Native navigation traditions in Mexico Central Plateau: a study between archaeology and ethnology

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Abstract

In the Americas, long before the Conquest, existed various native navigation techniques (coastal, lacustrine and fluvial), aboard numerous and diversified wooden boats. Among these, stands one that was made by carving a tree trunk: the dugout cance. As an evidence of human ingenuity, it acquired its importance by being the bridge between land and water, representing the bond between the human and the aquatic world. Similarly, this means of transportation played a primordial part in the native civilizations as it was involved in daily activities at different levels: transportation (people, goods, raw material), natural resource exploitation (hunting, gathering and fishing), rituals and war. These activities implied the organization of the lacustrine areas, thanks to adapted facilities such as channels, piers, bridges and warehouses.

In Mexico's Central Plateau, in the endoreic basins of Mexico and Pátzcuaro, flourished two of the most powerful contemporaneous and rival empires in all Mesoamerica: the Mexica and the Tarascan (Fig.1). Based on their respective lacustrine surroundings and specific methods, they accomplished the edification of their capitals, Tenochtitlan and Tzintzuntzan, through the use of navigation.

Nowadays, some remains of these antique and powerful civilizations naval technology still exists, allowing us, thanks to a multidisciplinary method, to approach a broad vision of their history and transformation.

Key words: cross-cultural, navigation, Americas, Mexico, dugout, naval, technology

Introduction

Contrasting with other civilizations of the ancient world such as those of the Mediterranean or South-East Asia, Mesoamerican cultures are not particularly renowned for their maritime history or naval architecture.

We owe the first in-depth studies of Mesoamerican navigation in the 1980s to the British archaeologist Norman Hammond, who focused largely on the transportation of goods

and traffic along the entire coastline of the Gulf of Mexico and the Yucatán Peninsula. Historical sources show us that, along this maritime navigation studied by Hammond, another very important form of navigation existed, on rivers and lakes. Unfortunately, few researchers bore attention to these freshwater examples, even though, according to the cultural ecology theory, numerous writers, such as Sanders and Price (1968), have the confirmed that they favored development of highly complex social



Fig.1-Endoreic Basin of the Mexico's Central Plateau (lakes of Mexico and Patzcuaroand) and the Post-classic Empires (Mexica and Tarscan)

structures. It is indeed in the center of the closed-water basins of Mexico's central plateau that we see the flourishing of successive great civilizations such as Teotihuacan, the Mexica s and the Tarascans, and a key correlation between their development and lake navigation has been systemically asserted. Nevertheless, scientific investigation about the dugout canoe as an indispensable tool in a navigation system, specifically in the Basin of Mexico, is only due to Margaret Leshikar as late as 1982. She wrote her PHD Thesis about a dugout canoe discovered in 1959 during a preventive excavation in the heart of Mexico City, using this artifact as an important source to collect new data about the Mexica Empire's organization.

Unfortunately, concerning the Tarascan Empire, there exist no scientific investigation about the navigation system or the dugout canoes, even if nowadays, some of the Lake Pátzcuaro fishermen still use this traditional craft to work. The only evidence we have comes from the CREFAL, an international organism founded in1951 by the UNESCO to approach and educate isolated community about sanitary, social and educative problems. This is why all the available investigations bear on the fishermen's skills and way of life, rather than on navigation techniques.

Due to the perishable raw materiel used to build the canoes and most lacustrine installations, wood, archaeological remains are scarce. The only examples of prehispanic boats from the Basin of Mexico found to date are a wooden one-man canoe

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on display in the Mexica Hall of the National Anthropology Museum (Fig.2a) and a miniature model found in Offering 41 of the Templo Mayor (Fig.2b), though we know other similar examples have been found in other parts of Mesoamerica, in Belize for instance. The single-person canoe of the Anthropology Museum was discovered in the 1960s along the actual Calzada de Tlalpan. Judging from its dimensions and carrying capacity, we can estimate it was able to carry about a ton of weight – by our reckoning, after studying similar examples, a vessel able to transport large monoliths, such as several Mexica monuments. Tying together several canoes could of course allow for larger and heavier charges. But this implies sufficient breadth, both of the canoe and of the canals along which it travelled. This is why ethnology and history are the best way to compensate the shortcomings of archaeological research, because native navigation in Xochimilco canals and in Lake Pátzcuaro (Michoacán) is always practiced.



