



*Delmarva*

*Photo: Fran Symes*

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## IN THIS ISSUE

Sandy Noyes once again brings readers a view from East Greenland. Combining evocative photographs and thoughtful writing, his article conveys the beauty of the landscape, and its people, that has captivated so many who have spent time there.

A talented artist and daughter of long-time Qajaq USA board advisor Wes Ostertag, Molly Ostertag portrays Greenland kayak construction and father-daughter bonds with a series of delightful comics.

In two provocative articles, Ralph Young brings an engineer's perspective to Greenland kayak design and construction. Ralph's willingness to address his reviewers' counterpoints—revising the text as a result or offering a rebuttal—is commendable.

Beau Miles attended the 2012 Hudson River Greenland Festival. He intended to be a participant, but a dog bite he suffered shortly before the event forced him to be an observer. His loss was our gain as he brings an anthropologist's perspective to his observations of the event.

For three days in January of this year, Don Beale, Phil Ellis, Vernon Doucette, and Tom Milani worked at the Museum Support Center of the Smithsonian National Museum of Natural History surveying a variety of paddles in the collection. This issue describes the effort and provides a scan of one of the surveys.

Anyone who has participated in a Qajaq USA event has seen the Smurf gear, perhaps paddled a fleet kayak, or learned to roll with a blue avataq. Member funds paid for this gear, and the funds also go toward bringing guests to sanctioned events and producing the *Journal*. This issue includes a brief table of expenses, explaining in more detail how member dollars are used. Qajaq USA is run entirely by volunteers and efficiently marshals its resources to provide the most benefit for each dollar spent. If you're reading this issue and aren't a member, or if you've let your membership lapse, we ask that you consider joining or renewing your membership.

## EDITOR'S LETTER

At one of the Qajaq USA events I went to, Dan Segal said, "We're all mentors; we're all learners." When I first heard it as a student, I thought it was a nice idea, but I didn't believe it. The mentors all had ribbons on their hats, so it was clear to me who was who. When I eventually got into mentoring, it didn't occur to me that I could learn something from someone I was trying to teach how to roll.

Like a lot of beliefs I had when I was younger, this one has fallen by the wayside. The first time I tried the reverse sweep, I hit it. The problem was, I had no idea why or how, and had no success repeating it. Eventually, I worked out learning the second half of the roll by capsizing on the side on which I would come up and sweeping the paddle forward. With some help from Cheri Perry, I got a better idea on how to completely capsize and ultimately do the complete roll.

I brought these preconceptions into my teaching. I suggested that students break the roll down into steps: chest scull; capsize on the side you want to come up, and recover; then do the complete roll. It worked for me, after all. But it doesn't work for everybody and in fact can be confusing. After spending some time with one student trying to piece out the steps, I wasn't sure she was going to get it in the time we had. Then she asked if she could simply try the complete roll. Of course, she nailed it. Repeatedly.

I don't know that she learned much from me that day, but it was a good lesson for me: in observing the people I try to teach, and listening to them, I actually learn something myself. I only wish I realized it sooner.



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## PAST PRESIDENT'S LETTER

Dear Membership,

It is with great pleasure that I introduce Terry O'Malley as the one to whom I am passing the baton to become the next QAJAQ USA President. Many of you may have come to know Terry O'Malley as the energetic 'community builder' at QAJAQ USA Greenland Qajaqing events. You might also know him as the 'transporter' as he drives qajaq replicas everywhere along the east coast to give newbies their first opportunity to sit in a Skin on Frame, and to hold the Greenland stick for the first time. Still others know him as a fun-loving 'prankster' who is constantly pulling people onto the water for any possible reason.

As a close personal friend I have also come to know him as someone who possesses a deep knowledge and respect for the culture of Greenland Qajaqing. He is passionate and tireless about exposing as many people and youth to its legacy by inviting them to imagine the culture by sitting in one of the replicas at diverse outreach events in museums, library and fairs.

As a Board Member and Chair of the Public Relations and Membership Committees he has worked tirelessly to bring in new members from the diverse paddling groups with which he is involved. QAJAQ USA is grateful for his accomplishments.

In my role as Past-President, I look forward to supporting Terry in the next two years and to help him materialize many of the great ideas he will be putting forth during his two-year term as President. I am excited about the future of QAJAQ USA as Terry continues to build upon the legacy started by Greg Stamer and others over a decade ago.

It has been a privilege to lead and support Qajaq USA in its mission to be the US advocate of Greenland kayaking. Let us all heartily welcome and show our support to Qajaq USA's new President, Terry O'Malley.

Sincerely,  
Edward J. Zachowski  
Past President



## PRESIDENT'S MESSAGE

Dear Membership,

I am profoundly delighted to accept the position of President of Qajaq USA. It is a great honor to join the ranks, past and present, of the many people responsible for the creation, growth, and continued success of our organization and our extended community.

As president, I pledge to remain true to the mission of Qajaq USA to “support Qaannat Kattuffiat and their efforts to preserve, study and promote the traditions and techniques of Greenland kayaking while seeking to further the appreciation and development of Greenland-style kayaking in the United States.”

I hope to do this through expanding the number of Qajaq USA sanctioned events, enhancing our community outreach efforts, reintroducing and reinforcing our ties with Qaannat Kattuffiat and the Traditional Greenlandic Kayaking community at large.

As many of you who have attended Qajaq USA events know, there is a deep sense of community among the participants. I hope to make this sense of community available to a larger number of people by promoting smaller, Qajaq USA sanctioned, single day grass root mini-events in the same spirit and structure of our larger multi-day events. The mentoring approach and discovery process employed at these events are both refreshing and effective in allowing people to learn new skills and appreciate the culture. For many people, these events are their only chance to experience traditional qajaqs, paddles, tuiliks and aquilisaks, avataqs, norsaqs and harpoons, and Greenlandic Rope Gymnastics.

In addition to continuing to bring prominent Greenlanders to the US events to allow people to “learn from the source”, we will be stepping up our social media efforts to promote cross cultural ties to the Greenland Qajaq clubs and their members. We will also be looking to introduce or reacquaint our membership with some of the people responsible for ensuring that the traditions and culture of Greenlandic kayaking has survived and flourishes today.

On behalf of QAJAQ USA I thank you for your continued support of our organization by renewing your membership. Your support allows us to continue to provide such resources as our MASIK newsletter, QAJAQ Journal, free on-line forum, educational materials, building guides and links, and our fleet of replica qajaqs and gear which are available for use at Qajaq USA sanctioned events. I look forward to seeing you at an event soon!

Sincerely,  
Terry O'Malley, President



## Report from East Greenland by Sandy Noyes

All photographs © 2012 Sandy Noyes

### Arrival

It's surprisingly easy to get to East Greenland from the northeast United States. You must fly east to Iceland first, but then it takes only 2 hours flying west from Reykjavik by propjet to reach Greenland's east coast—thus eliminating jet lag. And it's only 5 hours from Boston to Reykjavik.

I was working out these logistics last spring because I wanted to see for myself what Tasiilaq was like—the place that produced the graceful “L19” East Greenland hunting kayak that I wrote about in *The Masik* in 2011.

An account of a trip to Tasiilaq in 2012 using direct observation might also be useful as an informal follow-up to studies of the town published by European scientists after 1970. Further, a photographic portrait of present-day Tasiilaq could be of interest to Qajaq USA members who take such pride in their replicas, especially if they are one of the East Greenland

reproductions we see at club events.

Tasiilaq and the district's small outlying settlements were the places where most museum specimens of East Greenland kayaks were collected. The accuracy of our replicas depends completely on surveys of these museum acquisitions.

I began my journal during the first leg of the flight: "On the geo-physical map of Greenland, all the colored areas showing mountains over 1500 meters are on the east coast, starting at Mt. Forel (3383 meters) near Tasiilaq." In other words, I will be in an extremely mountainous area compared with the smooth, rounded shapes of the Ilulissat landscape in West Greenland that I saw 4 years ago.

To recap fundamentals: Greenland is the world's largest island, all ice except for a fringe of green. The icecap is 700,000 square miles covering an overall land size of 844,000 square miles. The depth of the icecap is up to 10,000 feet.

I overnighted in Reykjavik, and then, on July 9, I left Iceland's domestic airport bound for Kulusuk, Greenland. From there, Tasiilaq is a 10-minute flight by helicopter. I bade farewell to Iceland as we passed land's end, the Snaefellsjokull—an extinct volcano, snow-capped, and looking like a mystical ice cream cone.

After experiencing Reykjavik, I knew I was headed into an utterly different landscape and culture. "East Greenland is one of the most isolated habitations in the world," says the tourist website. Yet the two countries are only 350 miles apart. Vikings from Norway inhabited Iceland after 874 AD, while East Greenland was inhabited by modern Inuit from about 1400. There were Viking farms in southern Greenland after 985 AD, but the Vikings disappeared after 500 years.

The most amazing fact of all is that Tasiilaq on the east coast was unknown to Europeans until 1884. It was, "in a way, a survival of 'pre-history'" (JR-L online).

11:29 a.m.: First sighting of sea ice, a circle-shaped cluster of icebergs perhaps 5 miles in diameter.

We are on Greenland time from now on, 2 hours behind Iceland time, almost the same as U.S. Eastern Daylight Time. Greenland in fact is part of North America if you look at the map. Canada's Ellesmere Island is only 18 miles away across the Nares strait at one point.

Out the window, more sea ice, like white lace in patches a mile square. No paddling possible here. The polar current is bringing this ice down from the North Pole region, according to my reading. On the right side of the plane, it is a vast ocean between Iceland and Greenland stretching to the north horizon and beyond. This is the Greenland Sea.

10:15 Greenland time: First landfall! Perhaps 40 mountains come into view at once—all of them are sticking

***The most amazing fact of all is that Tasiilaq on the east coast was unknown to Europeans until 1884.***

straight up like shark's teeth. They remind me of the shields of soldiers depicted in medieval battle paintings. There is as much snow as there is rock. As the plane gets closer, I can make out at least 10 glaciers of all sizes and shapes. No sign of mankind anywhere. I am looking down at valleys, fjords, moraines, snowfields, and razorback ridges, cliff faces. It is as if I am seeing an undiscovered planet.



*Approaching Kulusuk airport—probably the Igterajip Imô bay area, looking north toward mountains near Angmaggsalik Fjord.*

Soon we touch down on Kulusuk's dirt runway. I had assumed that by 2012 the strip would have been upgraded, but in fact, I learn that the dirt is there on purpose—macadam is too slippery for landing in winter—a mix of thin snow and finely engineered gravel being best for airplane tire traction.

10:47: Now in the Kulusuk terminal. The bay next to the airport is mirror smooth, just right for my L19 replica, which has proven to be quite squirrely in waves. Now I finally get it! I had been wondering: Why design a boat that has difficulty—a "kinngiavok"—

when negotiating big choppy waves?<sup>1</sup> There are too many small bergs here for waves to build up, which makes for, or used to make for, perfect seal hunting conditions for such a low-freeboard craft.

The helicopter to Tasiilaq rattles and shakes after takeoff, but the ride is awe-inspiring. It's an austere ragged coastline, but with curiously calm conditions today. In 10 minutes we are over the narrow ocean entrance of Kong Oscar's Havn, Tasiilaq's protected bay.

Eight of us step from the chopper, which has alighted on a patch of concrete not far from napping sled dogs. We walk uphill toward town.

Later on in my stay, the sound of this helicopter's comings and goings every few hours will become part of everyday town life.



*View west from Kulusuk Airport terminal.*

<sup>1</sup> "Kinngiavok" is the East Greenlandic word for a "cranky" kayak (Robbe 1986, p. 203).



*South end of Kulusuk Island, Cape Naujaangivit area, formerly Kap Dan.*

On the maps for the district, the coast is so indented by fjords, peninsulas, and inlets that features look like interlaced fingers of two hands. It's an ideal geography for hunting and water transport. A trip to the glaciers on my last day made it plain how critical the enclosed bay is for the town's survival. With an uninviting environment outside, which I experienced personally, the bay provides shelter, drinkable water nearby, food, beauty, and even electricity. The basin with its high rims affords the vertical drop needed to generate hydroelectric power. One saddleback had a lone cell tower on it. A sea-fog loitered out by the

entrance most days while I was there, even discouraging one tourist ship captain from coming in—to everyone's dismay, because they all had been preparing for the visit for weeks—while it remained sunny in the bay. Even the Saqqaq culture found sanctuary here. Prehistoric sites were discovered in Tasiilaq recently: "Møbjerg found several sites in Ammassalik (1988), comprising Saqqaq objects." (See Cultural Notes below.) One day I counted 12 small bergs and 1 big one in the bay. Bergs reduce fetches to a few hundred yards or less. The harbor itself is only 2.2 miles wide by 4.56 miles long, virtually a lagoon. It created ideal smooth-water seal hunting conditions over the centuries. I saw no waves over 6 inches in the harbor during my whole stay. And it's my belief that this made it possible for the master builders of the 1930s to design a tsaqqid with less than an inch of freeboard, providing extra camouflage for the hunt, because the hull was hard for seals to see during the approach.



*Entrance to Kong Oscar's Havn, looking south.*

Tinitequilaq, in contrast, base of operations for anthropologist Gert Nooter (Nooter 1991) doesn't have the luxury of a large protected bay. The Sermilik fjord opposite the town is 6 miles across and has a 33-mile fetch in a north wind. The southeastern fjord passage, the Ikâsagtivaq, stretching down toward Tasiilaq, has an 18-mile fetch in a north-west wind. There is a little harbor, however, called Sarpoq Âriâ, to the east of the village.



*Fog, Kong Oscar's Havn.*

*In Tasiilaq, it seems you are always looking up or down at everything but never straight across.*

Past the Tasiilaq heliport is an area by the water held sacred by the townspeople, called Ittun. There I found some interesting ruins.

### Settling In

In Tasiilaq, it seems you are always looking up or down at everything but never straight across. For a flatlander from upstate New York like me, or anyone from Delmarva, New Jersey, or Connecticut, looking only up and down is a different perceptual experience. In East Greenland mountains rise abruptly from sea level to about 3,000 feet. Normally, as in the Rocky Mountains, a 12,000-foot peak may begin its rise at 8,000 feet. In Tasiilaq the towering effect is quite similar, the difference being you start counting height at sea level.

Vast glaciers, upthrust mountains, and 23 hours per day of bright light have a distinct emotional effect. Weariness is washed from your eyes. The senses, already sharpened from the crisp and cool air, are so occupied with taking in alpine stimuli that there is no mental space left for past and future. You are drawn out of thought and out of yourself into presence.

This is the landscape that was home to the "tsaqqisikkeeperpor," the kayakman of old.



*Ruin at "Ittun," near heliport.*

At the hotel, "The Red House," I was directed to a separate building, which was the topmost cabin in the old section of town.<sup>2</sup> It had no running water or plumbing, just like the neighbor's cabin 20 feet away and all the small houses nearby. Water for each house is carried up by hand in large plastic containers, from the pump about 200 yards below. I saw my neighbor make

<sup>2</sup> In white letters, the words "Utiili Aapalartoq" were painted on the siding of The Red House. It reminded me that aappalartoq ("the red") is the nickname for the flag of Greenland.



*Dawn over Kong Oscar's Havn.*

and ammassat.<sup>3</sup>

"This is East Greenland!" was often the answer to my questions. This epithet required interpretation. Meanings might be a mix of:

"We get along without luxuries here."

"We do things our own way."

"This is a remote outpost."

"We are authentic."

"We lived here for hundreds of years without the outside world even knowing we existed."

"We are innovators."

"We are hunters."

And: "We have extraordinary alpine views."

That was true. Tasiilaq landscape is like Tyrol, the Tetons, Wyoming's Wind River Range, the Fjords of Norway, and the open ocean all rolled into one—with no coastal roads, no on-water traffic, and no crowds. The vista from my cabin deck was an array of craggy mountain forms extending 180 degrees, with patches of snow coming down to deep blue water. I was looking directly across at peaks of the Qimmeer-



*Dawn over mountains above Kong Oscar's Havn.*

six trips to the pump one morning. But we all have heat, electricity, and infinite views. My cabin was outfitted with a small indoor chemical toilet "for emergencies," but I was to use the showers and plumbing at the hotel down a steep hill and take my meals there, too. In effect, my room assignment allowed me to live as an East Greenlander—to be a "participant observer" of sorts.

The Red House had the flavor of a comfortable Swiss alpine hostel designed for hikers and mountaineers, with excellent local food served—including whale stroganoff

<sup>3</sup> Ammassat are small herring-like fish that swarm in the area during spring migration and are easily caught. The town was named Ammasalik (an older variant was Angmagssalik) for this reason, until it changed its name recently. The whole district is still called Ammassalik, from the same fish. I found ammassat mild and sweet tasting, delicious. Ammassat were undoubtedly part of the diet of the tsaqqisikkeeperpor.



*Overview of town of Tasiilaq.*

taajaliip Qaqqartivaa, 1003 meters at the highest. The mountains turned out to be most beautiful, tinged with gold at 3 a.m.

### **Townfolk**

Most older folk were on foot, climbing up and down the steep hills of the town, typically wearing a down vest for the midsummer temperature of 45–50 °F. There were about 35 cars, none new, and three taxis, and they drove fast. The macadam road network extends about 2000 meters from town edge to edge. On weekdays the town's several bucket loaders made a good

racket, but were delivering essentials. At noon, all the dogs broke into song at the siren. Otherwise, time seemed to stand still.

There is an East Greenlandic trait called "uppa." Uppa means "maybe" and refers to a certain philosophy about plans, appointments, or deadlines. Most obligations are "uppa" propositions if there is game to be had, but uppa can apply to most anything with a time relation. That's the way it is, and uppa is always understood.

One night at the hotel, the tour group was treated to a traditional drum dance. This is performed with rhythmic fortissimo singing, and tapping on the drum skin and rim with a flat stick from the underside. The dancer approached several women in the group closely and made a gesture to plant a kiss on their necks, to everyone's amusement. I happened to show a small boy some images a friend had taken of me doing a roll. Later whenever I passed the boy in the street, he made a paddling motion with his arms, with a big smile.



*Buildings in old section of town.*

Fine art crafts were also part of tsaqqisikkeerpor society. Examples of this artistry can be seen in the exquisite ornamental carving on throwing sticks on display at the museum.



*Cemetery in Valley of Flowers.*

## The Valley of Flowers

Wildflowers may seem like a marginal subject, but they play a role here, and many species are edible. The old and new sections of town (new is 1980 or later) are divided by a large stream and its ravine, and if you walk upstream you come to the “Valley of Flowers,” which could be considered the town park. It’s a wild alpine meadow a mile long with one meandering foot trail in the middle.

At the beginning of the path is the cemetery, where white crosses look out to the mountains much like the graves at Ilulissat that keep watch over the icefjordbanken.

The peaks to the west seemed new, as if recently pushed up in a tectonic event. Because the slope of the north and south valley walls was beyond the angle of repose (38 degrees for snow), avalanches in winter and spring could be a danger.

Identical white crosses in alpine sunlight combined to emit light like a beacon shining out from the amphitheater of grasses. I thought of Mathiassen’s finding that the ancestors of present day Tasiilaqimiit arrived in the latter part of the 14th century and what that implies about the tenacity and longevity of the settlement (Mathiassen 1933, 60).<sup>4</sup> That legacy is also alluded to in the gleam of the crosses. I realized that kayakmen of the 1930s (conceivably owners of the 189 kayaks counted in 1944) are buried here.



*Cemetery, view west.*

Further uphill was a glittering lake that is the town reservoir. Bluebells (“siamaaq”) gave a hillside a blue cast in low light. There were patches of cotton grass (“simi”), and a quantity of them looked like snow from a distance. I also noticed a yellow hawkweed species, dandelion, alpine campion, and a saxifrage species.

Yellows, magentas, and aquamarines of hawkweeds, champions, and bluebells looked like precious stones set into a thousand-acre hillside rock garden.

<sup>4</sup> Tasiilaqimiit means “people who come from Tasiilaq.” Also: “dasiilarmiit” means “people who live in Tasiilaq.”



*Flower at Rasmussen Glacier.*

At the glaciers I found a single specimen of dwarf saxifrage but a profusion of a white-magenta orchid-like flower, possibly a member of our coralroot family, living in alpine desert conditions.

The lavish purple-magenta national flower, Niviarsiaq (spelled Niivarsiaq here; “young maidens” in translation), a willow herb, grew alongside most town roads.

The effect of alpine climate on flowers is

much the same as anywhere else—low tundra, dwarf species—except to see that in Montana, you need to be above 10,000 feet. Here, you are at sea level, and sea level just under the Arctic Circle is above timberline. These flowers actually grow almost 24 hours a day, twice as long as their Rocky Mountain counterparts, because they keep growing all night in the summer light cycle. There are only 30 minutes of “nighttime” on June 20.

I saw no butterflies and only one species of small moth. There were two bird species, sea gulls and snow buntings. The buntings were numerous and had adapted to living around houses. Their song is a pleasant loud warble.

### Quest

I was mystified last year, when doing research for another article, to find out that the classic “tsaqqid” kayaks in Tasiilaq had vanished by 1972.<sup>5</sup> During 1944 there were as many as 189, and in 1950 there were 161, counted by the French anthropologist Robert Gessain (cited in Petersen 1984, p. 629). But in 1972 there were none left in Tasiilaq,

*I wanted to find some traces of the tsaqqisid—perhaps old frames hidden away in attics and basements.*



*Sign at Tasiilaq kayak club building.*

<sup>5</sup> There are many terms for “hunting kayak” on west and east coasts, but for this essay I’ll use the local term in Tasiilaq, which is “tsaqqid.” The plural of tsaqqid is “tsaqqisid.”



*Restored umiak at Tasiilaq museum.*



*Fiberglass kayaks at Tasiilaq harbor.*



*Barbed gaff stick at Tasiilaq Harbor.*

although there were 23 in Tinitequilaq that year—but only 6 of those remained in 1979 (JR-L 1986, p. 291).

I wanted to find some traces of the tsaqqid—perhaps old frames hidden away in attics and basements. I began at the harbor, where I found a hand-painted sign on a small building reading: “Tsaqqid-Tasiilaq.” It could be roughly translated as “hunting kayak from the place that is like a lake.” This sounded promising. Around the corner I found a bulletin on letterhead saying “Kayakklubben i Tasiilaq” and listing club officers. I decided to try to locate the “Formand” (Director), Jan Andreassen, and speak with him as soon as possible.

A restored umiak rested on a high rack uphill from the club building, part of the Ammassalik Museum’s display. It seemed an appropriate artifact, for it was by umiak that the first European reached Tasiilaq in 1884 (see “Brief History” at [www.eastgreenland.com/userfiles/file/Welcome%20to%20Tasiilaq.pdf](http://www.eastgreenland.com/userfiles/file/Welcome%20to%20Tasiilaq.pdf)). That umiak hull looked woefully inadequate for making the dangerous voyage from South Greenland 128 years ago.

I started finding kayaks at the waterfront, but no skin-on-frame types. Four plastic kayaks turned up, one tossed aside in a pile of debris, two upside down on the ground, apparently in use fairly recently, and one resting at a mooring in the harbor.

But all the action at the waterfront was focused on something else entirely—the



Wall display at Tasiilaq museum.

two motorboat wharfs. Among the constant comings and goings were men arriving from the hunt with rifles in carrying cases, a motorboat with a dead seal floating beside it on a leash, outboard engines being tuned or dismantled, boat interiors with three-barbed-hook gaffing poles and steel-pointed lances for fending off ice. I counted 64 motorboats, 2 trawlers, and 1 large cargo carrier. I also counted 13 Royal Arctic ship containers stacked nearby. The ambience at the commercial dock was industrial.

