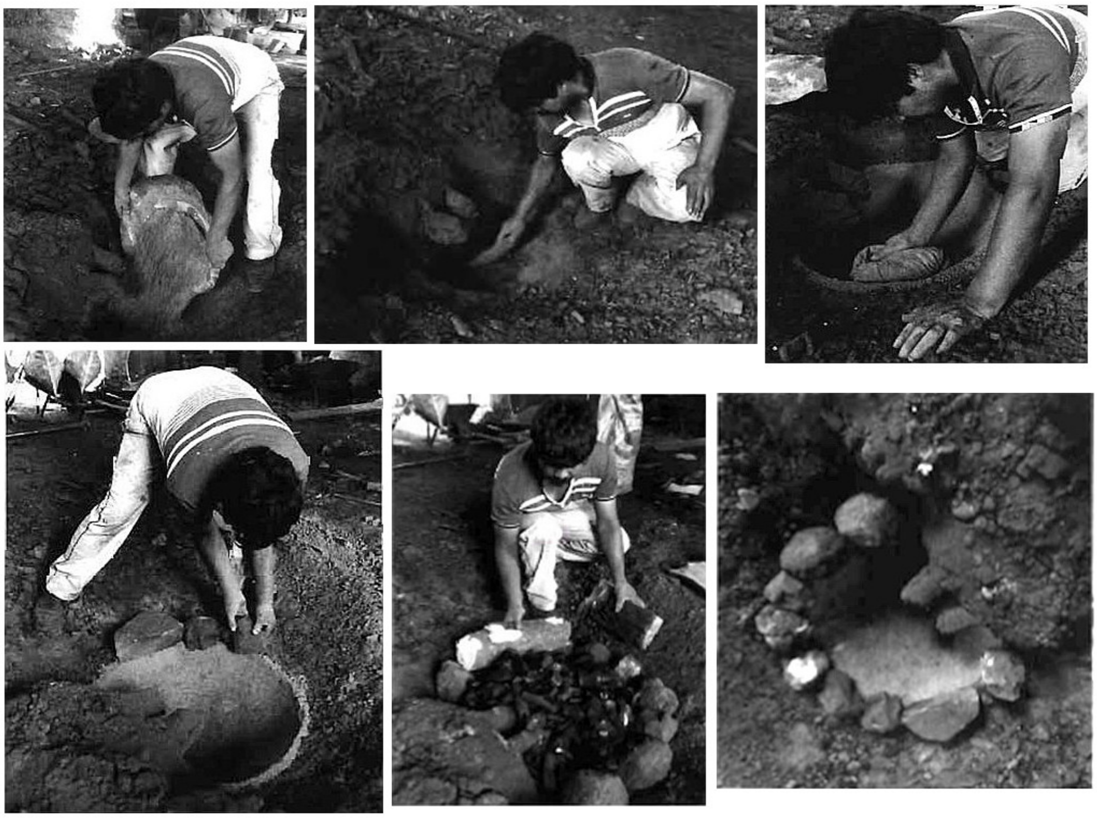

Figure 25. Image of a *cendrada* used today in the town of Santa Clara de Cobre and the sequential steps involved in its construction.

The report of Captain García is formed of two clearly different parts. In the first part, he introduces his impressions about the processes of production and carries out the tests for checking the richness, availability of ores, and the overall costs of production. The second part of his report is dedicated to his suggestions for increasing regional production. These suggestions are mainly focused on the reorganization of the native labour force that, according to him, was the core of the issue. In this section I have tried to explore in detail the first part of his report because I consider it an essential document to shed light upon the very much unknown copper smelting technology of the period. The second part of his report will be analysed in the following section in order to frame it within the broader context of the policy of congregations.

6.4.3 The Process of *Congregaciones de Indios* (1595-1607)

The *congregaciones de indios* were not an unknown practice in Michoacán. Several years earlier the religious orders that arrived in Michoacán established the first congregations, such as the one in Pátzcuaro in 1538, promoted by Vasco de Quiroga. However, the process of congregations executed between 1595 and 1625 was very particular. First, it was a large scale process that affected the whole of New Spain. Second, the rationale behind the decision to congregate a given group of towns was according to a number of factors besides to Christianising the indigenous populations, which had been the main concern during the first congregation exercises (Chapter 1).

This process of congregations was a long one, initiated in the government of Luis de Velasco (1590-1595), consolidated under the rule of Gaspar de Zuñiga "*conde de monterrey*" (1595-1603), and executed mainly during the government of Juan de Mendoza y Luna "*Marqués de Montesclaros"* (1603-1607)[693]. As previously mentioned the process was massive and included the whole of New Spain. In Michoacán several congregations were proposed and executed, and in fact more than forty were established just in my region of study (Map 20).

In general terms, the plan intended to reorganize the human geography of New Spain after the devastation left by the epidemics of the previous years. The aim was to enhance the colonial government, facilitating tax collection, Christian indoctrination, and the proliferation of urban settlements organized in accordance with Spanish spatial patterns[694]. However, some of the congregations were planned not only with the idea of fulfilling these conditions, but also with the aim of maintaining or boosting the production of a determined good or material that the crown considered important. This is the case of the three congregations that I will discuss in the following paragraphs.

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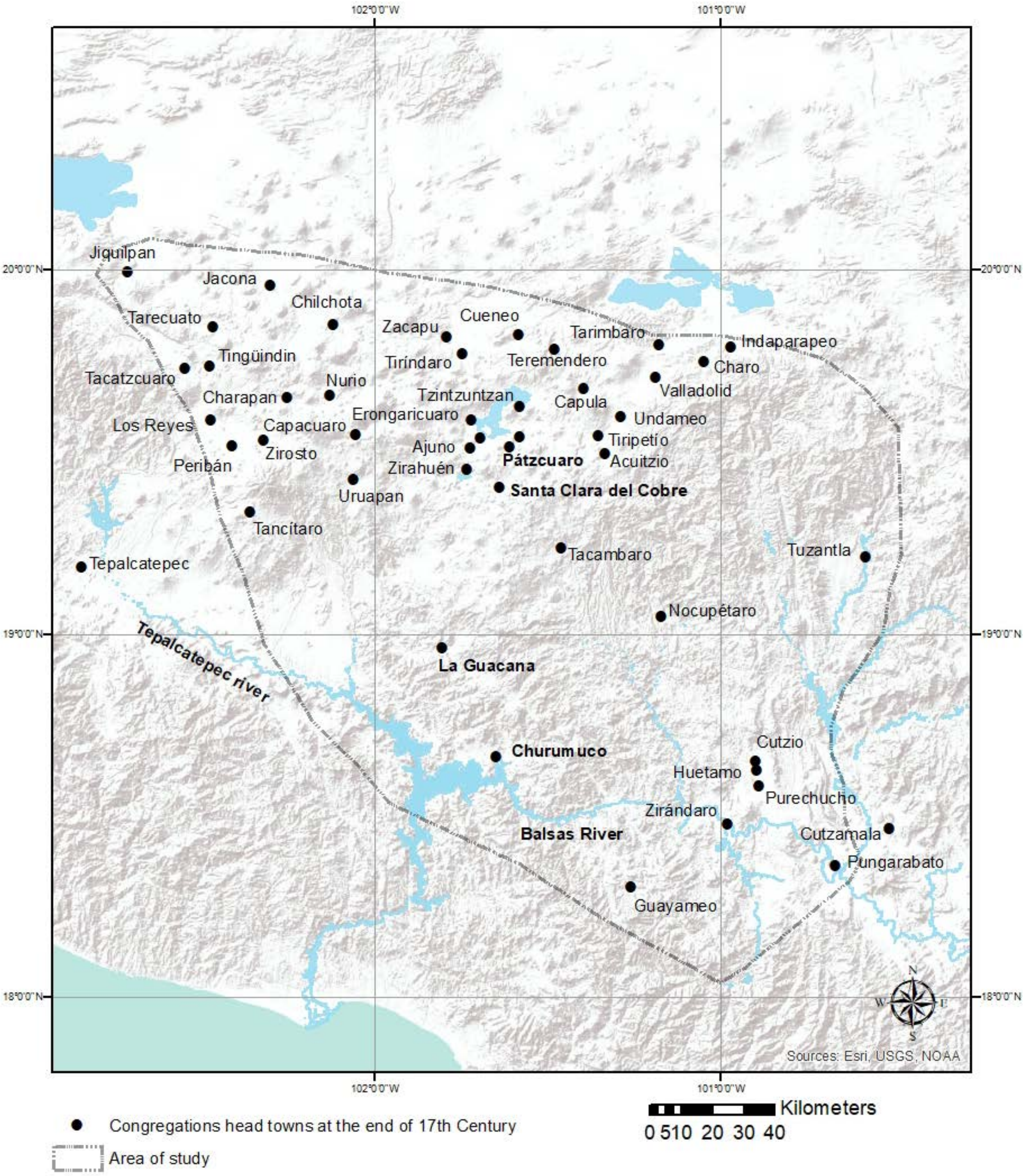
[693] Castro 2004:80
[694] Fernandez and Urquijo 2006:146-150



