NAVIGATION AND PRIMITIVE CRAFTS – NECESSITY AND CREATION OF HOMO SAPIENS

Vasile Dobref, Prof., PhD, ”Mircea cel Bătrân” Naval Academy of Constanța; Lorin Cantemir, Prof., PhD, Technical University of Iași; Edith-Hilde Kaiter, ”Mircea cel Bătrân” Naval Academy of Constanța

Abstract: The essence of the paper is given by the generalized finding that Homo-sapiens, as an exponent of the superior organized living matter, benefits from the mobility property that he is bound to manifest in his life environment characterized by the existence of land, water and air. Consequently, he must find concrete solutions to benefit from mobility.

The hereby paper presents aspects of primitive means they used in order to enjoy mobility in the aquatic environment: rafts and hollowed tree trunks, called in different ways by the craftsmen.

The man was born free; since then he has done all possible efforts to keep this condition, considered as a natural and ancestral right.

Under this right, condition that he didn't quite realize for a while, he practiced migration and, as an aggressive form, the invasions. Under these conditions, the man had to find ways to exercise his condition of freedom of movement. Hence, he came into contact with the three states of nature: earth, water and air. The history has confirmed that Homo sapiens have been able to find solutions so that he shouldn't be restricted in exercising his condition of freedom. Born on Earth, the man adapted himself as best and fast as he could to this environment, even if it wasn't always beneficial and hospitable. More difficult was the problem of water, especially when this was in important quantities and volumes and when it flowed influenced by gravity. As in most cases, Mother Nature has provided the solution – floating of tree trunks. The primitive man could not explain it to himself, but he used it successfully.

Today science and the measurements explain that the majority of trees' species weigh less than water. From this difference, it results the ability of wood to float.

The first means of navigation, or of using the water way, was demonstrated by nature by means of floating bodies which were lighter than water, various kinds and types of existing wood such as trees or stems, twigs, branches or other tubular shaped vegetation, more or less woody but resistant, similar to bamboo or cane, which was stiffened by binding, weaving or even soaking, as found in the Euphrates area, Kuwait or Oman. The oldest traces come from As-Sabiyah in Kuwait. Of course, we do not know exactly how these ways of navigation were used; we do not know what and how they were carrying, or how their propulsion and movement were achieved. The logic tells us that they used sticks, pipes and in some cases even arms, legs and palms. Subsequently, the improved propulsion of palms led to the appearance of shovels, oars, paddles, rotating blades and of the rotating hub with multiple blades, which much later turned into a wheel paddle.

Of all the navigation means that nature suggested to man, the raft was the preferred option. Through its ruggedness and its floating ability, it represents the surest navigation means; we have to appreciate that completing a raft requires a simple technology, possible to be used in Neolithic. The tree trunks could be achieved by carving, using stone axes, and by combining it with cutting, the latter process being performed with the help of flint blades whose blade presented a natural irregular toothing, which could be used for a more superficial cutting of the chips derived from the chopping axe. Of course, cutting

Arhipelag XXI Press, Tîrgu Mureș, ISBN: 978-606-8624-03-7

a tree trunk couldn't be made quickly and easily, so it is believed that the first rafts were made of thinner young trees.

About the composition of rafts

Typically a raft contains a variable number of logs; their number is conditioned by the specific of the sailing route, so on a lake, where the waters are calmer and the banks are wide, a raft can contain between 15 and 30 logs. The limit is determined by the necessary pulling force and by the handling typically required by the length of the log, commonly of 10-15 m, and their diameters may vary between 0.6 and 0.8 m.

To prevent the dispersal of logs and ensuring their consistent behaviour, the rafts are transversally reinforced by 2-3 beams attached to the raft's longitudinal trunks, by means of iron staples or nails in the Iron Age.

The first representation of a log raft appears on a Mesopotamian bas-relief, which dates from the 7th century B.C. Of course, neither the bas-reliefs nor the pictographs detail the way in which the raft's logs are laterally connected. Sources dealing with this issue mention various ways that differ from area to area.

The authors will mention some solutions that seem to depend on the local conditions. Generally, in the absence of iron, there were used belts or leather straps, or various types of ropes and strings made of in a traditional way or created from yak hair. Most rafts were made of tree trunks, a solution which involved the simplest technology, by means of using stone tools, axes and flint blades with naturally toothed edges of 40-50 cm long; a lot of time and high energy consumption was demanded, but not only tree trunks were used as navigational aids.