The community had apparently moved on from kayaking days to the era of the internal combustion engine—from human power to mechanical power. You could say that the grandchildren and great-grandchildren of the storied kayak hunters of the 1930s are now devoting their energy to small engine repair and maintaining and using a fleet of outboard motorboats as their primary hunting craft. That would reconfirm French scholar Joelle Robert-Lamblin's findings in 1986 (See JR-L 1986, pp. 293–94). It would also corroborate her observation that people here have always been quick to pick up a new technology.

At mid-century there was a kayak for virtually every family in town, but picturing that in 2012 is like longing for a lost golden age—because that life, ably described by Gert Nooter (1991) and F. Spencer Chapman (1932), is so far from what is happening now.<sup>6</sup> In Tasiilaq you have to think through reality as it is.

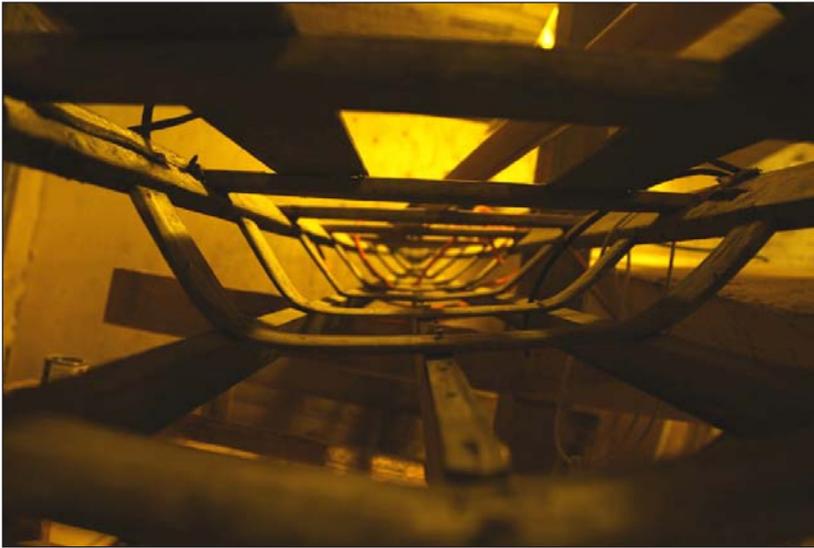
After I observed activities at the harbor for a few days, it was obvious to me that motorboats did in fact have the advantage in getting out of the harbor fast, and they could range far up the fjords and get back the same day, provided that there were no mechanical failures.

But on the downside, I also learned that seals shot at a distance with high-caliber rifles often sink before they can be gaffed; a number are lost this way in spring and summer. Hunters have to approach the dead seal at top speed in their motorboat or it will sink (in fall, seals may float longer because they have become fatter). Also, motorboats obviously can't maneuver on ice. Kayaks can and did, and paddles were often fitted with metal tips to get purchase on ice (see Golden 2006, p. 524).

But anyone can see that the motorboat is safer for the hunter than the kayak ever was. On my trip to the glaciers on the last day, I witnessed ocean waves coming from three directions in a rip by the harbor entrance in a

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<sup>6</sup> Also see Victor/Lamblin, 1989. Text and illustrations in this coffee table-size book give an intimate view of life in Tasiilaq 1934 to 1989. Includes drawings of 20 types of rolls.



*Frame of "Julia's kayak," structure forward of cockpit.*

rounded hull bottom. Carl-Erik Holm, the museum director, told me the larger one was made in 1950. There was a smaller one on the floor, perhaps made for a child.

### **Discovery**

Then Carl-Erik led me to a darkened building that served as a workshop for the kayak club. There I found the most interesting hull of the trip, an authentic tsaqqid frame, dusty and old and in process of repair, lit by a single light bulb.

Its unique feature was a set of original elbowed ribs, pegged in place forward of the cockpit, that were bent identically to form almost 60 degree angles at the chine. Several drawings in Harvey Golden's *Kayaks of Greenland* show similar bent ribs but with shallower angles (see p. 427 and p. 434) The sheer line was entirely flat; length was 18 feet.

The masik was 4 inches wide looking down from above. Distance from top of masik to the top of rib under it was 6-1/2 inches. That would be a tight fit. The frame's maximum beam at the cockpit was 19-1/2 inches—just like my L19 replica, which was based on an original collected by the archeologist Therkel Mathiassen in 1931. Gunwales had compound flare. The coaming ring was pegged. The forward deck had two stringers 3 inches wide and 24 inches long. (All measurements are approximate.)

The ribs aft were new curved replacements, lacking elbows. The isserfik, no longer attached, was double-el-

fog, and it was hard enough for our hefty speedboat to maintain control, never mind a kayak. Guiding services prefer to accompany kayak groups out beyond the entrance for that reason, as currents from three fjords meet there with the polar current.

The first true skin-on-frame kayaks I found were at the local museum. They were seal-skinned, although the skin was cracked, and they appeared to be from the period described by Robert Gessain as fourth stage (Gessain 1968, p. 163), with a more

***Its unique feature was a set of original elbowed ribs, pegged in place forward of the cockpit, that were bent identically to form almost 60 degree angles at the chine.***

bowed, and it looked as if it allowed for a comfortable standard Greenland roll, because the hunter's lower back would fit neatly into the recess in the layback position. Beams were mortised in 1 inch below top of gunwale. The bow was misshapen and may have been formerly damaged.

I learned that this frame is known as "Julia's kayak" and was made by her grandfather. Someone had half-completed a well-crafted hardwood-edged Greenlandic paddle, which lay on top of the tsaqqid coaming. Using Gessain's (1968, p. 163) design classification system, this kayak is from third stage, with straight stem projections—the situation he found in 1935.



*Tobias's skin-on-frame kayaks in storage.*

Julia's kayak was a first-class find, and I was convinced it was the real thing. The discovery of Julia's kayak made the existence of the 160 tsaqqid in 1950 much less of an abstraction and more valid for me at a visceral level. Julia's was like an ambassador for all of them, a symbol that stood for the whole, and it was a thrill to find a relatively untouched original in the flesh, so to speak. It was like an archeological find. Instead of excavating, you had to open the right doors.

I realized then that it wouldn't take many years for sealskin kayaks to deteriorate in Tasiilaq's extreme climate if left outdoors. Intricate frames made of spruce driftwood are not likely to last.

But Julia's wasn't the only tsaqqid in town. There was a well-preserved sealskin tsaqqid on display in the formal breakfast room at the town's tourist hotel, Hotel Angmagssalik. Jan Andreassen told me that this was likely the same hull that was used in the 1937 movie *Palo's Wedding*. It was poignant to see this iconic hunting machine, looking very much like my replica, being shown off like an old trophy moose head at an Adirondack lodge.



*Harpoon practice at Tasiilaq Harbor.*

Back at the darkened room next to the

museum, there was a second kayak, with white canvas skin intact, but the form suggested a build after 1970 and of no discernable design lineage. The third was a shorter kayak frame under construction, with gunwales and seven beams only.

After some detective work I found two other skinned kayaks in the rafters at the supply house for the outfitter associated with The Red House. They were owned by Tobias Ignatiussen, a partner in the hotel business. These two hulls were in good condition, probably post-1970 construction, but were evidently not in use.

One day I spotted a man throwing a harpoon at a target in the harbor. He was in a small, homemade white fiberglass kayak, rough-hewn, and he had evidently taught himself how to sculpt in fiberglass using additive process. I also saw a skiff formed by him out of the same patchy white material. The kayak had a cockpit with fiberglass coaming, no bulkheads, a 10-inch diameter unfinished hole 8 inches behind the cockpit, and was 12 feet long when I paced it out later.

Jan Andreasson told me that there used to be a tradition in East Greenland of building smaller SOFs for travel in rough water. That may be new data for kayak historians and could explain the smaller size kayaks both at the museum and the warehouse.

The kayaks in the Tsaqqid-Tasiilaq clubhouse were all made of fiberglass, it turned out.

In all, I found eight skin-on-frame kayaks. My curiosity was satisfied.

### **Tsaqqid-Tasiilaq**

I found out in my visit with Jan Andreassen that the trip to the west coast from the east coast takes 2 weeks by ship and that the ship goes only to the west coast but doesn't return back to the east coast. To participate in Qaannat Katuffiat competitions, the team would have to leave their kayaks on the west coast and fly home. That would be completely impractical. So while they are able to compete and are entitled to compete, club members can't get to the competition.

An article in the August 2009 issue of *Sea Kayaker* mentions that the club was officially inducted into Qaannat Katuffiat in 2005, when Suzanne Jars was club president. That would make Tsaqqid-Tasiilaq the equivalent of a sister organization of Qajaq USA. The article is called "The Women Kayakers of Greenland," by Martin Nissen, and incidentally includes a picture of the wife of anthropologist William Thalbitzer paddling a large tsaqqid in Ammassalik fjord 1906. Her husband was one of the first European scientists to describe the people of Tasiilaq at the beginning of the 20th century.

### **Game**

With my short time frame, I had to rely on whale watch participants for an account of a trip to the giant Sermilik fjord. The fjord is 51 miles long and 8.5 miles wide at its widest, and is easily spotted on satellite photographs of the coast. The Sermilik was important hunting territory for the Tsaqqisikkeeperpor in early to mid-20th century.

A gentleman at the hotel told me he saw two hunters reclining on an iceberg behind a white blind with rifles at the ready. Their motorboat was tied up behind the berg. Later, in his motor skiff he was 5 meters from an adult humpback whale, which then proceeded to swim—harmlessly—under the skiff. He said seals did appear in the fjord but that they “submerged very fast.” However, he saw seals reclining on another berg later. The day he was on his trip, it was flat calm in the fjord. The day I went out in a neighboring fjord, it was anything but.



*Heading north up Sermiligâq Fjord.*

Timothy, a knowledgeable glaciologist at the hotel, told me that narwhal are still hunted by kayak at a fjord to the north, the Kangerdlugssuak. The approach is made in a large boat with kayaks on deck. Hunters get into their kayaks at exactly the right place, because if narwhal hear the sound of propellers, they shy away. For this reason, narwhal can *only* be hunted by kayak.

When Timothy and his colleagues told me about walking by a polar bear carcass behind my cabin, it brought home the point that such finds—including the intact

whale backbone I stumbled over near the harbor—are to be expected when you are visiting a hunter society. It is we foreigners who have gradually isolated ourselves from the one unavoidable fact of the hunt, that the animal must be, will be, dispatched, as we say euphemistically, and then we clean everything up so as to make the event invisible, or we carry it out behind closed doors in “abattoirs,” so the public never sees what happens. Yet packaged meat product in supermarkets is acceptable to most of us. In East Greenland there is less inhibition. I found it bracing once I got over the initial jolt. You could say that skin-on-frame kayak purpose and design are part of the phenomenon of direct contact with food sources. In fact the kayak was the vehicle par excellence for direct contact with the source of protein.

You could say that in kayak hunting days that the life cycle of the seal was part of the design and useful life of the tsaqqid. But while the seal could get along very well without the tsaqqid, the Tsaqqisik-



*Sermiligâp Gingertivâ.*

keeperpor could not get along at all without the seal.

### The Enchanted Pond

*"...Some of the subtlest secrets of the seas seemed divulged to us in this enchanted pond."*

—Herman Melville, *Moby Dick*, "The Grand Armada"



*Face of Kârale Glacier, looking west.*

On my last day I was invited to join a German tour group on their trip to two spectacular glaciers, the Knud Rasmussen and the Kârale. The tsaqqisikkeeperpor likely hunted for narwhal in the fjord headwaters years ago. After a 40 mile ride up the Sermiligâq Fjord, with fog and 4-foot waves, the fog burned off, wind ceased, water turned a blue-green white, and we found ourselves at the inception point of the fjord and at the termini of the two glaciers.

On the chart, the head of the fjord looks like the floor plan for a cruciform cathedral, with Kârale as left transept and Rasmussen as right transept, the fjord as nave, and the Qaersertivaq cliffs as altar. The spire would be the mountain behind the cliffs, 1500 meters high.

Earth, sky, sea, and ice combined to form a saturated milky viscera 5 nautical miles across at the Sermiligâp Gingertivâ, the head of the fjord, which is a sister to the headwaters of the colossal Sermilik fjord

20 miles to the west, where two glaciers meet at right angles to the fjord in a similar confluence. We would have to face the wind tunnel and waves going home, but for now peace reigned except for an occasional thunder crack as some deep internal stress was relieved. You sensed the latent tension in these two rivers of ice, which could be released at any moment, but for the meantime it was the meeting place of great calm beings and the incubator of bergs. It's a place that engenders transcendental thoughts. But mankind has no significance here;



*Face of Rasmussen Glacier.*

we're just two tiny red dots floating in a lake of cerulean. What you see here surpasses all naming. It could be the origin of all names or it could be beyond nameable, a place of blinding light and generativity, a crucible, the birthing chamber for ice bodies from where they begin their journey to the sea—though the place is massively indifferent to human imagination. For that matter, no one would be able to dream up anything as fantastical as this.



*Going south toward Tasillaq on Sermiligâq Fjord, Rasmussen Glacier in background.*

Scientists invented the word “calving,” but it’s not just a curious term alluding to a bovine mother in labor. If there were a calving event anything like what my glaciologist friends describe—an entire 1/2-mile section can break off at once—our enchanted pond could turn into a maelstrom and we might all end up in the drink.<sup>7</sup> Instead, we rafted the boats together and it’s time for *kaffee* and conversation.

At Rasmussen glacier we met up with a small group of hikers coming off the ice. The leader was sporting an Australian hat and carried a high-power rifle, but when I asked Robin, our tour

leader, if this wasn’t a bit of posturing, she exclaimed: “Oh no, you must carry one, on account of polar bears who walk the edge of glaciers! They are hungry especially in spring, and are very dangerous.”

On the way to the glaciers, in Ikateq fjord, we passed a forlorn-looking former U.S. airfield from WWII, with thousands, literally thousands, of rusty gasoline barrels lying around in piles, left behind when the base moved to Kulusuk. Ugly in this pristine glacial setting. Known as “Blue East Two,” the strip operated from 1942 to 1947.<sup>8</sup>

Kârale is about 25 km in length but formerly had arms where it met the sea. Each arm is now a separate unnamed glacier because of melt. Rasmussen is about 30 km long and at its origin it joins up with the September Sixteenth and the Håbets glaciers, which flow off to the northwest.



*Sled dogs, ship and sled near heliport.*

<sup>7</sup>To see what this situation looks like actually filmed, go to: <http://video.msnbc.msn.com/nbcnews.com/50199593#50177491>

<sup>8</sup>For more detail, go to: [http://en.wikipedia.org/wiki/Blue\\_East\\_Two](http://en.wikipedia.org/wiki/Blue_East_Two)



*Sled dog, sled and skimobile, Tasiilaq.*

Only the infrequent report indicated that this ice is alive and flowing downhill into the sea—at a glacial pace of course. But glacial pace is faster than you think: nearby Helheim travels 28 meters per day.

Heading home was quiet at first, but soon the wind and waves were disagreeable and it became very cold, with much spray and shocks to the coccyx. It would have been hell in a kayak. I couldn't help but remember that, seated in the tsaqqid, you are separated from the sea only by a thin membrane and a half-inch of freeboard.

That places the onus on great skill if you are going to operate in these waters.

We passed a small motorboat up there headed north at 8 p.m. and gave them a wave. Of course, with 23 hours of light, you can head out whenever you want this time of year.

I was able to talk briefly to the tour group about my research on the tsaqqid—with Robin, their guide, translating into German. She had been exposing them to a steady stream of East Greenland history and culture, including the film, *Palo's Wedding*, with its dramatic tsaqqid chase scene at the end, so it was fitting to contribute something about hunting craft.



*Norsaq decorations, Ammassalik Museum.*

## Essences

It was sad to leave this complex and beautiful community, and I knew I would miss my sunlight-filled kitchen at 4 a.m. Ittuarmgjit!<sup>9</sup>

## What is the essence of Tasiilaq?

It is still a hunter society at heart, but the means have changed. It's still the only large town (population about 1800) in a 1750-mile coastline, except for 460 souls 500 miles to the north at Ittoqqortoormiit and various small outlying settlements. Kayaks are out, except for narwhal hunting at Kangerdlugssuak fjord. High-powered motorboats are in. Although sledges for dogsled-

<sup>9</sup> "Goodbye!" (Robbe 1986, p. 240.)

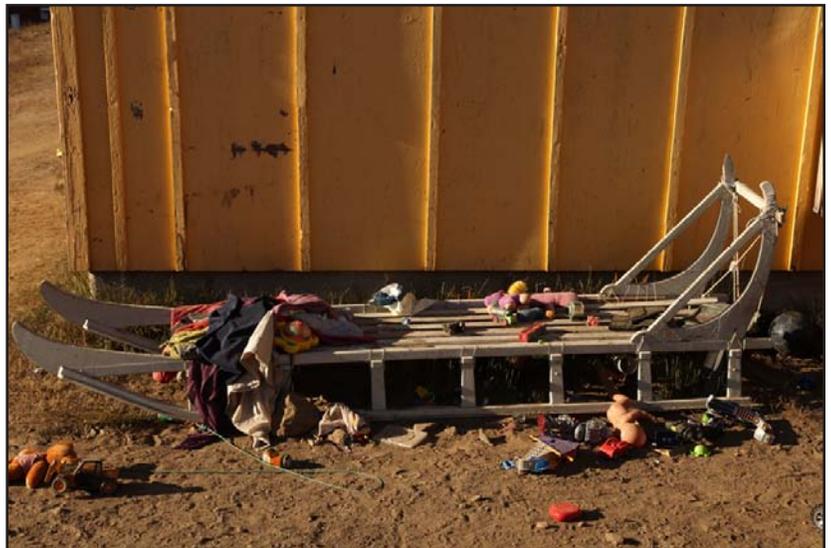


*Sled dog puppies in old section of town.*

ding are visible everywhere in town, I was told that the trend is toward use of skimobiles. Tasiilaq went from Stone Age to internal-combustion age in 88 years—a rapid acceleration with not always very good outcomes (see JR-L online).

There is a desire to build skin-on-frames at the kayak club, but materials and available time are in short supply. There is currently no practical way to get to Qaannat Katuffiat events on the west coast. But it sounded like a revival of skin-on-frame building could occur in the future if conditions improve.

Mathiassen made a prediction in 1933: “At the moment, an East-West mixed culture is prevailing; in the course of the next decade or so it will be entirely West Greenland” (Mathiassen 1933,144). But many decades have passed and it hasn’t happened entirely yet. You see cell phones, computers, a short ski lift—“We ski all winter!” said Miki, a local acquaintance—and satellite disks on old houses, but you also see water being carried by hand to houses without plumbing. Land is communal as it always has been. The ages-old East Greenland language Tunumiit Oraasiat is still spoken at home—but not taught at school. Yet it persists.



*Sled in use as playground, near post office.*

The harbor is like a protective nurturing deity as it has been since the 15th century, providing life’s essentials. The “Alps” of Greenland, looking down on the village as they always did, form a crown around the bay. But the Piteraqa wind has been clocked at 200 mph (360 km/hr) in winter, can arrive at any time, and is not always possible to predict. Apparently the only warning is lenticular-shaped clouds (*Hiking Map East Greenland, verso*).

Soccer is an important sport and the players are excellent athletes dressed in colorful uniforms. Fine crafts persist and are still made by what William Thalbitzer called “Greenland’s most exclusive, most complex, and most artistic com-

munity” (Thalbitzer 1914, 732). There is a beautiful new school with European standards of teaching.<sup>10</sup> But there is no fish processing plant to boost the economy like the one in Ilulissat.

The desire to hunt still hangs in the air almost palpably. It has been historically an absolute necessity here. Sled dogs nap next to the helipad amid patchworks of white “simi.” But I was told not to approach the dogs. Sled dog puppies play in debris around houses. Children have converted a sledge into a miniature playground.

Once in a while you see a contrail in the sky: the London to Kennedy flight? Without the helicopter service, it would feel almost like the 1930s here. I was vaguely aware of how isolated Tasiilaq is and was. “Tunumiit” literally means *from the hinterlands*. When icebergs block the harbor entrance, the town can be blockaded for days. The first supply ship from Denmark, one of only six to eight per year, arrives in June of each new year (see the *EastGreenland.com* site); the town is on its own for the first 6 months, and on December 21, the longest night, there are 21 hours of darkness. Without fresh game, the townspeople would only have expensive Danish imports to eat. Whale remains and polar bear carcasses create a certain primal aura.

Tasiilaqimiit continue to live intimately with nature, and close to some essential heartbeat or timeless source. The Saqqaq partook of it too, in the same place thousands of years ago. They too were immersed in marine life processes. There is a heightened sense of reality in Tasiilaq, and a sensation of the wholeness of time and space. To be there is a planetary experience. The coastline today looks like what the north near the Arctic Circle probably looked like before our species assumed its present form.

## Postlude

*“This is as far from crowded tourist destinations as you’re ever going to get....”* (Destination East Greenland brochure)

Tasiilaq today is an attraction for mountaineers and serious backcountry hikers who are looking for unspoiled wilderness. “Always assume you are left completely to your own devices and that only very limited assistance is available for the hill walker, such as marked paths,” says the verso of the hiking map.

Foreigners like me come to love Tasiilaq and long to return. The harbor perimeter and smooth water invite exploration by kayak. Tasiilaq could become a destination for kayakers, who can enjoy the scenery while knowing that only 50 years ago, this was home port for a species of sleek hunting skinboat without parallel—the tsaqqid and the skillful man who paddled it, the tsaqqisikkeepor.

East Greenland is a “free country,” said Robert, the hotelier at the Red House. I think I now know what he meant.

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<sup>10</sup>See “School” at: <http://www.eastgreenland.com/userfiles/file/Welcome%20to%20Tasiilaq.pdf>

## Language

The East Greenlandic language is not as distinct from that of the west coast as, for instance, Portuguese is from Spanish, but it also is much more than an accent, as west Texas would be to Brooklyn. East (speaking “Tunumiit Oraasiat”) can understand west, but west cannot understand east. In town, west coast Greenlandic is taught in school, but traditional East Greenlandic is spoken at home. Especially when spoken by girls, Tunumiit Oraasiat pronunciation seemed soft and delicate to my ear. At times I heard vowel sounds that resembled Quebecois. Chapman made a similar point: “The east coast has a soft language sounding almost like French” (Chapman 1932, 83).

***There is actually no official way to spell words in East Greenlandic, and even pronunciation can differ from individual to individual.***

An important contribution was made in 1986 by the French scholar Pierre Robbe, who published a dictionary with entries in East Greenlandic, West Greenlandic, Danish, English, and French. (See Robbe 1986 and [http://uz-translations.net/?category=paleobokspaleosiberian&altname=tunumiit\\_oraasiat\\_eastern\\_greenlandic](http://uz-translations.net/?category=paleobokspaleosiberian&altname=tunumiit_oraasiat_eastern_greenlandic).) Most East Greenlandic nouns are different from West Greenlandic. This table of examples is based on Robbe 1986.

