14. Planks made of mora fina timber. Unlike balsa logs, mora fina is very heavy. These boards were used for "guara" centerboards as part of the steering system on the Tangaroa raft. Guara centerboards were an ingenious invention by early sailors, enabling them to control the direction of the vessel despite strong currents or headwinds.

More than 300 applicants from all over the world had sought this position. Everybody wanted to be in Bjarne's shoes. On board the raft, it didn't take long for the crew to realize that Bjarne was irreplaceable. He became the key person behind the success of our expedition. In addition, he was also responsible for any medical situation that might arise.

Øyvin Lauten, 55, served as the "XO" (Executive Officer), which made him second in command. He is an experienced sailor, as well as a carpenter. He had also worked at the Geological Institute at Oslo University. For that reason, he was responsible for collecting the ocean water samples for scientific study during the voyage. Such analysis is of international interest by organizations such as the United Nations, World Wildlife Fund, the Norwegian Council of Research, and various universities which are analysing the samples now. .

The last member to join our crew was Roberto Sala, 45. Actually, it was the Peruvian Navy that chose him to represent South American seamanship. Roberto turned out to be the only person on the raft who never had any conflicts with anyone else during the entire voyage—those three months at sea. Teambuilding is invaluable under such cramped and perilous conditions, but Roberto proved that inborn politeness is even more effective in such circumstances.

Also, there's another person—back on land—half a world away who was indispensable for the project— Anne Thorenfeldt. I would never have managed to keep track of all the details throughout the planning and execution of the expedition without her enormous assistance. She became our coordinator back in Norway and worked behind the scenes, and has worked almost on a daily basis for the past two years. She's another person who never seems to get tired of what we were doing with the Tangaroa.

ANDERS BERG / TANGAROA

TSUNAMI DELAYS TRIP

Eventually, we felt convinced that we could launch from Peru in April 2005. Everything was targeted for that date but then disaster struck when a deadly tsunami in the Indian Ocean came onshore on December 26, 2004, killing approximately 300,000 Indonesians, Thais and Malaysians. It was the deadliest tsunami in recorded history. Several of our donors backed off, and directed their funds to help out in this tragedy. We supported their decision, but it meant our plans for launching the Tangaroa would have to be postponed for another year until 2006.

Later, fortunately, we were able to gain back some of those donors. The extra year gave us some time to meet other potential donors and a chance to make more specific plans about the film that we wanted to make. The community in Larvik, the town in Norway where Heyerdahl had grown up, became more and more interested in the project. Businessman Thore Liverød made the decision to purchase our raft even before we had built it. He wanted to bring it back to Larvik so it could be the main attraction in a museum that would be dedicated to the legacy of Thor Heyerdahl. He wanted to make Larvik a world center in memory of its most famous citizen.

Frankly speaking, I didn't look forward to having to spend another year in planning, but I was convinced we could still carry out the expedition if we could only stick together and not give up on the idea.

In short, the major obstacles that we faced those first two years were in keeping the team together and generating sufficient funds for the project. I had to borrow money from my wife and from my family. At the same time, I kept saying "no" to practically every invitation that came from friends—"no" to joining them on national holidays when people normally take a break

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PHOTOS

15. Eleven large balsa logs were used to construct the base of the Tangaroa raft. The diameters of the logs were between 80-100 cm (32-39 inches) and their length was 14-17 m (45 to 51 feet). Their combined weight was 20 tons.

16. The Tangaroa crew found a family of four expert Peruvian carpenters to prepare the 13m (nearly 43 ft.) mast from pine wood. The tools that had been shipped from Norway, however, got stuck in customs at Callao, resulting in serious delays as the carpenters had to use their own very simple tools to tackle this very big job.

17. Planks used for the nine "guara" centerboards, which could be raised and lowered to steer the raft. The guara centerboards were 4m x 50cm (13 ft x 20 inches) and made of mora fiña.

and have fun. Instead, there I was hunkered down creating PowerPoint presentations on my laptop, collecting invoices and keeping track of all the financial accounts for this dream.

Whenever I felt a bit depressed about all the effort and time it took, I had only to take a turn on the television to see how many people were out there suffering who would have loved to have been in my shoes. And when hundreds of men and women wrote us from all over the world applying as crewmembers, I was reminded that our expedition was, indeed, a rare privilege.

We learned so much throughout the process of preparations. I'll have to admit that when we first started planning for the Tangaroa, I underestimated how much labor it would take to construct the raft.

If someone, not familiar with boat building, had looked at our raft, and compared it with another raft, maybe they wouldn't have seen any differences; that is, unless they studied the details carefully. It's hard to describe what an effort it takes to construct a good solid raft like the one we sailed to Polynesia. We needed a strong, reliable vessel for the high seas but it also had to be versatile enough to steer through the narrow passages of coral reefs against strong currents and tidal waters in the lagoons.

PHOTO

18. Jacob Sæverud Minde, 7, who lives in Bryne, Norway, attended the Tangaroa launching ceremony in Callao, Peru, on April 26, 2006. There he presented the Norwegian flag to his Uncle Torgeir who had organized the Tangaroa Expedition.

The Norwegian flag was affixed to the top of the raft's mast along with flags from Peru, Ecuador, Sweden, French Polynesia, the United Nations and the Larvik community in Norway. Larvik is the hometown of Thor Heyerdahl where the raft has been returned to become the main exhibition in a future museum to Heyerdahl's legacy.

