



**HAL**  
open science

# Indigenous Navigation in the Caribbean Basin: a Historical, Ethnoarchaeological and Experimental Approach to the Caribbean-Guyanese Kanawa

Benoît Bérard, Alexandra Biar

► **To cite this version:**

Benoît Bérard, Alexandra Biar. Indigenous Navigation in the Caribbean Basin: a Historical, Ethnoarchaeological and Experimental Approach to the Caribbean-Guyanese Kanawa. *Archaeonautica*, 2021. hal-03344356

**HAL Id: hal-03344356**

**<https://hal.univ-antilles.fr/hal-03344356>**

Submitted on 15 Sep 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# INDIGENOUS NAVIGATION IN THE CARIBBEAN BASIN: A HISTORICAL, ETHNOARCHAEOLOGICAL AND EXPERIMENTAL APPROACH TO THE CARIBBEAN-GUYANESE *KANAWA*

Benoît BÉRARD and Alexandra BIAR

---

## Abstract

The early human occupation of the Antilles was based on the manufacture and use of expanded and extended dugout canoes named *kanawa*. The same boat type is also associated with the Carib linguistic family groups precolonial expansion along the coasts from Brazil to Venezuela. This paper describes this type of boat and its construction process in a comparative approach to archaeological and ethnohistorical data related to the Antillean archipelago and an ethnoarchaeological study of the contemporary construction process of the *kanawa* by the Kali'na Amerindians of Guiana (French Guiana/Suriname). Lastly, an experimental maritime archaeology programme carried out in the Antilles over several years allows us to discuss the nature of navigation permitted by this type of boat.

## Keywords

Caribbean, dugout canoes, experimentation, Guiana, maritime technology

## Résumé

La première occupation humaine des Antilles a été rendue possible par la fabrication et l'utilisation de pirogues expansées désignées sous le nom de *kanawa*. Ce même type d'embarcation est également associé à l'expansion précoloniale des groupes familiaux linguistiques caraïbes le long des côtes du Brésil et du Venezuela. Cet article décrit ce type de bateau et sa technique de construction dans une approche comparative des données archéologiques et ethno-historiques liées à l'archipel antillais, avec une étude ethno-archéologique du processus de construction contemporain du *kanawa* par les Amérindiens Kali'na de Guyane et du Suriname. Enfin, un programme expérimental d'archéologie maritime mené aux Antilles sur plusieurs années permet de discuter des capacités de navigation de ce type de bateau.

## Mots clés

Caraïbes, pirogue monoxyle, expérimentation, Guyane, technologie maritime

---

The Caribbean Sea forms a kind of “American Mediterranean” with the Gulf of Mexico. The Antillean Islands that separate it from the Atlantic Ocean extend over 4000 km between the north coast of South America and Florida (fig. 1). The Amerindian peopling of the archipelago took place in several waves (Keegan *et al.* 2013; Rouse 1992). The presence of archaic groups, whose origin could be Mesoamerican, was identified in the Greater Antilles as early as the 5<sup>th</sup> millennium BC. Later (end of the 4<sup>th</sup> millennium BC) groups of maritime nomads crisscrossed the northern Lesser Antilles and the Virgin Islands (Bonnissent 2013; Hofman *et al.* 2006). Are they the descendants of groups that were present earlier in the Greater Antilles or the result of a new migration of populations from northern South America? There is currently no consensus within the Caribbean archaeological community on this issue (Callaghan 2010). During the second half of the 1st millennium BC, a new population influx from northern South America (Orinoco Basin) marked the beginning of the development of formative societies in the archipelago. They were particularly characterised by the establishment of important networks of inter-island exchange, as well as between the islands and the continent (Berard 2013a). Finally, important links with the Guiana Shield, probably associated with a population influx,

have been documented (Boomert 1986; Hofman, Hoogland 2012). Their dating as well as their exact modalities have still to be established (Bérard 2011).