English	West Greenlandic	East Greenlandic
kayak	qajaq	tsaqqid
deck beam at aft end of coaming	isserfik	eserpik
coaming	paaq	saqqisip paaja
curved deck beam supporting forward end of coaming	masik	masek
rib	tippik	tippik
		saqqisiguvik
sealskin float	avataq	puttarngit
throwing stick	norsaq	ajatsit

## Photographer’s Note

All subject matter I found had a cultural element present, be it sleds or sled dogs, drying halibut, snowmobiles, outboard engines, or mountain crags. Colors were saturated, and heavy textures made surfaces come alive. A “cubist” geometric arrangement of buildings gratified every desire for dynamic composition.

The sun “set” behind a mountain in the northeast and “rose” an hour or two later in the southeast (it never gets totally dark in July), so you can photograph anytime you want in a 24-hour period. It seemed that the sun was going around in a circle in the east, overhead at noon but never completely below the horizon in the middle of the night.

Tasiilaq is more primal and more culturally unique than any place I have ever seen. There is a time warp, conducive to thinking in geologic time.

I photographed for two days in pearly overcast lighting, mostly in the old part of town. For my remaining time it was clear and sunny. Most days were in the low 50s (°F), but with the intense sun, I found walking around all day and into the half-twilight quite comfortable. On the third day it was crystal clear except that wreathlike bands of fog came in from the harbor entrance and appeared to flow like water up and over ridge crests and down again. I used a hand-held digital SLR, set at about 1 mega-byte file size.

The man who paddles a tsaqqid is a “Tsaqqisikkeerpor.”<sup>11</sup> In West Greenlandic that man is a “qajartorpoq.” Other examples are: Immikkoortoq (East Greenlandic) means island, not qeqertoq (West Greenlandic). Kangersik means fjord, not kangerluk; sigivit means pack ice, not sikorsuit; imeq means lake, not taseq; kaattuulit means sledge, not qamutit (based on Robbe 1986, p. 184)

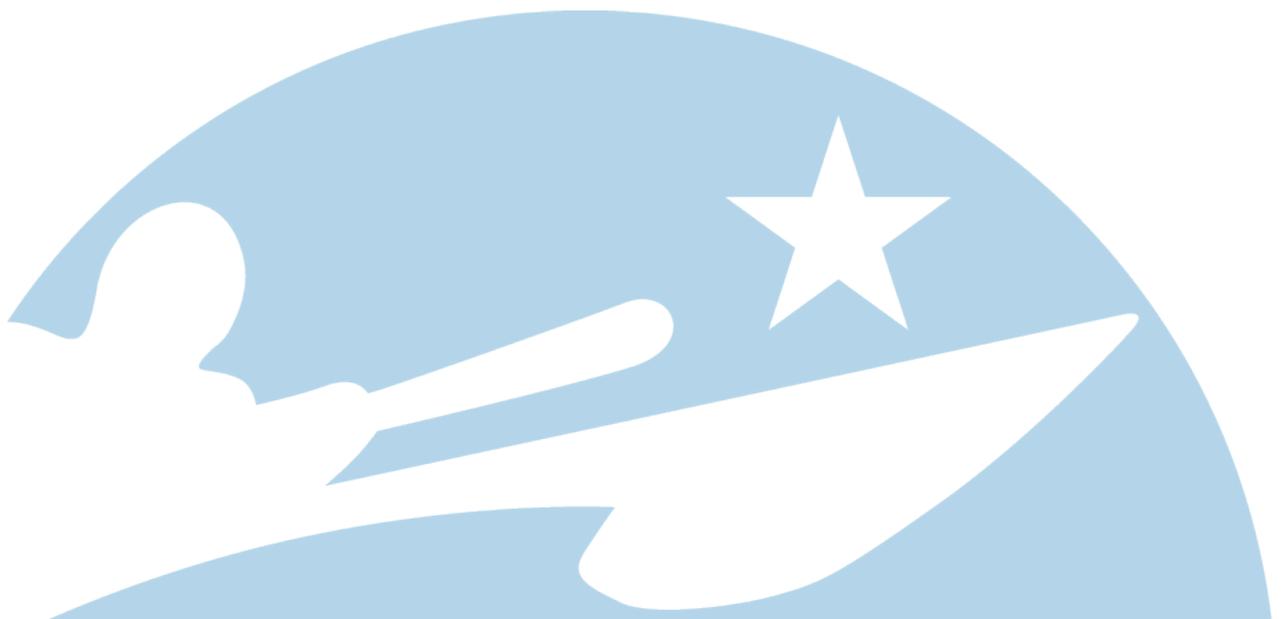
There is actually no official way to spell words in East Greenlandic, and even pronunciation can differ from individual to individual. *Tunumiit Oraasiat* is a fluid and changeable affair. It allows a person to use language in his or her own way—to an extent (See Robbe 1986, pp. xix to xxi). Being free is part of the flavor of living in Tasiilaq. Individualized language is of a piece with individualized tsaqqid construction. A person’s unique body dimensions determine the kayak form. The skin-on-frame kayak fits like a bespoke suit if made properly. It sounds like language too can be customized.

Language should be of interest to owners and builders of East Greenland replicas, for *Tunumiit Oraasiat* would have been the language that all hunters used during the hunt and on land. In a sense, *Tunumiit Oraasiat* is part of the identity of the tsaqqid.

For this article it seemed appropriate to be faithful to hunting tradition and use *Tunumiit Oraasiat* vocabulary.

### Acknowledgments

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<sup>11</sup>2012 source—see notes at end of references section. It’s important to know also that consonants at the end of words are not ordinarily pronounced (Robbe 1986, p. xxi). Also: Robbe gave “sarilerpoq” as a word for “paddles a kayak,” but gave no plural spelling (Robbe 1986, p. 204.)

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- . 1941. *The Ammassalik Eskimo: Contributions to the Ethnology of the East Greenland Natives. Second Part/ Second Half volume*, Kobenhavn, C. A. Reitzels Forlag, 1941. This book is primarily about customs, and gives a good picture of the life of people living in Ammassalik in the early 20th century. This volume can be downloaded complete as a pdf at: [http://openlibrary.org/books/OL23276073M/The\\_Ammassalik\\_Eskimo](http://openlibrary.org/books/OL23276073M/The_Ammassalik_Eskimo) or read at: [www.archive.org/stream/ammassalikeskimo02thaluoft#page/n45/mode/2up](http://www.archive.org/stream/ammassalikeskimo02thaluoft#page/n45/mode/2up).
- Victor, Paul-Émile and Joëlle Robert-Lamblin. 1989. *La Civilization du Phoque*, Jeux, Gestes, et Techniques des Eskimo d'Ammassalik. Paris: A. Colin and R Chabaud.

### Cultural Notes:

Museum: The Ammassalik Museum [Tasiilaq Katersugaasivia], Carl-Erik Holm, Museumsleder, Postboks 112, 3913 Tasiilaq.

You can view the kayak from Palo's Wedding at: [http://www.tripadvisor.com.my/Hotel\\_Review-g1096226-d609255-Reviews-Angmagssalik\\_Hotel-Tasiilaq.html](http://www.tripadvisor.com.my/Hotel_Review-g1096226-d609255-Reviews-Angmagssalik_Hotel-Tasiilaq.html).

For more detail on drum dancing see: <http://www.eastgreenland.com/database.asp?lang=eng&num=203>. A short video of a drum dance being performed recently in Kulusuk can be viewed at: [http://search.yahoo.com/search;\\_ylt=A0oG7iJla8ZQgC8A69IXNyoA?p=tunumiit%20oraasiat&fr2=sb-top&fr=yfp-t-701](http://search.yahoo.com/search;_ylt=A0oG7iJla8ZQgC8A69IXNyoA?p=tunumiit%20oraasiat&fr2=sb-top&fr=yfp-t-701).

For a detailed study of amulets and their use in Tasiilaq to show respect for seals and to communicate with them, see Gulløv 2009, pp. 250–255 (“...it is only in Ammassalik that the carvings of the hunted animals occur on the hunting equipment and on the fittings of the kayak....” Gulløv, 2009, p. 251).

The townspeople are in all probability the descendants of the kayakmen of the thirties and forties, and some of the homes shown in photographs were likely the former homes of these master hunters. You can read about the customs, rituals and life style of the kayakmen and their families in Thalbitzer and Mathiassen (Mathiassen 1933; Thalbitzer 1941.) Rituals for resolving disputes are especially interesting to visualize and apparently were very important for maintaining social harmony. (See <http://www.eastgreenland.com/database.asp?lang=eng&num=203>.)

Saqqaq Culture existed in Greenland between 2400 BCE and 800 BCE. For a recent article on DNA findings, Go to: <http://www.scientificamerican.com/article.cfm?id=ancient-human-genome>

For more information about Saqqaq objects, see <http://natmus.dk/en/forsknings-og-formidlingsafdelingen/etnografisk-samling/sila-arctic-centre/prehistory-of-greenland/saqqaq/> and search under “History of Research.”

For a detailed description of a narwhal hunt from kayaks, see Northern Lights, The Art of Kayaking, p. 8, at: [www.arctickayaks.com/PDF/Chapman1932/chapman.pdf](http://www.arctickayaks.com/PDF/Chapman1932/chapman.pdf)

### Language sources:

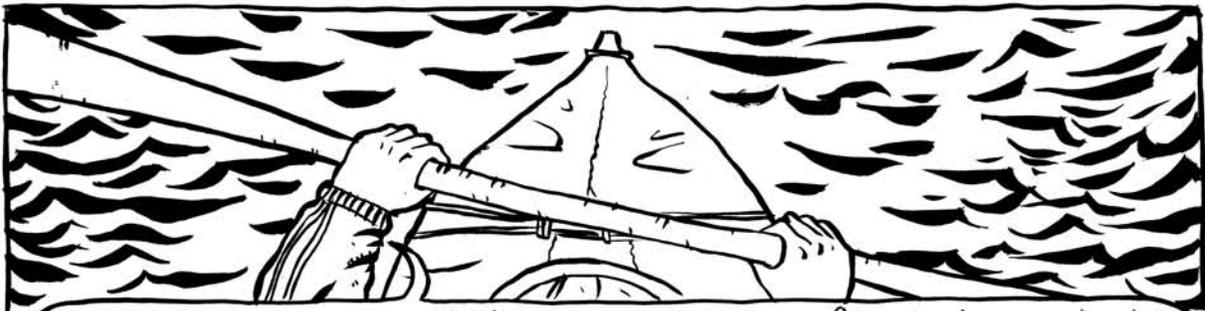
—For “tasiilaqimiit,” Suzanne Jars of Tasiilaq, personal communication, 2012

—For “tsaqqid” and “tsaqqisid”: Aviaja Lyberth of Nuuk, personal communication, 2011.

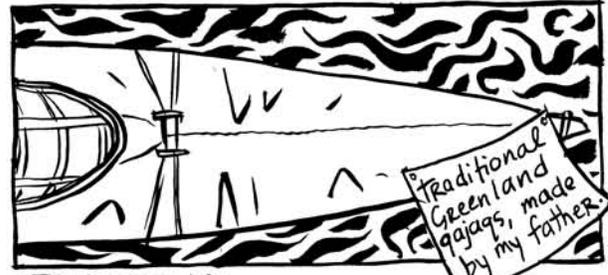
—For “tsaqqisikkeerpor” and “dasiilarmiit”: Jan Andreassen of Tasiilaq, personal communication, 2012.

*Author bio: Sandy Noyes has been making photographs for 50 years and paddling kayaks since 2005. He graduated from Yale University in 1963, and began researching Arctic Greenland five years ago with a trip to Ilulissat.*

# MOLLY OSTERTAG COMICS



Some of my strongest childhood memories are of navigating a slender, hand-crafted boat through the chilly waters of Nova Scotia. I also remember marvelling with my parents at the bulky plastic kayaks used by tourists.



## HOW TO BUILD A TRADITIONAL, SKIN-ON-FRAME, GREENLAND QAJAQ\*

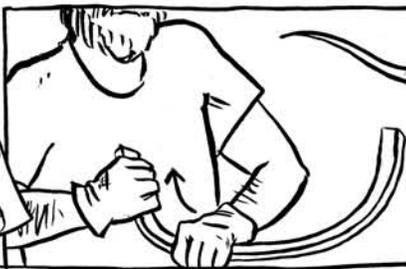


First, buy the right piece of wood - something soft, like white pine or yellow cedar. Most of the qajaq will be cut from this, beginning with the gunwales.

Mortises are cut into the wood to receive the ends of the deck beams inside and the ribs below. The ends of the gunwales are held together with dowels.

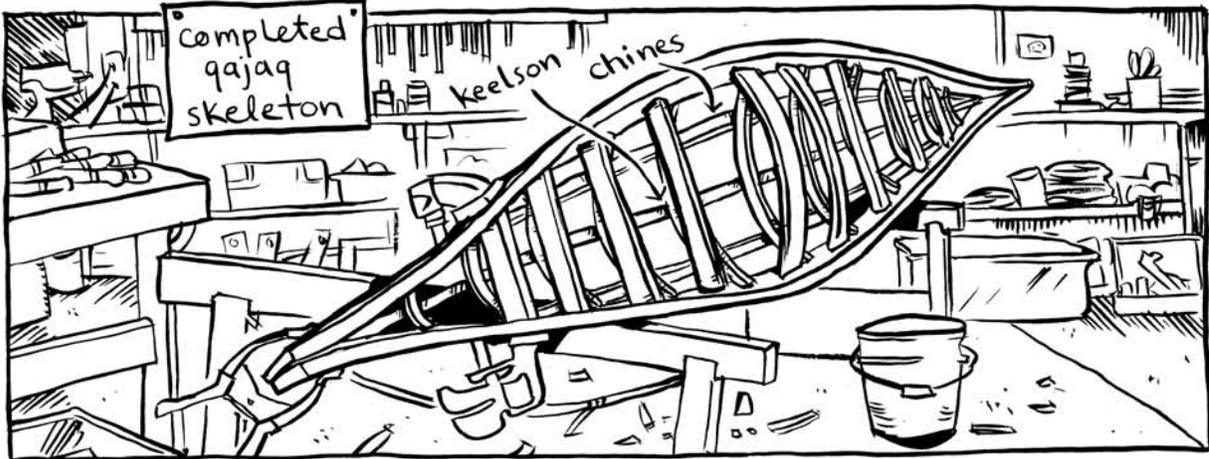


After the deck beams are in place, put the ribs in a steam box.



The ribs are quickly bent into shape and clamped in place in the qajaq.

\*"kayak" is an anglicization of this Greenland word.



Everything is lashed together using fake sinew.

Unless you're in Greenland, where they use real sinew.



The coaming hoop, which will be the qajaq's entrance, is bent into shape.

clamp

coaming (6' circumference)



Then, the -traditionally seal-skin (we use nylon) is sewn on to the frame.

coaming is sewn into skin



Finally, the skin is painted with tinted polyurethane to make it waterproof.

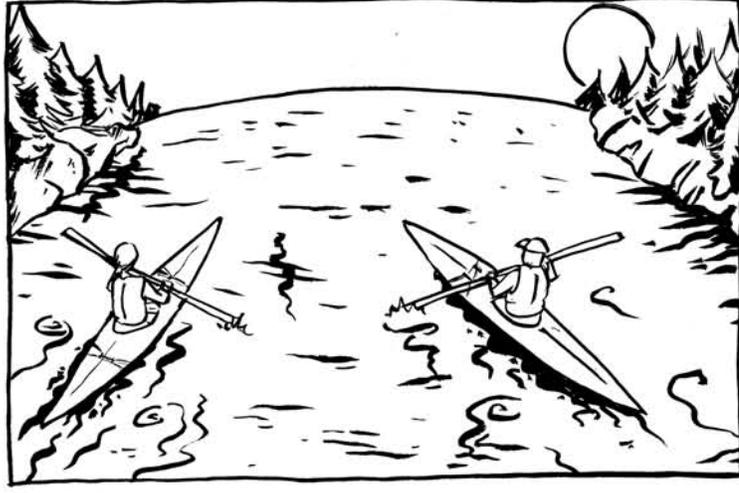
Is that all you need, Molly?

Yeah, thanks Dad!



Want to take her for a test run?

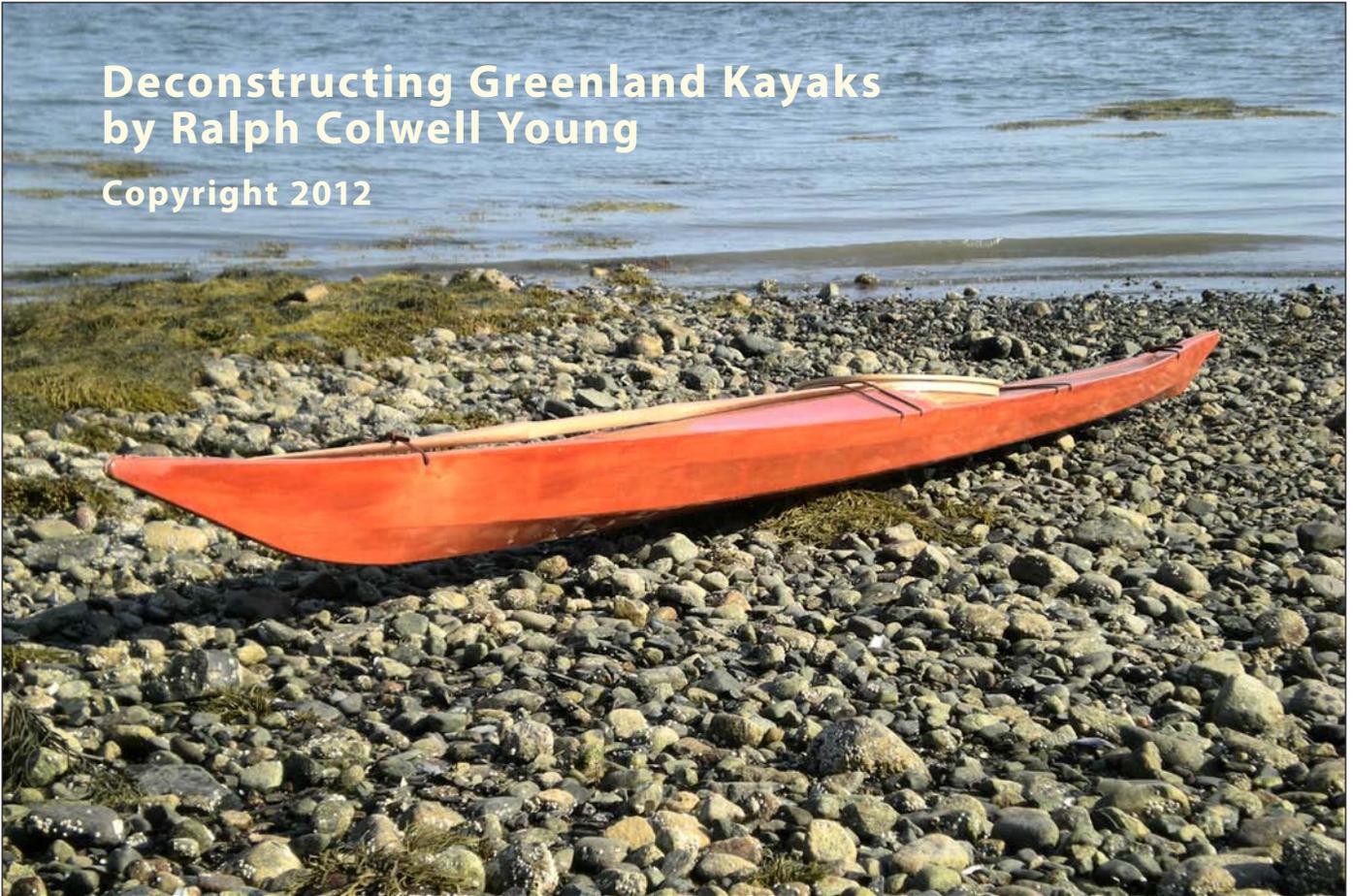
Yeah!



Molly Ostertag grew up in the lush forests of the Hudson Valley and now lives in New York City. During the summer she works at a fantasy adventure camp for teenagers, and for the rest of the year she makes and studies comics and illustrations at the School of Visual Arts. She also draws *Strong Female Protagonist*, a twice weekly webcomic about superheroes and New Yorkers. You can see more of Molly's art at [www.mollyostertag.com](http://www.mollyostertag.com).

# Deconstructing Greenland Kayaks by Ralph Colwell Young

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## Introduction

Reverse engineering is the process of disassembling someone else's product to discover how it works. The idea of reverse engineering a kayak first occurred to me when I was building a replica of a Disko Bay West Greenland kayak (plate 67, page 308 of Harvey Golden's *Kayaks of Greenland*) under the direction of Mark Kaufman at the Wooden Boat School. I was so impressed with the elegance of the kayak that I decided to study the vessel in greater detail, subjecting the components to detailed engineering analysis. There's a saying in research and development: "Well, it works in practice, let's see how it does in theory." The Greenland kayak clearly works in practice, so I decided to learn why.

*The Greenland kayak clearly works in practice, so I decided to learn why.*

I was in the shop getting ready to steam bend the ribs, which were white ash strips of wood about an inch wide and 1/8" thick. I made a table that listed the rib number, the width of the rib as measured from gunwale to gunwale (or sheer boards as Peterson calls them), and the depth of the rib as measured from the top of the gunwale to the top of the keelson. Halfway through the table I realized that my table was a crude approximation of the cross-sectional area of the kayak (below the gunwales) at each rib. Narrow and deep at the bow and stern, wide and shallow at the cockpit. Having the cross-sectional area allowed me to prepare a crude approximation of the volume of the each section (at or below the waterline), which allowed me to prepare a crude approximation of the buoyancy

of each section. Why would you do such a thing, you ask? This is the kind of thing that engineers do to entertain themselves.

In this yin and yang world of opposing forces, buoyancy is what kept the Inuit alive, as it does all mariners. Buoyancy is the property of a fluid to exert an upward force on a body that is wholly or partly submerged in it, and per Archimedes, a floating object displaces its own weight in fluid. Gravity is the relentless enemy—lose your buoyancy, or move it to the wrong place, and you end up wet, cold, and possibly dead. There are an infinite number of ways that buoyancy can be distributed in designing a boat. My revelation that day in Maine was that the Inuit distributed buoyancy relatively uniformly from the bow to stern. I was in awe, because the shape of the hull changes dramatically from the bow to the stern. How could the volume be relatively constant when the hull changes shape from rib to rib? In my mind, this was evidence of some pretty serious engineering. I expect that level of sophistication out of modern kayak builders armed with computer-aided design and manufacturing tools, but not an isolated indigenous society. Without the benefit of written language, the Inuit designed and built kayaks that are, in my opinion, more sophisticated than production kayaks. In fact, our motto in the class was “The best boat that money can’t buy.” But back to buoyancy. Look at the figures below.

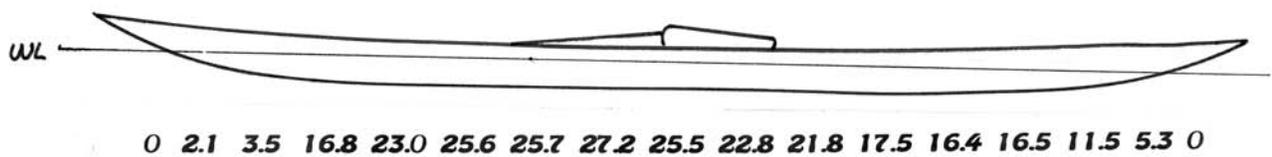


Figure 1. Distribution of buoyancy (in pounds) at the waterline of a West Greenland kayak (note how uniformly the buoyancy is distributed across the center two-thirds of the vessel).