Map 20. Congregations of our region of study at the end of the 17th century (Based on Castro Gutierrez 2005:75-98)

The congregations of La Guacana, Churumuco, and Santa Clara were not simply created with the objective of enhancing the regional colonial government, in terms of tax collection, catholic doctrine, and governability. According to the documentary evidence available, these were secondary issues, with the main objective being the protection of the strategic copper production, alongside increasing the level of production and ensuring the supply of copper to the artillery foundries both within and outside New Spain.

The deadly epidemics of the previous years left a distressing scenario in the region; entire towns were devastated, the communities left isolated and dispersed, and population density reached minimum levels. This was a problematic issue for the crown overall but with regard to copper production it was even more significant due to the increasing need for copper previously discussed. The native population comprised not only the core of the labour force in all stages of production, but also the highly skilled specialists who were needed to produce the quality and quantity of metal demanded.

In 1595, Viceroy Luis de Velasco issued an order to the governor of the province and the local authorities to provide detailed information about the convenience of congregating the towns of Sinagua, La Guacana and Churumuco (the core of the copper mining region). The viceroy also asked for information about the best location for this resettlement[695]. As we previously saw, in 1599 the viceroy commissioned Captain Garcia to visit the mines and smelters in order to produce a detailed report on the state of production and, if necessary, give suggestions on the way that these activities could be enhanced with the aim of building up a bigger artillery factory in New Spain.

In his report, Rodriguez de Valdes said that the copper from Michoacán was of great quality overall and the mines were abundant enough to supply a big artillery factory; however, there were not enough Indians who knew how to work them. According to Rodriguez, that shortage was the real issue that impeded a further enhancing of mining and hence of production. Rodríguez de Valdés is reiterative in the idea that copper ore and charcoal were the two most important elements in the chain of production, and that although they were widely available, procurement and production had to be reorganized in a more efficient way. To solve this problem, he suggested the creation of two congregations, one that would be in charge of mining the ore, and a second in charge of producing high quality charcoal and smelting.

According to the captain, the first congregation should be located in the town of La Guacana, which at that time was inhabited by 50 heads of households (vecinos) and was three leagues (13-15 km) away from the mines of Inguarán. He said that La Guacana could congregate the

[695] AGN,INDIOS,VOL.6,EXP.857

people of Sinagua (40 inhabitants), Inguarán (20 vecinos), Chiromuco (Churumuco – 120 vecinos), and Pumacopeo (16 vecinos), for a grand total of 236 able mine workers[696]. He added that with this number of people working the mines, even if more people were added to the smelter the production would not stop, at least not because of a lack of ore.

He continued the report with the information of his visit to the smelter at Satzeo. According to Rodriguez de Valdes, the smelter was located in a perfect place, surrounded by large masses of forest from which a great quantity of good quality charcoal could be made. However, the location of the smelter was rather isolated from the main trading routes, hence he suggested the establishment of the smelting congregation in the town of Ario, located two leagues (9 km) away from Satzeo, where the proposed town would focus on charcoal making.

According to de Valdes, Ario was a perfect place to hold the settlement because it was a territory with ample arable lands and abundant running water where maize could be harvested twice a year, and that could easily maintain a population of more than a thousand natives. He suggested the relocation of all the small villages located in a radius of 2 to 2.5 leagues which, including those already living in Ario would make 100 *vecinos*. In addition, he suggested the resettling of people from charcoal-making towns located between 4 and 5.5 leagues away, among them Santa Clara (40 vecinos), Huaniqueo (30), Opopeo (51), Urecho and Tepitaro (60), Temapeo (20), Yranesa (30), Suscal (16), Uspio (8), Satzeo (40) and other minor towns (100)[697].

Rodriguez de Valdes stated in his report that the most essential function of this congregation was to produce abundant charcoal because proper smelting would only need some specialized workers and other temporary workers to move the bellows. Due to the type of work, this could be done by any person from the congregation, including youngsters and women. These workers would be taken under the regime of *repartimiento* (labour draft). As a final remark on the setting up of a proper royal smelter, the captain suggested that the crown should buy 50 pairs of bellows to ensure continuous production[698].

The congregations proposed by Rodriguez de Valdes were not carried out but the detailed report he produced opened discussion to advance the issue and would become the basis for future congregation plans in the copper production region. These plans were reconsidered and carried out only a few years later.

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696 AGI,MEXICO,258,N.12; AGI,MEXICO,24
697 Ibid.
698 Ibid.

In 1605, Baltazar Dorantes Carranza, judge of resettlement court (*sala de congregaciones*), was sent to the region to make the necessary arrangements for the congregation of the natives living in the vicinity of La Guacana[699]. Dorantes made a further inspection of the area, visited all of the towns involved and took statements from several witnesses in the region. Based on the previous report of Captain García, the information gathered by him, along with information about distances, population and available productive lands, he proposed the establishment of two mining congregations, one in La Guacana and another one 50 km away, in Churumuco[700].

The proposed congregation of La Guacana (Map 21) would resettle people from the towns of Capirio (13 *vecinos*), Inguaran (9) and Pumacopeo (13). The congregation of Churumuco (Map 21) would do the same with the people of Sinagua (42.5 *vecinos*), San Martín (1), Santiago (30) and Cutzaro-Xalpa (9.5). In the document produced during the whole process, the judge stated that in order to increase copper mining production there should be a permanent labour force in the mines consisting of experienced copper miners. This labour force would be supported by a variable group of between 15 and 20 occasional workers, and another eight natives should be recruited each week to carry the ore out of the mines[701].