As regards navigation conditions in the West Indies, outside the hurricane season, the wind regime is dominated by trade winds blowing from the northeast. The currents are permanent and significant, mainly linked to the entry of Atlantic waters through the channels that separate the islands from each other and especially between the southern end of the archipelago and the continental coasts (South Equatorial current). The relative narrowness of these channels means that, with one exception (the Anegada Passage between Anguilla and the Virgin Islands), the islands are visible to one another (Torres, Rodriguez Ramos 2008): hence the metaphor of stepping stones that has been used by archaeologists to describe the archipelago. In any case, the precolonial human occupation of the Antilles is one of the rare examples of early human occupation of an oceanic archipelago, and a large set of archaeological data has demonstrated the capacity of all those groups to create and maintain important exchange networks inside the archipelago and with several continental areas (Hofman, van Duijvenbode 2011; Curet, Hauser 2011).

Therefore, an evaluation of the navigation capacities of pre-Columbian populations is central for any archaeologist

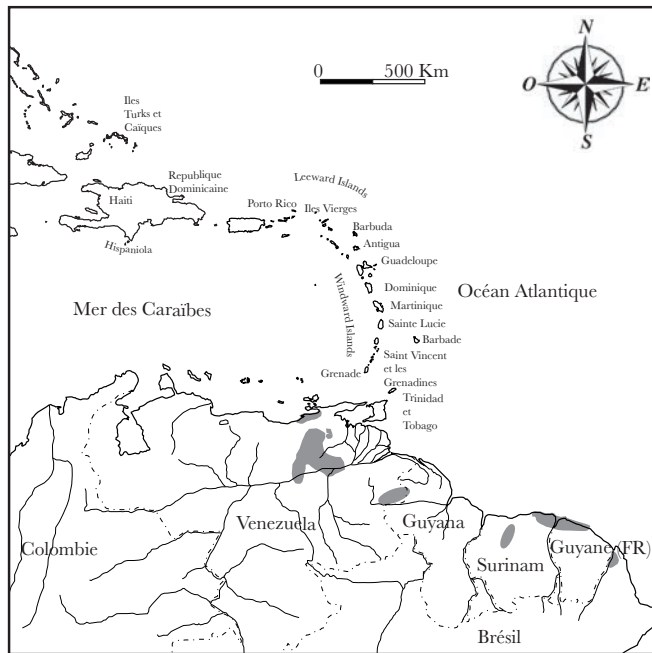


Fig. 1: Map of the Caribbean Sea and of the Guiana Shield (CAD B. Bérard). Modern distribution of Kali'na groups in grey.

working on the indigenous peoples and cultures that inhabit the Antillean archipelago. However, surprising as it may be, until the past decade only a few research works have been dedicated to this topic. This has led us to develop a long-term programme aimed at addressing the issue. Our multidisciplinary programme was divided into three parts:

- a wide-reaching review of the available archaeological and ethnohistorical data;
- an ethnoarchaeological programme dedicated to the building of large oceanic canoes conforming to historical descriptions;
- an experimental navigation programme.

Understanding the navigational capacities of the pre-Columbian populations of the Caribbean islands is central to many issues that occupy the scientific community. These include: the nature of the technical means developed; the impact of environmental factors; the possible connections between the islands of the Caribbean arc and between this latter and different areas of the American continent; the routes followed by the different migrations that led to the settlement of the archipelago (Fitzpatrick 2013).

The project we set up was not primarily intended to answer all these questions. It originates from within a broader project whose objective was to develop a social geography of the territories (Di Méo 1998) of the first agro-ceramicist groups in the Caribbean archipelago (Bérard 2018). This type of approach could not avoid a serious assessment of the technical capacity of these populations to develop and maintain regular relations and exchanges between the different islands. Very quickly, the studies we had carried out on the ancient ceramic occupations of Martinique (Bérard 2004) and Dominica (Bérard 2013b) had shown that it was imperative to try to identify and define these territories by leaving a terrestrial and insular approach and adopting a more maritime and archipelagic perspective.

## 1. ARCHAEOLOGICAL AND HISTORICAL APPROACH TO PRECOLONIAL AND CONTACT PERIOD INDIGENOUS NAVIGATION TECHNIQUES IN THE ANTILLES