Fig.2a-Dugout canoeof Tlalpan causeway in the Mexica Hall of the National Anthropology Museum, Meico City - A.BIAR

Fig.2b-Miniatures models founds in Offering 41 of the Templo Mayor, Templo Mayor Museum

General environment adaptation

Establishment

Around 1325, two of the main Mesoamerican empires founded their capital in direct connexion with a lacustrine environment. Tenochtitlan, capital of the Mexica Empire, was built on a small island within Lake Texcoco. Tzintzuntzan, capital of the Tarascan Empire, was established on the northeast shore of Lake Patzcuaro. In order to assert themselves as the centers of the two powerful empires later confronted by the Conquistadors, both cities' inhabitants had to learn to dominate their environment – to exploit it to economic, political and religious ends. Not only did they took maximum

advantage, like their contemporaries and others before them, of one-man canoes carved from a single log of wood, but they developed complex technological systems in order to control their lakeside world, the supply of goods and the growth of towns and cities. But each one, due to their distinct location, used the lake with different goals.

Mexica space engineering

The Mexica s soon shaped their environment to suit their needs and to consolidate their power. The major hydraulic works that they and their neighbors on the lakes of the Valley of Mexico engineered fulfilled different objectives.

The first and best documented of these was clearly to reclaim land from the lakes using the ingenious system of 'Chinampas ' and canals, artificial physical extensions of preexisting islands. As is well known, the invention of Chinampas is probably due to the inhabitants of Lakes Xochimilco and Chalco, in the south of the Mexico Basin, and was intended originally as a means of developing intensive agriculture. It is worth remembering here something clearly illustrated in the Plano en Papel de Maguey, which is that the Chinampas of Tenochtitlan served not only as plots of cultivated land, but also as a residential zone, implying control over the soil dampness.

The second objective of Mexica engineering was to control the disastrous fluctuations in lake water levels, by constructing canals, dykes and even aqueducts - public works that also helped reduce the (previously high) water saline levels. The benefits these environmental changes brought complemented each other, but needed daily maintenance, with the use of lake crafts and a large, well organized labor force.

The canals of the island of Tenochtitlan, which earned the city the nickname of Venice of the New World, crisscrossed the entire metropolis, creating a grid-like landscape structure and allowing fast communication both within and outside the city. Thanks to the historian Edward Calnek (1972) and the architect Jorge González Aragón, we know that two kinds of canals existed: regular ones that followed labyrinthine [maze-like] routes and which measured up to two meters width, and main canals, facing East-West and measuring 3-5 meters in width. When we consider that the largest Aztec monoliths – such as the goddess Tlaltecuhtli weighing 12 tons and measuring 4.19 x 3.62 m –

were transported on the lake and to the city's heart, it stands to reason that some of the principal canals must have been at least 6 meters wide.

The main canals, epitomized by the famous Acequia Real (Royal Channel) that ran along the length of today's Corregidora Avenue in Mexico City Historic Centre, were ideal for carrying large boats - used as much for transporting tribute items to Moctezuma's palace as for bearing religious monuments and processional celebrants. By contrast, the regular canals carried a still larger volume of smaller boats with their daily loads of passengers and goods. Of course, we shouldn't forget that a significant part of urban traffic took place on land, suggesting the existence of fixed and moveable bridges – a fact confirmed in the accounts of the Spanish defeat during the Sad Night.

The broad and lengthy causeways connecting the island of Tenochtitlan with the mainland served several purposes: first, as a means of communication by land; secondly, they acted as dykes to hold the water at bay, and complemented the great stone levee-bridge constructed under the leadership of Nezahualcóyotl, the wise king of Texcoco. The three main causeways were those from Tepeyac (to the north), Tlacopan (to the west) and Iztapalapan (to the south). It's worth noting that this last one was built by the Xochimilcas, clear proof of the political power of the Mexica s and of their influence over neighboring peoples.

A fourth, smaller, causeway was that of Chapultepec. This uniquely supported the aqueduct constructed in the decade following 1420 and re-built on the orders of Nezahualcóyotl two decades later, supplying fresh water to the island city of Tenochtitlan, surrounded by salty water. In the construction and maintenance of these great public works, it's obvious that single-man canoes played a key role, helping to ferry materials and every-day goods.

It's impossible to imagine life in Tenochtitlan and the coastal communities of the Basin of Mexico without navigation. While navigation is hardly mentioned in the historical accounts of great hydraulic works, its crucial role is evident from the descriptions of daily life and commerce, first and foremost in the southern lakes of Chalco and Xochimilco. As a matter of fact, the pictographic and historical documents describe the movement of products along lacustrine routes that remained in use even into the first half of the 20th century, as in the case of the Canal de la Viga. These routes were

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privileged with installations such as harbors and jetties to control the flow of people and goods. Cortés (1983) wrote:

'At each entrance to the city, where the canoes unload [...] there are houses where live officials in charge of supervising and taxing every product [...]'

