From the Sea to the Stars: The Forgotten Journeys of the Philippines' Ancient Explorers

by

Timothy James M. Dimacali

B.A. English, University of the Philippines, 2001

SUBMITTED TO THE PROGRAM IN COMPARATIVE MEDIA STUDIES/WRITING
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN SCIENCE WRITING

AT THE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

SEPTEMBER 2018

Signature of Author:_____
Department of Comparative Media Studies/Writing
May 25, 2018

Certified by:_____
Marcia Bartusiak
Professor of the Practice of Science Writing
Thesis Supervisor

Accepted by:_____
Seth Mnookin
Professor of Science Writing
Director, Graduate Program in Science Writing

From the Sea to the Stars: The Forgotten Journeys of the Philippines' Ancient Explorers

by

Timothy James M. Dimacali

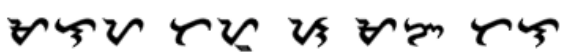
Submitted to the Program in Comparative Media Studies/Writing on May 25, 2018
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Science Writing

ABSTRACT

Linguistic, genetic, and archaeological evidence indicate that the Philippines has been inhabited by humans for many thousands of years. By what means the earliest settlers arrived in the archipelago is still a mystery, but a growing body of evidence points to the likelihood that they possessed seafaring technology. If so, then modern Filipinos—who are even now making their first tentative steps into space—are heirs to a rich heritage of exploration, the story of which has yet to be fully told.

Thesis Supervisor: Marcia Bartusiak
Title: Professor of the Practice of Science Writing

To my family, classmates, professors, and friends:



Let us go among the stars.

Ely, akala ko ba gagawin mo ang lahat pati ang thesis ko?
Pinansin ko naman ang bagong t-shirt mo.

As it made its way above the tip of Africa on an April evening in 2016, the International Space Station deployed a small but very special payload out into the night: a shiny silver and gold cube, no bigger than a kitchen stove.

The microsatellite hurtled silently into orbit, a humble affair with little more than a basic telemetry system, three onboard cameras, and a solar array for power. All it could do—all it was built to do—was send a steady stream of photos of Earth and a log of its location back to its makers, until gravity inevitably won over and pulled it out of the sky in a few short years.

It bore no markings, no hint of its origins, no indication of the many thousands of man-hours of labor spent in its careful crafting. The only sign of its provenance was in its name, logged neatly into the space station's manifest: Diwata 1.

Taken from ancient Philippine folklore, *diwata* is often translated into English as "fairy" or "nymph" and described in much the same way: as an ephemeral entity, a thing of the air. But this tiny creature of myth was much more powerful than its impish Western counterparts—it was also revered as a protector spirit that bestowed blessings on those who respected its home and cultivated its favor.

And here was a modern-day *diwata*, flitting across the firmament, joining the celestial pantheon of spacefaring nations, whose programs likewise drew inspiration from their respective mythologies: Apollo. Bhaskara. Garuda. It was an apt name indeed for the first fully Philippine made and owned satellite, the country's first tentative step into space.

But it was also something much more for astronomer Rogel Mari Sese, the square-jawed yet soft-spoken head of the newly minted Philippine Space Agency. He firmly sees the auspiciously named Diwata 1 as a timely opportunity to revisit the country's forgotten scientific traditions—to ponder what might have been and to appreciate what lay ahead, a way of showing that astronomy and science weren't new to Filipino society. "It's something we've been doing and using since ancient times," Sese says. "We always think of astronomy

as a western construct. We always see it through the lens of ancient Greek civilization. As a result, we don't think that our ancestors had their own way of naming stars and constellations based on their daily realities."

As a young student growing up in one of the country's main rice-growing regions, Sese knew that Filipinos have been farmers and seafarers for as long as the people's collective consciousness can remember. Historical records show that, for over a thousand years, trade routes and settlement patterns across Asia connected islands in the Philippines to their neighbors, particularly those with good harbors and a steady supply of local products. But few others who looked up at the sky and cheered that fine April night realized that the launching of the Diwata 1 was just the latest leg of a journey that Filipinos' ancestors began many millennia ago.

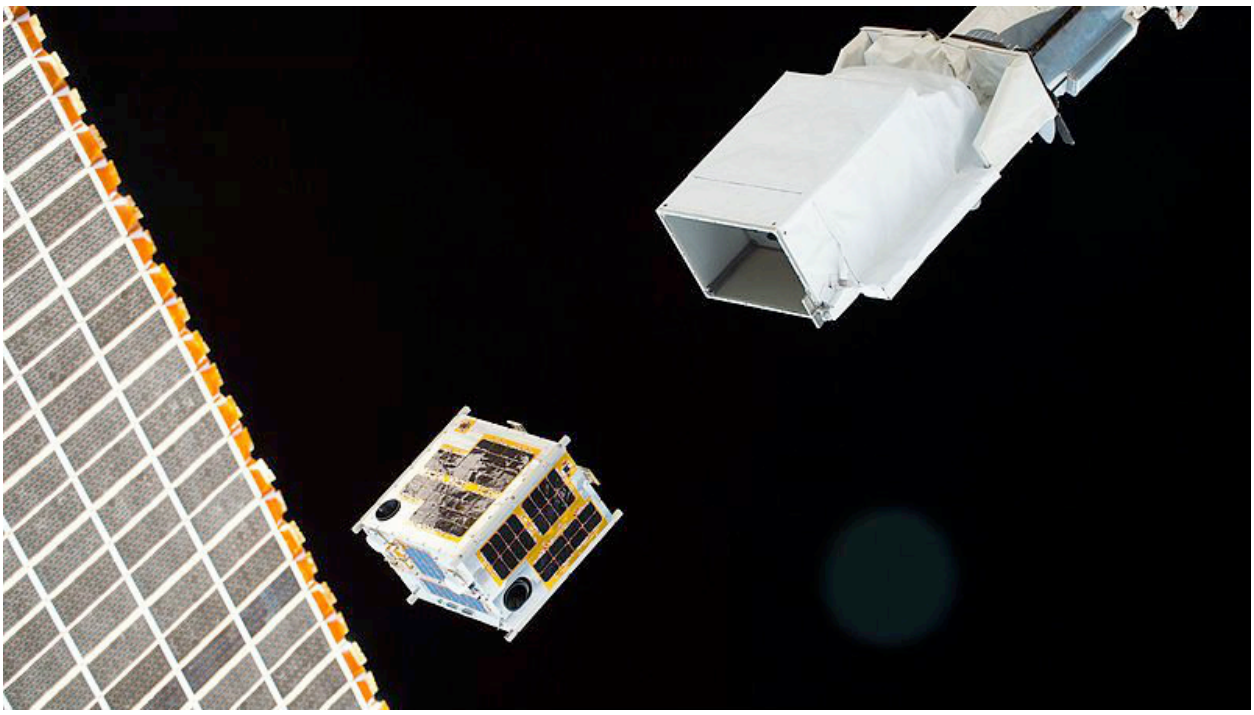


Figure 1: *The Diwata 1 microsatellite, photographed as it left the International Space Station on April 27, 2016.*