Until now very few remains of pre-Columbian canoes have been found in the Antilles. One of these is the so-called Stargate canoe found in a blue hole off Andros Island, Bahamas (Callaghan, Schwabe 2001). This is a very small, simple, dugout canoe, only 1.5 m long. The remains of two other canoes have been found during excavations of the Los Buchillones site in Cuba. The first one is also a simple dugout while the second has been described as a fragment of a large oceanic canoe, possibly an expanded and extended dugout (Cooper 2004). Our knowledge of pre-Columbian Antillean paddles is more extensive<sup>1</sup>. Eight complete paddles and preforms have been discovered sharing approximately the same shape (Bérard *et al.* 2016a, fig. 6). They are composed of a crosspiece, a shaft, and a lanceolate blade. This sort of blade, with a relatively reduced surface, is generally used for long distance navigation in deep water (Warren, Gidmark 2001; Fitzpatrick 2013). Due to this scarcity of direct archaeological evidence, we decided to complement our review with an analysis of the large set of historical European sources dating from the contact period (Bérard *et al.* 2016a). This provided us with a description of the Kalinago Amerindian vessels, composed of four general types. The most basic was a simple balsa (*Ochroma pyramidale*) trunk used for leisure purposes as a sort of archaic bodyboard (Breton 1665). The second was a pumpwood (*Cecropia scheberiana*) raft known as *boùlali* (Breton 1665), and used for fishing in calm waters near the coast. The first canoe built by the Antillean Amerindian groups was called *kuliala*. This was a simple dugout utilised mainly for fishing and coastal navigation. The second type of sea craft was called *kanawa* (fig. 2). It was a large boat capable of transporting up to 40 people and was more specifically dedicated to inter-island navigation. The *kanawa* can be characterised as a dugout canoe expanded by firing and extended by framing and planking. The quality of the historical sources has allowed us to reconstruct the entire operational chain for the construction of this type of boat, from the decision to implement the process to the naming of the new canoe (Bérard *et al.* 2016a).

## 2. BOAT CONSTRUCTION BY THE KALI'NA OF FRENCH GUIANA

Having collected and studied the available archaeological and historical data, we hoped to give substance to this information by constructing a *kanawa*, which would be the basis for developing an experimental navigation programme. To this end, we approached the last remaining marine carpenters of the Kali'na indigenous community in French Guiana. At the beginning of the 17<sup>th</sup> century, the Kali'na, named Galibi by the first European travellers, were family groups of farmers, hunters and fishermen, renowned for their imposing maritime fleets composed of large dugout canoes adapted to coastal and