Like most boys, Jacob loves the Kon-Tiki story. Here he helps the crew by cleaning up the sawdust between the logs and the bamboo deck. It was in this compartment that the crew stowed their huge supply of bottled water. According to Torgeir, this space was sufficient enough to have transported 10 tons of goods.

ANDERS BERG / TANGAROA

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IDENTIFYING TASKS

Actually, the Tangaroa really did perform quite well at sea, but it has been a difficult task to convince people that a successful archaeological experiment doesn't just happen by mere chance or coincidence!

From the beginning, we had to divide the project into hundreds of smaller tasks. First, we had to fund the project properly. After that, we could start looking for the right trees to be cut down in the right season so they would be sufficiently buoyant. Another task was to make the sail. Another, to construct the mast, and then to affix it to the log platform.

Tangaroa consisted of thousands of hours of labor. And the project involved hundreds of experts in as many different tasks. Each one of them was vital to the success of the voyage.

One of my photos is captioned: "Old experts prepare the mast". We were able to locate a family team of four carpenters who worked for weeks just to prepare the masts. Who would have guessed that the process was so involved?

"Logs finally arrived" is another of Anders' photos. Look at those logs! Imagine that you had only one month to transform those logs into a perfect ocean-going vessel. That's why this project was so difficult and one of the reasons why the outcome is something to be proud of. The honor belongs to the hundreds of dedicated people who were involved with the process and who identify themselves with Tangaroa.

The Tangaroa expedition had two objectives: (1) to demonstrate the versatility of the navigation system with "guaras" (centerboards) and (2) to analyze the contamination in the Pacific Ocean on a molecular level.

GUARA BOARDS

We also were able to carry out some very interesting experiments with the use of the guara boards, testing the speed and steering limitations of the ancient balsa raft. Our experience at sea convinced us that the craftsmen who made such rafts probably could have gone very far in such vessels, without ever being concerned about the possibility of sinking.

To maintain control of the raft, you need large sails, along with the knowledge of how to handle them. We used sails that were three times larger than those on Kon-Tiki. The idealized sketches [illustrating this article] show how the Tangaroa was equipped with several keels. In Peru they call these keels "guaras".

They are boards, about 12-feet in length, a couple of inches thick, and about 20 inches wide. They're made of heavy and durable wood. These boards have holes drilled through them spaced several centimeters apart, starting from the top and extending about half way down, through which wooden pins can be inserted. The pins are about a foot long with a two-inch diameter. The boards serve as a sort of rudder to steer the raft. They are constructed so that they can slide into specific slots between the bamboo floor and the balsa hull logs. These boards provide a surface area, which offer some resistance in the water beneath the vessel.

The Kon-Tiki raft was equipped with four such centerboards but they were "fixed" and could not be raised or lowered. However, the whole point of this clever invention is to raise or lower the boards depending upon the winds and currents. When the wind is constant, the direction and course of the vessel can be changed if you move the boards to a higher or lower

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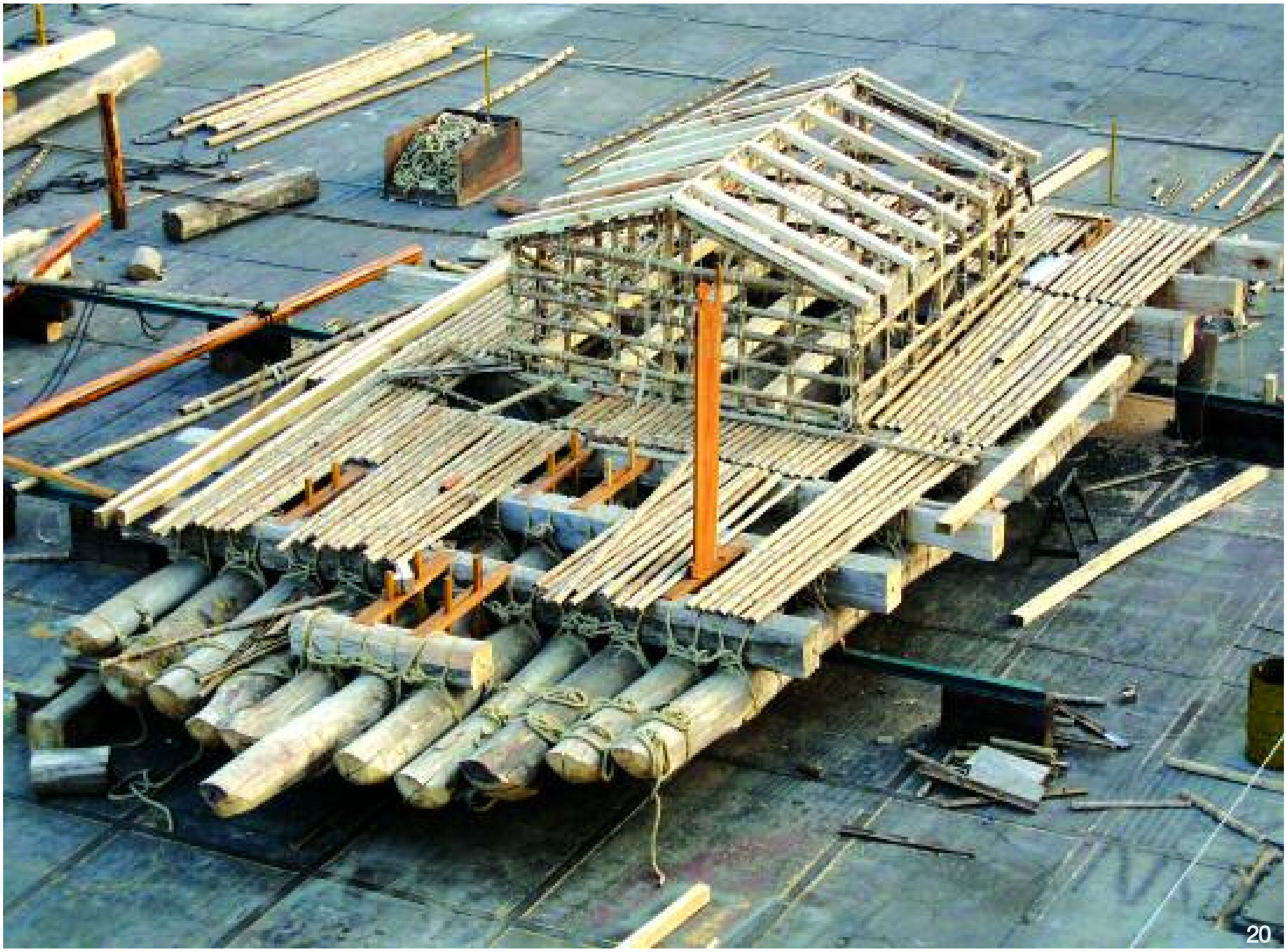