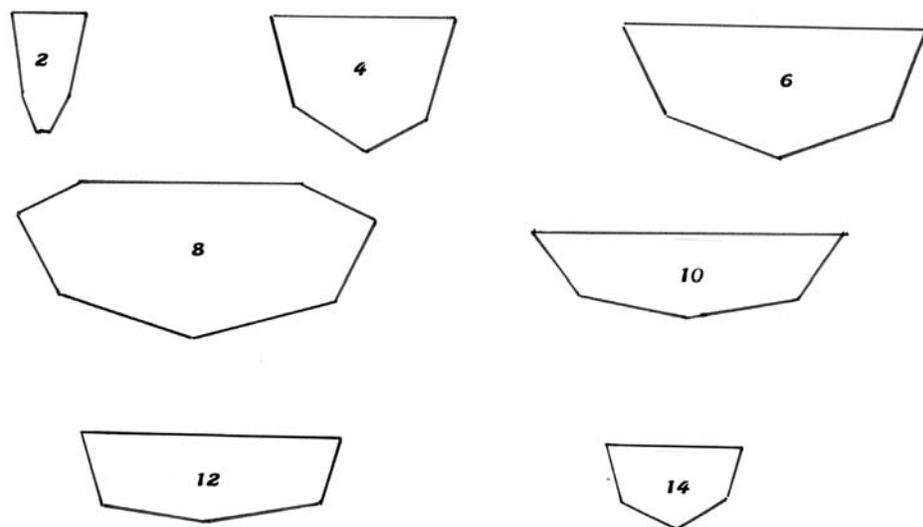


Figure 2. Shape of the kayak at various ribs (note the dramatic changes in the shape over the length of the vessel).

I thought that it absolutely has to be intentional, yet how did they do it? I had assumed that the design of the kayak was an evolutionary thing, that the Inuit learned what worked (and more importantly, what didn't work) over hundreds of years. I also assumed that the Inuit were not engineers. But the buoyancy calculations suggest that the kayak builders knew exactly what they were doing: they understood the principles of buoyancy, naval architecture, and strength of materials. Uniformly distributed buoyancy means that the static and dynamic loads are also distributed uniformly over the space-frame structure that is the frame of the kayak (more about space frames later), which means you can get by with a lighter frame. They placed slightly more buoyancy in the forward half of the kayak than the aft half, which aids in handling heavy seas. They designed a hull shape that resisted capsizing, but allowed rolling if a capsize did occur. All this suggests that not only did the Inuit fully understand the importance of properly distributing buoyancy, but they also had the means to either calculate or measure volume and its associated buoyancy.

At that point I came to the conclusion that the Inuit were in fact skilled engineers as well as sophisticated boat builders and that the Greenland kayak is one of the most sophisticated examples of indigenous technologies in our history. But words (and opinions) are cheap, so I decided to take things one step further and document my beliefs. I wrote this article and submitted a draft to some friends and associates to review, and they came back with comments like this:

"The buoyancy numbers don't look uniform to me. Uniform means constant, those numbers aren't constant."

"Many vessels have uniform distribution of buoyancy, like canoes or bulk carriers, how do you know the distribution just isn't incidental to the hull design?"

"There are inconsistencies in your data."

Needless to say I was disheartened. I thought I was on to something, but people who were smarter and more experienced than I was saw it differently. I went back and rechecked my measurements and data, but came up with the same data. I looked at the data and saw that the reviewers were right, the data really weren't that uniform, a floating log has a more uniform distribution of buoyancy than my kayak. This is evidence of a sophisticated design? I saw my whole theory (and all the research that went into it) going down the drain.

A couple of days (and beers) later, I was thumbing through Peterson's *Skinboats* and there was a picture of a hunter in his kayak, with all kinds of stuff lashed on the foredeck. I went back to my data and did some calculations. There was roughly 60 pounds more buoyancy forward of the cockpit than there was aft of the cockpit. I looked at the picture again. There was no way there was 60 pounds of harpoons, lines, shields, etc. on the deck of the kayak. Twenty pounds tops, not a pound over that. It took forever, but finally the light bulb went off. A quick Google search confirmed my guess—a pair of legs accounts for around 20% of a person's total body mass. For me, that means a little more than 30 pounds of my mass is sticking out in front of the qajaq. Check out the figure below:

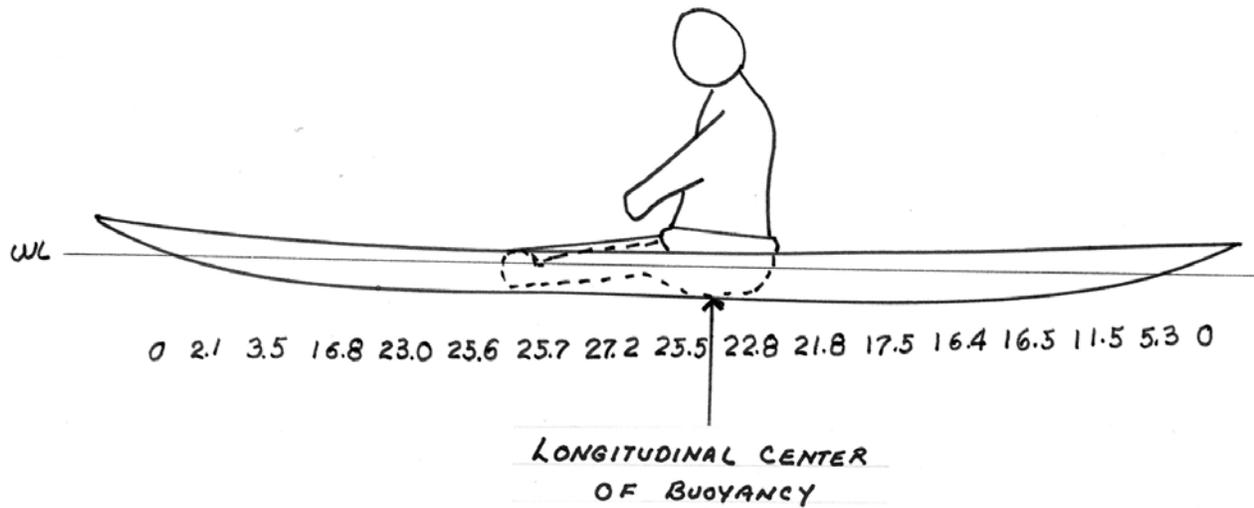


Figure 3: Longitudinal center of buoyancy of a West Greenland kayak.

I no longer believe that the Inuit designed the kayak to have a uniform distribution of buoyancy. The reviewers were right. The evidence suggests that the Inuit distributed buoyancy to match the distribution of mass. They put more buoyancy where there was more mass, less buoyancy where there was less mass, with a smooth transition from stem to stern, and I think I figured out how they did it. Buoyancy requires three dimensions: the hull shape in plan view (two dimensions) plus the depth of the hull. The hull shape of Greenland kayaks is defined in part by anthropomorphic measurements (the length of the vessel is approximately three times the paddler's height, the width of the vessel is based on the width of the paddler's hips, and you have to provide ample space for the paddler's legs and feet) and in part through tradition—the stem and stern are pointy and the sheer boards typically angle in. The upper deck of Greenland kayaks is constructed first using the anthropomorphic measurements and then the ribs, chines, and keelsons are added. H. C. Peterson describes the process in *Skinboats of Greenland*:

To get the right working position the Kayak frame is turned upside down and raised about ½ metre off the ground. Starting at the middle the Kayak builder straddles the frame. He lays the wood for the rib over the frame where the finished rib will be. The length of the rib is traditionally determined: placing his hands palms up against the outside of the sheerboards the builder marks a number of fingers' width from the boards; 2 or 3 fingers are added to each side to the width of the Kayak for shallower Kayaks, and 4 fingers for deeper ones, as in Kangaamiut.

Figure 4 illustrates how the length of each rib is determined, as well as the effect rib length has on the shape of the hull.

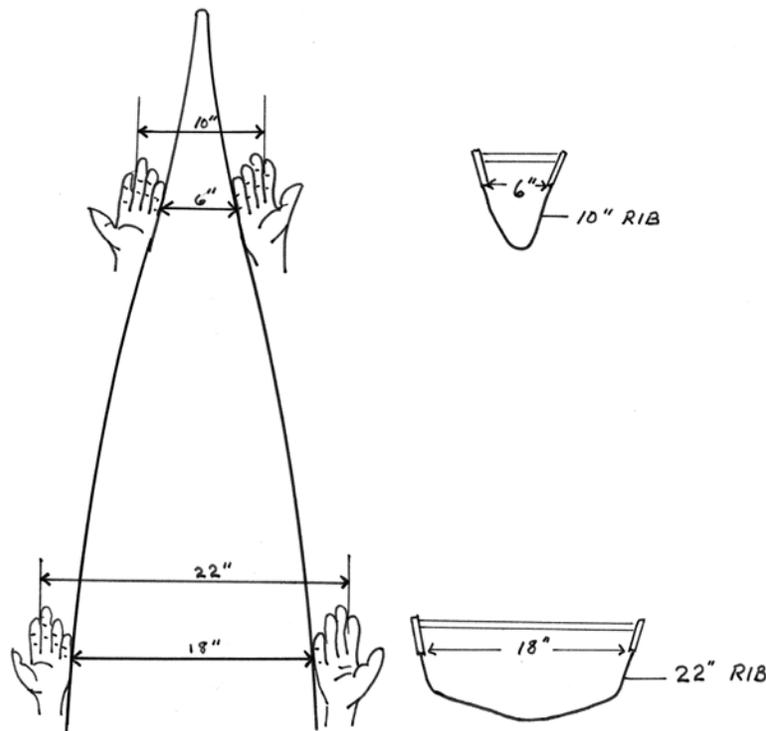


Figure 4: The traditional method for determining rib lengths.

By adding a constant (the width of the fingers) to a variable (the width of the frame), the Inuit kayak builders instituted an elegant engineering solution to a complex problem. The additional constant length forces the kayak builder to sharply bend the forward and aft ribs into a V shape; there is simply no other way to bend a 10" rib into a 6" wide frame without creating a V shape. The builder has more options at the middle of the kayak because the constant value is only a percentage of the variable width, permitting a more rounded hull shape if that is what the builder desires. The traditional method results in smooth transitions from rib to rib, creating an efficient hydrodynamic hull and a visually appealing shape. Is there anything more we could ask from an engineer?

To summarize, the traditional method for determining rib lengths has the following engineering characteristics:

1. The method defines a distribution of buoyancy compatible with the space frame structure.
2. The method helps to define the shape of the hull and forces an efficient hydrodynamic solution.
3. The method produces predictable and repeatable results.
4. The method is easily adjusted for create higher or lower buoyancy vessels.
5. The method is based on mathematics and sound engineering principles.
6. The method can be easily communicated to future generations of kayak builders without the need for written plans or instructions.

To me, the traditional method for determining the length of a rib qualifies as engineering: applying scientific knowledge, mathematics, and ingenuity to develop solutions to technical problems. Somewhere deep in Inuit history kayak builders struggled with the problems associated with hull design until they came up with the four-finger

method, and the shape of modern kayaks still reflects that moment of engineering brilliance. And this is not the only example of engineering excellence; the frame design, fastening methods, and hull design are equally impressive. I am going to deconstruct my kayak, analyze every little aspect of it from an engineer's perspective, and see where this journey takes me. The plan is as follows:

1. I research the underlying engineering of Greenland kayaks and document my findings.
2. I submit my work to a group of subject-matter experts and solicit their comments.
3. I publish my work and the review comments in the *Masik*.
4. You make up your own mind.

Something else I learned in the peer-review process was to be specific and define my terms:

**Proof:** Sufficient evidence for the truth of a proposition.

**Evidence:** The available body of facts or information indicating whether a belief or proposition is true or valid.

**Engineering:** Applying scientific knowledge, mathematics, and ingenuity to develop solutions to technical problems. From the Latin *ingeniare*—to contrive, devise, and *ingenium*—cleverness.

**Truth:** Conformity with fact or reality, a verified or indisputable fact, proposition, principle.

**Knowledge:** (according to Bertrand Russell) Belief which is in agreement with the facts).

### **Distribution of Buoyancy**

**Buoyancy:** The property of a fluid to exert an upward force on a body that is wholly or partly submerged in it.

Gravity pulls us down, buoyancy holds us up. As noted earlier, buoyancy and gravity are opposing forces, and so long as we are not in the process of sinking, they are balanced forces. Critical considerations in kayak design include providing just the right amount of buoyancy and putting that buoyancy in all the right places. The purpose of the vessel and the strength of the vessel's structure help guide the placement of buoyancy. Think of the difference between the hull shapes of bulk carriers and destroyers. The purpose of a bulk carrier is to carry as much oil, grain, or ore as it can, which means creating a hull with as much volume (buoyancy) as possible. The destroyer has to hunt down its prey as quickly as possible, so things like volume, buoyancy, and wetted surface area are kept to a minimum. In both vessels the hulls are built to withstand the static and dynamic forces of the seas; it is up to the marine engineer to make sure the structures are strong enough.

The purpose of the Greenland kayak was to transport a hunter to his prey, allow the hunter to approach his prey in a stealthy manner, and to transport the hunter and his prey back home in a wide variety of sea and weather conditions. On occasion the hunter may be required to transport his vessel over sections of sea ice if it converges on

him. The Greenland kayak is quite similar in function and design to a hunter-killer naval vessel—small, fast, stealthy, and deadly—but two striking differences are weight and hull structure. The kayak needs to be as light as possible (but strong enough to carry a load) for those over-ice journeys, and the hull does not contribute to the strength of the vessel. Naval vessels have steel hulls reinforced with steel bracing, bulkheads, keels, and so on. There is no real strength in the skin of a West Greenland kayak (aside from the tensile strength that holds everything together and transmits forces to the space frame structure). The strength of the hull comes predominantly from the space frame structure inside.

I was showing one of my colleagues pictures of my kayak before it was skinned and he commented: “That’s a space-frame structure. We invented them about a hundred years ago. All of the early aircraft used space frames covered with canvas.”

Space Frame: A three-dimensional structural framework that is designed to behave as an integral unit and to withstand loads applied at any point.

“I’m pretty sure these boats go back a thousand years or more,” I replied.

“So they invented space frames before we did, and someone else invented them before your kayak builders. The old skin or thatch structures were all space frames. Instead of using a few strong and heavy structural members, like posts and beams, you use smaller components in compression or tension to distribute the load over the whole structure, like Buckminster Fuller’s geodesic structures. Much lighter, more efficient use of materials, but they have one major drawback: you have to distribute the external loads uniformly over the structure. If you load up one section more heavily than another, the structure will crumble and fail.”

Another light bulb went off in my head. Now I knew why the Inuit distributed their buoyancy as they did. The external forces on the space-frame structure (the buoyancy of the seawater) are distributed so as to not overload their lightweight space-frame structure. Although buoyancy is distributed across the length of the kayak, by adding more buoyancy where the mass is concentrated, the builder can reduce the strength requirements and weight of the structural members, which reduces the weight of the kayak and further reduces the need for buoyant forces. The real beauty is figuring out where to put your buoyancy.

In the case of kayaks the center of mass (located somewhere in your midsection) is above the center of buoyancy (located somewhere near your hips), making us the equivalent of an upside down hot air balloons. OK, maybe it’s not that bad, let’s leave it at this: in my limited experience Greenland kayaks are more stable when the center of buoyancy is above the center of mass (i.e., when they are upside down).

***Our inconvenient truth is that the kayaks we paddle about would be happier if they were on the top and we were on the bottom.***

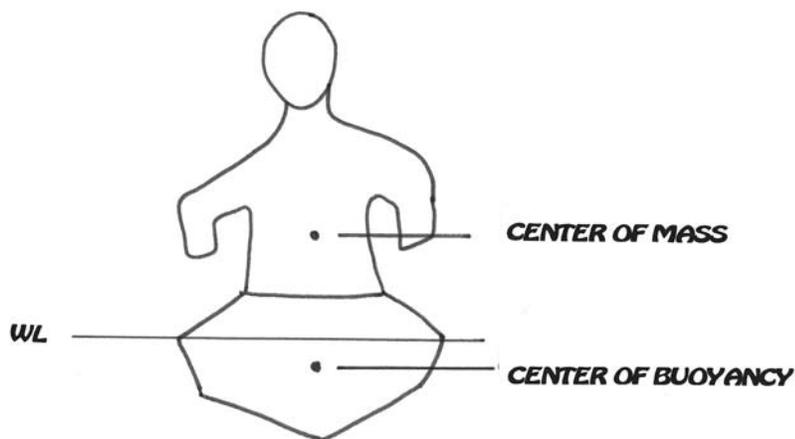


Figure 5. Kayak in an unstable (albeit desirable) configuration.

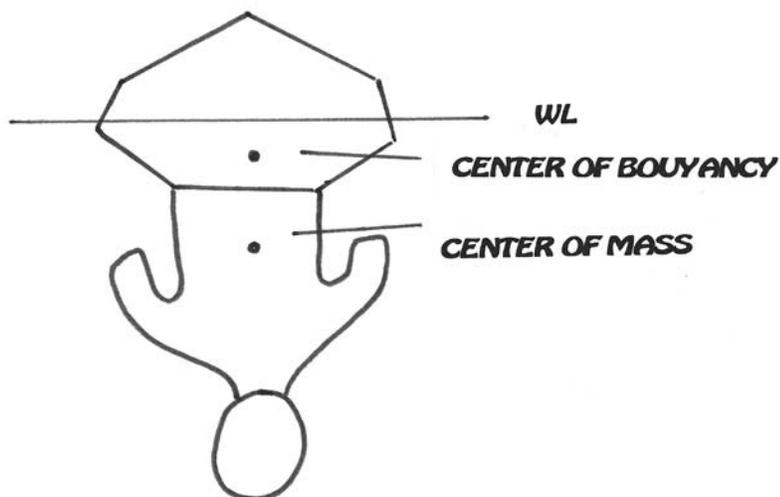


Figure 6. Kayak in a stable (albeit undesirable) configuration.

Our inconvenient truth is that the kayaks we paddle about would be happier if they were on the top and we were on the bottom. Fortunately for them, our Inuit antecedents distributed buoyancy of the kayak laterally to resist capsizing; developed balance and paddling skills to prevent capsizing; and when physics took over, developed the skills to recover from the more stable position (rolling).

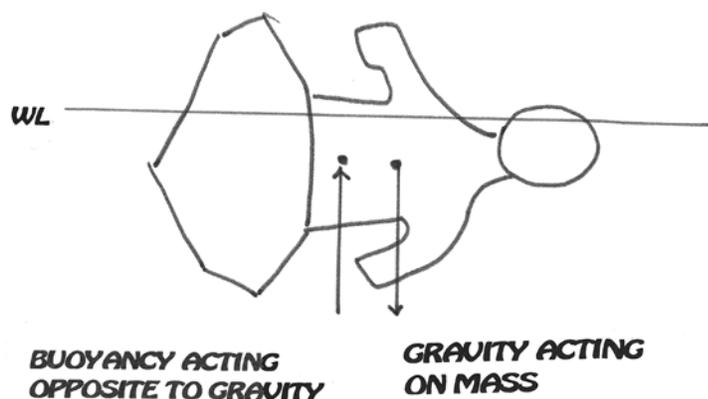


Figure 7. Kayak in transition.



### Wooden Boat School

The Wooden Boat School (<http://www.thewoodenboatschool.com/>) is like an adult version of summer camp, where you get to share your appreciation of old-school maritime craftsmanship and seamanship, fine wine, and craft beers with like-minded individuals. The school does an excellent job of preserving the fundamental technology, knowledge, and skill sets required to build, operate, and maintain wooden boats, while doing a pretty good job of feeding, housing, and entertaining its clientele. Best of all, it's located in Downeast Maine on some of the best kayak waters on the east coast. Plenty of deep, sheltered water connected to reasonably well-mannered open water; you can be out in the open but retreat to sheltered water quickly if you have to.

## Mark Kaufman is the Cal Ripken of high school woodworking teachers

Mark Kaufman is the Cal Ripken of high school woodworking teachers. Really, his day job is a high school technology education instructor. He took a diverse collection of strong-willed individuals, aligned us like ties on a railroad track, worked us like a chain gang, and had us thanking him after it was all over. I logged over seventy hours in six days and Mark was there the whole time. Mark has created a remarkably efficient process for constructing accurate replicas of Greenland kayaks; a modestly skilled person can build a beautiful and sophisticated kayak in one week.

The lateral (side-to-side) distribution of buoyancy plays a huge role in the stability of the kayak. Not only is buoyancy distributed lengthwise, but sideways as well. Placing buoyancy well outboard of the center of rotation is a good way to make a vessel more stable (think catamaran). There are many excellent discourses on kayak hull designs and stability available, and this article is not about the advantages of one hull design over another, but rather to show evidence that the Inuit understood how hull design and the distribution of buoyancy affected kayak stability. Even more impressive is that the Inuit balanced the need to maintain stability with the other features necessary to meet the mission objectives. The Inuit refined the hull shapes to reduce the probability of capsize, within the constraints of the vessel's purpose and function. Remember, this is a stealthy hunter killer, not a leisurely pleasure craft, so there has to be a compromise between stability and other factors like speed (length and wetted surface area), exposed surface area above the waterline (stealth), and seaworthiness. I don't mean compromise to be taken as a negative thing. The kayak has a mission, to transport the hunter to his prey, allow him to approach the prey to within striking distance without being detected, to make the kill, and return the hunter and his prey to his home, given a wide variety of sea conditions.

Triangles and triangle-like shapes are good shapes for kayaks because they are somewhere between logs and planks with the lateral distribution of buoyancy. Another phenomenon associated with triangles is that the center of buoyancy moves as the vessel leans right or left, and it moves in the direction of the lean, which serves to resist rotation. It's a little hard to visualize, but remember that all the buoyancy action is below the waterline. As the kayak tips, the displacement of water shifts in the direction of the tip, moving the center of buoyancy and creating a sense of well-being, commonly referred to as stability.

### Some notes on rolling

As an aside, for everyone who has tried to roll a kayak and failed, there is a simple explanation for your lack of success. Note our poor fellow in Figure 5. The center of gravity is outboard of the center of buoyancy, and which makes it farther from the center of rotation (located somewhere in the kayak itself). Even though buoyancy and gravity are equal forces, because the center of gravity is farther away from the center of rotation it overwhelms the buoyant forces and down you go. (One of the keys to success in rolling is to move your mass closer to the centers of buoyancy and rotation by leaning forward or backward).

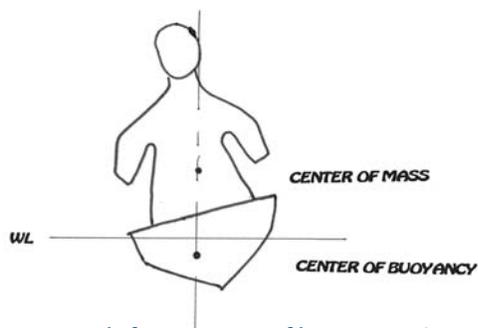


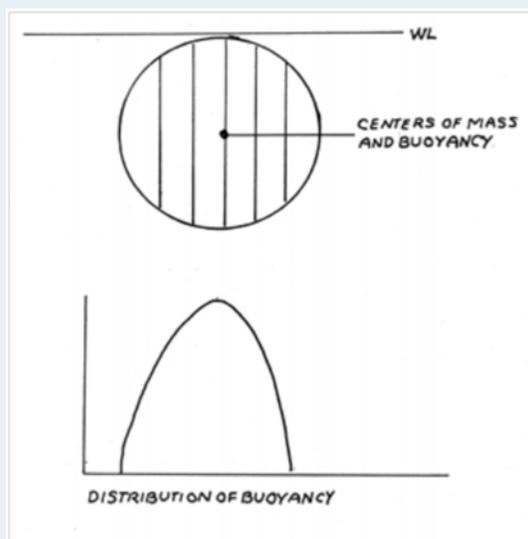
Figure 8. Shifting center of buoyancy (note how the center of buoyancy shifted to the left as the kayak leans to the left, helping to maintain the paddler in an upright position).