Gazing into that distant past is not much different from looking at the farthermost reaches of the sky: we strain and peer at the hopelessly inaccessible with our meager tools, trying to understand what came before us and what led to us being where we are today. With some persistence, you might find some specks here and there that hint at a larger picture.

And then, very rarely, and only if you're lucky enough, you might find something that changes everything you thought you knew about the world.

One such stellar discovery was unearthed less than two years after Diwata's launch, in an idyllic paradise locked away in the northern tip of Luzon, the Philippines' largest island.

A boat ride to Eden

Half a day's drive away from the Philippine capital, in Kalinga Province, is a quiet dale that was once the muddy bank of a river many thousands of years ago. In May 2018, anthropologist Thomas Ingicco and his team found the butchered remains of an extinct rhinoceros buried in the hardened mud: its bones showed cut marks where the flesh had been stripped away and where its legs had been hammered open to get at the precious marrow. Nearby were stone flake tools, likely left behind by the people who had taken down the giant creature some 700,000 years ago. It is the oldest evidence to date that hominins in the Philippines used tools long before the arrival of modern humans.

We may never know who the Kalinga toolmakers were—but they were not the last to settle in Northern Luzon.

Just a few miles north of the Kalinga site, tucked away in the western foothills of the Sierra Madre mountains, is the Callao Cave complex. Comprised of seven chambers, the caves must have been a welcome relief to ancient hunter-gatherers seeking shelter from torrential rains and gusts of wind. Even today, the calm serenity of the complex continues to draw people into its embrace: its main chamber, lit by a hole in the hundred-foot-high ceiling, now serves as a chapel for tourists and locals alike.

The serene alcove is also a treasure trove of human artifacts and remains spanning tens of thousands of years. Everything from bones and hearths to glass beads and earthenware has been found in its inner reaches. Among these riches, University of the Philippines archaeologist Armand Mijares came upon a remarkable find: a 67,000-year-old human foot

bone, just two and a half inches long and barely the width of a pencil—possibly the oldest *Homo sapiens* remains yet found in the country.

Still, the most striking thing about the Kalinga and Callao fossils isn't their age but that they were found on an island cut off from the rest of the world by foreboding seas. Both discoveries were made in an area nestled between the country's tallest mountain ranges, beyond which lie the West Philippine Sea and the Pacific Ocean. To the north are the dark and deep waters of the Luzon Strait, where even today only seasoned fishermen or the foolhardy dare go.

This was proof, Mijares told the media in 2010, that "these early humans already possessed knowledge of seacraft-making in this early period."

Felipe Jocano Jr., an anthropologist and professor of Science, Technology, and Society at the University of the Philippines, says that ancient Filipinos may have been more advanced than previously thought. "If they had boats traveling then, then the level of technology was certainly more sophisticated than we had assumed. And that raises all sorts of interesting questions about the rate at which technological advancement occurs," he says. "If there were boat technologies then, what would they have looked like? How far along had they advanced? What was the navigational method used? It'd be very exciting to reconstruct."

But we know nothing about how these people made their way to Luzon. Who they were and what kind of boats they used—or, for that matter, whatever other technologies they may have had other than stone tools—have yet to be found.

The exodus to Polynesia and beyond

Between that brief glimpse of the beginnings of Philippine prehistory in Northern Luzon and modern humans' journey across the islands lies a span of many thousands of years over which the veil of time has yet to be lifted. Perhaps someday, we might uncover more

clues about these First Filipinos and the boats and technologies they used to get there. But, for now at least, the historical record is silent.

What is known, however, is that some 7,000 years ago another group of intrepid explorers began a grand exodus the likes of which has never been seen before or since.

Modern humans in the Stone Age set out from China through Taiwan and braved the deep seas into Northern Luzon. Some of them might even have settled in Callao Cave and Kalinga. But they didn't stop there. They eventually pushed on through the archipelago's over 7,000 islands and continued outwards to some of the most remote places in the world. Whoever these people were, the Philippines served as a jump-off point to the farthest reaches of Southeast Asia, Australia, and beyond—to Polynesia, Hawaii, and Easter Island in the middle of the Pacific Ocean.