ANDERS BERG / TANGAROA

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position. For example, if you raise one of them 20 centimeters, the course can change 20 degrees. So by lifting them up and down, we learned how to steer the raft the way ancient man did. We discovered that we could even steer directly into the wind.

Apparently, Heyerdahl had not seen sketches to understand that the crew had to raise these guara boards up and down. At least that's what he wrote in "American Indians". He mentions there that if he had known how to steer the raft with centerboards, he would never have smashed into the reef off the island of Raroia in the Tuamotu Islands when they reached their destination in August 1947.

Kon-Tiki also had a steering oar, but it wasn't very functional. Consequently, the Kon-Tiki was largely subject to the whim of wind and currents because they didn't know how to sail it directly into the wind.

Vital Alsar, who organized the expedition of La Balsa raft, used guara boards on his raft in 1970—the craft he used to sail between Peru all the way to Australia. By then it was understood how to use them.

Our use of the guara on the Tangaroa is based on Heyerdahl's observations that he made after completing his expedition of the Kon-Tiki. In 1953, he carried out an experiment in Ecuador with a small raft using the guara to understand how this mechanism worked. He wrote about the dexterity of the centerboards in several of his books, including "Early Man and the Ocean" (1978).

POLLUTION

Our second major task concerned pollution in the ocean. On board, we carried sophisticated scientific equipment in which to collect ocean samples. We were

PHOTOS

19. Mona Sæverud Higraff, wife of Expedition Leader Torgeir, christening the Tangaroa in Callao, Peru, on April 28, 2006, when it launched. The Norwegian couple had spent their honeymoon in Ecuador looking for balsa trees in 2003.

20. Construction in progress of the Tangaroa at the navy shipyard at Callao, Peru. The skeleton platform shows the balsa logs, cross beams, bamboo flooring, and cabin prior to laying down the "totora" reed on deck, which had been specially made by Indians living at Lake Titicaca. Sisal hemp was used to tie everything together.

Note the tall wooden guara (centerboard) in the lower right corner of the raft. Skillful use of the guaras—by raising and lowering these boards—enabled the crew to steer the raft against strong winds and currents.

The 30-foot mast for the sail is lying to the left of the raft. Photo: April 13, 2006—two weeks prior to launching the raft.

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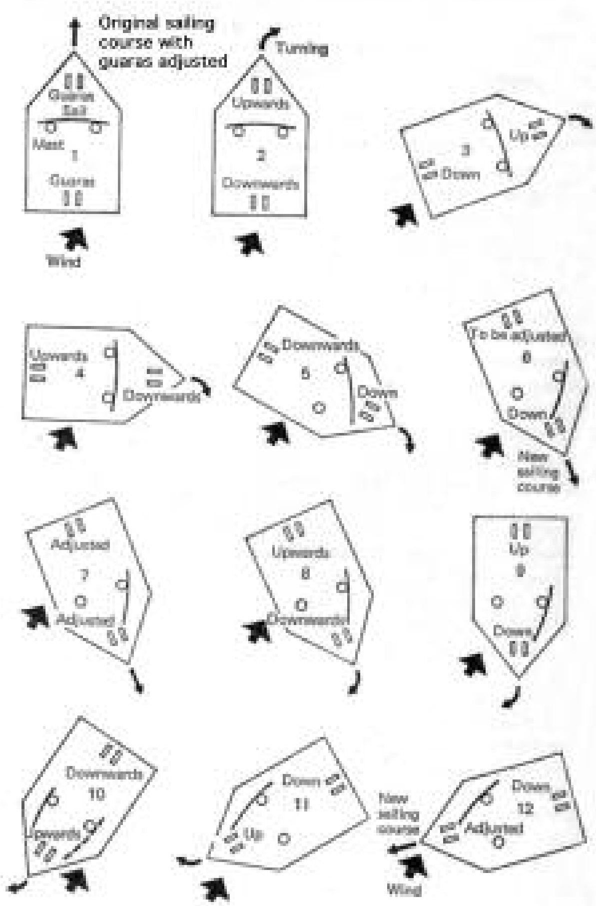
Principles of Guara Navigation



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FROM: THOR HEYERDAHL THE EXPLORER BY SNORRE EVENSBERGET, 227.