According to the document of Dorantes, the congregation of Churumuco was not created for exploiting a particular mine in the vicinity, or at least the document does not mention any mine other than Inguarán. Instead, this congregation would provide 20 miners (*barreteros*) per week to the mines of Inguarán, and would supply the mine with additional food stock. This is peculiar because from at least 1533 until 1581 we have information detailing the exploitation of the surrounding copper mines by the natives of Sinagua, Churumuco and Cutzaro[702].

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[699] Lemoine 1962:669-702

[700] Barrett 1987:22

[701] Ibid.

[702] Two years later, in a letter accompanying the commission given to the new copper administrator Alonso Pacho de Guevara, the viceroy Juan de Mendoza granted him permission to appoint a trustworthy person to be in charge of the charcoal maker facilities. In this letter the viceroy refers to Guevara as *Corregidor* of Sinagua and Santa Clara, in charge of exploiting the copper mines of Condémbaro for the benefit of the crown (AGN,Indios,Vol.5,Exp.663). This is an important piece of information because it shows that the crown exploited other copper deposits besides the famous mines of Inguarán referred to, and it is possible that these mines were being exploited by the people congregated in Churumuco. It is not the first time that the mines of Condémbaro are mentioned in the documents; for instance, in the *Lienzo de Jicalán* it is the end of one of the routes towards some copper deposits. In his report of 1605, Dorantes also mentions the mines although he says they were abandoned.

The natives of the towns mentioned had their opportunity to protest against the plan of Dorantes. During the process some of these communities did indeed express their approval or rejection of the proposed plan. The people of Pumacopeo protested that if they were resettled to La Guacana this would bring grievances and the loss of their crops. Rather, they proposed that they be congregated with the miners of Inguarán in the vicinity of the mines, allowing them to be within a reachable distance of their crops. This petition was supported by Roque de Olibera, justice of La Guacana and renowned intermediary between the miners and the crown. Olibera argued that congregating the people of Pumacopeo and Inguarán in a place near the mines would be convenient. He added as well that instead of reducing the miners to wage labourers it would be better if they kept ownership over the mine, selling to the crown (under supervision) all the ore mined, as it had been done up until then[703]. This confirms that in 1605 the crown did not have its own mining operation.

The people of La Guacana (mostly Spaniards) also expressed their objection to the idea of two congregations; they argued that their lands and waters were abundant enough to support a bigger congregation which could include Churumuco and its neighbouring towns. They added that Churumuco and Sinagua were plague lands with no good source of water, terrible roads and off the path of the royal road that linked the pacific coast with the interior. According to La Guacana the only intention of the people of Churumuco was to stay in their towns most of the year and therefore they asked the judge to conduct an investigation into these issues. The people of Churumuco replied and, supported by several other witnesses (Spanish and natives), they accused La Guacana of giving a false and sinister account of their town, people and lands[704].

Dorantes gave his final verdict on 24th October 1605, dismissing all of the different protests expressed by the towns or the individuals, and he did not take into account the advice of Roque de Olibera, perhaps due to its controversial past (he had been legally accused in the process of 1599-1600). Therefore, he maintained his original statement for creating two mining congregations in the places where the towns were originally established. In addition, he ordered the configuration of a smelting congregation that could ensure the production of high quality metal. He did not conduct any deep research into the topic of this congregation and only added that it should be established in Satzeo, Opopeo or any other desirable place[705].

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703 Lemoine 1962:695-696
704 Ibid., pp.696-701
705 Ibid., pp.701-702

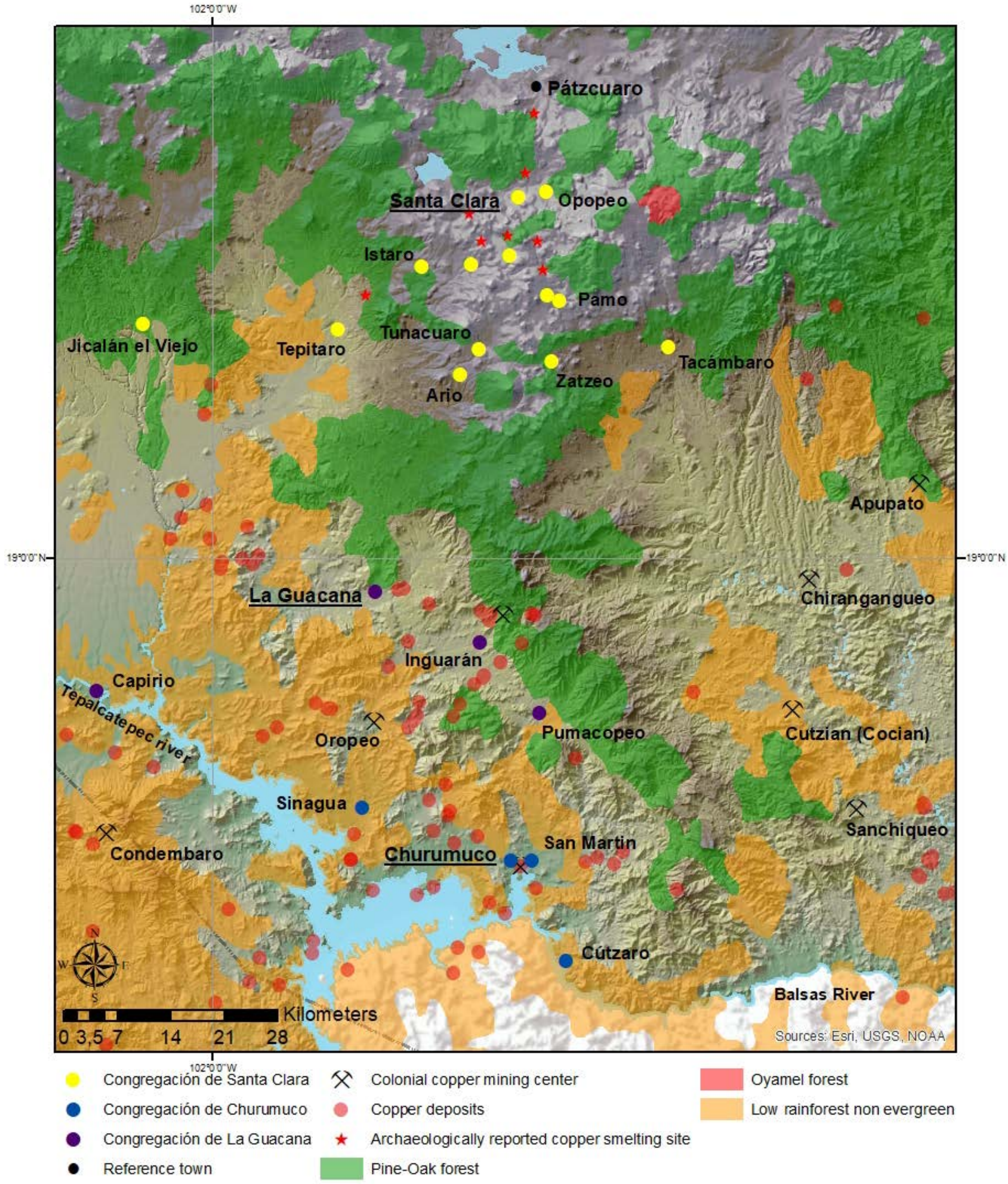
During his visits Dorantes calculated that 1000 *cargas* of ore could be produced on an annual basis in the mines with the proposed labour force; furthermore, he suggested that in order for the established miners to be devoted only to mining, the crown should make the necessary arrangements to secure a salary and food for the work gangs. According to the judge, those 1000 *cargas* would produce between 400 and 500 quintals of copper. In order for this to work additional people should be congregated (with the same characteristics; i.e. full time and part time specialists) at the smelter of Satzeo (which was already being called the royal smelter) or in another convenient place. These developments could indicate that at least some of the suggestions of Captain Rodriguez were carried out, and that apparently between 1601 and 1605 the crown had set up its own smelter in the town of Satzeo.