1. There is no precolonial use of sail in the Antilles (Bérard *et al.* 2016a).



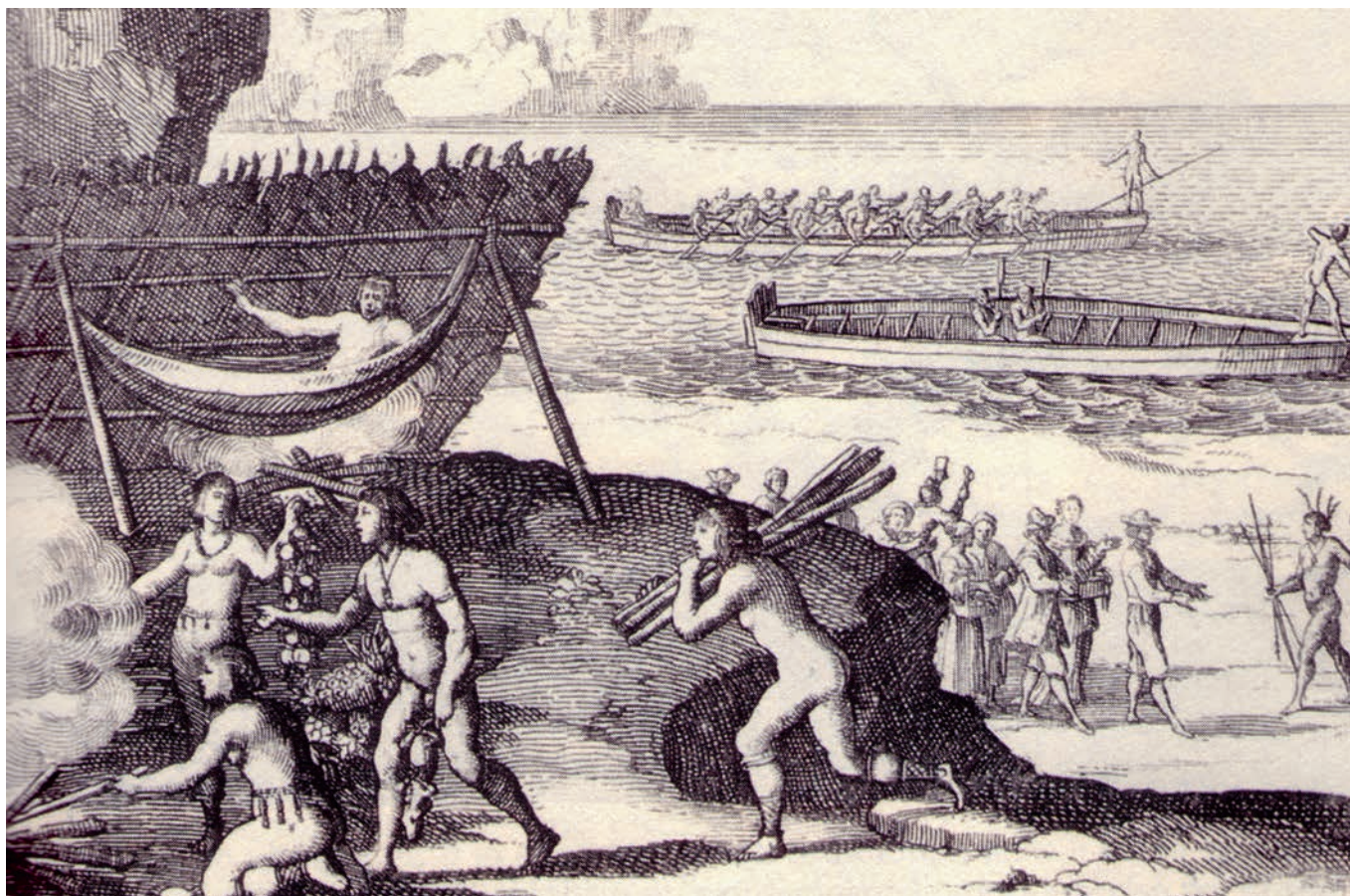


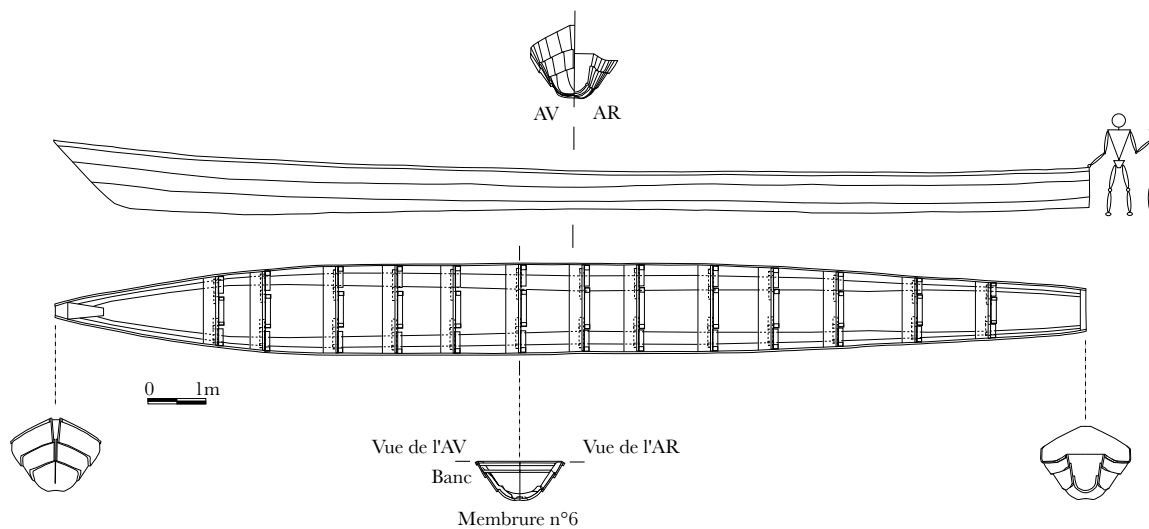
Fig. 2: Representation of a Kalinago kanawa, Lesser Antilles (from Du Tertre 1667, vol. 2, p. 395; source Gallica).