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PHOTOS

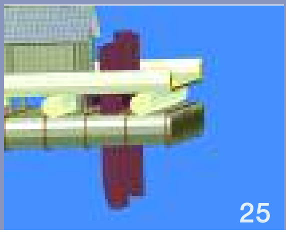
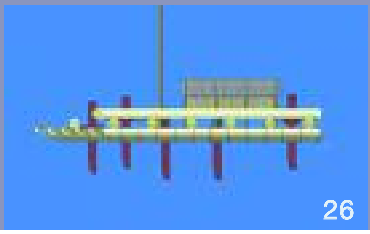
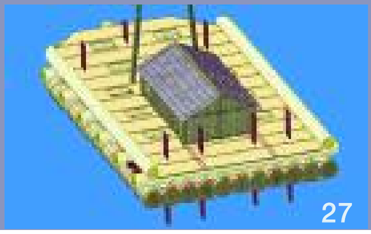
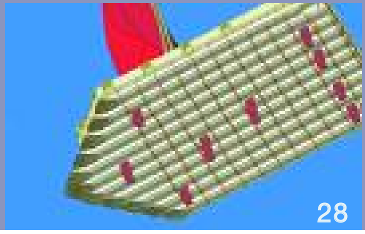
21. Positioning one of the nine "guara" centerboards during construction of the Tangaroa. Each guara was about 4 m (13 ft) long.

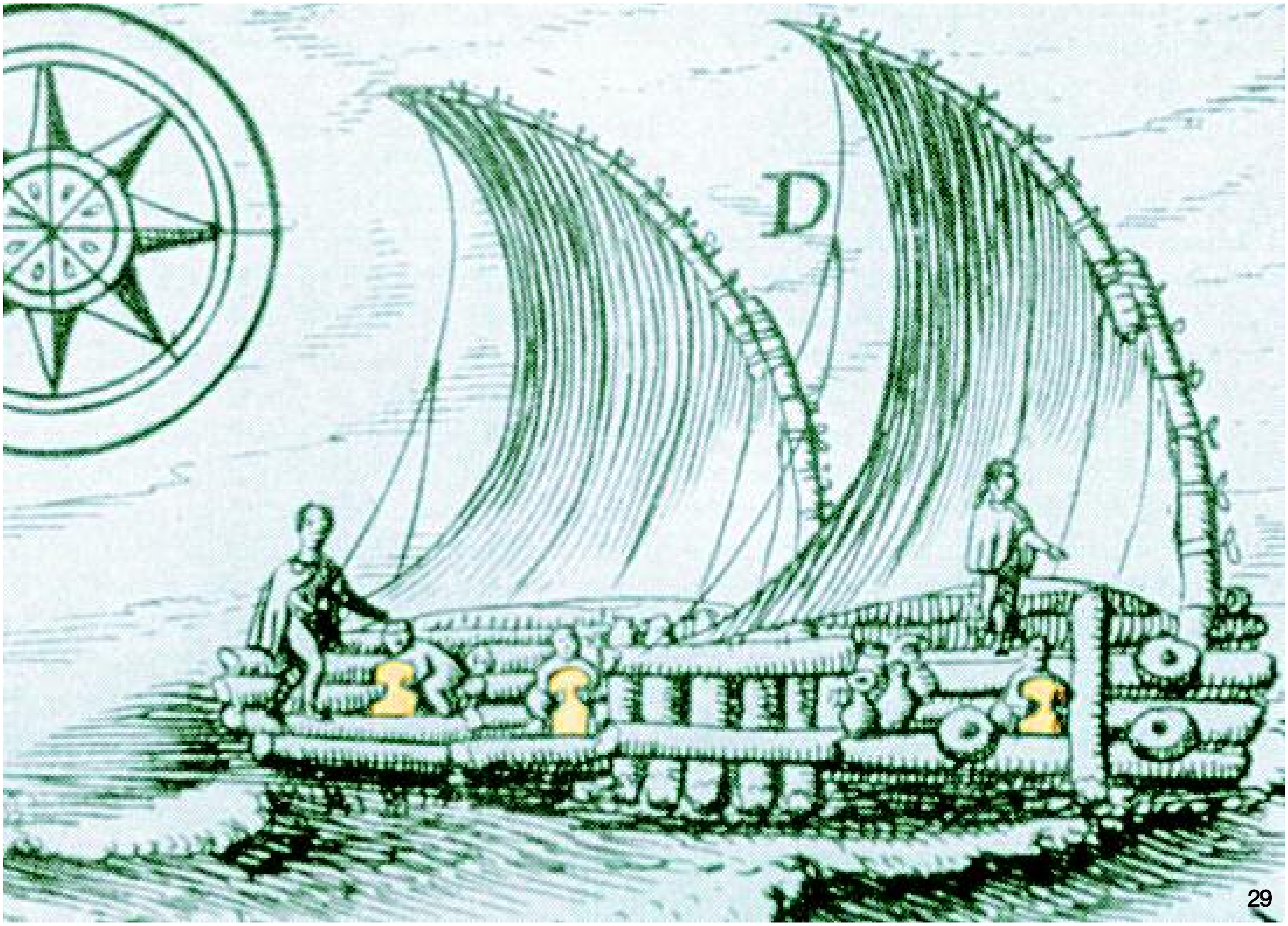
22. "Guara" can be raised or lowered according to the currents and prevailing winds to keep the vessel on course. Note the pegs that are used in this process.