Dorantes continued his report, suggesting that at least 20 workers could be taken from Tacámbaro and villages subject to Santa Clara, in addition to some eight to ten workers from Jicalán. The location of Satzeo appears to have been a rather problematic issue. It was still a small village off the main trading and transport paths and it seems that the natives refused to move there. Therefore, in 1605 there was a plan to move the royal smelter to the town of Opopeo which was in a better location, still had the necessary skilled workers, and had been smelting copper since at least 1570. The smelting congregation was carried out between 1605 and 1606, but instead of using Opopeo as the head town of the congregation the authorities decided to set up the royal smelter in the town of Santa Clara[706] located 4 km to the west (Maps 21 and 22).

Until that time, Santa Clara had been a secondary settlement, rarely mentioned in the sources and never associated with copper production. According to Carolina Velazquez, in the early colonial years, the town was a poorly populated Tarascan settlement called Xácuaro which adopted the Christian name of Santa Clara de Xácuaro in 1553 through a royal decree promoted by Juan de Villa[707]. With regard to administrative issues, the town was a subject of Pátzcuaro from 1540 throughout most of the colonial period. In terms of religious issues, the town was part of Pátzcuaro until 1577 when it became a parish administered by the secular clergy, a position that was held until 1593[708]. During this time the town lost Xácuaro as part of its name and started to be referred to only as Santa Clara. In 1616 we find the first mention of

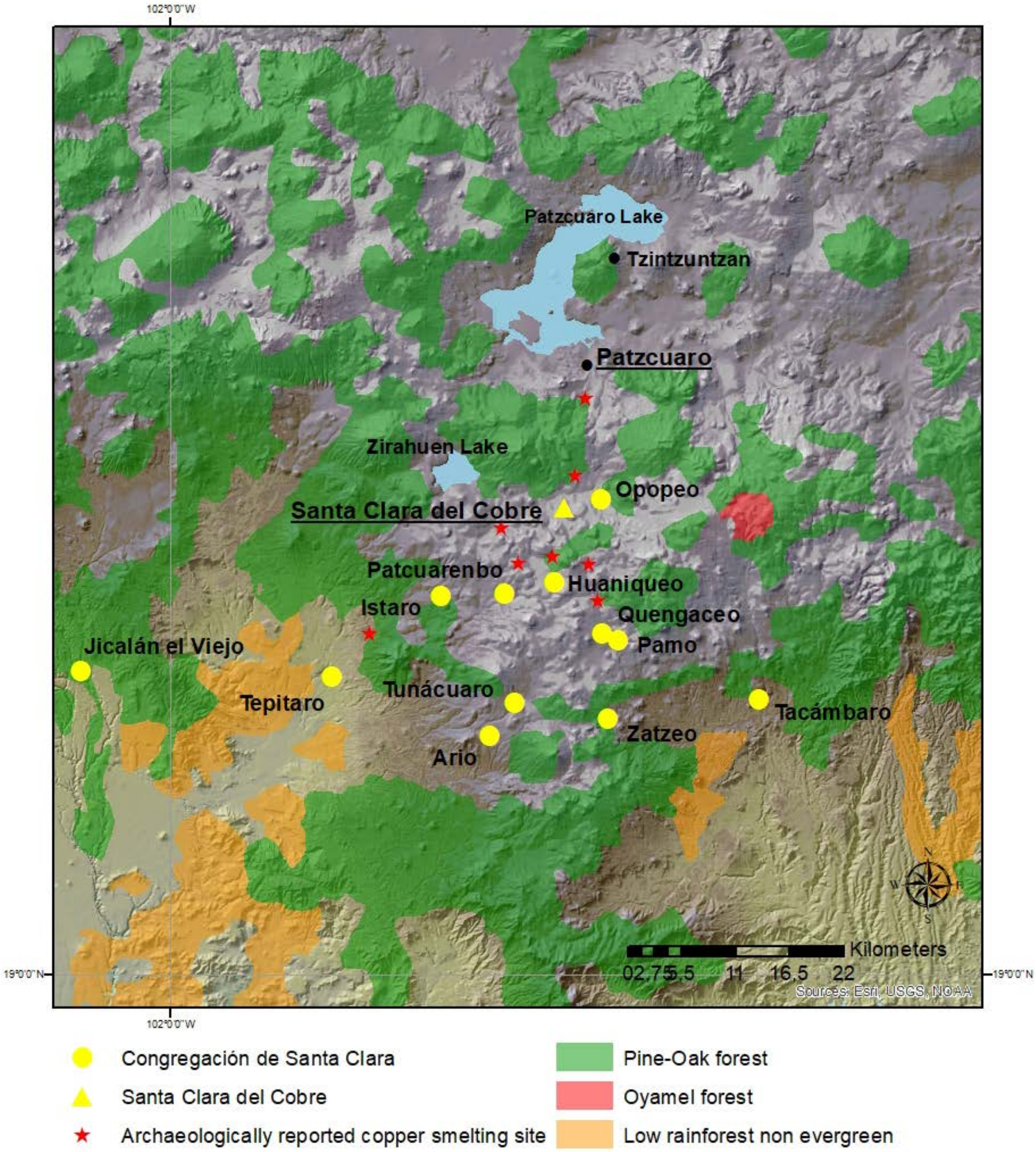
[706] Barrett 1987:23
[707] Velázquez 2015:135
[708] Ibid., pp.136

the town as *Santa Clara de los Cobres* in a clear allusion to the concentration of copper metallurgical practices[709].



Map 21. Map of the smelting and mining congregations of 1606 in relation to ore deposits, colonial mining places, and charcoal fuel sources.

709 AGN,Indios,Vol.7,Exp.75



Map 22. Detail of the smelting congregation of Santa Clara de los Cobres in relation to the fuel sources and the archaeologically recognized smelting sites

The congregation of Santa Clara and the relocation of the royal smelter were remarkable events for both the region and the production, but perhaps not for the indigenous workers whose future as wage labourers was going to be full of abuses. Santa Clara became the most important copper production center in New Spain for the next three centuries. By the end of the century, Santa Clara, Churumuco, and La Guacana were concentrating the native labour forces from towns located all over the region of study, most of them recruited through the draft labour system. Map 23 shows the level of expansion that copper production saw during the 17th century, and although not all of the towns provided labour force at the same time[710], the map helps to visualize how production increased, to the point of demanding workers from across a wide area.

The final order from the viceroy for establishing the three congregations should have been issued at the end of 1605 because in March 1606, the viceroy ordered the implementation of small changes with regard to these already established congregations. The most important ones were the orders given to the administrators in the mines and the smelter in which he stipulated that the specialized native workers should not be employed in any other tasks than copper production, whether this was mining, charcoal making, or smelting[711].