Finally, there is a third dimension on our physical world, the vertical dimension. Buoyancy is not only distributed longitudinally (lengthwise) and laterally (widthwise), but also vertically. Remember the mission of the kayak—a successful hunter will come back with a significantly heavier kayak than the one that he left with, possibly 30% to 50% heavier depending on the weight of the seal that he was able to kill. This great fortune brings risk, because now there is more mass above the center of buoyancy, and the handling characteristics of the kayak have changed. No problem, because the Inuit designed a triangular-shaped hull. The more mass you apply, the deeper the kayak sinks, but the triangular shape minimizes the loss of freeboard.

What this means to the hunter is that when he throws all or a portion of his kill onto the deck of the kayak, the kayak will settle down a little lower than it was before, but not much. Doubling the load that the kayak has to support will not double the depth of the kayak in the water, but only cause the depth

## Center of mass and center of buoyancy

I have been using the terms “center of mass” and “center of buoyancy.” These terms are technically accurate but simplistic descriptors of the real conditions. Consider a fully submerged yet floating log. The centers of mass and buoyancy are coincident in the center of the log.



The submerged log.

The submerged log seems simple enough because we have created a simplistic model of the log that accurately predicts the behavior of the log if it is subjected to outside forces. Yes, there is a center of mass, and yes, there is a center of buoyancy, but there is much more that we are ignoring. Buoyancy is not equally distributed across the log. There is much more buoyancy in the middle of the log than there is on the edges, as the graph illustrates. There is also more mass in the middle of the log than there is on the outside edges. The laws of physics dictate that the farther that you place mass and its counterpart, buoyancy, from the center of rotation, the more energy it takes to cause it to rotate (think of flywheels on stationary bikes). As a result, the log has little resistance to rotation—hence log-rolling competitions. Now, suppose we slice a log into a slab, and throw that slab of wood into the water.

***The laws of physics dictate that the farther that you place mass and its counterpart, buoyancy, from the center of rotation, the more energy it takes to cause it to rotate...***

to increase slightly. As a result, the handling characteristics of the kayak should not vary that much loaded or unloaded. The wetted surface area will certainly increase, with a subsequent increase in effort to maintain a given speed, but changes in the seaworthiness of the kayak should not be greatly affected.

All things considered, I think the Inuit did a pretty good job of distributing buoyancy longitudinally, laterally, and vertically.

Although my research has only just begun, I am finding many narratives that suggest the Inuit possessed both the knowledge to understand the physics and the measurement systems necessary to implement engineered designs. H. C. Petersen's *Skinboats of Greenland* has excellent descriptions of the purpose of various design features and how anthropomorphic dimensions are used to size the kayak.

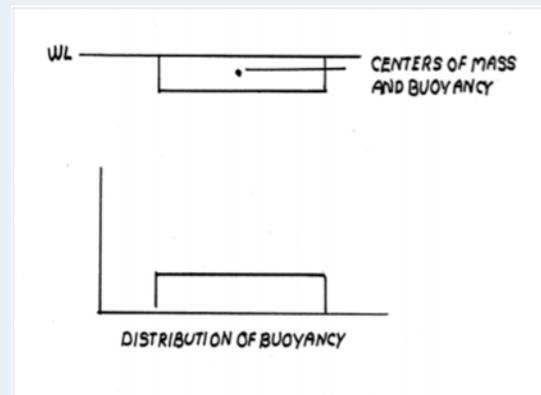
From a reverse-engineering perspective, I have nothing but respect and admiration for the product and the builders. To me, there is no other explanation but that the Inuit knew exactly what they were building. Maybe this is all semantics, maybe it all comes down to the definition of knowledge. This is the first definition that came up in my Google search:

*Knowledge: (1) the fact or condition of knowing something with familiarity gained through experience or association; (2) acquaintance with or understanding of a science, art, or technique*

However we define knowledge, the engineering sophistication of the traditional kayak deserves our respect and admiration. More to follow.

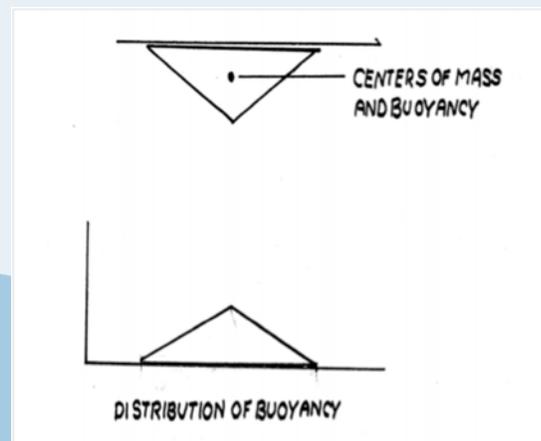
### Acknowledgments

The writer would like to acknowledge Mark Kaufman for sharing his knowledge of kayak construction, Nick Schade and Len Thunberg for their technical reviews and guidance, and Tom Milani for converting my rambling writing into a cohesive document.



*Buoyancy of a submerged plank.*

We now have uniform distribution of buoyancy across the width of the plank. The centers of mass and buoyancy are still located in the center, just like the log, but because the buoyancy and mass are evenly distributed across the plank, there is much more resistance to rotation (there are substantial amounts of both mass and buoyancy outboard from the center of rotation. No such thing as plank rolling competitions, but there are surfboards and paddleboards that rely on uniform distributions of buoyancy. So what does this have to do with kayaks? Consider the triangle:



*Distribution of buoyancy of a triangle.*

The triangle is a pretty good approximation of the hull shape of the Greenland kayak below the waterline, and the key features are increased stability over a more cylindrical shape and better sea handling characteristics than a slab.

# Deconstructing Greenland Kayaks Part II

## The Mighty Keelson

By: Ralph Colwell Young

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### Introduction

I was showing an engineering colleague pictures of the frame of my Disko Bay replica (plate 67, page 308 of Harvey Golden's *Kayaks of Greenland*). Being an experienced structural engineer, he was unimpressed.

"Pretty simple space frame structure, but I don't get it. All the structure is above the waterline, and it's got that skinny little keel; it's no wonder you spend so much time underwater."

I tried to defend the design. "You need a strong deck to support dead seals and your gear, that's why the deck beams and stringers are so big."

"You weigh a lot more than a dead seal, and there is nothing below your butt except some ribs and that stupid little keel."

"It's called a keelson," I replied. Not being able to counter his logic, I could at least correct his nomenclature.

"It should be called a not-a-keel. Look, I get it, you built this craft, it's historical, you are proud of it. But the truth is, it is fundamentally flawed. All of the mass is above the waterline, which adds to the instability. If the Inuit had followed conventional boat building wisdom and built boats with real keels they could have navigated themselves out of that God-forsaken climate. Nice workmanship, though."

I don't agree with my colleague, but I do understand what he is saying. I calculated the mass of the frame and determined that 10.4 kilograms (22.9 pounds) is above the waterline, and 3.3 kilograms (7.3 pounds) is below the waterline. Seventy-six percent of the mass of the kayak frame is above the waterline. Most of the mass of the paddler is above the waterline. The center of buoyancy is by definition below the waterline, and when the center of mass is located above the center of buoyancy you have an inherently unstable vessel. There is no question that the Inuit put themselves at greater risk by building their boats this way, the question is why? Why not build a boat with a heavy keel and light deck like just about every other seagoing vessel ever built? We can't ask the Inuit, but we can employ reverse engineering to get an idea of what they were thinking. By deconstructing the frame of a Greenland kayak we may get a glimpse of what the Inuit knew and how they applied that knowledge.

### The Frame

The frame of a skin-on-frame kayak conforms to the definition of a space frame structure as defined by the Interna-

***Why not build a boat  
with a heavy keel and  
light deck like just  
about every other sea-  
going vessel ever built?***

tional Association for Shell and Spatial Systems: "A space frame is a structural system, assembled of linear elements so arranged that the loads are distributed in a three dimensional manner."

Alexander Graham Bell is generally acknowledged as the modern day inventor of space frames; aviation would be all but impossible without space frames; Buckminster Fuller made space frames cool for a couple of years with the geodesic dome. We are surrounded by these structures, sometimes called lattice structures; the Eiffel Tower is a perfect example. The primary advantage of space frames is the strength-to-weight ratio; if you want a strong but lightweight structure, space frame is the way to go because the structural members are either in tension or compression. The elements of space frame structures are not generally exposed to bending forces; most structural materials handle compression and tension better than they withstand bending forces. Space frames are typically assembled using a limited number of identical components, and a lot of attention is paid to the method of connecting the components. And no offense to Bell and Fuller, but the Inuit beat you to the punch by more than a few centuries.

**The primary advantage of space frames is the strength-to-weight ratio; if you want a strong but lightweight structure, space frame is the way to go because the structural members are either in tension or compression.**

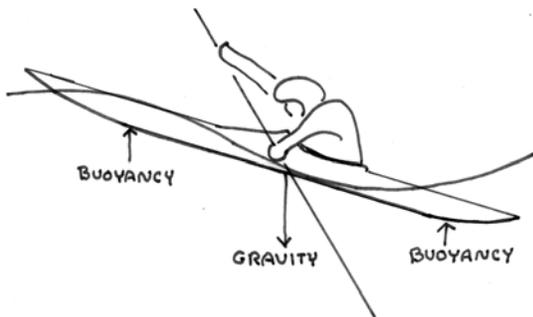


Figure 1. Three-dimensional dynamic loading. A simple two-dimensional static loading model can provide some insight into how complicated the engineering can be.

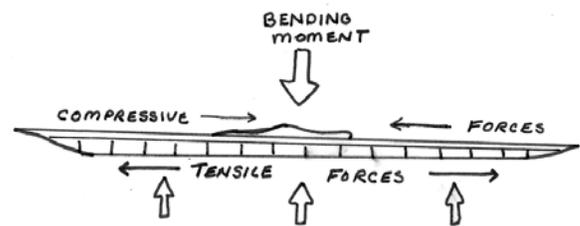


Figure 2. Static two-dimensional analysis. The downward force of gravity in the middle countered by the upward force of buoyancy distributed throughout the length of the vessel creates a bending moment on the frame.

To analyze the underlying engineering of the kayak frame we need to understand the function of the frame and the forces the frame is subjected to. The frame defines the shape of the hull, supports the occupant, and resists the forces that threaten to deform or destroy the structure. The forces come from all directions and are constantly changing; an engineer would describe it as a three-dimensional dynamic loading problem, a euphemism for two-meter waves driven by 30-knot winds. Gravity is pulling down; buoyancy is pushing up; the wind, waves, and paddler are exerting forces of their own in all directions; and the forces are significant.

Assuming that we don't want the kayak to behave like a life raft, we need a frame that is strong enough to resist

the bending forces. A stiff, strong frame is essential if you want features like speed, efficiency, and the ability to withstand severe sea conditions. Wood is generally pliable and does not provide much resistance to bending, especially over long spans, yet the Greenland skin-on-frame kayak is in fact rigid and withstands these bending forces with minimal deflection. To understand how a relatively lightweight wooden structure can withstand these forces we can employ basic structural engineering principles. When bending forces are applied to a simple beam, it experiences a combination of compressive and tensile forces—the top goes into compression and the bottom goes into tension.

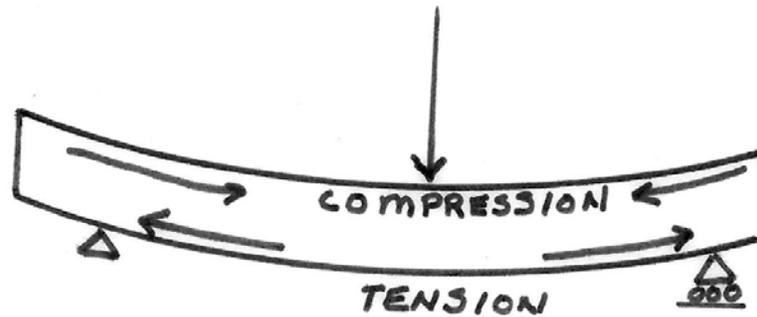


Figure 3. Bending moments create compressive and tensile forces. The top surface is being compressed while the bottom surface is being stretched.

The top of the object being bent is subjected to compressive forces—as the object yields to the forces the distance between the ends of the top surface is decreased and the material has to yield to the forces. The bottom of the object is being stretched—it is in tension. The center of the object is not being distorted at all and therefore sees neither compressive nor tensile forces. The center portion of structures subjected to bending moments does not contribute much strength, which is why beams in aircraft and high-tech automobiles have holes in them, why I beams and H beams have narrow webs, and why bridge decks and roof trusses don't even have middle sections.

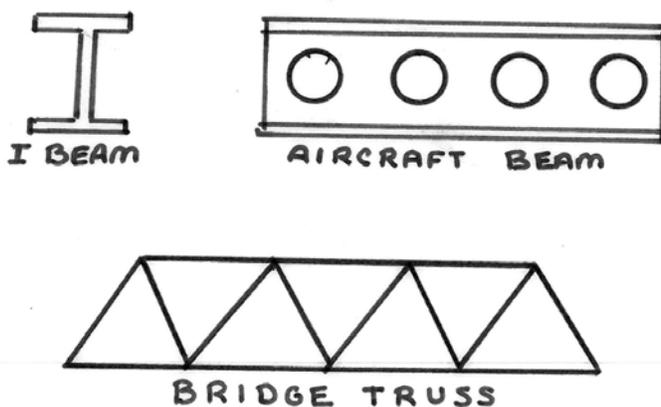


Figure 4. Structures designed to withstand bending moments. Bridge decks and other space frame structures are subjected to the same forces as kayak frames: the top of the structure is in compression and the bottom of the structure is in tension, and the cross members are either in compression or tension, depending on where the load is applied.

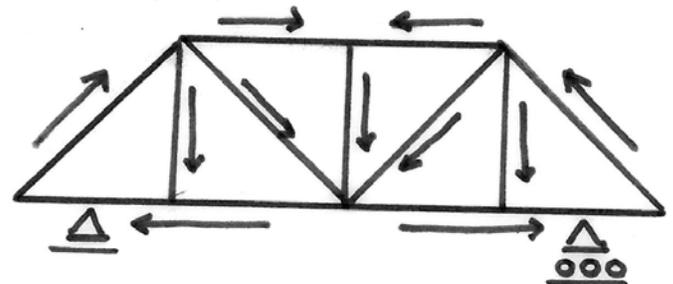
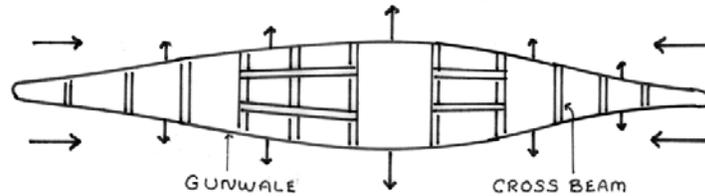


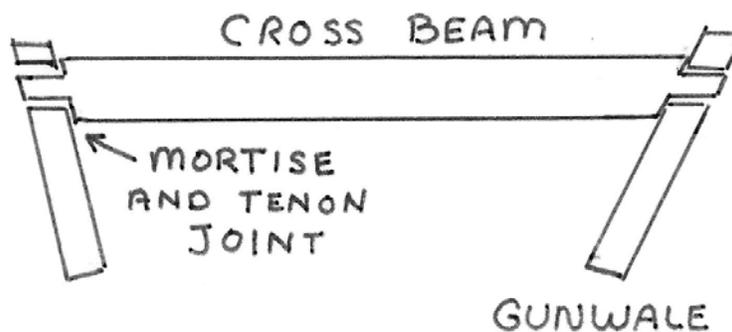
Figure 5. Distribution of forces in a truss structure.

The frame of a kayak is subjected to the same kind of forces; gravity acting on the mass of the paddler creates a downward force on the structure, and the force of buoyancy distributed across the length of the kayak creates upward forces. If all the buoyancy was located under the paddler (like whitewater kayaks) there wouldn't be any bending moments, but sea kayaks have buoyancy distributed throughout the length of the vessel, and therefore the frame has to accept bending moments and the resultant compressive and tensile forces. Insofar as sea kayaks have to deal with sea conditions, these forces can be significant. Under these conditions, from a macroscopic perspective, the top of the kayak is in compression, and the bottom of the kayak is under tension. Of course, there really isn't much to the bottom of a skin-on-frame kayak, just that skinny little keelson. Applying reverse engineering to the deck of a kayak does produce some interesting observations.



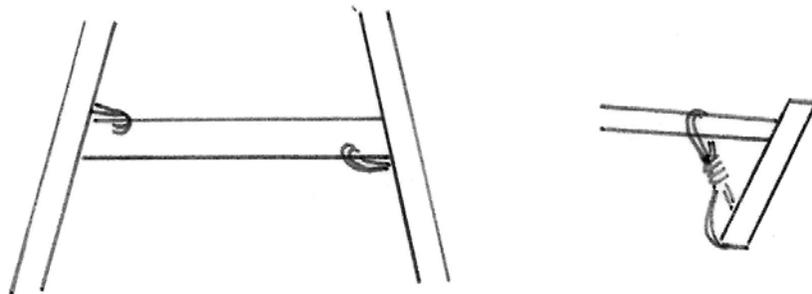
*Figure 6. The deck under compression. The gunwales will tend to bow out when the deck is subjected to longitudinal compression forces.*

From above, the upper deck of a kayak looks very much like a ladder, a simple structure designed specifically to withstand the compressive forces of a person standing on it. The rungs on a ladder serve two purposes; not only do they support us as we climb, but they also prevent the ladder rails from bowing in or out. If you apply a compressive force on a long, thin piece of wood, like a ladder rail or the gunwale of a kayak, it is going to bow out, and it really doesn't take much force. In fact, the gunwale of a Greenland kayak will bend significantly under its own weight. By adding rungs, or cross beams, two long pliable pieces of wood are effectively converted to short sections of stiff lumber. The cross beams go into tension and keep the gunwales from bowing out. I didn't know that when I was building my replica, I just assumed that the cross beams were in compression. I assumed that the beams were designed to withstand compressive forces, that the pressure of the water against the side of the kayak was transmitted to the ribs and gunwales, and that there was a lot of force on either side of the kayak pushing it together. I mean, the mortise-and-tenon joint between the gunwale and the cross beam cries out compression.



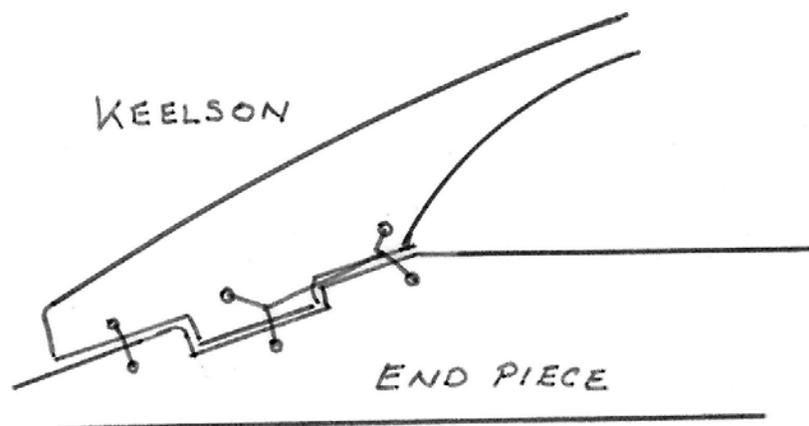
*Figure 7. Mortise-and-tenon joint between gunwale and cross beams. The larger cross section of the cross beam prevents the gunwales from moving inward.*

The skin is tied around the frame as tight as you can make it, and then all that water is pressing up against the skin, and there is a lot of surface area the water can push against. In fact, in my replica I did not make any provision for the possibility of the gunwale pulling away from the deck beam, I mean, why add complications where none are required? There are certain joints in the frame of the kayak that definitely must be pinned, like where the gunwales meet at the bow and stern, but there are other joints where it is not necessary to secure the joint, and to install pins or nails where they do not belong may result in excessive localized forces which could split the wood. I simply did not see the need to secure the cross beams to the gunwales. I'm guessing I'm not alone in this arena. The engineer in me says to connect the cross beams to prevent the gunwales from bowing out, causing the kayak to sag and maybe fail when encountering a large wave. The boat builder in me says to create some surface area to accept the compressive forces, that there are no tensile forces, and if there are any they are not large enough to matter. So what did the Inuit think? Figure 18 on page 32 of H.C. Petersen's *Instruction in Kayak Building* looks something like this:



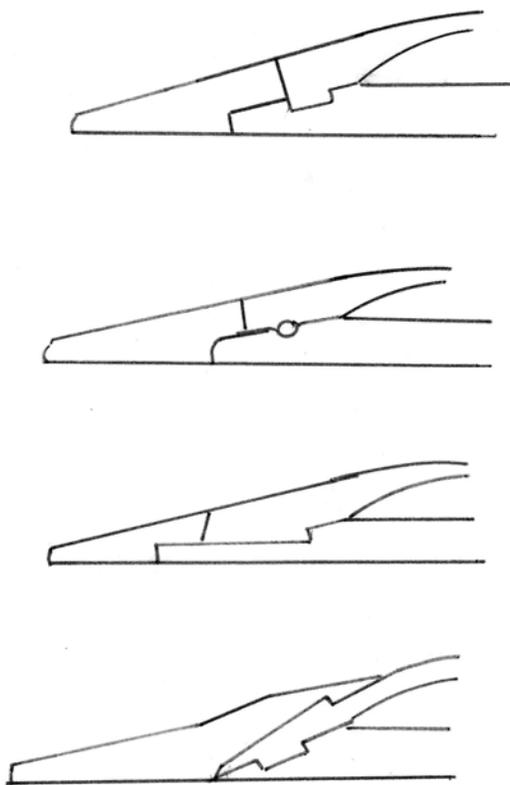
*Figure 8. The Inuit method of attaching cross beams to the gunwales. The lashing prevents the gunwales from pulling away from the cross beams.*

The Inuit saw the need to tie the crossbeams to the gunwales; to me that is pretty strong evidence that the Inuit knew that there were circumstances that the gunwale would try to pull away from the crossbeams and that it was important to prevent that from happening. There is no evidence they knew that the deck was in compression, which is why the gunwales have to be restrained, just that they knew the gunwales had to be tied to the crossbeams. There is, however, pretty strong evidence that the Inuit knew very well that the keelson was in tension.



*Figure 9: Attaching the keelson to the bow and stern-note the notch in the end piece (H. C. Peterson, *Instruction in Kayak Building*, p. 37).*

Petersen calls for making the keelson out of a single plank of wood, with as few knots as possible, and then to notch and lash the keelson at both ends. Using a single plank of wood means continuity in the wood fibers; a continuous board will always be stronger than two boards joined together. A knot means a weak spot, so limiting the presence of knots translates to increasing the strength of the board. Putting a notched and lashed joint at each end tells us the Inuit knew that the keelson was under tension, and that it was important to engineer the points of connection to withstand the tensile forces. Sadly, I must admit that I did not notch my keelson, just lashed it in (although I did peg them). Page 27 of *Skinboats of Greenland* illustrates five different methods of forming the end of a kayak, and four of the five methods clearly show that the builder knew the keelson would be subjected to significant tensile forces, and that he must build in one or more features into his boat to withstand those forces.