23. When Heyerdahl made his 1947 Kon-Tiki voyage, he did not understand the mechanism of "guara" in steering the raft. Kon-Tiki had four "guara" that were "fixed", and which could not be raised or lowered.

It meant that his crew was entirely at the mercy of the winds. Years later (1953), Heyerdahl learned how the "guara" should have been used. The diagrams here illustrate his understanding of how the boards should be raised or lowered under specific wind conditions to stay on the desired course. The Tangaroa (2006) had nine guara, and its crew learned to steer the craft quite effectively, which resulted in cutting down their stay at sea by a substantial number of days.

Illustration: "Early Man and the Ocean: A Search for the Beginnings of Navigation and Seaborne Civilizations," by Thor Heyerdahl, Vintage Books: New York, 1980, page 227.



FROM: THOR HEYERDAHL THE EXPLORER BY SNORRE EVENSBERGET, 119.

24. Ancient Incan navigators (Peru) used to be buried along with their "guara" centerboards, according to archaeological findings by the German scholar Gretzer. Obviously, this speaks to the importance and status of the "guara" in society. This "guara" was based on a design found in a grave.

25-28. Various sketches to show placement of the nine "guara" centerboards on the Tangaroa.

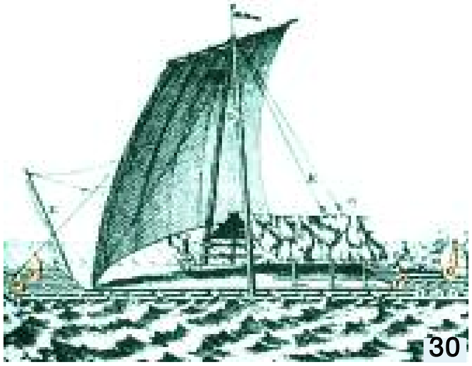
29. A 17th century drawing of a balsa raft under full sail off the coast of Peru. Note the placement of the "guaras" highlighted here in yellow (Photoshop).

30. A drawing dated 1748 by Juan and Ulloa showing a balsa raft from Guayaquil [Ecuador]. Note the "guara" centerboards, again highlighted in yellow here, and the tall guara at the back of the raft, which seems to also double as a rudder. Illustration: "Early Man and the Ocean," page 227.

particularly interested in trying to detect and measure what is often referred to as "hidden pollution". This refers not to oil slicks and such, but rather to the antibiotic and hormone runoff into the oceans, which is leading to aberrations and inability for species to reproduce. We wanted to examine water pollution to determine how it affects the ability of animals and plants to reproduce in the world's largest ocean.

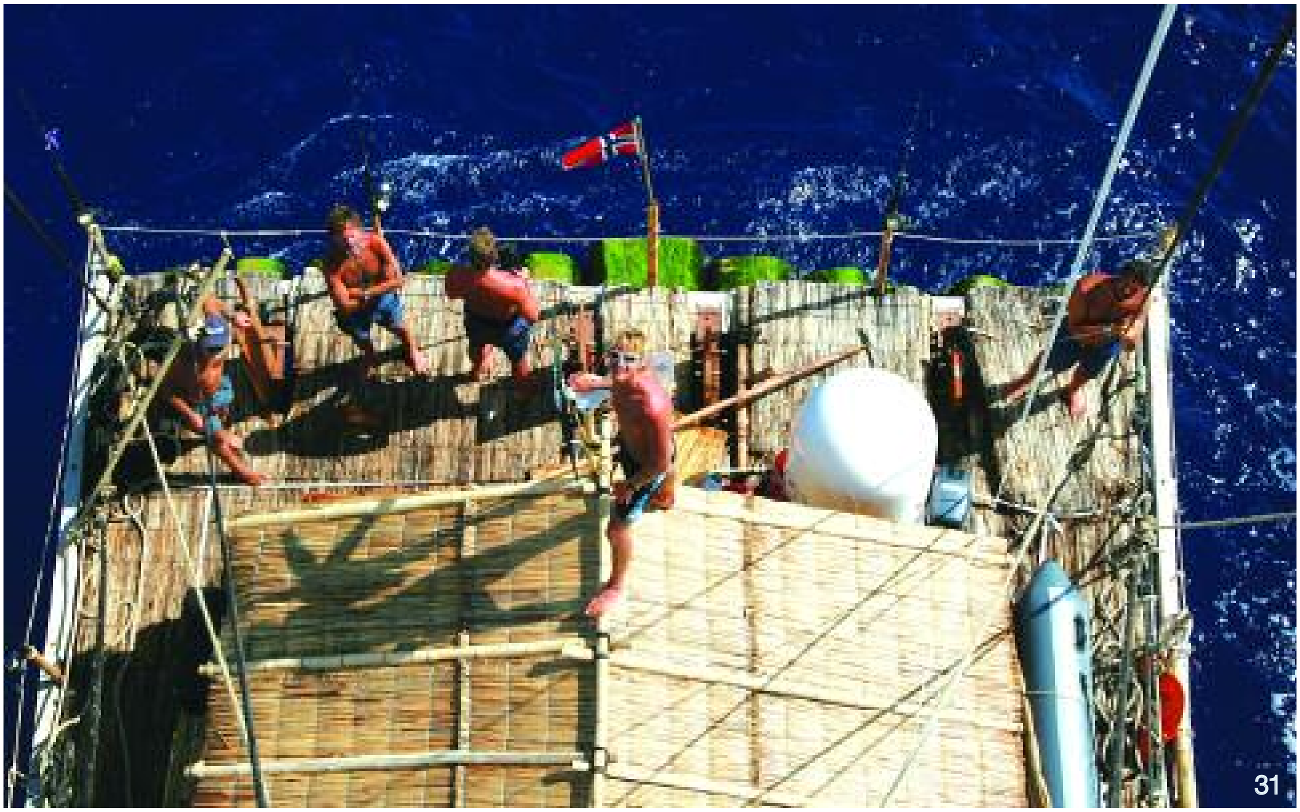
According to Dag Oppen-Berntsen, Tangaroa's Science Officer on land, "Oil usually attracts a great deal of attention since oil slicks are so visible. It's easy to understand that oil spills are detrimental for the environment. But invisible contamination is worse. It can't be detected by the naked eye, yet it also has a serious negative impact on plant and animal life in the sea."