In early 1606 the recently appointed administrator of copper, Juan de Espinosa Mondragon, wrote a letter to the new viceroy, the Marqués de Montesclaros, to confirm the order given by his predecessor, the Count of Monterrey, to provide the native workers of the royal smelter of Santa Clara with 300 *fanegas* of maize on behalf of the crown[712]. By providing food stock to these skilled labourers, they would no longer need to occupy themselves with food production, thus could dedicate all of their time to copper production. This is perhaps the first step taken by the crown towards creating full-time specialists among the native workers. The development of this new concept was going to be complemented by the congregation, the creation of a royal smelter, and the employment of native specialists as wage labourers, all part of a strategy to boost production.

With the establishment of the smelting congregation in Santa Clara, a new copper administrator was appointed and with him, a few modifications were made with regard to his duties. First of all, his commission included all of the standard responsibilities of the position, including buying ore from the natives in the mines which means that at least until this time (March 1607) the crown had not taken over the copper mines from the native owners[713]. For the first time it also included the explicit order to take seven labourers from the town of Zirosto to be employed in the royal smelter, as it was their duty according to the draft labour system.

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[710] See for instance the great summary made by Castro Gutierrez on the draft labour system for copper production in Michoacán during the 17th century (2005:231-234)
[711] AGN,Reales Cedulas Duplicadas,Vol.16,Exp.277
[712]AGN,Indiferente Virreinal,Caja 4070,Exp.007
[713] AGN,Reales Cedulas Duplicadas, Vol.5,Exp.660 and 662

The commission to Alonso Pacheco de Guevara had one important innovation compared to his predecessors. According to a document dated April 1607, the administrator was also appointed to exploit the copper mines of Condémbaro (Map 21) which had originally been mentioned in the *Lienzo de Jicalán* in 1565 and later on by Baltazar Dorantes in 1605, though Dorantes stated that the mines were abandoned. This is interesting because it shows the interest of the crown in exploiting other mines, using the congregation of Churumuco to do so. Perhaps that is why in the commission Guevara is also appointed as *Corregidor* of Sinagua[714]and Santa Clara.

One last outcome from the process of congregations was the change of ownership in the Inguarán mines. The mines passed from belonging to the natives of Inguarán to being claimed by the king as part of his royal heritage. In his report of 1605, Dorantes recognized that the mine belonged to the natives, but in his initial recommendations he suggested that this status should be changed, and the crown should take possession of the mine[715]. In his final report, Dorantes reiterated that the mine should be worked by the crown as it was the only solution for assuring an adequate supply of ore for the smelter. He also added that given the fact that the labour draft was already extensively used, there would be no problems in maintaining the necessary labour force in the mines[716].

We do not know when exactly the crown took over the mines, but this should have happened after 1607 because, at least in the document of the commission, nothing is mentioned with regard to this important issue. However, in a document of September 1606, Pedro Pantoja, *encomendero* of La Guacana, asked the authorities to forbid the mayor of Michoacán from employing "his Indians" in tasks other than copper mining. He claimed that the natives of his *encomienda* were employed in the service of his majesty in the mines that were being worked on behalf of the crown. It is possible that the expropriation of the hill was not a single and immediate event, but rather it was a gradual one that could have started with the first orders to work the mines on behalf of the crown in 1588 and ended sometime between 1607 and 1616.

In 1616 the mines were already being called the "copper mines of his majesty", and these were not only circumscribed to a particular group of mines but to the entire hill. However, in legal terms, the mines were already considered the property of the crown, especially since

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[714] AGN,Reales Cédulas Duplicadas,Vol.5,Exp.663
[715] Barrett 1987:23
[716] Ibid., pp.24

1584 when the king proclaimed the new mining ordinances (*ordenanzas del nuevo cuaderno*), reaffirming that all minerals were part of the royal heritage, differentiating between ownership of the surface and the mineral-bearing undersoil.

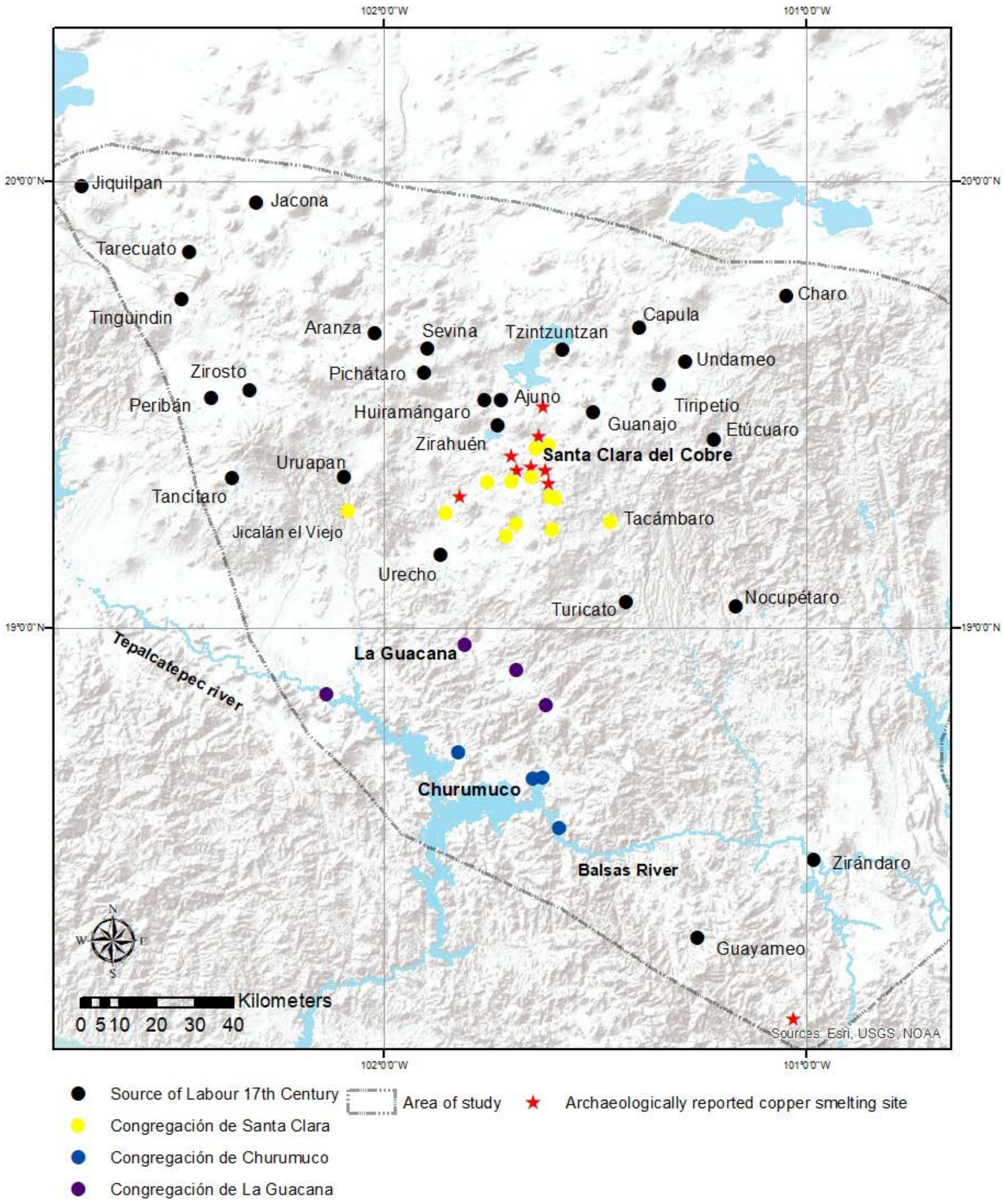
This event was very rare in America; in New Spain at least, it occurred only once when the crown took possession of the rich silver mines discovered by the Spaniard Francisco Morcillo in 1525[717]. In the rest of the continent, the mercury mines of Huancavelica (Peru) were taken by the crown in 1568 after their discovery in 1563, with the aim of acquiring a monopoly on mercury production and distribution given its strategic importance for silver production[718]. The same motivation was behind acquisition of the copper mines of Cocorote in Venezuela, discovered in 1612 but annexed by the crown in 1632[719]. Thus, this was not a common practice and only happened in certain times and with certain products that the crown considered to be strategic. In this case, copper was considered a high priority during this particular period (1585-1616) given its importance for artillery making. Considering that the hill of Inguarán was the main source of copper in New Spain, the crown exercised its right following the advice of Dorantes.