open-sea navigation. Scattered along the coast of the Guiana Shield, Kali'na people settled over a vast area currently divided among the modern countries of Venezuela, Guyana, Suriname, French Guiana and as far as the western bank of the Oyapock River in Brazil (fig. 1). Such an expansion explains why, at the end of the 16<sup>th</sup> century, Kali'na people were among the first indigenous groups of the region to establish contact with Europeans. Today, the communities attached to the Kali'na are still scattered along a coastal fringe stretching from the Brazilian Amazon to the Orinoco Delta. Some elders still possess knowledge inherited from their long maritime tradition, which is doomed to disappear if it is not passed on to the younger generations. The construction of two *kanawa* took place over a period of three months under the direction of Felix Brickman, a Kali'na marine carpenter from Suriname. The construction process followed the steps and principles drawn from the study of archaeological and ethnohistorical data and was enhanced by using Kali'na know-how. Thus, the building process was the result of technical exchanges between the experts of the scientific team and the Amerindian experts in charge of boat construction. To provide a framework for these exchanges, the documentation of the construction process was supplemented by a series of ethnographic interviews. The construction team, but also a larger part of the population, was interviewed using a semi-structured questionnaire. The latter sought to acquire technical information, but also ethnological testimonies, essential to the understanding of traditional navigation and how these boats are an important element in their own conception of Kali'na cultural identity.

The *kanawa* presented here was named *Akayouman* (fig. 3), which means “The spirit of the grandfather snake”. Its dimensions are: length, 17.52 m; width, 1.5 m; minimum planking height, 74 cm. It weighs 1.4 tons empty and its maximum displacement was 8 tons, which leaves numerous theories regarding capacity to be considered. Examinations carried out on its hull in 2008 showed that the monoxyle element followed the shape of the original trunk. The canoe has a maximum flaring around 3 m from the bow. The dugout structure has a residual thickness that varies between 5 and 8 cm, except for the solid front. It has an 8 cm-thick solid transom with notches to hold the *pagalle*, a large steering paddle, as well as a footrest and backrest crossbar. The structure is reinforced by 13 frames, spaced from 1 to 1.2 m apart. The monoxyle element is connected to a stem post limited to the upper part of the bow linking the washboards forwards. Each frame is composed of a floor timber (sided dimension 6 cm) with limber hole and futtock (sided dimension 5 cm), which maintains the washboard (average thickness 2.5 cm). Screws and nails arranged as close as possible to the presumed line of the former vegetable fibre stitching provide the connections. Finally, tropical plant fibres and bitumen are used for caulking.

### 3. THE EXPERIMENTAL NAVIGATION PROGRAMME

The final part of the project was dedicated to an experimental navigation programme (Bérard *et al.* 2016b). First, we had to



### THE KANAWA "AKAYOUMAN"



Fig. 3: The kanawa "Akayouman" (CAD B. Bérard; photography Association Karisko).

train a crew and reconstitute, step by step, the set of skills associated with navigating this very specific type of boat. We gathered and collated the knowledge and know-how that has been preserved until the present day by native and Creole societies in the West Indies. We benefited from the support of an experienced *va'a* instructor from French Polynesia. After a long preparation and training process, we conducted four expeditions in the Lesser Antilles between 2008 and 2011 (fig. 4).

The first was a one-day navigation dedicated to crossing the 24 nautical mile channel between Martinique and Dominica. Carried out in exceptionally calm conditions, it took us 6 hours and 48 minutes. The second was a nine-day trip including seven navigation days and two rest days. By paddling for almost 44 hours over 139 nautical miles, we reach English Harbour, Antigua, from northern Martinique. The third expedition in May 2010 took us from Grenada to Martinique (31 h 37 for 82 NM) in eight navigation days. Finally, in 2011, we again made the crossing between Martinique and Dominica but with crew changes.

*Akayouman's* standard crew consists of 28 people: 26 paddlers, a boatswain at the front in charge of the rhythm, and a steersman at the stern. One of the forward paddlers occasionally assists the steering in difficult seas or when mooring by acting as a 'bow thruster'. Between December 2007 and May