Xenobiotics (man-made molecules) can interfere with normal embryonic development and sexual reproduction in a wide range of invertebrates from fish to man.



FROM HEYERDAHL: EARLY MAN, 227

According to Oppen-Berntsen, the Tangaroa had some advantages in collecting data over other types of modern ocean-going research vessels. For example, the Tangaroa raft sailed so much closer to the surface of the water. This gave the crew a chance to sample surface film across the whole transect of the Pacific Ocean.



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View of the Tangaroa at sea and its crew from atop the mast. Olav Heyerdahl, grandson of Thor Heyerdahl, looks up from the cabin roof.

"I don't believe in war as a solution to any kind of conflict, nor do I believe in heroism on the battlefield because I have never seen any. I was in uniform for four years, and I know that heroism doesn't occur from taking orders, but rather from people who through their own willpower and strength are willing to sacrifice their lives for an idea."

—from "Thor Heyerdahl, The Explorer," by Snorre Evensberget. Oslo: J.M. Stenersens, 1994, p. 207

Because the raft moved rather slowly [about the pace of a brisk walk], the crew was able to affix devices under the raft to collect and concentrate lipophilic pesticides and hormone disruptors. This facilitated the replication of the way these organic environmental toxins are bio-accumulated in living aquatic organisms. Again, because of the slow pace of the raft, these samplings could be collected over a time span of weeks, rather than days of faster sea-going vessels.

Therefore, the expedition hopes to produce more knowledge about such "invisible" pollution that will enable scientists to understand more about the marine food chain and find out how this hidden pollution is affecting the life in the ocean. Universities will have to determine if the water samples that we collected contain dangerous molecules—pollution that makes you and me unable to reproduce. We'll have to wait for the results. Meantime, we can try to alert people to a problem that potentially may even be more troubling than Global Warming.

Xenobiotics is cutting-edge science and the Tangaroa is cooperating in this research with various scientific institutions, such as: Biosense (Norway), Veterinary Institute (Norway), University of Zurich (Switzerland), University of Bergen (Norway) and the Institute of Water Investigations (Sweden). Currently, we're waiting to hear from these scientific institutions to learn what their analyses show.

FOOD AND WATER

The Kon-Tiki carried 250 gallons of water. For food, they took 200 coconuts, sweet potatoes, bottle gourds and other assorted fruit and roots. The Quarter-Masters Department of the U.S. Army provided field rations, tinned food, and survival equipment. They also caught plentiful numbers of fish, particularly the species that is known as "flying fish" (Parexocoetus brachypterus), "dolphin" which often go by the name of "Dorado" but which are also known as "Mahi Mahi" (Coryphaena hippurus), yellowfin tuna and shark.

We, too, ate a lot of "flying fish". They would often land right on the deck and we would fry and eat them. They tasted like the small trout that one might catch in the icy mountain rivers in Norway.

In addition, they would have been able to carry many tons of water and food, like the dried potatoes from the Andes. Actually, we were able to test the viability of transporting potatoes during the three months we were at sea. Our experiment provides more data to the theories that relate to ancient voyaging and inter-continental contacts.

We carried along potatoes from the Andes, which had been dried by the Indians allegedly in the same way that the Incas had done it centuries ago. Amazingly, those potatoes were still good six months later. Primarily, Heyerdahl and his crew had relied upon field rations from U.S. Navy in 1947 and had supplemented their meals, as did we, with "dolphin" (Dorado) almost every day.