*Figure 10. Methods of connecting the keelson to the bow and stern plates. Note that each joint has a provision to prevent the keelson from pulling away from the end pieces (H. C. Peterson, Skinboats of Greenland).*

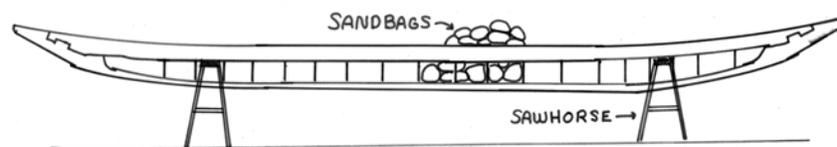
One reviewer posed this question: If the keelson is under so much tension, why is it so small? (the keelson on my boat measures 25 mm (1") by 25 mm (1")). I actually knew the answer; wood is much stronger in tension than it is in compression. You won't find tensile strength values for wood in your standard material property tables because the method of attaching the two ends of the test piece will affect the test results, and wood is rarely used to withstand tensile loads in commercial structures. You will find tensile values for the amount of force required to pull the fibers apart from one another (shear strength parallel to the grain), but that number does not represent the amount of force that a piece of wood can withstand under tension before it fails. You can also find values for the compressive strength of wood parallel to the grain, but that represents the amount of force it takes to crush the wood. In the real world, a single two-by-four eight feet long will start to buckle under a few hundred pounds of load. Take that same two-by-four and put in in tension, and you can pick up 40,000 pounds if your end attachments don't fail. It sounds bizarre, but it is true; the tensile strength of most soft woods is around 8,000 pounds per square inch. The keelson on a Greenland kayak has a tensile strength of approximately 8,000 pounds (3,628 kilograms). If you don't believe me, try to think of wood as a stiff version of rope; wood is made of fibers and just like rope is much stronger in tension than it is in compression. You won't get far in this life pushing on a rope, but a rope can pull you to safety.

So far in this deconstruction we have ascertained that the Inuit designed the deck of the kayak to withstand compressive forces, and they have designed the keelson to withstand tensile forces, which strongly suggests that they understood the fundamentals of Structural Engineering 101, but we really haven't proved it. Per our definitions in the

first article, proof is defined as “sufficient evidence for the truth of a proposition.” Evidence; but their designs are all we have—they had no written language; everything was in their heads, and there can be no other evidence. But we can postulate—if the Inuit really understood structural engineering, if they really understood the complexity of space frame structures, they would have optimized the design; after all, they had hundreds of years to refine the design. If you define optimizing a space frame structure as maximizing the strength-to-weight ratio, they pass that test. Skin-on-frame kayaks are much lighter than production shell-type kayaks, even those made of Kevlar. Still, in this skeptical world, proof is hard to come by. I mean, if you showed me that the tensile strength of the keelson equaled or exceeded the compressive strength of the entire deck structure, then yes, I would say that was proof; there is no way they could have accidentally built a boat that balanced. I mean, a skinny little keelson being as strong as that massive (poetic license) deck structure? No way, not possible.

If you have stayed with me this far, I ask only for a few more minutes. I always liked the expression “seeing is believing” so I set up the following experiment.

1. Build two identical Greenland kayak deck structures, complete with ribs.
2. Install a keelson per Peterson’s design standards to one of the deck structures.
3. Destructively tested each frame by loading up the middle of the frame with weight while supporting either end.



*Figure 11. Testing the strength contribution of the keelson by testing two identical frames, one with a keelson and one without a keelson, we can determine how much strength the keelson contributes to the overall strength of the frame.*

And the results are: Coming in the next edition of the Masik.

### **Engineering Observation**

There is one critical flaw to the frame, and the flaw occurs in the worst possible place. Looking from above, there is a big hole in the deck, right in the middle of the kayak. That flaw, commonly referred to as the cockpit, is a necessary defect: after all, a kayak without an occupant is not going to kill a seal. The frame of the kayak is weakened because of the cockpit, but this weakness is compensated for by the occupant. Figure 12 illustrates how the occupant’s feet, thighs, and back interact with elements of the frame. Think of your own experiences while kayaking. In casual paddling situations, there is minimal pressure with the foot peg, masik, or back rest; we are relaxed. However, when confronted with a sizable wave, we naturally tense up. We straighten our legs, push against the foot pegs, which forces our thighs against the masik and pushes our back against the back beam. By doing so we become part of the frame, our legs become trusses, and we add strength to the frame in the exact location that strength is needed. Whatever weakness is introduced by adding a cockpit is compensated for by our legs. From an engineering perspective, the kayak may in fact be unique in our history—a biomechanical structural system where the bio adds strength to the mechanical, as opposed to the other way around. When we say that skin-on-frame kayak is an extension of our bodies, we are not be-

ing completely accurate. In fact, our legs are an extension of the kayak frame, and without the bracing that our legs provide, the kayak frame would be significantly weaker. Although my search was not exhaustive, I could not find another example of any engineered structure where parts of the human body contributed to the strength of the structure. I found numerous examples of mechanical systems contributing to the strength of a human body, but that was it. Now this may not sound that significant, but I can count the number of truly unique engineering accomplishments on one hand.

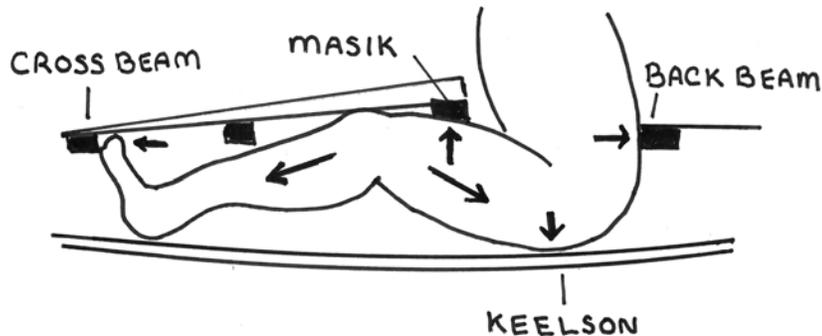


Figure 12. The world's first (and possibly only) biomechanical space frame structure.

*From an engineering perspective, the kayak may in fact be unique in our history—a biomechanical structural system where the bio adds strength to the mechanical, as opposed to the other way around.*

### Author's Commentary

In my research I saw several references to the Inuit building flexible kayaks. Nothing in this engineering analysis indicates that they intended to build a flexible kayak. Although there is a certain amount of logic behind the idea of a flexible kayak (if it doesn't bend it will break), there is also a significant penalty when it comes to hull efficiency and hull speed. Try paddling an inflatable kayak and you will see what I mean. The kayak was a hunter killer, fast, efficient, and silent. Everything I see from this analysis suggests that the Inuit intended to build a rigid frame. Perhaps after years of use the joints loosen up some and the kayak loses some stiffness, but in my opinion the idea that the Inuit intentionally built flexible kayaks is a misnomer.

I have also heard that skin-on-frame replicas tend to sag over time. Again, just my opinion, but maybe these sagging kayaks didn't incorporate all of the engineering features that the originals had; just maybe the keelson slips a little under tension, maybe the deck frame doesn't handle the compressive loads quite as well as the originals. Replica builders will be well served by adhering to the design conventions of the Inuit.

### Peer-review comments

#### Mark Kaufman:

In my opinion, you are making this much more complicated than it really is. The Greenland style skin-on-frame kayak is built like a basket with all of the forces being distributed between the gunwales, deck beams, ribs, keel stringer and stems, deck stringers, cockpit rim and chine stringers. As you know, most of these individual components are not ex-

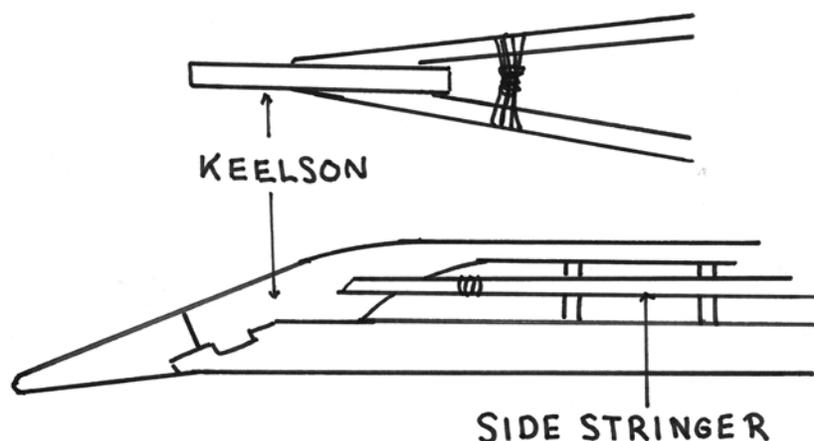
ceptionally strong alone, but when the whole structure is pinned, and/or lashed together, you are essentially creating a (space frame) basket style structure that is very strong for its light weight. There is much more involved than the keel stringer. It provides only one-third of the strength with the two chine stringers providing two-thirds once everything is lashed together.

Other comments are the deck beam sizing. They form the shape of the deck profile and are usually sized as necessary to hold the desired gunwale angle (example approximately 18 degrees on your West Greenland style kayak). You mention that the keelson is under a lot of tension. That force is shared by the keel stringers as I had mentioned earlier. These are the things that I have observed in my experiences of building several kayaks over the years.

**Author's response:**

Mark is correct; there are other components on the kayak frame that contribute to the strength of the structure. For example, the deck stringers do add significant strength to the deck structure to help resist the bending moments; Peterson calls that reinforcement of the deck. And Mark comes up with an interesting observation: not only do the cross beams maintain the width of the kayak, they also set the angle of the gunwales. It is entirely possible that the lashing between the cross beams and the gunwales is there to hold the gunwale at its desired angle.

I respectfully disagree with the idea that the chine stringers contribute two-thirds of the strength on the bottom for two reasons. First, the chine stringers are located at or near the middle of the structure, an area that is not subjected to either tensile or compressive forces. Second, according to H.C. Peterson (page 45, Instruction in Kayak Building), "The ends [of the chine stringers], which rest on the sides of the ends of the keel, are neither to be nailed nor lashed." If the ends of the chine stringers are not attached to anything other than the ribs, they really can't contribute that much tensile strength. It is interesting that the Inuit would intentionally not fasten the chine stringers to the keel, but if Peterson points it out in his book, it must be important. I can't figure it out; maybe you can.



*Figure 13. Attaching the side stringers. Note that the side stringers are not fastened to the keelson and are free to slide on the surface.*

### **Harvey Golden:**

I've given your article a read and it is clear and well written. Some of the engineering terminology is above me, but I understood the point. It's probably (and should be) inconsequential, but I disagree on some matters, but that in no way should be a reason to retract or change your thesis. Briefly, it's the bio-structural element, which seems based on the presumption that the paddler's back is against the back rest. I'm not so sure Greenland kayaks were historically paddled this way (I think I even scrubbed my KOG manuscript of the term "back-rest"...), but, again this may be a moot point as many paddlers do paddle this way today, so it is a pertinent and interesting observation. Don't mind my opinions, though: Your article is good and forwards some interesting ideas not really taken on before.

### **Author's response:**

I really appreciate your taking the time to review and comment on the article. And I am in full agreement with you regarding the bio-structural observation, I could find no evidence that the Inuit built and paddled their kayaks with the knowledge that their legs would add to the strength of the frame. I believe there is indisputable evidence that the Inuit knew the keelson was under tension, and they designed it accordingly, but there is no similar evidence that they were aware of the bio-structural element. I included this discussion under the engineering observation heading because of the lack of evidence.

There is an interesting theme in these articles that focuses on what the Inuit knew. Knowledge comes in many forms; there is the kind of knowledge you obtain from researching a subject and drawing engineering diagrams, and then there is the kind of knowledge you obtain from building and paddling kayaks over your lifetime. In my opinion the Inuit knew that it was important to brace yourself when taking on large waves. Following that logic, they also knew it was important to properly position the toe brace, masik, and the cross beam that is just aft of the cockpit. They may not have been drawing free body diagrams in the sand (or maybe they did), but I believe they knew. I just can't prove it. Again, thank you for your insights and comments.

### **Nick Schade:**

Comment 1:

You are putting a lot of thoughts in the minds of Inuits without much evidence. You say, "There is, however, pretty strong evidence that the Inuit knew very well that the keelson was in tension," and then provide examples of how the keelson is built to withstand the forces. Evidence of a keel in tension is not evidence of knowledge of tension in the keel; it may be that they just fixed something that broke. From an engineering perspective, the Inuit knew the keelson was in tension if he stood back looked at the keelson and said, "That is going to pull away there," and then designs a solution to make sure it doesn't happen. Another alternative is way back thousands of years ago proto-Inuits built kayaks where they just lashed the gunwales, stringers and keelson together somehow, but they found that things kept slipping around and the boat got bent out of shape or broke. So, they started doing things to keep the keelson from moving and eventually arrived at a solution. Anything that broke got fixed so it wouldn't break again. This does not mean the Inuits had a word for "tension" and evaluated their boat longevity issues in the light of that concept. Experience may have told them that the keelson tended to move, sliding away from the ends, and they developed a method

to stop that sliding.

In theory a modern engineer should be able to sit down with some material specs and knowledge of statics and how forces propagate around a loaded structure and come up with a design that takes into account material properties and force distributions. They could engineer a solution for a completely new design, from scratch, without prior knowledge of kayaks and get it pretty close to right. The Inuits were probably never in quite that situation. They almost always had their own experience, plus the prior efforts of their friends, fathers and uncles from whom they could learn and improve upon.

While it is possible that one day thousands of years ago, an early kayak builder sat on the beach and saw in his mind the “tension” in the keelson and analyzing the forces and arrived at an elegant solution and passed these concepts on to his sons. What is much more likely is over the years kayak builders did what lots of people still do today: If it breaks, make it bigger; if it doesn’t break, make it lighter; if it slides apart, tie it together; if it slides together, block it apart. The results of this seat-of-the-pants construction method will often quickly result in an elegant solution. It doesn’t require the builder to fully understand and analyze all the complexities of what may be going on in the way we understand modern engineering. While I would still call it engineering, the seat-of-the-pants method of design is more based on trial and error and practical understanding of what works and what doesn’t.

Comment 2:

Space frames: I think it is interesting that modern space frames almost always incorporate triangles. Buckminster Fuller called the triangle the “perfect form” because the geometry of triangles does not allow them to distort; where a square can easily become a rhombus without the sides changing in length, a triangle stays the same. The Inuit never seemed to come up with this principle. If you left a modern engineer to design a SOF kayak he or she would likely make it “geodesic,” and as a matter of fact, that’s what a modern engineer did: <http://www.gaboats.com/>

Inuit-style kayaks largely depend on the stiffness of mortices/tenons to deal with sheering forces. There are only two triangles in traditional SOF kayaks, located at each end, where the gunwales meet. The stems are built quite heavily to prevent the keelson and gunwales from sliding forward and back relative to each other. By incorporating more triangles, such as ribs installed on a diagonal relative to each other and deck beams running in opposing diagonals, the whole frame could likely be made lighter without significant loss of strength. Of course, this might complicate the building process.

If the Inuits had a modern understanding of tension and compression and “engineered” their design in the modern sense of the word, I think they may have arrived at geodesic construction methods. However, their techniques worked and from the seat-of-the-pants perspective did not need to be improved much.

Comment 3:

Your analysis leaves out the skin. The skin is an integral part of the structure of the boat. It binds all the parts together. Much of the lashing and pegging could be eliminated if it weren’t for the fact the skin needs to be able to be removed

and replaced. The skin is almost always in tension and much of the frame starts out in compression holding back the skin. This tension is distributed in almost all directions, including diagonally between frame members, and provides some of the “triangular” properties of geodesic construction. I don’t know the tension bearing properties of wet seal-skin, but it undoubtedly is part of the structural system.

Comment 4:

You write: “In casual paddling situations, there is minimal pressure with the foot peg, masak, or back rest; we are relaxed. However, when confronted with a sizable wave, we naturally tense up. We straighten our legs, push against the foot pegs, which forces our thighs against the masak, and pushes our back against the back beam.” I’m sorry, I disagree. I personally don’t tense up on waves and I don’t think for a second that a SOF kayak requires the body of the kayaker as part of its structure. For the legs to provide structure you would need to be pushing back against the frame with your body braced between the back of the cockpit and your feet against the cross beam. A back band was not a part of traditional Inuit kayaks and the paddler traditionally did not sit with his back against the back beam so this force was not available in a traditionally built and paddled SOF kayak.

In most natural loading conditions the gunwales are in compression. The deck stringers are not significantly higher than the gunwales so they don’t absorb much compression and the gap of the cockpit is not a gap at all, it is just another space between deck beams.

Comment 5:

You wrote “I have also heard that skin-on-frame replicas tend to sag over time.” Actually, I’ve heard of original kayaks sagging over time. Many museum specimens are distorted, sagged or bent out of shape. It happens for a variety of reasons. It is unnecessary to assume that any replica that sags did so because the builder made it in without following the design conventions of the Inuit. A little seat-of-the-pants engineering based on an inspection of what is getting bent or coming apart would probably provide hints at a solution.

***Author’s response:***

First of all, I want to thank Nick for the thought and effort that he puts into his reviews. His insights into kayak building and the underlying engineering create a formidable hurdle—if I can get an idea past Nick I know I am onto something. He challenges me to dig below the surface, and for that I am grateful. Nick truly lives up to the purpose and intent of peer review.

Comment 1:

I think Nick concedes that the keelson is in fact designed to withstand tensile forces. I further believe that Nick’s comments focus my conclusion that the Inuit knew what tension is, they knew where the tension was coming from, they knew what the tensile strength of wood is, and they knew how to design a space frame structure to withstand tensile forces. I concede that I probably cannot produce enough evidence to prove that the Inuit possessed all of that knowledge, but I may be able to make a plausible argument on their behalf.

First, I agree that the design and construction of their kayaks depended almost exclusively on experience and trial and error. I do not believe that the Inuit sat down and pre-engineered the kayak; I agree with Nick that the design evolved over time in the manner he described. However, almost all technological advances in our society are based in some part on the exact same process. Watch the videos for the early aircraft flights, or the early rocket launches at White Sands, or Google "Engineering Disasters." We lost two Space Shuttles and countless military aircraft to trial and error. There is even a discipline in engineering dedicated to analyzing failures to identify the root causes of the failures so as to avoid them in the future. Something breaks, we analyze the failure, we develop an understanding of the root causes of the failure, and using that knowledge we redesign the component.

What I do believe is that the many generations of Inuit boat builders understood what forces the frames were subjected to, where those forces came from, and how to deal with those forces, and that understanding constituted detailed engineering knowledge. I believe that in part because I have hung out with engineers, constructors, and contractors my entire career, and I know how they think. The good ones possess fundamental knowledge as to how things work, how strong they are, where the weakness lie, and how to build something that won't fall down, and they didn't obtain that knowledge in the classroom. The other reason I believe the Inuit were in fact engineers is because they had no written language. Knowledge had to be transferred verbally, face to face, over and over, and having raised three kids I am sure the word "why" came up over and over: "Why do I have to use a single board for the keelson, why can't I just join two smaller boards? Why can't I use this board that is full of knots? Why do I have to notch the keelson into place? Why do we have to bend the frame to snap the keelson in place?" Given the challenging attitudes of all human beings, I am certain that countless discussions of the engineering aspects of kayaks occurred in every kayak builder's life. I also know a few boat builders, and the word "why" is an integral part of their language when they get together: "Why did you build it that way, why didn't you do it this way?" Give beer to boat builders and the knowledge flows. Why should we believe that the Inuit are any different than all the boat builders in the world?

#### Comment 2:

When I first started on this article I went to a structural engineer and asked him if he could perform a finite-element analysis on the frame of my kayak. He looked at the drawing I had prepared for him and shrugged. "I guess I could, but it would take a lot of effort. Every element is different, the attachments are all unique, how do I model that?" The bottom line was that the finite-element-analysis software we use was designed to analyze modern production space frame structures, not one-of-a-kind custom structures. It is very difficult to analyze the strength of space frame structures, so a lot of effort goes into standardizing the components and the connectors. Buckminster Fuller's geodesic domes are considered elegant because all of the structural components are identical, all of the connectors are identical, all of the assembly angles are identical, and if it wasn't for gravity, all of the forces would be identical. In Buckminster Fuller's world the triangle is the perfect form because the components can be standardized and mass produced, they can be shipped and assembled with minimum expense, and you don't have to analyze the loads with every new application.

The Greenland kayak is not a mass-production craft. Every piece is custom fabricated. The design incorporates the use of triangles where appropriate and does not incorporate them when it is not appropriate. The elegance of the kayak

frame is its uniqueness, its strength, its lightness, the shape it creates. Maybe we are back to the different kinds of knowledge—education versus experience. Education-based knowledge would require standardized designs like triangles so that we could analyze and understand the structures using conventional engineering tools, whereas experience based knowledge does not impose those constraints.

Comment 3:

Nick is absolutely correct. The skin is an integral part of the structure. The skin is in tension, which helps to prevent the upper deck from bowing out and also contributes to the strength of the keelson. The skin also defines the shape of the hull, which is not exactly the same as the shape of the frame. I hope to look at the skin in greater detail in a future article.

Comment 4:

I built my SOF replica using the ergonomic methods specified by Petersen. When I paddle my back rests against the back brace, and when I break through a large wave I definitely push on the foot pegs and lock my thighs on the masik. The foot pegs are attached to the gunwales. I don't believe that the frame on my kayak requires the strength of my legs to complement the strength of the frame, but I do believe that my legs add to the strength of the frame. I also think that my legs being bent results in a shock-absorber effect, and any energy that is absorbed by my legs is energy that doesn't have to be absorbed by the kayak frame.

Comment 5

My objective here was simply to advise SOF builders to be aware of the forces on the frame, to be cognizant of the methods the Inuit devised to handle those forces, and to understand that if the forces are not properly accommodated your SOF replica may end up sagging.

**Author's Acknowledgments:**

I would again like to thank Tom Milani, Mark Kaufman, Harvey Golden, and Nick Schade for their insights, time, efforts, and knowledge. When I look at my original drafts I am embarrassed, when I look at the finished products I am proud, and it is all because of help I get from Tom and the reviewers.

**Contributing to  
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# The Coast, Technology and Character of the Eighth Annual Hudson River Greenland Sea Kayaking Festival

## By: Beau Miles

**June 21, 2012. Burr Pond, Pittsford, VT:**

I jump, then feel a momentary puncturing of flesh, of being gripped. Followed immediately by the slide of teeth over skin. That bloody dog bit me! I surface, neither refreshed nor atoning for my hard work, a relentless week of jacking up sunken, foot-rot cabins during the first heat wave of the summer. The golden retriever I'd thought harmless looks nervously from the dock. I'm more furious at actually being bitten, the plain injustice of it, than concerned for the physical meat of me, the wound. Barely slick, I peel from the water. Bloody water pools at my feet. After clamping the bleed, then shoving back in a neat thread of subcutaneous fat (wrongly), my first thought concerned my life over the next three days. Attending the Hudson River Greenland Festival (HRGF), or more specifically, of immersion, literally or not, into the watery world of kayaking. My mother, a nurse, gives strict instructions not to head back into the water. A week, she says, before I risk inundating the wound. Like it or not, I would be grounded.