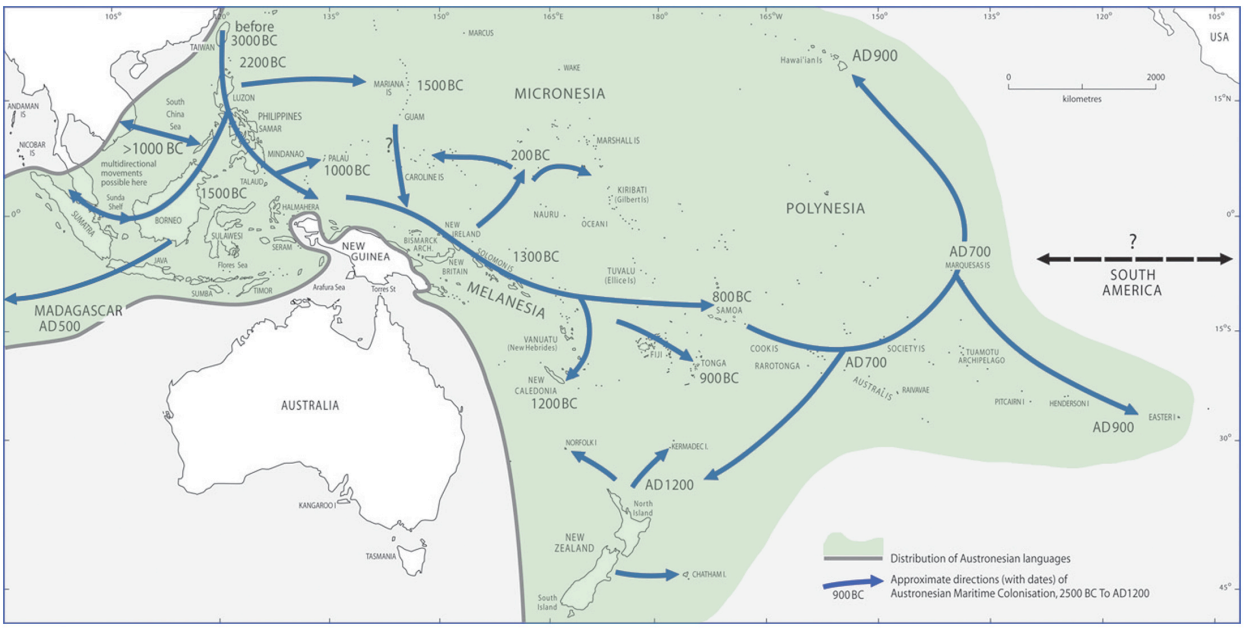


Figure 2: *A map outlining the migratory paths of Austronesian speaking populations, including estimated dates.*

They could not have known how far they would go, what dangers were ahead, nor what new world awaited them. Nobody even knows for certain what drove them to make the journey in the first place. And yet, equipped with nothing more than stone-age tools and

technology, these people succeeded in establishing themselves thousands of miles from the nearest continent.

This Great Austronesian Expansion, as it is called, is undoubtedly one of humanity's most monumental undertakings. But the journey of these ancient, unknown explorers started in Asia—and the Philippines was a vital staging ground for their voyage. "Whoever they were, they were here first," says Filipino archaeologist Vito Hernandez, who pointed out that linguistic evidence shows that these stone-age explorers passed through and populated the Philippines before moving out into the Pacific.

Experts agree that the Philippines' almost 200 languages are Austronesian in origin. By looking at commonalities between the languages that exist today in Southeast Asia and Polynesia—such as similar-sounding words with similar meanings—we get an idea of the shared ancestry of the various tongues and an indication of how their speakers spread and settled across the land. What we have is a picture of a people who came through the Philippines before venturing out across Southeast Asia and the Pacific.

There are echoes of this shared but forgotten past, hidden in folktales and traditions. Filipino-American sociologist and author Lane Wilcken points to a common thread of folklore among Philippine cultures that connects them to Polynesian seafaring peoples, suggesting that modern Filipinos are descendants of the great Stone Age navigators who settled the Pacific islands thousands of years ago. "Ultimately, many of our traditions poetically relate that our ancestors dwell in the west—the underworld—just as in the Polynesians' traditions. This implies that our [common] ancestral homeland was somewhere west of the Philippines," he notes.

Polynesian traditions seem to point back to the Philippines: Hawaii's central folk hero, Maui, bears a striking similarity to the Filipino hero-god *Lumauig*, whose name can mean either "fishhook" —incidentally, Maui's signature implement—or "voyage." "Some of the traditions of Maui suggest that Maui—that is, the Polynesians—knew of the Philippines as a place where his ancestors once lived and that he even made voyages there, since he is

credited with 'fishing up' our islands," Wilcken explains. All these, he says, are an indication that the Philippines and Polynesia have a shared history of migration.

"It is not unlikely that ancient Polynesian peoples knew the location of the Philippines and how to travel there. It is certainly true that their canoe technology and navigational knowledge was more than sufficient to enable them to make the journey," Wilcken says.

And then there is the tantalizing possibility that ancient Filipinos may even have had a hand in building the giant *mo'ai* statues on Easter Island. These imposing stone figures, each as tall as a six-story building, were carved from local rock and face stoically inward as if guarding the island's inhabitants.

For such a small and distant place, the presence of these impressive statues indicates the existence of a highly organized and technologically advanced people. They needed to know enough about stone cutting and basic mechanics in order to shape, transport, and erect the statues in their current locations. They must also have had a well-developed society to coordinate such massive undertakings.

It may very well be, Wilcken believes, that today's Filipinos are blissfully unaware that they are descended from the same people that populated *Rapa Nui*—the Polynesian name for Easter Island—and who had the scientific and technological capability to build the large stone monuments that the isle is famous for.

"Voyaging canoes make more than just one-way trips like migration theories sometimes allude. It's more likely that the Philippines was one of the first areas to be colonized by the mutual ancestors of Filipinos and Polynesians," he says. "So it's totally possible that the *Rapa Nui* people are of Filipino descent or at least have contributing ancestors from the Philippines."

Centuries later, explorer Ferdinand Magellan's chronicler, Antonio Pigafetta, made special note in his journal of Philippine laborers being shipped en masse overseas to other

kingdoms. According to historian Arnold Azurin, “Raja Humabon boasted to Magellan that some boatloads of slaves had just left Cebu for Cambodia and Champa—likely in need of warm bodies for their wars of succession, or for new stonecutters for their megalithic shrines.”

In 1917, a flood uncovered a solid gold statuette on the muddy bank of the Agusan River in Mindanano in the southern Philippines. Dated to the thirteenth century, it is thought to represent the goddess Vajralasya—proof that ancient Filipinos were in contact with their Buddhist neighbors.

Figure 3: *The Agusan Gold Vajralasya statue at the Field Museum in Chicago, IL.*

Could Filipino craftsmen, descended from the same people who built the monuments of Easter Island, have also built grand Asian Buddhist monuments like Angkor Wat in Cambodia and Borobudur in Indonesia? “That's a possible conjecture, considering that archeologists like Robert Fox, H. Otley Beyer and others have pointed out that some islands in southern Philippines had communities linked to [these places],” Azurin says.

These clues speak to us across the ages, whispering of a much grander epic that has yet to be told.

Genetic echoes of the Great Migration

Traces of this grand diaspora can still be found in the blood of the descendants of those ancient pioneers—not all of whom were human. In 2011, scientists from Australia National University discovered a genetic link tying the people of Polynesia to the Philippines in a very unlikely place: the mitochondrial DNA of chickens.