The Tangaroa carried 1700 liters (450 gallons) in 20-liter plastic bottles stashed away between the large balsa logs and the bamboo deck. There was plenty of space in that compartment. Actually, we could have stored about 10 tons there. Sometimes, we used some seawater in our dinner, or when making bread. But it turned out we weren't really so thirsty and we had plenty of water left when we reached land.

And what did we do with all that plastic? Upon arrival in Tahiti, we met with the Ministry of Environment, and passed along those plastic bottles from our water supply and army rations. It's amazing how much plastic is used to wrap military rations. The question is: "What does the U.S. Navy do with all their plastic? There must be thousands of tons of it.

CONFIRMATION OF EARLY TRAVEL

Though we didn't set out on this voyage to prove any specific theory as Heyerdahl had, what we discovered is yet another argument against anyone who thinks the oceans were barriers for non-industrial people. Heyerdahl was convinced that oceans and seas served as communicators for early man. Clearly, he was right.

Also, those who say that people could not navigate the seas using such "primitive" rafts are wrong. Kon-Tiki was not really a good example because Heyerdahl did not use the guara boards the correct way. Tangaroa is a good example, but others can construct even better rafts. Such is the process of science. Little by little, knowledge and accurate information accumulate.

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Torgeir Higraff holding a Snake Mackerel (Gempylus serpent). Sixty years earlier crewmembers on the Kon-Tiki had been startled from their sleep one morning to discover such a creature in one of their beds. The snake mackerel is found worldwide in temperate oceanic waters. It has an elongated, compressed body and grows to about three feet long. Its mouth is large with fang-like teeth. A solitary creature, it feeds on fishes, cephalopods and crustaceans.

In the beginning, Tangaroa was just a dream. But after I convinced myself that the project really was possible, I took it on as a self-assigned mission. I felt it was a duty, more than a dream. I'm convinced that's the reason we succeeded in carrying it out, especially after the year's delay brought on by the tsunami disaster. I'd have to admit that along the way I discovered more than just the sea.

POTENTIAL PROBLEMS

The Tangaroa was so well prepared that upon looking back, it seems so easy because we had no major problems. We never had to carry out any spectacular emergency situations. We tried to anticipate every possible difficulty before launching into the Pacific—before, we were isolated and alone.

Bjarne was such an experienced sailor. He never allowed us to launch this expedition without being prepared for every imaginable emergency. And I'm sure we avoided numerous problems simply by following his advice. He had vast experience. Many evenings he would tell us: "Trim the sail tonight and we'll avoid problems." And he was right.

We never took any chances. We tried to prepare for everything, for hundreds of situations that, fortunately, did not happen. Nevertheless, we prepared for them just the same. For example: a simple small infection 2,000 miles from land can turn into a major crisis. We carried medical supplies just like a field hospital in anticipation of such problems.

"Man overboard!" can be a frightening prospect. We equipped the raft with a rubber boat and engine. And we had a rope of 300 meters length hanging from back of the raft. A big yellow plastic buoy was tied to its end. Each night, everyone who had watch duty had to wear life jackets.

In addition, we had outfitted our raft with two lifeboats and six survival jackets from the Norwegian Navy. If we ever found ourselves in an emergency, abandoned and floating in the Pacific, a rescue team would have

ANDERS BERG / TANGAROA

33. Torgeir Higraff, sitting starboard of the cabin just before sunset, writing in his diary, which he kept for the duration of the three-month voyage. "Alone, at sea, surrounded by the voices of nature, the vast ocean became a familiar friend," he says, as the raft rolled over wave after wave.

immediately been alerted to identify our exact position in the water. These suits had been specially designed by the Navy and had special reflector lights sewn into the shoulders which would make a man swimming in the dark waters visible at night. Whenever we felt there was a storm approaching, we all put on these jackets.

"Breaking the Yard" (referring to the wooden beam attached at the top of the sail) can also be a major problem. We carried spare parts just in case we had to build a new one. The same held true for the sail and ropes. As well, our diving equipment, worth about $25,000, enabled us to repair anything that might break underneath the raft.

Suddenly finding a big ship at sea bearing down on us would have been a major problem. Our electronic equipment enabled us to be aware of any ship's presence long before it appeared on the horizon. We had to be concerned about any collision, especially since we were relatively small, moved slowly and weren't so easily visible to others.

At the same time, if we ran into a problem, we needed to have the capability of alerting ships that might be passing. There have been harrowing examples when rafts out in the ocean had no equipment onboard to make other ships aware of them. Ships would pass within a few miles distance while people were dying on deck as was the experience of Tahiti Nui, for example.

OTHER EXPEDITIONS

Tangaroa is not the only vessel that set sail following the illustrious example of Kon-Tiki in 1947. In fact, there have been at least 40 others (rafts, reed boats and canoes) according to Peter Capelotti who researched the topic in his book, "Sea Drift: Rafting Adventures in the Wake of Kon-Tiki". He describes several of these voyages in great detail. Most of these experiments ran into serious problems. Some were so badly conceived that you could even call them irresponsible. The most serious problems dealt with the crew, like when someone fell overboard, got sick, injured or was in danger of dying.

Then there were some crews that had so many bitter arguments among themselves that it jeopardized the voyage. For example, during the last experiment made by John Haslett, one person had been added to the crew whom the organizers really had not spent time getting to know. It turned out to be a very bad decision, despite how adventurous their story made for "exciting" reading.