Between 1607 and 1620, the crown gradually ceased to have the urgent need for copper that had manifested during the previous two decades and that had influenced deep changes in the human geography and regional dynamics of production in Michoacán. In 1620 the crown decided to give the mines and the smelter in concession (*asiento*) to the last copper administrator Fernando Moreno Alvarez de Toledo who worked them until 1630. Although the production of copper in New Spain grew throughout the 17th century[720], the famous copper mines of his majesty passed from one concessionaire to the other, generally with great losses as the price paid by the crown for the copper produced dropped considerably in the following years[721].

I believe that there is not one single but rather multiple causes for this gradual diminishing in the crown's need for copper. The Anglo-Spanish war had ended in 1604 with the signing of the treaty of London, and the Dutch revolt was under the twelve years' truce. For the first time in more than twenty years the sea and port cities were not under permanent threat, hence

[717] Ibid., pp.25
[718] Lohmann 1949:24
[719] Urbina 1992:157-159
[720] This was mostly because of the exploitation of new copper deposits in Michoacán, Zitacuaro, Tuzantla, Sonora, and Jalisco.
[721] Barrett 1987:28-31

lowering the demand for artillery. In addition, Cuba had been shipping all of its copper to Spain since the dismantling of the artillery foundry in 1607. Venezuela was also starting to produce copper for the crown since the discovery of the mines of Cocorote (Aroa) in 1612. Nonetheless, this period has to be further explored.



Map 23. Source of Labour for copper production during the 17th century (Based on Barrett 1987: Map 2)

CONCLUSIONS

This dissertation has by far exceeded the reach of my initial hypothesis. I never imagined that the topic of copper production in Michoacán could provide such a rich and deep field of enquiry or that my research would spatially extend to considering distant lands such as Hungary, the Philippines, Cuba or Bolivia, or even that chronologically it would go back in time to the Roman occupation of Iberia. As such, and as a means of consolidating and connecting the different topics previously discussed I will present in the next paragraphs the conclusive ideas of the present study.

As it was mentioned in the state of the art section, this dissertation was partly built over the great work done by Elinore Barrett, as such; I will first introduce how my work has added new data and higher resolution over the Indigenous-Spanish productive relationship on copper production during the 16th century.

Barrett brilliantly suggested that the initial period of colonial copper production was characterized by a strong indigenous influence, and that the Spaniards, pursuing the richness of gold and silver had left the production of copper in the hands of the natives until 1606, moment in which the crown takes over the control of the main ore deposit. This dissertation confirms Barrett's statements, and by building a very detailed chronological sequence of archival material introduces a large number of detailed information for understanding why the indigenous influence was ubiquitous during this period and thus why the Spaniards left the production on the hands of the natives. By providing the previously unknown information on the Spanish impossibility of copper production due to their lack of copper extraction knowledge this dissertation provides the key element for understanding not only the data from archival and archaeological sources but also for contextualizing it within a broader framework.

This dissertation clarifies that leaving the production of copper on the hands of the natives was not due to the Spanish lack of interest in this metal but to the acknowledgement of indigenous metallurgical expertise by the colonial authorities. Copper was not a very profitable material, especially if we compare it with silver or gold, but its importance was strategic for the crown as a fundamental metal to be used in the mint and the artillery foundry in Mexico City. Because of this the authorities demanded a high quality metal which due to the complexities of its production could only be achieved by highly skilled specialists. During most of the 16th century this expertise was held exclusively within the communities of specialized metalworkers of South-Central Michoacán and those who travelled north with the silver mining expansion. We can now affirm that the metallurgists of Michoacán used their expertise as a negotiation tool to ensure their political and economic position in the colonial society under construction. The fact that they held the monopoly of copper production during the 16th century was a therefore a direct consequence of their negotiation skills based on their metallurgical expertise and their ability to adapt European tools and techniques to their own metallurgical *repertoire*.

Now I will proceed to introduce three main conclusions that resulted from the unforeseen depth of the topic and that are fundamental to understand the context of this dissertation. Subsequently I will present the conclusions with regard to my initial research questions and hypothesis. Finally, I will close this section with the particular contributions this dissertation has for the archaeology and history of copper production in New Spain, as well as for future research.

The first conclusion is that copper was a fundamental material in the early modern period and its importance have been massively underestimated in the historiography of the period. This importance had been previously highlighted by Barrett when mentioning that copper was used extensively for the manufacturing of all sorts of daily life items, as well as in the manufacturing of specific functional objects that were vital for the development of other important economic activities such as sugar or silver production. However through the analysis of the historical sources held in Mexican and Spanish archives I came to the conclusion that at the eyes of the crown copper had a deeper strategic importance. In terms of coinage it is important to remember that beyond the production of copper coins, every single silver coin produced by the mint of Mexico had a small percentage of copper and as such copper was an essential material in coinage. Furthermore, given its primary role in artillery making, copper was a crucial component of the offensive/defensive capabilities of the Spanish empire and as such its strategic importance exceeded the geographic scale of New Spain.

The second major conclusion is that in the period in which this research is framed, Spain had a poorly-developed copper industry in which mining and extracting knowledge was completely absent. For the crown, this produced a total dependency on the imports of metallic copper from the production centres in Central Europe. When American copper ore deposits became available in the early 16th century the lack of essential extractive knowledge forced the crown to rely heavily on other's extractive technologies. The two more iconic cases were the exploitation of copper in Cuba and Michoacán. The rich ore deposits of Cuba were only possible to exploit thanks to the introduction of German technology in the decade of 1540. The case of Michoacán is even more particular because it implied not only relying on indigenous knowledge, technology and labour but also working in close collaboration with the indigenous communities of specialists to develop a hybrid Indigenous-Spanish colonial copper production technology.

The last major unforeseen conclusion of this research is that Michoacán, as an important production centre was heavily influenced by events developed on the imperial scale during the 16th century. Based on the available documents, I identified two main periods in which larger events increased the Spanish demand for copper and pushed the crown to act upon the only two copper deposits in the Spanish empire at the moment: Cuba and Michoacán. The first period (1530-1545), marks the beginning of the exploration, initial exploitation of ores, and development of the necessary extractive technologies in both regions. The second period (1585-1616) marks a new series of events that aimed desperately to increase the local production of copper and artillery, and to strengthen the crown's control over this strategic material.