By studying the common genetic traits of the animals that people had domesticated and brought with them—whether for food or companionship, like chickens, cows, and dogs—Vicki Thomson and her team of researchers hoped to shed more light on the migration patterns of ancient Polynesians. Chicken bones dug up from archaeological sites were found to contain a genetic signature that's unique to Polynesia and Southeast Asia. Most surprising, however, is that this signature can still be found in modern chickens in Camiguin and Manila in the Philippines, suggesting that Polynesian chickens are descended from Philippine stock.

The spread of Philippine chickens across the Pacific may simply have been through barter between early Filipinos and early Polynesians, who sailed back and forth across the open seas on now long-forgotten trade routes. Perhaps a Polynesian fisherman found himself in the Philippines and, finding the local fowl particularly delectable, decided to take a few with him back home. But it's more likely that early Filipinos brought the chickens with them when they migrated out of the archipelago, and their descendants later became the Polynesians.

"All we can say [right now] is that if this is the same group of people moving from Taiwan south to the Philippines, they only picked up the chicken from the Philippines," Thomson says. She thinks that further research into rats, because of how these unwanted stowaways

follow humans wherever they go, can provide a better picture of Austronesian migration patterns.

And then there's the genetic evidence from the descendants of the explorers themselves.

Looking at linguistic evidence alone to trace migration patterns can be tricky, says the Philippine Genomics Center's Frederick Delfin, because language can spread independently of populations. You don't need to be born into a culture to learn its language, after all.

For several years now, he has been pushing for a comprehensive survey of the genetic characteristics of the Philippines' over 100 ethnolinguistic groups—the elusive Filipino Genome. Studies so far have barely scratched the surface of modern Filipinos' genetic makeup, he says, but they provide the most palpable picture yet of the peopling of the Philippines.

Between 1997 and 2005, teams of international researchers collected over a thousand DNA samples from six regional centers and nineteen ethnolinguistic groups across the country. These samples were then compared with the genes of other ethnic peoples from across Asia and the Pacific, as well as with Denisovans, an extinct cousin of modern-day humans. Delfin and his colleagues discovered that today's Filipinos bear a close genetic affinity with other Asia-Pacific groups that likely predates the Austronesian expansion.

Just like Wilcken, Delfin believes that there's more to the story of the Philippines than just successive outward waves of migration. He thinks that there was a coming and going of people in the Asia-Pacific over thousands of years. "Our Filipino ancestors did not just come into the archipelago and become isolated in their niches after the initial peopling. They could have possibly moved around… had contact with other groups," Delfin says. "Then the Austronesians came and shared their language and DNA with the early Filipinos already in the archipelago."

Perhaps the first Austronesians to set foot in the Philippines encountered the descendants of the Kalinga toolmakers and of Callao Man. If so, then the Philippines was likely a major maritime hub for millennia before recorded history—a fertile ground for the development of indigenous science and technology, particularly in the way of seafaring, mathematics, and astronomy.

Figure 4: *The Sultan Sin Sulu, a modern-day replica balangay.*

The voyages of the *balangays*

By the time Spanish conquerors arrived in the Philippines in the sixteenth century, they came upon already highly-developed maritime societies with seafaring technology capable of making routine voyages across the vast open seas. Historical records from as early as the tenth century show that Filipinos' ancestors regularly traveled throughout Southeast Asia on trade routes that were by then already well-established—voyages that reached as far as the eastern coast of Vietnam and all the way north to China. These routes predate by at least hundreds of years Magellan's circumnavigation of the globe as well as his arrival, and death, in the Philippines in 1521. They are even older than the Chinese explorer Zheng He's expedition across Asia in 1400.

There are stories of hand-carved wooden boats so large that they could carry entire extended families, yet were light enough that they could be lifted on the shoulders of a few dozen men and deployed at a moment's notice. No mere dugout canoes, these flexible boats could sail both deep ocean waters and shallow island reefs—a versatility that left the Spaniards, with their gross and heavy ships, in awe.

In his journal, Pigafetta briefly mentioned just such an advanced type of seacraft that is unique to the Philippines, which he called a *balanghai*. According to historian William Henry Scott, these boats represented a level of technology far advanced from that of the stone-age people who colonized Easter Island, because of the way the planks were joined together with wooden pegs. "Stone tools are probably inadequate for drilling deep holes in the thin edges of boards," he wrote. " It is therefore not surprising that edge-pegging does not appear in those distant Pacific Islands whose inhabitants presumably migrated there without metal."

This type of boat was likely in common use throughout the archipelago because variations of the name appear across all major Philippine languages—often as *balangay* or *barangay*—all with the same meaning: a large, crescent-shaped vessel that was a fundamental part of the communal lives of ancient Filipinos.

Over a century after Pigafetta, in 1668, a Jesuit missionary by the name of Francisco Ignacio Alcina wrote an overview of life in the Philippine Islands for the Spanish Crown and included in his account a very detailed description of the *balangay*. Not a single nail was used in its construction, he remarked. Its long planks were painstakingly carved from hardwood tree trunks, which were then fitted edge-to-edge with wooden pegs and caulked with fibers and resin. Each plank had carved into it a series of raised rectangular lugs—a distinctive feature called a *tambuko*—positioned at regular intervals, through which holes were drilled and threaded with rattan strips or cords from the *cabo negro* palm so as to form its trademark flexible bulkhead. Like an Oriental window blind or Spanish hand fan, this plank-built, edge-pegged, rope-lashed design allowed the lenticular craft to remain

supple while still retaining its shape as it was thrown against the harsh ocean waves and shallow coral reefs.

At the height of their golden age, *balangays* were even said to have been commissioned by Spanish authorities to fend off Islamic invaders. But their dominance of the seas would eventually come to an end. Though it is not known exactly when or why native Filipinos stopped using *balangays*, the fabled craft all but disappeared, fading into story and legend.

All that changed in 1976, when treasure hunters digging not far from where the Vajralasya statue was found unearthed a set of soggy wooden planks in a marshy plain in Butuan, Mindanao. These boards, as it turned out, belonged to a set of sea craft that exactly matched Alcina's description. The site, although now inland, once opened out to the sea: all the *balangays* were "drydocked" on what used to be the Butuan seashore. That the vessels were so well preserved is largely because they were buried intact, and the submergence of the area over succeeding centuries kept the wood from decaying.