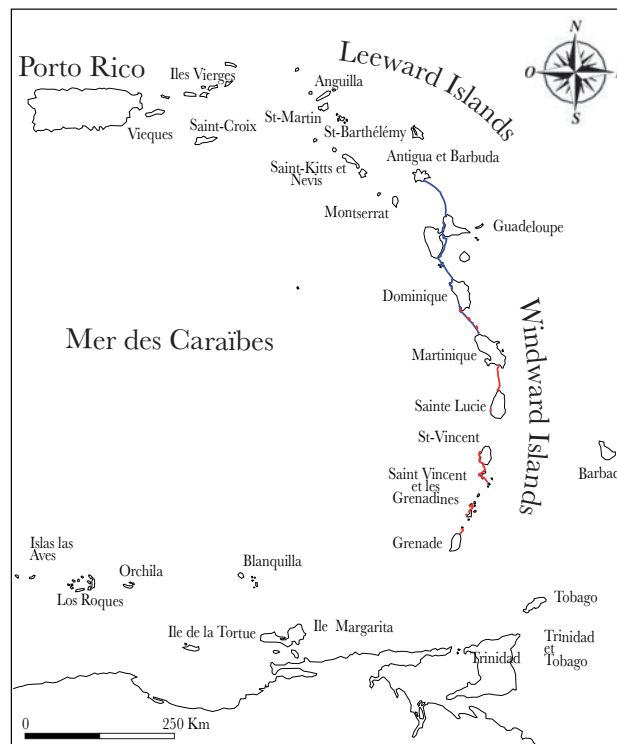


Fig. 4: The expedition routes: red dotted line, Martinique-Dominica 2008; blue line, Martinique-Antigua 2009; red line, Grenada-Martinique 2010 (CAD B. Bérard).



2011, during which time the quantitative data were collected<sup>2</sup> the personnel of this crew obviously changed, but we were able to benefit from a small stable core of crewmembers. The general principle of crew composition did not change. Indeed, the objective of our programme was to assess the navigational capacities of pre-Columbian Caribbean populations in the context of migratory phenomena or economic and/or social trips. Thus, during the first three expeditions, our crew always included women and men, whose ages ranged from 18 to nearly 70 years. In 2011, in order to test the impact of crew composition on the data collected, we modified the composition. The new crew was almost exclusively male and composed of young soldiers from the 1st RSMA<sup>3</sup>, who had undergone several months of training comparable to those preparing for the other expeditions. Despite the change, the data collected were very similar to those obtained in May 2008 and May 2009 on the same route. The distance of 23.7 nautical miles was covered in 6 hours and 37 minutes.

In addition to the information gathered during the various inter-island expeditions, data from various navigations along the coasts of Martinique were also collected for a total distance of 140 nautical miles. Therefore, we have been able to constitute a corpus of quantitative data (route, surface speed, ground speed, environmental data – current, wind and waves) based on a total of 410 nautical miles of navigation. This allowed us to estimate the average speed of these boats at 3 knots. This experimental navigation programme has been complemented by a hydrostatic study of the *Akayouman* (Billard *et al.* 2009) that has provided major data about its cargo capacity, which can reach 1 ton in calm waters. This study also demonstrated that *kanawa* that are not outriggered must carry a significant amount of ballast to ensure their stability. We made our various crossings with a load of about 500 kg as ballast. Thus, with an average speed of 3 knot for a crew of 27 people and a load of 500 kg, i.e. a displacement of 4 t and a draught of 0.41 m, we have been able to estimate the power developed by the crew at about 1/2 hp.

2. Qualitative data collection was never completed, since the use of the *kanawa* continues to this day in the activities of the *Karisko* society. It has even spread to the Guadeloupe archipelago through the activities of the *Association K'nawa*, to which we have sold one of the two boats built in French Guiana.

3. Régiment du Service Militaire Adapté.

## 5. DISCUSSION AND CONCLUSION

The *kanawa* is an expanded and extended dugout canoe for which navigation on the high seas does not present any major difficulty. However, the morphology, as well as the mode of propulsion, the paddle, impose certain limitations. The first and probably the most important of these is the need in rough seas to maintain permanent forward movement in order to ensure the boat's stability. Given that we were reasonably able to estimate cruising speed at 3 knots, the combination of these two elements, with regard to a crew's ability to maintain paddling effort, allows us to approach a limit of navigation in a *kanawa*. A further limitation is related to environmental conditions. The most constraining factor at this level is the swell, however, it is a complex system that integrates wave height, frequency and direction with respect to route. Some conditions would require a change of course and therefore an extension of the route, others simply act against navigation. Nonetheless, observation of meteorological data shows that it is possible to navigate between the islands of the West Indies most days of the year. Concerning navigation between the islands of the archipelago, the navigation capacities of the *kanawa* make it possible to envisage a high frequency of trips. In addition, with two exceptions, each channel can be crossed during one day. Lastly, each trip allows the transport of many passengers and a large cargo. This navigation capacity has not only made it possible to make the archipelago a real specific space of civilisation (Keegan, Hofman 2017) but has also served as a basis for the development of important exchange networks (Hofman, Hoogland 2011; Knippenberg 2006) and the creation of inter-island micro-territories (Bérard 2018).