Although this topic needs further stages of research, these two periods of intense activity in copper procurement and production can be associated with larger imperial armed conflicts that generated a high need of artillery. The first period coincides with two important conflicts that mobilized large amounts of Spanish warfare resources, the war against the Ottoman Empire in the Mediterranean, and the Italian Wars. With these two major conflicts underway it would have been almost impossible for the crown to provide the American colonies with the necessary offensive/defensive artillery to continue the imperial expansion; as such it encouraged the local production of copper and artillery by establishing alliances with German (Cuba) and Indigenous specialists (Michoacán).

The second period of intense activity in the copper centres of Michoacán and Cuba coincides with the development of two major armed conflicts that took the war directly to the Spanish colonial possessions. The eighty years war against the Dutch and the Anglo-Spanish war against England applied great pressure over the regional dynamics of production. The numerous and constant attacks on Spanish port cities and merchant fleets produced a new increase in the demand of copper for artillery. The need to enhance the defensive capabilities of colonial ports and fleets on the Pacific and Atlantic oceans led the crown to get directly involved in the production, triggering most of the regional scale events discussed during the last chapter of this dissertation.

These three unforeseen large scale conclusions serve to contextualize the main conclusions derived from my initial research questions. The first conclusion is that the indigenous specialized communities of Michoacán and their expertise, technology and labour were the basis of the copper production of New Spain during the 16th and early 17th century.

The second conclusion is that in the process of becoming the core of New Spain's copper production, the communities of native copper producers of Michoacán incorporated Spanish techniques and tools into their own technical *repertoire*. These processes of technological hybridization were promoted and encouraged by both societies, indigenous and Spanish, and functioned as strategies of adaptation to the rapid changes inherent to the formation of a colonial world. The outcome of these processes was a new technology to produce copper that although based on indigenous know-how and labour, obeyed to new social, economic and political colonial dynamics. On this regard it is pertinent to say that indigenous metallurgical technology was not primitive as it has been suggested elsewhere. On the contrary, the hybridization of copper production technology was not a consequence of the demand of quality but on an increasing demand of quantity and in the relationship volume/time, two variables for which traditional indigenous technology was not suitable for.

The third main conclusion is that this new technology was exclusive to indigenous communities until 1588. However during the last decade of the 16th century, in a context of dynamic interaction between the native communities and the crown, this technology was eventually accepted, learnt, and used by the emerging *mestizo* and Spanish communities of the late 16th and early 17th century. As such, it became the predominant copper production technology for the next two centuries and thus, a key feature in the development of the Mexican copper industry of the 17th and 18th centuries.

With these main conclusions in mind, one of my initial hypothesis stated that technology, in this case metallurgical, served as a common ground for cultural interaction, dialogue, exchange, negotiation, and cooperation between indigenous and Spanish communities. My research has served to confirm that copper metallurgy in Michoacán during the 16th century functioned as a common place for establishing a dialogue between the communities of specialists (miners, charcoal makers, smelters, and copper smiths) and the Spanish crown. The familiarity of both cultures with a general framework of technical processes (mining, smelting, refining, and metalworking) permitted the construction of a socio-technological interaction that, at its base, allowed and encouraged technical exchange, creating at the same time spaces for political and economic negotiation and cooperation.

These processes were nonetheless immersed in complex asymmetric power relations that were inherent in the colonial structure and that cannot be disassociated from the discussion. This asymmetry defined, for instance, what to produce, by whom, in what quantity, and how often. In the same way, it restricted indigenous metallurgical practice to copper production in a region that was historically characterised by a metallurgical tradition that involved extensive work of other metals (silver, gold, tin, and arsenic) besides copper.

The human geography associated with copper production was also massively modified throughout the century, reaching its peak in the first decade of the 17th century with the policy of congregations. One more example of these power relations is seen in the gradual transformation of native labour, from the part-time metallurgical specialists in 1533 to the full-time wage labourers of 1607, and from the native specialist who was at the same time miner, smelter and coppersmith in 1533, to the specialist miner (*barretero*), smelter (*fundidor*) and coppersmith (*calderero*) of the end of the 16th century.

The interaction structured around copper metallurgy created spaces of technical exchange, negotiation, and cooperation between the natives and the Spaniards at different levels, from the state level represented by the crown, to the Spanish *encomenderos* and private entrepreneurs. However, these processes most certainly would not have occurred without the existence of the Spanish need for copper and its inability to produce it (due to the lack of fundamental extractive metallurgical knowledge), and on the existence of a region with vast ore deposits and an almost millennium-long indigenous metallurgical tradition based on copper and its alloys.

Different episodes of technological exchange were present throughout the 16th century, unfortunately it is pertinent to say that we are still far from identifying the technical particularities of copper production and this can only be solved through further archaeological research. Nonetheless thanks to the archival work I was able to document different moments of technological exchange. The first of these is framed within the conquest campaigns, when the Spanish forces turned to the indigenous metallurgical expertise to make copper (or bronze) bolts, arrow- and spear-heads, to be used by them or by their indigenous allied forces. I believe that from this early time, the technological exchange in copper production was almost constant but only systematically started with the report of Vasco de Quiroga of 1533. In this, the basis for incorporating Castilian technology and tools into the technical *repertoire* of indigenous metallurgy was first outlined. In fact, the document highlights the importance of introducing bellows and forges for smelting and copper work, and iron tools for facilitating mining. These initial ideas were shared by the two specialized interlocutors, Spaniards and natives.

Based on this initial dialogue, the period of 1538-1545 presents itself as a fundamental time of technological exchange, but also one of political and economic negotiation and cooperation between the native communities of the region and the Spanish crown. Two prominent Spanish figures served as the facilitators of these processes: the Bishop Vasco de Quiroga and the first viceroy of New Spain, Antonio de Mendoza. In this regard, Quiroga's ideas of socio-political organization applied to the region included an economic model of production in which native communities and their technologies could be incorporated into the colonial project, simultaneously serving the interests of the natives, the colony, and the crown.

On his part, Antonio de Mendoza had had first-hand experience of the productive capabilities of the natives of Michoacán, especially during his time in the region between 1540 and 1542. Mendoza encouraged the native production of copper in Michoacán at a time when both the crown and he himself were looking to obtain this strategic metal in the colonies to avoid the difficulties and high costs associated with importing it from Spain, especially if we consider that the crown also had to import it from the production areas in Central Europe. Therefore, in around 1542 the viceroy established a production alliance with the natives of Pátzcuaro for supplying copper initially to the artillery foundry of Mexico City. In this context, he granted a *merced* to the producers of Pátzcuaro, regarding the metal provided as a part of their tribute loads in a clear example of an early political and economic indigenous negotiation based on their ability to produce copper.

In the following year, the natives of Michoacán also started to supply copper to the mint of Mexico City to be used for the manufacture of copper and silver coins. It is at this moment that we can document a new episode of technological exchange when the workers at the mint could not produce copper blanks of sufficient quality to be struck for coinage. Through the intercession of the viceroy, the natives of Michoacán took the job and as such they were instructed in the mint as to the technical characteristics of the task. Since that time and until at least 1545 or, more probably, until 1549, they produced and cut the blanks used for copper coins in Michoacán.

These initial processes of exchange, negotiation, and cooperation between the native producers of Michoacán and the Spanish authorities left the monopoly on copper production in the hands of the indigenous communities until at least 1588 when the crown decided to introduce a royal officer (*juez administrador de cobres*) to the region who was responsible for the procurement of copper on behalf of the crown. The end of the monopoly, which was heavily influenced by the massive native population loss after the deadly epidemics of 1576-1578, brought new Spanish entrepreneurs to the region, who inserted themselves into the chain of production. This series of events, in addition to a new period of high imperial demand for copper, triggered new processes of exchange and cooperation between the natives and the Spaniards.