Exactly how the Butuan *balangays* came to rest there is an enduring mystery. Perhaps they were intentionally buried, an offering or memorial of some kind. Perhaps they were left behind after a sudden cataclysm, like a tsunami or a landslide. Or maybe they were simply abandoned and forgotten—but if so, why? Did their makers migrate elsewhere, or were they captured and sold as slaves? The answers likely lie buried in the marshlands that now blanket the ancient shore.

Although little more than flattened hardwood staves are all that remain of these once majestic boats—most of their finer trappings had likely decayed or had been washed away—their design still speaks of the skill of their Filipino makers who, many generations ago, painstakingly carved flotillas of *balangays* for routine journeys across Asia.

After the initial fanfare over the Butuan site had died down, little changed in the four decades since the first *balangays* were discovered. The marsh in which they were found is now private land a good distance away from the main road. It remains waterlogged,

surrounded by thickets of cogon grass and a scattering of coconut trees. Occasionally, a *carabao* water buffalo crosses the muddy path leading to the site, but for the most part it receives few visitors. Most tourists prefer to visit the nearby museum, where one of the original *balangays* is on permanent display.

In 2009, a triad of replica *balangay*—one of which was also named Diwata—successfully undertook a 17-month-long sojourn across Southeast Asia. Their ambitious journey rivaled Thor Heyerdahl's famous demonstration of ocean migration to Easter Island aboard the balsa-wood raft *Kon-Tiki* in 1947. But even this widely publicized feat did little to spur renewed interest in the Butuan site.

Figure 5: *The centerpiece of the Balangay Shrine Museum in Butuan, Mindanao.*

A massive discovery in Butuan

Excavation and preservation efforts continued at a snail's pace over the years until 2012, when Philippine National Museum archaeologists stumbled onto something big in Butuan—literally and figuratively. At first, the wooden planks that peeked out of the damp earth seemed to them like just yet another *balangay*. But as the excavation wore on, they realized that they had something much larger on their hands. "Everything about it was massive," archaeologist Mary Jane Louise Bolunia recalls when she talks about the discovery. She holds up her hand and curls her fingers into a large circle. "That's just one of

the treenails." Treenails, the technical term for the wooden pegs used to put the planks of a *balangay* together, are usually about as thick around as a thumb. These newfound ones were the size of soda cans.

The boards of the boat itself were wider and longer than anything she had seen before. Twice the size of those used on any of the other ships at the site, each plank of what Bolunia was now fondly calling a "mother boat" was the breadth of a man's chest—so big that they can no longer be replicated today, because there are no more living trees in the country that are large enough to make them.

Bolunia took out a piece of onionskin paper with a carefully inked map of the site. On the upper corner was a roughly pea pod-shaped boat wreck, about 50 feet long, one of the eight previously-discovered *balangays*. But right next to it were the remains of a ninth *balangay* so wide that it could easily fit the smaller craft into itself twice over—and that was just the part that had been uncovered. Although the boat has yet to be fully excavated, it is estimated to be over eighty feet long, bigger than two school buses laid end to end.

The find caused quite a stir among archaeologists because it directly challenged the now commonly held belief that Filipinos embarked overseas on flotillas of small *balangays*. The discovery of this massive craft suggested that ancient Filipinos could have orchestrated their overseas voyages from a main ship, with the smaller vessels perhaps serving as support ships for protection as well as for shuttling people and supplies to and from the shore. Such an arrangement hints at a complex maritime social structure that was more centralized and organized than previously thought.

There is also another, more chilling possibility: the craft may be the first known example of a special type of *balangay* that terrorized the Pacific seas long before the European privateers and slavers of the seventeenth century. This man-o-war was spoken of in hushed whispers among the people of neighboring Indonesian islands as a *korakora*. The Spaniards, whose lumbering oceangoing carracks were no match for the vessel's speed and agility, knew of it in their tongue as a *caracoa*. Like Viking longships, these battle-ready

balangays were as swift as they were terrifying, "intended to carry warriors at high speeds before seasonal winds through dangerous reef-filled waters with treacherous currents on interisland raids," according to Scott.

The fearsome Philippine *karakoa* featured the same versatile edge-pegged plank construction as its smaller brethren, but it was not designed for long overseas voyages. It bore no provisions, stored no trade goods. It was outfitted only for war, with a raised platform amidships manned by warriors at the ready to board rival boats and to swarm enemy shores. It was also double ended, with tripod sails and double outriggers manned by dozens of paddlers who could change its direction in an instant. The entire ship was built with the singular purpose of launching swift surprise attacks on hapless nearby targets—the blitzkrieg troop transport of its day.

But a positive identification of Bolunia's beloved "Mother Boat"—be it a mothership or a warship—has to wait. As of 2018, over half a decade after the giant *balangay* was discovered, it remains submerged and waterlogged on the site with the rest of its brethren. This is the best they can do for now to preserve it. The National Museum is still negotiating with the owners of the land to acquire the plot and hopefully convert it into an outdoor museum.

A different view of numbers, space, and time

The existence of the *balangays* points toward a civilization that was sophisticated enough, in terms of social structure and scientific skill, to drive the development of such advanced maritime technology.

"When you have a boat like that, it means a complex organization is in place already," Jocano says. "Why make a *balangay*? You can't do it all by yourself. Boat building connotes [the existence of] trade, warfare, migration, and folklore. And if you had exchanges of goods, then you already had specialization of production."

One of the hints we have of the possible scientific mindset of ancient Filipinos is a series of scratches carved into a chalky white hillside in the province of Angono, Rizal, in southern Luzon. They are said to date to the late Neolithic period, about 5,000 years ago—around the same time that Filipinos' and Polynesians' ancestors were venturing out from Southeast Asia into the Pacific.

Most of the figures are of people or animals, with round heads and either rectangular or V-shaped bodies. But there are also abstract figures as well: triangles, rectangles, and circles. The meanings of the carvings have long been forgotten, but this much is certain: they were put there by a firm hand, etched with decisive purpose.