Thus some credible sources asserted that the natives of New Guinea used, as floating bodies, roots of large trees, which were thus more stable and afloat. Coming back to the traditional rafts made of tree trunks, their use and existence is recorded both in documents and artifacts, so the work "De bellum Galane-Julius Caesar" reports that during the conquest campaign of Gallia Comata, the Gallo-Celtic population used rafts for crossing watercourses. We will also state that the conquest campaign of Gallia Comata / Gaul by the Romans took place during 58-52 B.C.; later, after about two centuries, there were found the remains of two log rafts on the banks of the Rhine. Thus it is known that the Celts were great craftsmen, who used iron tools, more effective than the stone ones that were used by the Romans, both to improve various types of carts and to build ships of boards which were bound with iron nails. It is believed that the Roman army arrived in Britain using boats or rafts made by Celt craftsmen from Gallia, helped by the Roman artisans; it is possible that there were used rafts to sail to cross the English Channel. The known historical sources do not refer to how the Roman legions came to Britain in 43 B.C. What is undeniable is the fact that traditional rafts allowed the existence of significant buoyancy and Gallia Comata (meaning forested) used to have sufficient forests.

To get an idea about a possible performance regarding the buoyancy of a raft, we will consider first a single easy tree trunk, for example fir, larch, pine or spruce. For our estimation, we will choose a spruce trunk of 5 m length and with a diameter of 0.3 m and, as a rough guide, we will mention the specific weights of the related tree species considering their humidity in a percentage of 15%. The specific weight will be expressed in g/cm3:

- Fir: 0.45
- Spruce: 0.48
- Larch: 0.6
- Pine: 0.52

We will mention that in Romania the normal humidity is considered to be 16%. We will emphasize that the specific gravity of water at 0° C is 0.99987 kg / dm3 and 0.0097 g / cm3, so higher

Arhipelag XXI Press, Tîrgu Mureș, ISBN: 978-606-8624-03-7

than in most wood species. It follows that at a higher humidity level, the specific weight of the wet wood will increase and buoyancy will be reduced.

Further on we will present the density ρ (kg / m^3) of softwoods with a humidity of ρ_u (5%) and ρ_u (95%) as well as the percentage increase in specific weight

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	ρ_u (5%)	ρ_u (95%)	Weight increase %
Fir	400	480	20%
Larch	500	600	20%
Spruce	375	440	17,3%
Pinus Sylvestris	430	560	30%

Resinous densities depending on humidity

As it can be noticed, the woody essences mentioned above are specific to areas with temperate climate which is characteristic for Europe. But we cannot neglect the other areas, particularly the hot area where balsa grows, the wood with the lowest specific gravity of 0.17 g/ cm3 and bamboo, a species very resistant from the mechanical point of view, with a specific lightweight situated between 0.3 and 0.4 g/ cm3. These qualities favourable to good buoyancy convinced the Huari Indians from South America to devise a minimum raft, made only of nine bamboo sticks, arranged crosswise, which ensured a good stability; and the Aymara Indians, created floating bridges out of bamboo sticks.

About floating-buoyancy

The floating capability of some bodies was found and perceived only by visual observation and understood from a physical point of view by the great Archimedes through stating his principle. Essentially, Archimedes formulated the principle of rejecting the introduction of a body in a fluid (in the first stage a liquid that opposes this action with a force of antigravitational sense created by a pressure produced by the weight of the water volume displaced by that body). It follows therefore that if the weight of the body subjected to gravitational force is greater than the reaction force generated by the weight of the displaced water volume, the body will sink in the liquid, and vice versa, if the weight of the displaced liquid volume is greater than the weight of the submerged body, the submerged body will float.
These two situations are expressed by two inequalities, namely:

When:

a. -$G_{es} > G_{vad}$ appears sinking
b. -$G_{es} < G_{vac}$ appears floating to the surface

In the two inequalities the terms have the following meanings:

G_{es}= weight of the submerged body
G_{vad}= weight of displaced water volume

Finally, the following situation appears: $G_{es} = G_{vad}$ where the body floats inside the liquid at a certain depth.
Finally, the three cases can be discussed helped by the following explanations: both G_{es} and G_{vad} can be expressed through the volume Vcs body multiplied by the adequate specific gravity ρ_{cs} of the submerged body and ρ_{vad}= specific weight of the displaced liquid volume.

It appears that: $V_{cs} \text{ x } \rho_{cs} = V_{vad} \text{ x } \rho_{vad}$.

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How the two volumes are identical, it results that the three cases discussed depend only on the specific weights. Hence, water of a greater specific gravity helps buoyancy. Thus specific seawater gravity is greater than that of freshwater courses. Thus the Black Sea water contains 1770 mg/litre of salt water, the Mediterranean Sea water contains 3370 mg/litre and the Dead Sea waters contain 23,200 mg/litre.

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Arhipelag XXI Press, Tîrgu Mureș, ISBN: 978-606-8624-03-7