Compared to previous work based on drift models (Altes 2011; Callaghan 2001, 2010, 2011 and 2013), our research allows us to move from what is possible in terms of pre-Columbian navigation to what is probable by reintegrating the human factor through practical experience. Thus, the experimental data collected have recently been integrated into a new type of simulation (Slayton 2018) allowing much more detailed evaluation than in previous work. All the same, the production of new experimental data still seems necessary, particularly when it comes to designing hypotheses based on longer navigations, in particular, direct navigations between continental areas and the heart of the archipelago. For this reason we are preparing a new expedition between the Yucatan peninsula and the western tip of Cuba (115 NM) for July 2022.

## REFERENCES

- ALTES C.  
2011 A brief note on currents, current archaeologists, and ancient fire-tempered pots, *The Florida Anthropologist* 64.2, p. 113-118.
- BÉRARD B.  
2004 *Les premières occupations agricoles de l'arc antillais, migrations et insularité*, Oxford, Archaeopress, BAR International series 1299, Paris Monographs in American Archaeology 15.  
2011 A la recherche des Caraïbes archéologiques, in B. Grunberg (ed.), *Les Indiens des Petites Antilles. Des premiers peuples aux débuts de la colonisation européenne*, Paris, L'Harmattan, Cahiers d'Histoire de l'Amérique Coloniale 5, p. 27-36.
- 2013a The Saladoid, in W. Keegan, C. Hofman, R. Rodriguez Ramos (eds), *The Oxford Handbook of Caribbean Archaeology*, Oxford, Oxford University Press, Oxford Handbooks of Archaeology, p. 184-197.  
2013b L'occupation saladoïde ancienne de la Dominique, vers une nouvelle définition des territoires culturels précolombiens, in B. Bérard (ed.), *Martinique, terre amérindienne. Une approche pluridisciplinaire*, Leiden, Sidestones Press, p. 235-246.