As an Australian new to the world of skin-on-frame paddling, I intended this paper, defaulted by dog bite, at being an observational piece. Naturally, as an observer, my interpretation is biased. My painting of the scene comes through a comparison with my own sea-kayaking experiences as an expeditionary, open coast paddler in mostly southern hemisphere locations. What emerged was a comparison of sea-kayak settings and sea-kayak "types." In this way my observations and self-critique has double meaning—types being the actual sea kayak itself and the particular character of those who paddle. For example, my plastic, rotational molded, materially "unseen" synthetic craft, is compared to the skin-on-frame, tangibly "raw" boat builds typical of those paddled at the eighth annual Hudson River Greenland Festival.<sup>1</sup> And perhaps, because of the craft, the characters are different.

The story of this festival, for me, emerged as this narrative. It's highlighted first, through the specific attributes of the paddling location, and second, through the particulars of the sea-kayaking acts. Comparing myself as expeditioner, Australian and coastal, to the American Greenlandic paddler, might suggest that different paddling geographies and equipment technologies, "homelands" of sorts, inform us of certain paddling characteristics, or paddling character.<sup>2</sup> We might call these "points of departure," assuming that different lands, and their edge, in marriage with a particular type and choice of boat, inform us of particular motivations. What van Manen (1990) calls "essences" particular to sub-cultural acts. From my position, shaded by two elder-willows, stranded above the high-tide mark on the banks of the Hudson, I formed this episodic narration of the HRGF

### **Day 1. Land, looking out**

In front of me, some way off, boats are being carried and carted. "Schlepping" they call it. Yiddish, to "drag." Urbanized portaging of kayaks from car park roof racks to water's edge. The people are decisive and oriented. They seem to know where they're going and carry their craft in oblique yet natural ways, overcoming the awkwardness of such a large item. Everything looks light. I look upon the scene as if I've stumbled upon it by mistake. As though I've come across a

secret gathering. Bold perhaps without being loud.

It's a "scene," all in company with each other and linked. Orchestrated comes to mind. And it's hot. I pull on the brim of my hat, squeezing it down another inch. Squinting, as if looking into a low sun, may be the image I need to start with. Broad-brimmed hat, long-sleeve shirt, khaki trousers, heavy boots. An iconic image, exaggerated perhaps through an out-of-place overdressing. I stand there, resting on one leg, sweat running into my socks, observing. It's my first glimpse of the festival. I lean my pack against a section of road railing, grab a drink, and continue looking. A long-range appraisal as if scanning. I think of the metaphor posed by the Australian architect Phillip Drew (1994), who calls Aussies a "verandah people," in the way we "look out" from our mostly coastal habitation. Perhaps through a distinctive Australian lens, we are conditioned to always be looking away from firm, coastal living grounds, toward a lineal expanse of water, or in this case upon the people that dwell upon the shore. It may also suggest, given my homeland's abundance of sun, a view that ought to be taken from a place of shade. I head for the trees, for cover.

***I look upon the scene as if I've stumbled upon it by mistake. As though I've come across a secret gathering.***

As a redhead, seeking a verandah as a viewing place from which to view the world, I feel impelled by two driving forces. One, through Drew's hinting of typical *Australianism* as a sundrenched coast/edge dweller, and two, through the very nature of my skin. My day-to-day outdoor life, I often recall, is in opposition of the great health directive of Ralph Waldo Emerson (1880), who like so many now, advocated health through open exposure to the elements: "Live in the sunshine, swim in the sea, drink the wild air." I could barely live by such advice, at least not without a protective brim or sheik-like drapes of clothing, particularly in Australia where melanoma is a world-class threat.

Floating somewhere between 30 and 40 degrees south of the equator<sup>3</sup> each year as a sea kayaker and outdoor educator I have seen much of my sea-kayaking kit bleached of color like washed-up coral. I go as far as smearing zinc on my gloves, loyally embodying my government's "sun-smart" jingle of the 1990s, a time when skin-cancer rates were dramatically increasing in an aging population: "Between 11 and 3 get under any tree and you won't get burnt!"<sup>4</sup> The catchy tune played during summer TV and radio programs of my teens.

Reinforcing this, my wounded leg could turn septic in dirty water, or so my mother cautioned, ruling out a swim, and the wild air, while emotive and refreshing, seemed urbanized. The gentle easterly carried a collection of mechanical noises from the close-by mariner, fumes from boat and car traffic, and ironically, the smell of sunscreen. Pleasant in some regards, exotic even, but far from the untamed air of wilderness. Nor was the scene a place of sea, an actual sea, one of the 111 recognized worldwide as open (to the ocean) and saline. It was, however, the perfect setting. Waldo, I dare say, would be shocked at my sweeping first take of such a fine setting. It was, in all ways, a handsome place to launch a sea kayak.

As the temperature climbed steadily into the 90s, anything at a distance began to take on a shimmer, typical of places

with explosive spring growth during a surprise period of heat.<sup>5</sup> You could almost see the transference of moisture from the high green grass into atmosphere. I crossed the open field of several hundred meters to the willows. The great trees overlooked a sand and pebble beach. I had measured, at a glance I suppose, the worth of the willows by the reach of their shade. I thought of the often-mused saying that the person, who planted the trees (as I presume they were planted), never had the pleasure of experiencing their shade. I lumped my bag and thermos at the base of the smaller tree, laying claim to it as a potential backrest, my office. The small beach, an inkpot-sized bay, was gravelly and dark. In contrast to my familiar home coasts as clean-shaven and light in color, the small beach looked as if it had gone several days without seeing a razor. It seemed to lack a pushy surge of high water to wipe clean the slate. Driftwood, however, had accumulated at the high-tide mark. Teased with poison ivy and floored with a loose smattering of plastics, the little bay seemed untidy, uninhabited, and humanized at the same time. Skin-on-frame boats were gathering in number, sardined among the high-tide flotsam, placed with precision by their owners. The colors and lines of the boats were disarming. Unlike my own kit, hyper-colored in contrast to the natural world, the scene continued to unfold as a good fit.

### Interlude

At the end of day one I wrote two sea-kayaker biographies, one for each of the archetypes I had established and compared all day. One lens pointed at the Greenlander and the other turned back on myself, the Expeditioner. Each bio was written in the tone of an obituary, in a way to be playful (if somewhat morbid!) to reveal the essence of these different sea-kayak life worlds. It may also hint at the tenuous nature of subcultures or potential of such sea-kayaking archetypes running adrift without people asking questions of them during the living and breathing reality of their everyday.

### Obituary 1.

The expeditioner/Australian: Beyond sight of land, alone, paddling a dense, synthetic sea kayak, a vessel almost completely resilient of rough seas, volatile landings and puncture, this kayaker may have enticed an unfeeling of the sea unlike any form of craft in history. He

### Croton Point Park: Coastal Setting for “Ebb and Flow” Sea-Kayaking Identity?

As I’ve hinted, my first impression of the venue was its atypical sea-kayaking attributes. On a river, inland, it lacked the “outward,” easy passage to open water. The opposite bank was clearly visible, reachable within an hour of sustained paddling. While motorized leisure craft lay at anchor, buoys strewn at various distances marking boundaries, ownerships, and hazards, the scene appeared domestic. It lacked for me the sense of a “limitless, unfathomable deep” (Conery 1996). A place to pursue the intangible, an unknowing I consider inherent of a clean horizon. Where a sea kayaker may use, and need, openness to explore identity, Croton Point Park, while obviously not an open panorama of coast, seemed void, at least immediately and personally, of the opportunity to “seek the open...for its restless energy” (Duff 2003, p. i).

You could perceive this immediate scan of riverscape as a personal “ebb-and-flow,” an idea eloquently prosed by Australian coast writer Tim Winton (2010) as “scene-setter,” not unlike a curbside real-estate appraisal. From my new office beneath the willow I began questioning the particulars of the water’s edge, asking, “Who paddles here?” What is unique about this waterside location for the potential sea kayaker? Forming a comparison of my own form of coastal pushing-out to that of another. After all, what sort of paddler, am I? Where has

may have, we fear, lost his way in going so far, pushing out toward the unknown in search of the exotic. The craft may have taken on a manufacturing role, removed from the experiential outcomes. Nothing more than an effective mode of transport, used for its marvelous functionality. Its “bomber” hatches with cavernous storage (as if to bring back bounty), loose cockpit, and first-glance simplicity, all giving him the ability to travel and explore over the next horizon. The given day of paddling was spent thinking of the global position. Tracking of longitude vs. latitude a bearing within the world, as from above, boat and paddler a speck on the ocean. It was a lonely scene, but not void of partnership. As landscape geographer John Wylie (2004) writes of the “always different, always the same” sea, “tilting hugely in every direction, its real partner was the sky” (p. 241). The chromatic scene of blue split by an ever-present horizon. This fatally unnerving scene is only matched by the paddler’s ambition in its openness. Emotive reasoning behind pushing out seemed driven to and from the paddler and not the symbiosis shared with the vessel that kept him afloat. It may have been his undoing.

#### **Obituary 2.**

The Greenlander/Hudson River paddler: During the HRGF 2012 this kayaker represented, in antithesis to the above profile, indeed perhaps in *resistance* to it, a different sea kayaker in a different sea-kayaking world. This paddler is hard to talk of as an individual. It seems more appropriate to talk of the HRGF festival goer as a shared character and in several variations of this idea; both boat and paddler as one, and multiple paddlers as a collective. Perhaps this archetypal paddler went in search of self-discovery via the silk-thin material of his or her self-made vessel and found himself or herself in the company of people who were like-minded.

If we are to imagine the expeditionary sea kayaker’s mind as slightly abstract, a different and lesser breed of sea kayaker to that of the deliberate, socially engaged paddlers of the skin-on-frame sea-kayaking community, it may be that I am talking from the biased lens of one subculture and looking onto that of an equally unique subculture within the same field. The Greenlander was rarely alone. If traditionally such a paddler was in pursuit of food, and often in the company of another hunter, the contemporary Hudson River scene might represent a

this impression come from? And how, if at all, is this comparison useful?

If I am to suspend my own position for a moment in working through these questions, a generalization might presume that expeditionary sea kayaking is at the forefront of exploratory “boundary pushing” within the sea-kayaking world. That such a paddler be revered as elite, as suggested in Timothy O’Connell (2010), however, seems ill defined. I find this a strange claim for sea kayakers.

***Much like being called an elite gardener, I have always considered the act of sea kayaking an art form, a side profession amid or apart from regular life, something not undertaken for financial gain or elitism.***

Much like being called an elite gardener, I have always considered the act of sea kayaking an art form, a side profession amid or apart from regular life, something not undertaken for financial gain or elitism. Expedition paddlers are merely specialized, a mindset that has often troubled me for encouraging, I fear, weak associations of looking back toward general practice or an inability

similarly nourishing act. A way to sustain the paddlers in their regular life between sea and land. A great shame it would be to lose such a paddler, as with swirls and eddies beyond our stern disappearing unnoticed in to the sea.

## **Day 2. Sea-kayaking roots via our land and seascapes**

Arriving early at the waterfront after breakfast, I watch as the festival goers gather among their boats, tables, picnic throws, and gear crates. The momentum of the event had gained, now a thickened mix of people and equipment. Familiar in exchange, conversations start with first names and endearing nicknames. It's not, for many, the first time they've met. The scene itself—a sea-kayaking scene—is one of ease, endowed with closeness and familiarity. Sessions head to the water in tight clusters of conversation, sharing food and equipment, tactile in their gestures.

***The scene itself—a sea-kayaking scene—is one of ease, endowed with closeness and familiarity.***

Using what historical-geographers Labert, Martins, and Ogborn (2006) call “currents, visions and voyages: historical geographies of the sea,” much of my experiential bias, and my reason for first paddling, may have more to do with our visions of land and seascape. It is also highly dependent upon what form of sea kayaking I've been exposed and attracted to. At present, I have lived and experienced X amount of days inhabiting and transiting certain places, and X amount of days seated in my 16'L, 25"B Australis sea kayak. It is through this mix of social, cultural, historical, geographical and technological influences that my sea-kayaking world view has evolved. I packed in this trip to the Hudson River with a view to expand my experience and to question my ontological standing within my sea-kayaking involvement.<sup>6</sup> Not unlike the Hudson River landscaper who planted a willow tree seedling in the hope of one day providing shade, the idea hints at prospectus.

The “essence” of sea kayaking may be somewhere between the two worlds

to focus forward toward another equally specialized sector, or “types.”

Perhaps I am guilty of this. It has taken 12 years of sustained, journey-based sea kayaking to look beyond my own sea-kayaking type; this mixture of craft, coast, and self that I argue encapsulates paddling character. Put another way, I have begun to question where and why I push out to sea and indeed what sort of character I am, or become, through this. In going forward, until now, there was rarely time to pause and question these destinations. Nor did there seem enough time to glance astern, to look upon the fantastic patterns of the water, eddy-like in their dance off the paddle, a unique pattern of travel suddenly vanishing.

This unseen vanishing of our paddle swirls, or thoughtfulness in our forward tracking, may also be the homogenizing of this unique pastime, of sea kayaking becoming generic. Posed by Payne (2002) as a form of “technical reduction,” where lacking a knowledge of our kayaks (previous travels perhaps) may be a “commodification of experience” (p. 9) removing us, at least thoughtfully in this case, from a paddling act that considers our boat, our location, and our pasts in underpinning the act itself.

Through questioning these assumptions, principally my own sea-kayaking experience, I find myself at a Greenland paddling festival. I have presumed that Australian paddlers, like our U.S. cousins, are attracted to sea kayaking as a social

I have just described. A mix between the Greenland material appreciation and craft/history/home/art and the expeditionary challenge of destination/isolation/openness. Put this way, in light of contemporary sea-kayaking participation rising exponentially as a western form of recreation, both the expeditionary sea kayaking and Greenland paddling communities may be considered subcultural partners in the sea-kayaking arena.

***Personally, I have long regarded sea kayaking as expeditionary, the challenging open-sea characteristics (of the sea, and myself on them) as the sea-kayaking essence.***

Personally, I have long regarded sea kayaking as expeditionary, the challenging open-sea characteristics (of the sea, and myself on them) as *the* sea-kayaking essence.<sup>7</sup> This has been my definition of the act, biased as I say with a strong cultural history of a particular sea view and the timing of my first open-sea paddle being at a time in life when exploration beyond shore seemed eternal. It now seems appropriate, having paddled for X number of years, to question the factors that may have significantly contributed to this motivational “setting.”

Timothy O’Connell (2010), in a recent study conducted at four North American sea kayaking symposiums, looked into the defining motivations of attendees. The author cites the work of sports psychologists, environmental and experiential educators, and recreation/parks managers (among others). His work established four primary reasons why sea kayaking is undertaken: social needs, competence/challenge, intellectual needs, and stimulus-avoidance such as resting (see p. 53 for a fuller breakdown of motivations).

O’Connell goes on to talk about divergent factors that inform this

and skillful form of recreation and as a unique way to physically engage in the sea and water environment. Varying degrees of personal and felt responses to the paddling act itself, I had thought, were naturally emergent with this as a form of knowledge. Scholars will often call this way of knowing “embodiment” (see e.g., Ford and Brown 2006, for surfing) a “corporeal reality” (Phelan 2007).

It is these “felt” states of an alternative way of knowing boat and body that has attracted me to the Greenland paddling community. Having always considered Greenlandic paddling as a glide, a dance—compared with the expeditionary act as a push, a fight—it is by opposing what I have considered contrasting paddling “acts” that I hope to gain better insight into the particulars of paddling “types.” The Greenlander might be seen as “seakayaker,” as one; the expeditioner is sea-kayaker, a divided state of person and sea. Both are metamorphic in their own way, but divergent in the manner its paddlers might define the sea-kayaking act. Addressing one aspect of the more or less obvious partnership between person craft and sea might come via the concept of technics, defined by Don Ihde (1979) as an often “invisible” (p. 9) relationship between person and thing. In this case, how we might interpret our sea kayaking (worlds) through the type of sea kayak we paddle?

While Greenland and expedition-type

breakdown. Few words, other than “serenity, escape, being in/with nature, adventure” (p. 54) describe what I would consider explicit motivation for the expeditioner—experiencing “new, exotic coasts/places, of reading land from the sea, of departure and return at different locations”—furthering the idea that expeditionary travel may indeed be a subcultural act within the sea-kayaking fraternity (see “Landfalls and Departures,” Chapter I in Conrad, 1988). So too for the Greenland paddler (and potential boat builder), the intricate relationship of technics between boat and paddler is mystified within a generic, unspecific range of motivational attributes. Lack of specificity may indeed be the detraction from “regular” forms of sea kayaking, in exchange for more involved anatomies of paddler-boat relationships.<sup>8</sup>

The coastal locations of our “setting-off” (not to talk of this act as a return to the same location—another facet of exploratory/expeditionary paddling) and our interpretive feel for our craft may be considerable themes of participation for the contemporary expeditionary paddler, and indeed the contemporary (Western) Greenland paddler. Interpreted through such a lens, my current scene, even with the wide beam of the Hudson, “old-growth” landscaping, and terrestrial horizon, impressed a feeling of being closed-in.

To my right was a long line of fishing poles, pitched and taut in wait. Their owners sat idle on the beach wall, coolers—what we would call “Eskies”—keeping their drinks cool.<sup>9</sup> With me I had a thermos of percolated Americana coffee, one of the many things it has taken years to enjoy about America (also hinting at my English heritage, finding refreshment in drinking hot beverages on hot days). It was, given my circumstance, a perfect place to sit, here underneath the verandah shade of two trees. As Joseph W. Beach notes, “There is indeed, perhaps, no better way to hold communion with the Sea (water in this case) than sitting.... on the veranda of a fisherman’s café” (1905). And I had fisherman, a café (coffee at least) and a verandah, all at once.

### End of the heat wave

For the two days of the HRCF, occupying almost solely the shaded space of the willows, I noted the attributes of this unique paddling community. Typically, after several days of soaring temperatures, the “buster” quelled the heavy air with a heavy set of winds bringing the

craft-paddler relationships might lie at seemingly divergent ends of the experiential spectrum in very obvious ways, they may also be inexplicably linked. Curiously exploring the unknown world of Greenland paddling is to inquire of such links. My very presence at the event, having found it online, is evidence itself of the ease in which sea-kayaking communities can cross-pollinate across the globe. Ideas, brands, designs, event collaboration and, as might be the case for many sea-kayaking types, the ability to cultivate types. Distinct groups of people acting with certain characteristics, yet heavily linked through broad fundamentals.

And yet, as I have noted, it is the differences in essences of these sea-kayaking types that might tell us more about sea-kayaking characters and the societies that they’re attracted to or, as the case may be, feel impelled to push away from.

cool change. We had not long left the water.

***How strange and engrossing it was to see the paddlers so close to shore, so intimate in their teaching and practice.***

How strange and engrossing it was to see the paddlers so close to shore, so intimate in their teaching and practice. Having attended sea-kayaking symposiums in Australia, I know that typical programming would entail a very different kind of experience. To advance a particular skill, paddlers would stroke away from the launching location with lunch and provisions stowed, not returning until later that day. The HRGF attendees, for the most part, never left the waist-deep shore. For good reason. Rolling sessions alone made up a considerable part of the festival and seem to define Greenland paddling itself. Several variants of the roll were taught. Teachers did a fine job of spreading themselves as a resource. How different this scene was to my own rolling education. For the most part, I taught myself. A blunt and traumatic few weeks of trial and exit, empty and re-launch. At first, the motivation was to fight to gain breath, then, once a rough version worked on my strong side, to advance other strokes. Then the weak side, and the multiple variations that supplement a now healthy “war” roll.<sup>10</sup> Then, in the comfort of these skills I aimed to go further from shore. And lastly, to some degree, no longer roll. It was a means to an end, to maximize forwardness and outwardness.

Attendees of the HRGF, as with other Greenland paddling events, may have redefined Greenland paddling as Greenland rolling. A lengthy, challenging progression of mastering multiple rolls. The successful hunter, as was literal and then, now in the form of the sublime roller. It was binding to watch.

It did “feel” very much like what I imagine an actual Greenland kayaking scene would appear promote, the wise teaching the new. The

**Willowed Verandah**

Shade, as I say, acted as my outlook. Willow shade. Being non-indigenous, I imagined that the trees (*Salix Babylonica*, native to Northern China) and I had several, and tangible, themes in common. Its roots having not long pushed into U.S. soil, the willow was a product of internationalization. Transience in being carried across seas before taking stock in adapting to the local environment. Like the willow, I would use the local resources, the dirt (of my terrestrial viewing place) to develop.

In effect, I’m imagining that my fair skin and sea view have informed my socio-geographical perspective. Both tree and I are involved perhaps in finding the path of least resistance, a place to put down our roots, in new ground. And more obviously, the tree supplied me with a protective margin at the water’s edge, much like a verandah overlooking the coast.

Architecturally, a verandah is mostly practical. A solution to a particular climate and landscape. A roof of 6- to 8-foot long corrugated iron lean-to circumnavigating the archetypal *Australiana* house. Decked underfoot in gently sloping tongue-and-groove hardwoods, laid at right angles to the house to drain away slanting rain, it provides an edge like boundary for the house in a transitory way as both an inside and outside space. The house, like much of Australia’s desert interior, stays mostly dry. In

principal difference however, unlike traditional practice I assume, was not always the old teaching the young, far from it. Some of the most proficient were the young—strong and flexible. Like so much of the festival, hierarchies seemed subtle, based on the rudiments of task, craft, and skill, taught through open-minded attitudes, lacking the hard-edged atmosphere I often note of expeditionary mind-sets. If, to continue the comparison, I am to define expeditionary behavior as an act seeking the openness of the ocean, a blank canvas upon which to overlay explorations of self, it may also suggest tones of the expeditionary character being closed off—motivated in a pursuit of internality. Viewing contemporary Greenland paddling then, performed in a “closed” setting, in touch more with the shore and less with the open sea, one might surmise that sheer proximity of paddler(s) to boat(s) to shore encourages a greater sense of open-mindedness in terms of the socialization, sharing of knowledge, safety, touch-and-feel of craft, and an overall positive nature within the sea-kayaking act. This was inherently obvious throughout the event, as I suspect it is on a domestic and personal level.

While the expeditioner may push out toward the symbolic edge in a bid to gain a better understanding of self, contemporary Greenland paddlers may stay within grasp of land, the place where their societal and material world are not only tangible, but also adjoined to a notion of self-fulfillment.<sup>11</sup> By definition, this may be a true act of “liminality,” an essence of living and paddling amid the “boundary threshold” of our coasts, far more perhaps than the offshore equivalent who breaks this tie in going farther.

The very purpose of this episodic narrative may have been in search of a middle ground between the two “types” of sea kayakers—that is, to look at two subcultures within sea kayaking to delineate common essences. It may, in a very simple way, come down to the actual distance we travel from shore, the physical spaces we travel in removing ourselves from landscapes in which we find commonality. A place where the majority of our motivations are held within a comfortable bandwidth of in-touch versus out-of-touch. This distance may dictate what form of sea kayaking we are likely to engage. Sea kayaking, as a broad-reaching act, may for example take place most of the time within 800 meters or half a mile from shore. A place that, for most paddlers, is a

the summer, like our coasts, the verandah becomes more inhabited.