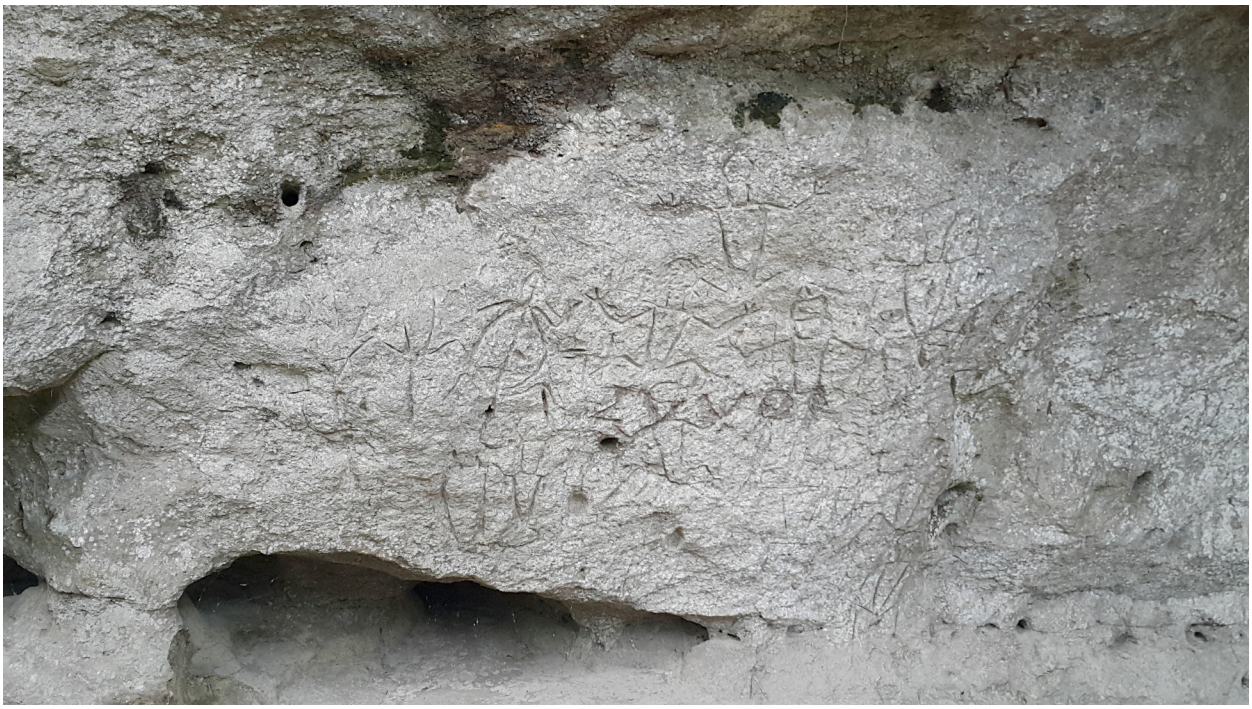


Figure 6: *A close-up of some of the Angono Petroglyphs.*

To historian Ricardo Manapat, these simple yet abstract figures that make up the so-called Angono Petroglyphs are in stark contrast to the more realistic execution of European lithic art.

He argued that the Angono figures are an indication that the Philippines' stone artists had an intuitive eye for the mathematical and aesthetical concepts of symmetry, proportion,

and scale. This tendency towards geometric abstraction can still be found today in indigenous Philippine cultures, from the Picasso-like angular human forms of the *bulul* statues of the Ifugao—whose vast rice terraces in the Cordillera mountains are a technical marvel in themselves—to the colorfully complex symmetries of the woven cloths of the Kankana-ey and other ethnic groups.

Ancient Filipinos, like other cultures, understood the world on their own terms. They developed their own means of making sense of what was around them and, ultimately, made use of that understanding for their own survival. Sometimes, basic scientific and technological knowledge overlapped—the independent invention by various societies of the wheel and the bow and arrow are just a couple of examples—but there were also areas in which ancient developments differed markedly in ways unique to each culture.

Take something as simple and as ubiquitous as counting. It seems natural to us to count in multiples of ten—because, after all, that's how many fingers and toes we have. It makes sense that ancient humans would have used their bodies as general units of measure, because our understanding of the world begins with ourselves.

But Filipinos had a base ten number system with its own cultural peculiarities and a complexity that amazed the colonizing Spaniards, according to Manapat.

The Tagalog people of Luzon, for example, had words for the cardinal numbers one to nine as well as specific root words for the numbers 10; 100; 1,000; 100,000; 1,000,000; 10,000,000; and multiples thereof. Counting up to these root numbers wasn't as straightforward as simply adding up in increments. Old Tagalog grammar was complex, and instead described a number in terms of how close it was to the nearest higher root number. So under this system, the number 21 is not described as one in excess of twenty—"twenty-one," as we would put it—but as *maykatlongisa*: "one closer to thirty."

Spanish observers found this method novel and orderly. Fray Sebastian de Totanes, in 1745, called it "a rigorous method" constructed with "ingenious artifice." It's a practical

way of thinking still in use today: it's not uncommon for street vendors to give change by first reciting the price of their wares then counting up the money as they hand it out, until they reach the amount given to them by the customer.

Ancient Filipinos also thought of time differently. They generally viewed it in terms of subjective moments rather than in strictly measured objective increments. "The conception of time here in the Philippines before the Europeans arrived was not Newtonian," says physicist Pecier Decierdo, who studied Polynesian navigation techniques. "There was not this thing called Time, with a capital T, a thing separate to the events of the world. The cycles of nature *were* time itself [to them]."

Filipino scholar Pedro Serrano Laktaw said it was "exceptionally original and interesting" how ancient Filipinos "managed time through what they observed in the stars, in what they saw in the plants and animals, and what they noted in their natural movements."

Native words still in use today hint at this sense of time among precolonial Filipinos that is markedly different, philosophically and conceptually, from the western notions of time that we're used to. For example, the Tagalog word for year, *taon,* is also the root of other words such as opportunity (*pagkakataon*), coincidence (*nagkataon*), and even weather (*panahon*). On top of this, the *taon* was closely tied to astronomical events—specifically the lunar cycles and the periodic appearance of certain constellations such as Orion and the Pleiades, which were surrounded by their own mythologies and beliefs.