- 2018 *Essai d'archéogéographie sociale des territoires amérindiens dans l'archipel antillais 300 av. J.-C./400 apr. J.-C.*, Mémoire original, Habilitation à diriger les recherches, Université de Paris 1 Panthéon-La Sorbonne.
- BÉRARD B., BILLARD J.-Y., L'ÉTANG TH., LALUBIE G., NICOLIZAS C., RAMSTEIN B., SLAYTON E.
- 2016a Technologie du fait maritime chez les Kalinago des Petites Antilles aux XVI<sup>e</sup> et XVII<sup>e</sup> siècles, *Journal de la société des Américanistes* 102.1, p. 129-158.
- 2016b Approche expérimentale de la navigation précolombienne dans les Antilles, *Journal de la Société des Américanistes* 102.2, p. 171-204.
- BILLARD J.-Y., BÉRARD B., RAMSTEIN B.
- 2009 Apports de l'hydrostatique à l'archéologie expérimentale. Étude d'une pirogue de haute mer (*kanawa*), in *Actes du 19<sup>e</sup> Congrès français de mécanique, Marseille 2009*, <http://documents.irevues.inist.fr/bitstream/handle/2042/36639/772.pdf?sequence=1>, consulted on 09/12/16).
- BONNISSENT D. (ED.)
- 2013 *Les gisements précolombiens de la Baie Orientale*, Paris, Maison des Sciences de l'Homme, DAF.
- BOOMERT A.
- 1986 The Cayo complex of St. Vincent: Ethnohistorical and archaeological aspects of the Island Carib problem, *Anthropologica* 66, p. 3-68.
- BRETON R.
- 1665 *Dictionnaire caraïbe-français meslé de quantité de Remarques historiques pour l'esclaircissement de la Langue*, Auxerre, Gilles Bouquet.
- CALLAGHAN R.
- 2001 Ceramic age seafaring and interaction potential in the Antilles. A computer simulation, *Current Anthropology* 42.2, p. 11-22.
- 2010 Crossing the Guadeloupe passage in the archaic age, in S.M. Fitzpatrick, A. Ross (eds), *Island shores, distant pasts*, Gainesville, University Press of Florida, p. 127-147.
- 2011 Patterns of contact between the islands of the Caribbean and the surrounding mainland as a navigation problem, in L.A. Curet, M.W. Hauser (eds), *Islands at the crossroads: migration, seafaring, and interaction in the Caribbean*, Tuscaloosa, University of Alabama Press, p. 59-72.
- 2013 Archaeological views of seafaring in the Caribbean, in W.F. Keegan, C.L. Hofman, R. Rodríguez Ramos (eds), *The Oxford Handbook of Caribbean Archaeology*, Oxford, Oxford University Press, Oxford Handbooks of Archaeology, p. 283-295.
- CALLAGHAN R., SCHWABE S.
- 2001 Watercraft of the islands, in *Actes du XVIII<sup>e</sup> congrès de l'Association internationale d'archéologie de la Caraïbe, St. George, Grenade 1999*, Basse-Terre, AIAC/Région Guadeloupe – Mission archéologique, p. 231-242.
- COOPER J.
- 2004 Islas y Isleños en el Caribe: Interacción a través del paisaje, *El Caribe Arqueológico* 8, p. 91-96.
- CURET L.A., HAUSER M.W. (EDS)
- 2011 *Islands at the crossroads: migration, seafaring, and interaction in the Caribbean*, Tuscaloosa, University of Alabama Press.
- DI MÉO G.
- 1998 *Géographie sociale et territoires*, Paris, Nathan.
- DU TERTRE J.-B.
- 1667-1971 *Histoire Générale des Antilles habitées par les Français*, Paris, Thomas Jolly, 4 vol.
- FITZPATRICK S.M.
- 2013 Seafaring capacities in the Pre-Columbian Caribbean, *Journal of Maritime Archaeology* 8.1, p. 101-138.
- HOFMAN C., BRIGHT A., HOOGLAND M.
- 2006 Archipelagic resource procurement and mobility in the Northern Lesser Antilles: the view from a 3000-years-old tropical forest campsite on Saba, *Journal of Island and Coastal Archaeology* 1.2, p. 145-164.
- HOFMAN C. L., VAN DUIJVENBODE A. (EDS)
- 2011 *Communities in contact. Essays in archaeology, ethnohistory and ethnography of the Amerindian circum-Caribbean*, Leiden, Sidestone Press.
- HOFMAN C.L., HOOGLAND M.
- 2011 Unravelling the multi-scale networks of mobility and exchange in the pre-colonial circum-Caribbean, in C.L. Hofman, A. van Duijvenbode (eds), *Communities in contact. Essays in Archaeology, Ethnohistory and Ethnography of the Amerindian circum-Caribbean*, Leiden, Sidestone Press, p. 15-43.
- 2012 Caribbean encounters: Rescue excavation at the early colonial Carib site of Argyle, St. Vincent, *Analecta Praehistorica Leidensia* 43-44, p. 63-76.
- KEEGAN W., HOFMAN C.L.
- 2017 *The Caribbean Before Columbus*, New York, Oxford University Press.
- KEEGAN W., HOFMAN C., RODRIGUEZ RAMOS R. (EDS)
- 2013 *The Oxford Handbook of Caribbean Archaeology*, Oxford, Oxford University Press, Oxford Handbooks of Archaeology.
- KNIPPENBERG S.
- 2006 *Stone artefact production and exchange among the Northern Lesser Antilles*, PhD dissertation, Faculty of Archaeology, Leiden University.
- ROUSE I.
- 1992 *The Tainos*, New Haven and London, Yale University Press.
- SLAYTON E.
- 2018 *Seascape corridors*, Leiden, Sidestone Press Dissertations.
- TORRES J., RODRIGUEZ RAMOS R.
- 2008 The Caribbean. A continent divided by water, in B. A. Reid (ed.), *Archaeology and Geoinformatics. Case studies from the Caribbean*, Tuscaloosa, University of Alabama Press, p. 13-29.
- WARREN G., GIDMARK D.
- 2001 *Canoe paddles*, Richmond Hill, Firefly Books Ltd.