This organization level demanded the construction and fitting-out of facilities and buildings tailor-made for the moving, storing and monitoring of goods and people by government authorities. These installations included (Fig.3):



Fig.3-Location of nautical installations in the lake of Mexico that contributed to the control and regulation of canoe traffic in the Post-classic period.

Harbors: natural or artificial havens suitable for the (un) loading of cargo and (dis) embarkation of passengers by boat, and for carrying out maintenance.

 Quays: places suitable for loading goods and people.

Port installations are in effect groupings of architectural structures that combine complementary roles: several custom points for the receipt and control of goods; warehouses and storage facilities; stalls

and posts for buying and selling; jetties for the transfer of goods from dry land to lake transportation, etc. The construction of these facilities requires both manpower and materials (wood, stone, lime, etc.).

Unfortunately, to date, few archaeological remains exist of such facilities, making it harder to draw firm conclusions regarding their construction and purpose.

Given their importance to the Mexica economy and government, more archaeological work is badly needed in the search for port installations, several of which should be located at the periphery of Tenochtitlan and the surrounding lake shores.

A quay is generally an impermanent construction requiring considerable space, with a jetty whose size would be relative to the breadth of the canal serving it and to the volume of goods passing through. The archaeologist Francisco González Rul (1998) identified two types of quay: stone and wood. Remains of these have been found under the present Palacio Nacional of Mexico. We also have a few descriptions of them in historical records from the 16th and 17th centuries, and litho-/photographs from the 19th and 20th centuries. On the site of the famous prehispanic and colonial quay (pic 10) at the corner of Alhóndiga Street and Corregidora Avenue stands today a stone bridge, evocative of Mexico City's bygone lakeside past.

Dockyards: military or private establishments dedicated to boat building, repair, maintenance and equipment. These facilities had to be located near large bodies of water and must have resembled hangars, capable of housing several small canoes as well as larger, more important vessels.

Fray Bernardino de Sahagún (1978) refers to these last items in his description of the ceremonies and sacrifices at the disposal site of Pantitlán, in the center of Lake Texcoco: 'When all were sacrificed, we took all the offerings... and we carried them to the place where the lake is called Pantitlán, which is found not far from the dockyards.' And later (Book 2, Florentine Codex) he indicates:

'and when [the fire priest] had cast away [papers in an incense ladle], then they turned the boat about [...] And when they had come to reach Tetamacolco, where there had been embarking at the place of embarkation, thereupon there was bathing; then there was [returning] on the part of each [boat].'

What's interesting in these passages is the specific reference to places for the keeping and return of craft, and in particular those for ritual or military use, suggesting the existence of different types of lakeside storage facilities around the Basin of Mexico – for trade, for military purposes and for religious ceremonies. It would also imply different types of boats, for specific uses. We know, for example, that some vessels were of large dimensions, used in festivals to carry the priests with their offerings, or the emperor and his court. According to historical sources, these boats were kitted out with benches and awnings to offer protection from the sun and the rain. We may then contemplate the existence of larger canoes, or even of rafts.

Finally, we should also recall the probable existence of large vessels for military use, as mentioned in the accounts of the Noche Triste (Sad Night) and of the victorious sally of

the Mexica against the Spanish at the beginning of the siege of the city. The simple fact that the Conquistadors had to build brigantines proves the critical role these were to play in achieving eventual control of the lakes.

Tarascan space organization

The Tarascans used the lacustrine world as an economic space, to provide them part of their basic alimentation, and as a center of distribution, but not to protect and centralize their power. Their capital, Tzintzuntzan, according to its location on the lakeshore, didn't face the same environmental problems as the Mexica 's, even if navigation was also used for religious and sometimes political matters. The most important historical data is



the *Relation of Michoacán* and the *Lienzo de Jucutacato*, studied by Hans Roskamp (1998).

Their economic and politic organization turned around three axes: the lake, the shore and the surrounding mountains. Each one provided the capital with basics needs: food, clothes, building materials. The islands of Janitzio, Jaracuaro, Yunuen y La Pacanda have their

Fig.4-Spatial organization and principal communication ways in the lake of Patzcuaro in the Post-Classic period.

proper fishing areas, which permit them to control all the pisicultural resources. Thanks to this monopole, they were able of supply the

more important shore side markets: Tzintzuntzan, Pátzcuaro, Asajo and Erongaricuaro, which allowed distributing local and regional goods. Pollard (1993) considers that the site of lhuatzio played an important part in storage activities (Fig.4). The only way to transport all merchandise and passengers to these places was by using dugout canoes. Boarding canoes was made from both lake and island natural beaches, today transformed as harbors.