Haslett also had problems with ship worms ("teredo navalis"). Within three weeks, the raft had been attacked and eaten by these worms that burrowed themselves into the logs.

In my opinion, Vital Alsar's voyage with the "La Balsa" in 1970 was the best one in terms of how the crew coped at sea. Alsar had constructed a

ANDERS BERG / TANGAROA

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34. And what did the crew do during their leisure at sea for three months? Captain Bjarne Kravik played the guitar whenever he was in the mood. Øyvin Lauten, the XO (Executive Officer), liked to sing. Anders Berg, the photographer, listened to music. Olav Heyerdahl and Bjarne, also, liked to create things out of wood and leather. Torgeir Higraff read from among the 47 books he had lugged along and he also compiled 300 pages of notes on his laptop. And Roberto Sala washed his clothes.

35. Map route of the Polynesian Islands and the zigzag route that the Tangaroa took between Raroia and Raiatea. The raft was then towed to Tahiti where it was shipped back to Norway.

rather small raft and sailed it between Ecuador and Australia. In comparison to the Tangaroa, La Balsa was a small and extremely light raft. This affected the way it rode the waves. Wind and water really beat down on them, while on our larger craft, we slept like angels. The four crew members on La Balsa were really tough guys. A gale blew up and badly battered their small raft, one of the crewmembers lost consciousness. Fortunately, they didn't lose anyone at sea. It was really admirable that they didn't give up.

Life on a rather large-sized raft can be quite relaxed and predictable, even amidst gales and storms. Size really does matter. I would never go out on a raft without plenty of food, water and safety equipment. It's too risky.

I tried to reach Alsar while making plans for the Tangaroa, but he's the kind of guy who has no phone, fax or email. After about a month of research, Nacho, a friend of mine from Spain, tracked down one of Alsar's friends, who, in turn, passed my letter to him. I had asked him what I thought were four critical questions. The reply came back: "Good luck!" That was all the advice he ever offered. Very informative! Perhaps, he was a busy man.

Another noble, but risky, experiment was the Tahiti Nui, led by 65-year-old Eric de Bisshop in 1959. At the end of that harrowing long voyage, the exhausted Bisshop collapsed and died. Such expeditions like either "Tahiti Nui" or "La Balsa" are much too risky if you're serious about presenting your project to future generations, not to mention if you love your wife and your family.

Hopefully, the Tangaroa experiment has hopefully set the standard for safety and communication for future experiments. But it was an expensive project, costing around $800,000, if one takes into account all the tools, equipment, volunteer service and cash that we spent.

Still I would encourage almost any attempt at such expeditions, even from those who can't afford the latest safety equipment or state-of-the art communications, just as long as they try to bring back valuable scientific information, and a good story.

BALSA LOGS

The reed boats that Heyerdahl sailed in the 1970s, 25 years after his Kon-Tiki experiment, were long and narrow. But the balsa raft is a totally different type of vessel. It is heavier, wider and more stable. Tangaroa was made of 11 large balsa logs with diameters between 80-100 cm (32-39 inches). Eight smaller logs served as crossbeams to form a platform on top of them.

At the stern, the raft was 8 m (26 ft) wide, and at the bow, it was 6 m (20 ft) wide. The longest log in the middle measured 17 m (51 ft). Those on the sides were 14 m (45 ft). Together the logs weighed more than 20 tons.

Balsa has unique properties; it is exceptionally light. On my honeymoon with Mona in 2003, we had visited one of the balsa tree plantations in Ecuador. I discovered that alone, I could lift and carry a two-meter section of the log. So in comparison to timber such as pine, balsa is exceptionally light—about one third the density of ordinary timber.

If a conventional sailboat even gets a small puncture in its hull, it will sink. By contrast, a balsa wood raft can lose two thirds of its hull and still keep its crew and cargo afloat.

I'm not sure how much Heyerdahl knew about balsa trees before he chose them for his raft. For example, we don't know if Heyerdahl cut male trees or female trees. I think I've exhausted everything there is to read about balsa trees. Anyone wishing to undertake such a voyage should research the topic themselves.

However, we do know that Heyerdahl's trees were harvested at a time when they were full of sap. Since 1947, the seasons have dramatically shifted and are delayed. When Heyerdahl cut the trees in the beginning of February, the rain had poured for several months. When we cut ours in late January, the rainy season had not actually started.

Heyerdahl did not choose the right season to cut the trees and it turns out that he was wrong in thinking that sap would protect the logs from becoming water-soaked. In fact, they float much better when they're drier.

Research convinced me to cut a ring in the trees and pull back the bark a few inches before the rainy season started. This would prevent the sap from rising in the trees from the wet ground. It is actually good to drain the trees of sap as much as possible. We facilitated the drying process by allowing the felled trees to dry without stripping the branches and leaves from the trunk.

The sap in the balsa trunks runs through tiny, almost invisible channels between the larger pores of wood fiber. Thus, when these channels are full of sap, they act as a damper between the pores that produce the hollow sound when you knock on the trunk. Indians can detect the difference between trees simply through sound. The less sap there is, the more resonance! Female trees are lighter than males. You have to know the difference before you set sail and give yourself to the sea. We've lost this basic knowledge in making observations ourselves about nature but it was critical for survival for early man.