Life among the stars

To those ancient Filipinos who lived in the archipelago generations after the Great Migration, the need for sophisticated navigation techniques may no longer have been necessary. With bountiful soil and accessible nearby waters, there may have been no need to preserve navigational knowledge. But in its place arose the need to predict the coming and going of the seasons—specifically the nourishing monsoons that arrive towards the

end of every year. For that, they needed to look up at the heavens, in which they saw not just the future but a bit of themselves as well.

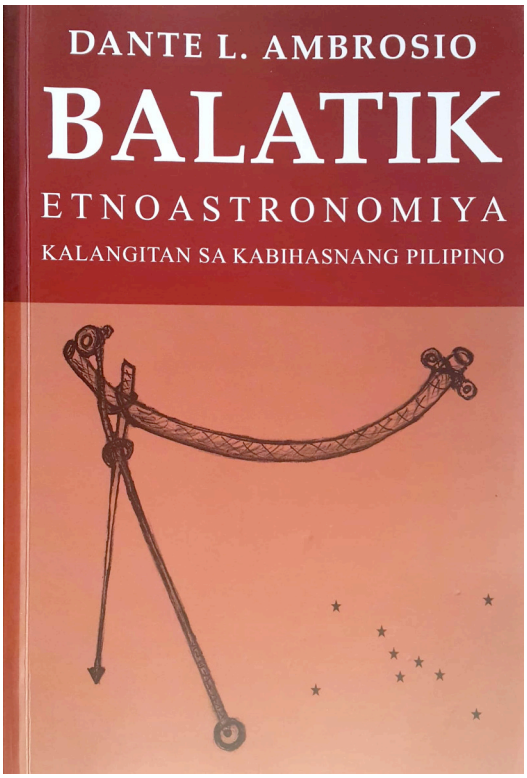


Figure 7: *Ancient Filipinos saw Orion as a boar trap, called a "balatik," seen here on the cover of Dante Ambrosio's book of the same name.*

Pioneer Philippine ethnoastronomer Dante Ambrosio believed that the constellations that ancient Filipinos saw in the night sky were reflections of their souls—their culture, their humanity, and their mortality. "When the ancient Filipinos looked up to the heavens, they didn't just see the sky. They also saw their own civilization, especially where stars are concerned," he wrote. "Like other cultures, they mapped onto the sky their own uniqueness. They claimed the heavens as their own." He spent much of his life extensively documenting folk names for the stars and traditional beliefs about the heavens among native peoples. He pointed out that the Philippines' many ethnolinguistic groups shared common names for the stars despite having hundreds of languages—a clear indication of their shared Austronesian roots.

The earliest known written documentation of ancient Filipinos' astronomical knowledge is from the fourteenth century, by a Franciscan friar named Juan de Plasencia, who came to the islands in 1577 on one of the first missionary expeditions from Spain. "Some of them… adored the stars, although they did not know them by their names, as the Spaniards and other nations know the planets—with the one exception of the morning star, which they called Tala," Plasencia wrote. *Tala* is still in common use even today, as a synonym for "star." He also wrote that Filipinos tracked other constellations in the sky—the ancients called them *talampad*—but none as closely as two formations known as *Balatik* and *Moroporo*.

Balatic, as Plasencia called it, is what Western civilizations know as Orion. Central to the figure is the triad of stars: Zeta, Epsilon, and Delta Orionis. But whereas the ancient Greeks saw these three as the cincture on a huntsman's robe, the ancient Filipinos saw a sharp arrow poised to strike. The other stars of the huntsman's body—Betelgeuse, Bellatrix, Saiph, and Rigel—were seen as a bow, with his sword as its bowstring. The Filipinos saw in Orion not a person, but a thing: a kind of ballista, an armed boar trap called a *balatik*. It is by this name that Filipinos across the archipelago knew this constellation, with only slight differences among the many languages: *balatik* to the Bagobos and Tagalogs, *bayatik* to the Mandaya, and *belatik* to the Manobos.

The other cluster of stars that Plasencia noted, which he called *Mapolon*, is what we know today as the Pleiades. Ancient Filipinos knew it by similar names, including *Moroporo* and *Mulupulu*, and its undulating shape was described as "boiling lights" or, perhaps more poetically, as "a flight of birds."

Both constellations come to dominate the sky around October of each year, just at the start of the rainy season in time for planting. They appear later and later in the sky until, by January or February, the constellations rise so late that they barely rise above the eastern horizon. This happens just as the days get longer towards the dry season, a perfect time for harvesting.

All this knowledge passed down through oral tradition across generations of Filipinos might have seemed very crude to Spanish colonizers, who were more used to the immutable precision of nautical charts and astrolabes and sextants. It's easy to believe that ancient Filipinos were primitive, because they didn't develop such tools.

But perhaps, after ages of migration and travel, Filipinos had no need to do so at all. "They were often familiar with the current patterns, the wind patterns. They knew the time of year. They would know the seasons. So they knew these things that the Europeans were unfamiliar with," Decierdo says. "A tool like the astrolabe was really not necessary in the context of the way that indigenous Filipinos used the stars."

Decierdo's own experience teaching astronomy at a local science museum made him appreciate the value of ethnoastronomy in promoting public interest in modern science and technology. "What I've come to realize is that when you inject culture and history and heritage in the popularization of astronomy, people seem to care about astronomy more. Because it ceases to be abstract and 'out there' and unreachable," he says.

An unfinished tapestry for future explorers

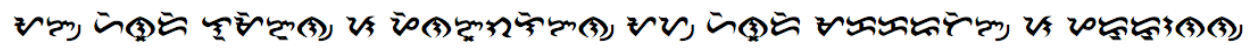
While finishing his astrophysics degree in Japan, the Philippine Space Agency's Sese read up on the navigational and astronomical traditions of other cultures and wondered at the Philippines' own beliefs and practices. He eventually encountered the work of Ambrosio and was surprised at why such a rich tradition was no longer widely practiced and is now in danger of being lost. "It's barely taught in schools! Ask any Filipino on the street what's the Filipino term for constellation and I would give 1,000 pesos to anyone who can answer it correctly," he lamented.

Sese had hoped to visit Ambrosio upon his return to the Philippines. But their meeting was not in the stars: the country's only ethnoastronomer passed away in 2011 from a lingering illness. His death was preceded by Manapat's in 2008, and Scott's in 1993. Between them, their tentative inquiries into the tapestry of indigenous Philippine science and technology have yet to be picked up by a new generation of researchers.