This looking out from the edge, no doubt typical of other cultures (island nations come to mind), could also be an apt way to describe the perspective of a sea kayaker before pushing out. An act, preclusive to the actual act itself, that in many regards sets the stage for what takes place on the water. Surfers too, who stand and watch, posted in the dunes, looking over their playground, will decipher a great many physical acts based on their shore-bound summations. For many Australians, this feeling of outlook and exposure may be typical of our geographical spaces. It is, as I have hinted, where most of us live.

Eighty-five percent of Australians live within 50 kilometers (30 miles) of the coast (2001) (ABOS). Few of us live internally as “bushies,” hardened and brown, blazed in blue skies and surrounded by old dirt. Alice Springs, our most inland city, almost equidistant to all four coasts (the Arafura/Timor Sea to the North, The Pacific Ocean/Tasman Sea to the east, Indian Ocean to the west, and Southern Ocean to the south) has a population of only 29,000. The vastness that surrounds this outpost is staggering, with less population per square kilometer than most other inhabited lands on Earth. Fewer than 0.1 people live per square mile in most of Australia, while the United States has an average density of 76 people per square mile (Australia’s

place of tactful balance. A place of eddy, where risk and competency and comfort come together to inform a state of flow.<sup>12</sup> This concept of distance, in marriage to where we live, may further support the idea that our coastscape geographies play a significant role in sea-kayaking enculturation, be it one form or another.

As I sat watching the HRGF paddlers, there seemed fragility among the practice, implicating perhaps certain inherent character traits in order to understand it. While the expeditioner must trust decisions based on unseen factors—knowledge of tides and currents, cloud progressions, trade winds, sea breezes, local weather distinctions based on land topography and so on<sup>13</sup>—the Greenland paddler is an expert technician and intimate engager with the local in less obvious ways. Subtlety is not lost on this paddler, as I would argue is often the case with the journey-based expeditioner. Greenland paddlers are preservers of the original form and act, keeping safe boat design, sea-kayak “language,” and styles and stories of a declining way of life.

To continue to oversimplify these two archetypes as binary subcultures, as opposites, is also a clearly flawed process of comparison. Naturally, and historically, Greenland paddling has been, as it still may be, expeditionary. But these traits are not what I have considered endemic to the Western form of Greenland paddling, nor, from what I can gather, live at the forefront of paddling types demonstrated in contemporary (U.S.) Greenland practice of this year’s HRGF. Indeed, traditional voyages of Arctic peoples, some responsible for human migration itself, let alone the daily, seasonal hunting for the survival of their culture, could be regarded as the most holistic, brave, expert paddling journeys ever undertaken. “Open” in all regard.

Ultimately, visiting the HRGF this year was timely. To be critical of my own background, auto-ethnographically distilling my life as Australian, sea-coast, expeditionary, plastic-boat paddler, was required if I am to comfortably theorize the material and cultural underpinnings of what many would regard as an explicitly practical, lived, and somewhat secret pastime.

What I observed on the shore of the Hudson, in the shade of willow trees, was a group of people and a form of sea kayaking that I feel will endure, refreshingly so, as a contemporary culture. As we move

overall average is 4.16 people per square mile, illustrating our coastal urbanization).

***Our heartland, to sustain the metaphor of Australia’s peripherals dominating the cultural lifeblood of the country, seems bound to the geographical externals.***

Our heartland, to sustain the metaphor of Australia’s peripherals dominating the cultural lifeblood of the country, seems bound to the geographical externals. As Australian political journalist Chris Hammer (2012) notes, Australia’s “coast, and its people help define our identity” (p. i). It is not until the green, forested, and hilled regions of our temperate edge do you find significant inhabitation, and therein, our social and cultural outlook. Yet, while most of us “live in suburbia...our hearts are elsewhere” (p. 212). As revealed earlier, novelist Tim Winton (2010) writes of his (West Australian) coastal existence, as literal “ebb and flow of the day becoming a way of life,” a love affair with the coast and sea. Our land’s edge is a place of surrender, play, and leisure.

Australian’s “coastness” if seen through the statistical breakdown of demographic trends, is also increasing. Between 1996 and 2001 data show a rapid increase in coastal town/

further from the roots of physical-human-travel in our everyday lives, it is invigorating to see a motivated group of individuals doing more in less space than almost any other form of sea kayaking I have witnessed.

I wish to thank the members of Qajaq USA, the organizers of the event, and the wonderful attendees who made for such a memorable festival.

### Bio:

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small city populations. (The most recent demographic data showing the trend that large coastal towns close to major Australian cities are exponentially rising in population supports the colloquial saying that people are adopting a less-urban form of "sea-change.") Australians are spreading along the coast, intensifying the populations of coastal towns and villages in a marked way. With this, we indulge in our most obvious of geographies, the sea. Perhaps, in this act, we wash away some of the inland dirt and smell of the bush that for so long has provided a defining cultural motif. Our new home is the coastal edge, touching the sea. Daily, we build a new icon though opportunities to swim, surf, row and fish, to name but a few. And as a nation we're also learning to paddle. (Saying nothing of the indigenous paddlers of our Australia, who made and traveled in watercraft for many thousands of years.) This is why, to some degree, I find myself in New York during mid-year. (Australian leisure rates are on the rise, particularly beach/coastal activities such as surfing. NB: sea kayaking is not denoted or segregated within this data (ABOS 2009).)

The typical Australian habit of people spending a good majority of their leisured summers enjoying the coastline may also contribute to our collective day-to-dayness around water. What Varley (2010), commenting on small-boat usage along British shores, calls "liminality." Of being shore-bound but also having space, open and blank to ponder the next move. Yet still be able to grasp and touch, and be grounded by land. Ask any lifeguard what their first tool of saving a pan-

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## Footnotes:

<sup>1</sup> Talking of human-made "synthetic" (petrochemical) plastics as opposed to animal "plastics." Large molecule polymers chemically arranged to create an infinite number of molds and items. "Plastics have revolutionized the world" (Freudenich 2012) yet might instill a certain degree of "neutrality," or "invisibility" to our idea and relationship to plastic as a material. Conceiving or replicating modern manufacturing processes using granulated plastic is near impossible on a domestic scale for most of us. Something we can't see or do ourselves might promote "plastic" as a material and idea that is overly complex and intangible, becoming almost "unseen" in our relationship with it. In a plastic sea kayak you can't see ribs, joins, parts, or their specific purpose in design, losing perhaps to the paddler a rational series of processes that define the material. Unlike a tree, or cotton, for example, that has a tangible life before used in the form of a kayak.

<sup>2</sup> Qajaq USA is the American chapter of the Greenland Kayak Association (Qaannat Kat-

icked swimmer is and it's usually to simply say, "Stand up," whereby the victim finds a footing. It's amazing the difference a foot of ocean can make to our mindset, of being in touch, with just a hint of depth and danger to offset our landness. Again, we are bound to this coastal fringe, attaching our way of life to the edge.

Through this idea of attachment, a binary feeling of "safe-thrill," it may be said that Australians, like Americans, play in the shallows of our coast more than reaching beyond it. The coast, as "boundary" in this way, may inform our recreational thresholds. Going beyond a safe distance from shore depends on the kind of shore we are talking about, thereby informing what kind of recreation, adventure, or play is carried out there. Something can also be said of the time we spend at these coasts.

Naturally, our coastal visits are undertaken with a swag of preconceptions stored as a form of geo-cultural ballast in what is a seemingly simple act. For Australians, the structure of our principal holiday season, for example, might play a considerable role in shaping this "coastness" and familiarity with open sea. Christmas and New Year's amid our December-February summer, "wallowing in the traditional post Christmas beach holiday" (Hammer 2012, p. x), Australians head to the beach in the skimpiest of clothing beneath a blazing sun. A time of family, community, food, and relaxation through a workless period of the calendar. Lazy and hot weeks of recluse from buildings and work, while winterized in layers, the northern hemisphere

tuffiat) and is dedicated to the continuation of traditional Greenland kayaking cultures. Greenlandic paddling in all instances (unless stated) throughout this paper refer to Qajaq USA, and particularly to the 2012 HRGF.

<sup>3</sup> Where ultraviolet radiation levels are on average twice that of the U.S. mainland. Averages across seasons and overall landmass. UVR statistics from U.S. Environmental Protection Agency (2011) and Australian Radiation Protection and Nuclear Safety Agency (2007).

<sup>4</sup> Australians were the first users (commercially) of zinc oxide for protection against the sun. It is still hard to find (a zinc stick or tube) in most parts of the world, yet one would be available at most petrol stations in Australia and every supermarket/pharmacy. It is also extremely hard to get out of clothing and sea kayaking kit. My PFD looks more like an artist's coat, covered in different colored zinc smears.

<sup>5</sup> The uses of imperial measurements, still dominant in the United States, are mostly lost in Australia. Some still remain; newborn baby weights and freshly caught fish in pounds, house sizes talked of in squares, and depth of graves in feet—as with a person's height. The imperial/metric subtlety came to mind at several occasions during the HRGF. Measuring tapes with dual scales (although still easy to buy in Australia) with inches and fractions on one side, metric decimals on the other were one instance. In boat building, the use of human body parts as measuring gauges is a wonderfully old-world remnant of how we copybook and self-patent our productions, as is the learned use of multiple scales of measure. Like food culture, such measures are often the last thing to depart from societal use.

<sup>6</sup> My current PhD working title is "The secret life of the sea kayaker" and will take a phenomenological perspective of sea kayaking using various ethnographic approaches. Naturally, it is also our winter in the south, often a time when sea-kayaking trips, symposiums, or festivals are shelved until the summer months.

<sup>7</sup> Noting in full that "expeditionary practice" is a defining trait of traditional and formative acts of sea kayaking and indeed a vital constituent of Greenlandic sea-kayak design and practice. The concluding remarks will reiterate this.

<sup>8</sup> Regular in this case, given the context of this paper, would include other forms of sea kayaking that are not directly involved in the Greenland paddling community, or multi-day expeditionary style journeying. Typically, for this author's definition of "regular," an involved interest in the material underpinnings of the sea kayak would also be minimal.

<sup>9</sup> Esky is a brand of cooler, originally made by an Australian company, associated the Eskimo people with cold climates. The logo is of an "Eskimo" holding a hunting spear. Use of the work Eskimo has decreased in the United States, given its pejorative connotations. I imagine this context would be rarely considered in Australia when we talk of an "Eskey." The U.S.-owned Coleman brand acquired the "Eskey" brand in 2009.

<sup>10</sup> The ability to roll in rough sea/surf (real) conditions. The first time someone asked if I could "war roll," I thought they were refereeing to sliding myself forward by elbows under barbed wire, thinking it an odd question to ask while at sea in a sea kayak.

<sup>11</sup> For "edgework," concepts within adventure (in this case away from the coast), see Lyng (1990).

<sup>12</sup> For "flow" concepts see Csikszentimihalyi (1990).

<sup>13</sup> Saying nothing of being seated in a craft composed of materials that are a product of a rigorous industrial age.

heads back to work, having only a brief pause in its employed life. Gaining this leisured sense of coast and free time through a substantial holiday period seems less afforded in the American summer. For the life of the northerner, this time of activity may also be constrained via the social and geographic coastscape (a more densely populated and owned coastline, and less of it, not counting Alaska) and through a more diverse range of seasonal climate variation, in all representing a different kind, or larger range, of sea-kayaking cultures.

**For reasons both obvious and subliminal, much of our leisure time is consumed through these coastal experiences and may very well be a profound ingredient in how we live.**

For reasons both obvious and subliminal, much of our leisure time is consumed through these coastal experiences and may very well be a profound ingredient in how we live. Like Winton, Leone Huntsman (2001) comments on how edge life can be likened to romantic love, a "love affair with the beach" (p. 2) and come to define how we act, forever after, in its presence. For the sea kayaker in marriage with a particular kind of vessel, this climatic, geographical, and social background might be instrumental in defining how our sea-kayaking acts take shape.

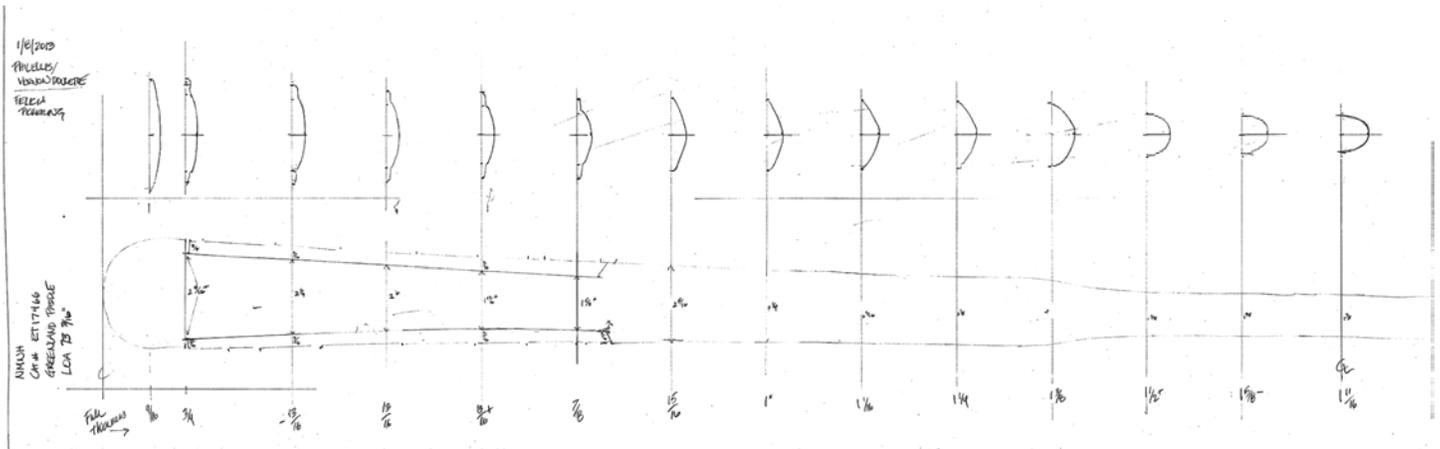


*Greenland Paddle, Cat. ET17466,  
National Museum of Natural History.  
Photo: Vernon Doucette*

## **Paddle Survey at the Museum Support Facility to the National Museum of Natural History, Suitland Maryland, 7–9 January 2013 By: Tom Milani**

Located a few miles northeast of Washington, DC, in Suitland, Maryland, the Museum Support Facility for the Smithsonian National Museum of Natural History (NMNH) is nestled in a saddle of land below an access road and several parking lots. A ring of sculptures seems to stand in welcome. Qajaq USA members Don Beale, Vernon Doucette, Phil Ellis, and Tom Milani spent three days surveying paddles in the facility's collection. Accompanying us on the first day was Joe Youcha, of the Alexandria Seaport Foundation; he'd worked closely with the National Museum of the American Indian and knew several of the facility personnel.

On day one we met Stephen Loring, Museum Anthropologist and Arctic Archaeologist, Arctic Studies Center/NMNH Smithsonian Institution, and Felicia Pickering, Museum Specialist, Ethnology, Department of Anthropology, NMNH, Smithsonian Museum Support Center. They had arranged for us to get badges, which enabled us access to the lab area. Stephen gave us a tour of some of the museum's holdings. The facility interior has an industrial look to it, but the collections are magical. Stephen opened cabinet after cabinet to reveal hundreds of artifacts—Arctic sunglasses,



*Greenland Paddle, Cat. ET17466, National Museum of Natural History. Survey drawing by Phil Ellis and Vernon Doucette.*

intricately carved paddles from the southern hemisphere, harpoons, spears, bows and arrows, and paddle after paddle after paddle—and the contents of any single drawer or shelf merited wonder.



*Facility interior. Photo: Tom Milani.*



*A sample of some of the artifacts in the Museum Support Facility. Photo: Tom Milani*

Felicia showed us the lab where we would be working and helped us gather paddles for the survey. Some discussions between Vernon and Don and the museum led to their selection of paddles from East and West Greenland, Alaska, and the Canadian Arctic, which included single-blade, symmetric, and asymmetric samples, along with one paddle fragment.



*Vernon, Felicia, and Don examine some paddle specimens.  
Photo: Tom Milani.*



*Cart holding paddles to be surveyed.  
Photo: Tom Milani.*



*Work area. Photo: Tom Milani.*

Before we left for the day, we discussed ground rules for working with artifacts. Gloves were to be worn at all times and handling the paddles was to be kept to a minimum. Where possible, the paddle was supported with sandbags or foam blocks, and care was to be exercised when taking off profiles with gauges.

On the second day our surveying began in earnest, but our approaches varied. How much detail to include depends on the purpose of the measurements. If it's to record identifying characteristics of the paddle as a means of highlighting its features to classify it as a type, less detail is needed than if the purpose is to be able to reproduce the paddle exactly. But the second purpose has its own set of complications because we have no way of knowing how much of the paddle's shape is the original maker's intent and how much is the result of age, storage conditions, or use. For example, we observed a Greenland paddle with

feathered blades and a single-blade paddle with the blade upswept in a curve at the end. The feathered blades, which were fairly symmetrical, didn't appear to be the result of wood warping. The single-blade paddle's curve, on the other hand, most likely was.



*Single-blade paddle. Photo: Tom Milani/Don Beale.*



*East Greenland paddle with feathered blades.  
Photo: Tom Milani/Don Beale.*



*Vernon examines a paddle before taking measurements.  
Photo: Tom Milani.*

The mechanics of taking a survey were straightforward. First, determine the orientation from which the paddle is to be surveyed initially. For our purposes, the left, top side of the paddle was designated A; the right, top side was designated A/A. The left, bottom side of the paddle was designated B; the right, bottom side was designated B/B. Once the orientation was established, baselines were drawn, and the length overall was measured and recorded. One of the initial photographs showed a ruler to establish scale and a color card for later color correction.

The paddle was traced, with notation made of identifying features. For example, for paddles with bone armor, the location of each pin securing the bone to the wood was noted, as was the thickness of the armor. More measurements were taken where the paddle shape changed, such as for the blades; fewer measurements were required for the loom. Once the basic shape and dimensions were established, profiles were taken at regular intervals using a pattern gauge. The pattern was then recorded above the drawing of the paddle itself. This established the shapes of the blade, but the thickness was also measured with a digital caliper and noted. If the paddle was essentially symmetric, the blade profiles need only be noted at one end. For Aleutian paddles, which have very different front and back side blade shapes, profiles were taken of each side and recorded. Also recorded were accession numbers and other collection information noted on the card accompanying each piece.



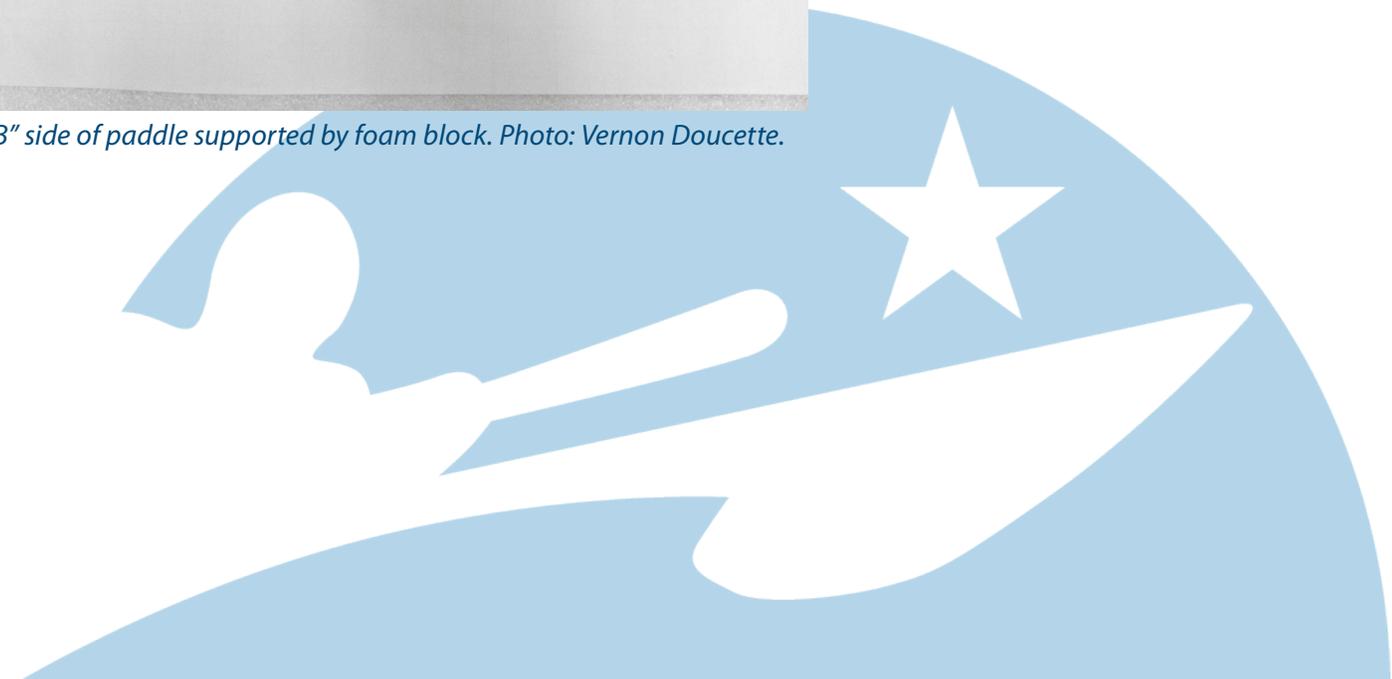
"A" side of a paddle, with color card and ruler. Photo: Vernon Doucette.



"B" side of paddle supported by foam block. Photo: Vernon Doucette.

One highlight of our visit was seeing several skinned kayaks—one Greenlandic, one Alaskan—and their associated paddles, and during our visit, we were able to help correct the accession information for one paddle. By the end of our last day, we had full-size drawings of around a dozen paddles. These will eventually be scanned and made available to the Qajaq USA community. Such drawings provide a valuable record of Inuit technology and, we hope, will spur future study. Reproductions of the paddles may provide even greater insight into their function.

All of us would like to express our appreciation to the Museum Support Facility staff for the extraordinary access granted us. Their hospitality made our work productive and enjoyable. We are grateful to Stephen Loring for helping facilitate our access and for his entertaining and enlightening tour of the facility. We also would like to thank Felicia Pickering for her patience and for so efficiently handling our many requests; we couldn't have done it without her.



# Qajaq USA Financials

## QAJAQ USA PATRONS

This table provides an indication of how member dues support the entire Qajaq USA community. The single most used asset, the Qajaq USA forum, is free to members and non-members alike and operated entirely by volunteers. If you are not a member, we ask that you consider joining.

### Qajaq USA expenses FY 2010–2011 and FY 2011–2012

Expense	Total	Notes
Board	5410.98	These funds help pay for some Board member travel and support at retreats and training camps; Board members usually are part of the mentor team at these same events.
Dues and taxes	526.42	
Membership	1000.87	Membership expenses
Publications	660	These funds supported preparation of the next issue of the <i>Journal</i> .
Public relations	2004.64	QUSA attendance at general paddling festivals and shows.
Store	7264.82	Merchandise expense and postage.
Trailer	306.4	Maintenance expense for the trailer used to haul Qajaq USA kayaks, paddles, and Smurf gear.
Website	1182.31	Fees for the Qajaq USA website.
Workshop support	4823.48	Qajaq USA offers stipends for all sanctioned events to help offset the cost of bringing in guests.

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