From the post conquest period to nowadays, canoes were used during religious ceremonies to transport saints from a village to another one. The canoe transporting the saint's effigy was decorated with flowers and conducted by the chief of the community, followed by other embarkations with musicians, incense, and singers. This ethnological

evidence allows us to imagine the native ceremonies, including matrimonial ceremony where the pretender had to navigate to the island to receive blessings from his family in law before marrying his wife. This sacred bond between religion and navigation is the same, even if more important in the Tarascan life and ritual than among the Mexica s. But as exemplified in the Mexica ritual calendar, numerous ceremonies involved lacustrine rituals or navigation.

Finally, we just have a testimony of a naval battle between the lords of the lakeshore city against the island lords:

"Las embarcaciones se dividen en tres grandes flotas mandadas cada una por uno de los principes [...] Hirépan dirige sus proas rumbo a Jaracuaro. Hiquingari lleva la dirección de Janitzio. Tangaxhuan hace deslizar sus ágiles piraguas [...] en las playas de Pacanda. [...] El aire cubrió de flechas, el silencio del lago fue interrumpido por una estruendosa gritería, y cuando las embarcaciones llegaron al abordaje, se oía el duro choque de las macanas [...] y bien pronto, el agua cristalina se tiño con la sangre de los heridos y de los moribundos" (Ruiz, 1891, Chapter XVIII)

This event, as the "Noche Triste" (Sad Night) in Mexico, reveals the naval military power of these empires. Both of them used their aquatic environment as an economical, political, religious and military way to build, assert and maintain their power. The arrival of the Spaniards in the 1520's ruined for good the equilibrium created by these two empires.

Vessel typology

The 16th century sources tell us much about the vessels used by the Mexica s and their neighbors, from the construction materials they used, through their shape and trim, to details such as their form of propulsion, carrying capacity and uses. A careful analysis of the data suggests that, as in the case of the boats spotted by Columbus on the open Caribbean Sea, those of the Basin of Mexico were mainly one-man canoes.

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Based on detailed study of the different depictions of canoes represented in the codices – some of which show a wide variety of shapes and styles even on a single page - we are today in a position to draw up a typology of canoes in use in the basins of Mexico and Patzcuaro in the 15th and 16th centuries, including a list of sources consulted for this study, amounting to 63 identified boats (Fig.5).

Data Period	Data	Actual localization	Number of identificate canoes
Early C16th	Codex Boturini	Mexico	2
1524	Letters from Cortés	USA	13
1540-41	Relación de Michoacán	Italy	2
1541-42	Codex Mendoza	England	9
1550-55	Uppsala Map (Alfonso de Santa Cruz)	Sweden	21
pre-1560	Lienzo de Tlaxcala	private collection)	22
1540-85	Florentine Codex	Italy	26
end C16th	Codex Azcatitlan	France	4
1576-81	Codex Durán	Spain	4
Total number of boats identified:			103
Total number of boats not identified:			40
Total number of boats included in this typology:			63

Fig.5-Table of the 16th century sources used to establish the vessels typology

Our own research shows that all vessels sported a flat bottom, perfectly adapted to lake use, allowing their crews to maneuver them easily and speedily.

To this cance typology (Fig.6), we need to add another for the vital propulsion tools. In the codices, two different types of paddle are shown: one in the form of a long, broad spade, the other a heart-shaped spade. We should of course add the pole, mentioned in the texts, though not shown graphically.

Conclusion

This paper is a summary of my PhD research to promote the importance of archaeological and ethnological studies of native navigation in Mesoamerican lakes. The relation between these civilizations and the use of wood as an indispensable material to adapt their customs to a lacustrine environment proves that their engineering capacity and organization were far more complex and elaborate than we imagine. Both material and techniques are underestimated by the scientific world because of the few

archaeological remains. This is why a multidisciplinary approach is necessary. These native navigation traditions are about to disappear because the world is changing too fast for these communities, to be able to adapt every aspect of their culture and traditions. I hope to be able to organize, with the help of the Mexica n archaeologist, Mariana Favila, to create a symposium around the theme of Native's navigation tradition in the Americas to. It will be interesting to join specialists of navigation in one place to highlight this underestimate aspect of our investigations.



Fig.6-Typology of Mexico's Central Plateau canoes: a first attempt to identify and classify canoe styles shown in the historical sources. Pictures map and table: A.BIAR

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Biography

Alexandra Biar started her studies in archaeology in 2005 at the University of Bordeaux3 to obtain, three years later, a Bachelor in Art History & Archaeology. She started a Master in the University oh Paris1 Panthéon-Sorbonne in 2008, her thesis was supervised by Eric Taladoire, Leonardo Lopez Lujan y Eric Rieth, and titled Navigation in the Basin of Mexico in the Post-classic period. She graduated in 2011 with honours. After beginning her investigations on this theme, she decided to extend her research on the Basin of Pátzcuaro for her PhD, which is supervised by Brigitte Faugère.