And then there are the physical threads of the story that have yet to be unearthed in Kalinga, Callao, Butuan, and elsewhere in the Philippines. Even the as-yet unsequenced Filipino Genome may have its own surprising secrets to tell.

Perhaps it is fitting, then, to return to all of this just as the Filipino people are at the cusp of a new journey of exploration beyond the familiar seas of our childhood, to the stars. For Sese, space exploration and historical appreciation are two sides of the same coin. "All this interest in new technologies can make one wonder what we did in the past. It's a way of

countering the naysayers: through astronomy, we can learn about our own culture and identity as Filipinos," he says. His words call to mind a common local adage:



—If you don't look back at where you came from, you won't get to where you're going.

And who knows where this journey will lead? Archaeologists in some far-distant future may find not a diminutive Filipino satellite but something more—a spacefaring vessel, perhaps, an interstellar *balangay*.

PHOTO CREDITS:

Figure 1: NASA [Public Domain]
Figure 2: Benton *et al.* Adapted from Bellwood *et al.*, (2011). doi: https://doi.org/10.1371/journal.pone.0035026.g001 [CC BY 4.0 (https://creativecommons.org/licenses/by/4.0/)]
Figure 3: Timothy James M. Dimacali
Figure 4: Timothy James M. Dimacali
Figure 5: Timothy James M. Dimacali
Figure 6: Timothy James M. Dimacali
Figure 7: Timothy James M. Dimacali

BIBLIOGRAPHY

Books

Ambrosio, Dante. *Balatik Etnoastronomiya: Kalangitan Sa Kabihasnang Pilipino*. University of the Philippines Press, 2010.

Blair, Emma Helen, and James Alexander Robertson. *The Philippine Islands, 1493-1898*. Vol. 7, Arthur H. Clark Co., 1906, www.gutenberg.org/ebooks/13701.

Lewis, David. *We, The Navigators*. The University Press of Hawaii, 1972.

Mojares, Resil B. *Isabelo's Archive*. Anvil Publishing, 2013.

Pigafetta, Antonio. *Magellan's Voyage Around the World.* Translated by James Alexander Robertson, Arthur H. Clark Co., 1906.

Scott, William Henry. *Barangay: Sixteenth-Century Philippine Culture and Society*. Ateneo De Manila University Press, 1994.

Wilcken, Lane. *The Forgotten Children of Maui: Filipino Myths, Tattoos, and Rituals of a Demigod*. Createspace, 2014.

Journal articles

Delfin, Frederick C. "The Population History of the Philippines: A Genetic Overview." *African Studies Review*, Cambridge University Press, 20 Nov. 2015, muse.jhu.edu/article/601704.

Ingicco, T., et al. "Earliest Known Hominin Activity in the Philippines by 709 Thousand Years Ago." *Nature*, Nature Publishing Group, 2 May 2018, www.nature.com/articles/s41586-018-0072-8.

Manapat, Ricardo. "Mathematical Ideas in Early Philippine Society (Posthumous Essay)." *Philippine Studies*, vol. 53, no. 3, 2011, pp. 291–336., www.jstor.org/stable/42634685.

Mijares, Armand Salvador, et al. "New Evidence for a 67,000-Year-Old Human Presence at Callao Cave, Luzon, Philippines." *Journal of Human Evolution*, vol. 59, no. 1, 2010, pp. 123–132., doi:10.1016/j.jhevol.2010.04.008.

Scott, William Henry. "Boat-Building and Seamanship in Classic Philippine Society." *Philippine Studies*, vol. 30, no. 3, 1982, pp. 335–376., www.jstor.org/stable/42632616.

Thomson, Vicki A., et al. “Using Ancient DNA to Study the Origins and Dispersal of Ancestral Polynesian Chickens across the Pacific.” *Proceedings of the National Academy of Sciences*, vol. 111, no. 13, 2014, pp. 4826–4831., doi:10.1073/pnas.1320412111.

News articles

Dimacali, Timothy James M. “Massive Balangay 'Mother Boat' Unearthed in Butuan.” *GMA News Online*, 9 Aug. 2013, www.gmanetwork.com/news/scitech/science/321334/massive-balangay-mother-boat-unearthed-in-butuan/story/.

Dimacali, Timothy James M. “PHL's First Satellite Diwata-1 Launched into Orbit.” *GMA News Online*, 27 Apr. 2016, www.gmanetwork.com/news/scitech/science/564245/phl-s-first-satellite-diwata-1-launched-into-orbit/story/.

Dimacali, Timothy James M. “Historic Giant Balangay Remains Unexcavated.” *GMA News Online*, 2 Aug. 2017, www.gmanetwork.com/news/scitech/science/620423/historic-giant-balangay-remains-unexcavated/story/.

Severino, Horacio ‘Howie’. “Researchers Discover Fossil of Human Older than Tabon Man.” *GMA News Online*, 1 Aug. 2010, www.gmanetwork.com/news/news/nation/197541/researchers-discover-fossil-of-human-older-than-tabon-man/story/.

Interviews

Azurin, Arnold. Facebook chat interview. 12 Aug. 2013.

Bolunia, Mary Jane Louise. In-person interview. Aug. 2013.

Bolunia, Mary Jane Louise. Email interview. 18 Jul. 2017.

Bolunia, Mary Jane Louise. Email interview. 17 Feb. 2018.

Decierdo, Pecier. Facebook chat interview. 27 Mar. 2018.

Decierdo, Pecier. Skype interview. 15 Apr. 2018.

Delfin, Frederick. Email interview. 14 Mar. 2018.

Delfin, Frederick. Skype interview. 3 Apr. 2018.

Hernandez, Vito. Facebook voice interview. 27 Oct 2017.

Hernandez, Vito. Facebook voice interview. 13 May 2018.

Jocano, Felipe, Jr. Facebook video interview. 28 Mar. 2018.

Jocano, Felipe, Jr. Facebook chat interview. 7 May 2018.

Lising, Mylene. Email interview. 14 May 2018.

Matherne, Neal. In-person interview. 21 Dec. 2017.

Sese, Rogel Mari. Facebook chat interview. 21 Oct. 2017.

Wilcken, Lane. Facebook chat interview. 14 Mar. 2015.

Verzola, Jun. Facebook chat interview. 11 Mar. 2018.