One of these processes was the extensive interaction between the native producers and the Spanish entrepreneurs who, since 1585, had become a permanent presence in the regional dynamics of copper production. The documents mention several examples of Spanish private enterprises in which positive cooperation with the native producers was at the core of the issue, and the success or failure of the business enterprises depended on the fluidity of this relationship. Essentially, the same situation is present in the pairing between crown and native producers; not surprisingly, the different commissions given to the copper administrators from 1588 to 1616 highlighted the importance of maintaining a fluid, cordial, and trustworthy relationship with the native copper producers.

My second hypothesis stated that technologies have strong traditional and ideological loads and that, based on these ties with tradition; they serve as mechanisms of identity, collective memory and cultural resistance. My research identified that this topic is more complex than previously thought and as such it demands further research. Nonetheless, the results of this dissertation allow me to affirm that copper work in New Spain was always associated with an indigenous tradition, or with a tradition of indigenous origin, not only in the centres of production of Michoacán but also during the expansion of the northern frontier. All the sources indicate that production of copper, at least until the end of the 16th century, was an activity exclusive to native specialists, whether that activity was ore mining, charcoal making, smelting, or the production of utilitarian objects.

This exclusivity certainly permitted them to maintain a base of traditional techniques, indigenous knowledge, and traditional forms of organization to a certain degree. Through time the technical base was enriched by the incorporation of European techniques, tools and ideas, and indigenous organization was heavily influenced by the colonial socio-political and economic dynamics, yet the traditional indigenous base survived. Its existence is confirmed and acknowledged by the sources of the late 18th century that refer to the regional copper technology as being deeply anchored in the ancient ways. Furthermore, in the collective memory of Santa Clara del Cobre today, although a mestizo town, it is common knowledge that their traditional copper technology has both indigenous and Spanish colonial roots that can be traced to the pre-Hispanic and early colonial periods.

The ideological component of the technology and its survival in metallurgical practice is a more difficult issue to approach than the survival of the traditional know-how. It is widely accepted among archaeologists and specialists in pre-Hispanic metallurgy of Western Mexico that this technology was considered heavily linked to the ideological sphere of society and its most important function was to serve as a vehicle for the display of socio-political and religious messages. It is not surprising that a very high percentage of metal objects from this period were used for personal adornment as an indicator of status and cultural affiliation, as well as in ceremonial and religious practices. In comparison, a very low percentage was used for tools, and even those were imbued with ideological messages, as suggested by their presence in funerary and ceremonial contexts.

The Spaniards categorically prohibited any material representation of indigenous ideology since it was considered to be a “pagan” practice, and the punishment was severe for those accused of idolatry. If we consider that one of the most important functions of pre-Hispanic metallurgy was the display of these cultural messages through the materiality of the technology, then it is not a surprise that the only indigenous objects that survived the 16th century were tools, especially axes and hoes. With the freedom to produce these objects suppressed, a big part of the ideological load should have been lost along the century. However, we know that the metallurgical process in itself was ideologically representative, as the *Lienzo de Jicalán* reminds us. It is possible that the ideological load imbued in the metallurgical process (mining included) had survived the religious indoctrination but up to now there is no documental evidence that can confirm this.

The results of this research have contributed to re-think the archaeology of early colonial copper metallurgy of South-Central Michoacán and by extension the archaeology of late pre-Hispanic metallurgy. For decades researchers have taken for granted that Spanish conquistadors and colonizers had advanced copper metallurgical knowledge inherited from a (idealized) homogenous European tradition. This assumption has led the researchers to believe that colonial copper metallurgy in New Spain was an easily recognizable Spanish technology, in which the material evidence of production would clearly indicate its European origins. This dissertation suggests that the material context of copper production is more complex than previously thought, and that perhaps the material evidence of production can be closer to the indigenous than to the Spanish metallurgical tradition.

This has important implications for the study of late pre-Hispanic west Mexican metallurgy. The two archaeological sites with metallurgical activity debris that have been described as belonging to this period show a chronology that spans between the late pre-Hispanic and the early colonial periods. The analyses on slags from these sites suggest that the smelting reached high temperatures and reducing conditions characteristic of the use of bellows but almost impossible to achieve using solely native blowpipes. These results led the researchers to think that it was either an early colonial use of bellows or an unknown pre-Hispanic native technology of natural draft use.

Before this research, there was no reason to believe that native communities had used bellows prior to 1599 (when they are mentioned for the first time in the documents) and as such it was thought that the idea of an unknown pre-Hispanic natural draft technology was more plausible. Now we know that there were plenty of reasons for an early incorporation of these techniques and tools into the indigenous technology, indeed several actions were taken by the Spaniards and the natives to encourage this type of exchange. Unfortunately we still cannot affirm that bellows were used prior to 1599, basically because the written sources do not mention it. Nonetheless, the historical context that this dissertation has provided can serve to re-open the discussion.

The depth of the topic demands further interdisciplinary work, especially in the areas of archaeology and materials science. With this in mind the future of this research passes through characterizing the technology of copper production in Michoacán during the colonial period using its material evidence. The first step for doing this lies in establishing a fieldwork survey project to identify on the field the sites mentioned in the documents, and their activity areas associated with metallurgical processes. Once identified, these sites have to be mapped, geolocated, and incorporated into our regional GIS database.

The next step will be to define which of these sites are suitable to be excavated. This can be done by grouping the sites into two categories under the light of the documental evidence: (1) sites with a transitional phase between the late pre-Hispanic and early colonial periods (Jicalán el Viejo, La Guacana, Churumuco, Sinagua, Turicato, and Cocian), and (2) sites developed during the 16th and early 17th century (Opopeo, Satzeo, Tunácuaro, Ario, and Santa Clara del Cobre).

With these two steps completed, the next main objective would be to excavate some of these sites with the aim of approaching the production of copper from its material evidence. The final objective then would be to define the technology of copper production in different moments of the 16th, 17th and 18th centuries. For doing this it is fundamental to date directly or indirectly the archaeological contexts with the idea of establishing a chronological sequence. With this at hand we can isolate groups of metallurgical debris and use them as unities of study to be analysed chemically and metalographically. Ideally the results will serve to particularize the technology of copper production in different moments and in combination with the written sources we can fill the gaps that both datasets inherently have.

Along this dissertation I have focused on the indigenous elements of the colonial copper production of New Spain as a way of rescuing part of the social history of the region, the technology, and the indigenous communities of South-Central Michoacán, and as a way of acknowledging their agency and cardinal importance in the configuration of the colonial world. An importance that historiography, consciously or unconsciously has until very recently denied or omitted. With this in mind I have included in this dissertation all the available sources that were relevant for the topic, and have presented them in a chronological sequence that had served to link the events in the region with the colonial dynamics of New Spain and with events at a larger imperial scale.

I strongly believe that this dissertation can be very helpful to anybody interested in the colonial period of Michoacán, Mexico, and Latin America in general. In the same manner I believe it can be interesting to researchers working on the history of science and technology during the early modern period from a non-Eurocentric perspective and/or that are curious about the role of non-western societies in the development of science and technology. With this in mind it is possible that similar processes of strong indigenous agency are yet to be found if we re-analyse other technologies previously thought to have been defined as of European influence.

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