Looking for Sites at the Water's Edge

For Canadian archaeologist Quentin Mackie, the story begins with an idle thought—and ends with a surprising find that could redraw human history for the coastal Pacific Northwest.

While flying to the 2013 Paleoamerican Odyssey conference in Santa Fe to present a paper on finding submerged archaeological sites, Mackie wondered what sort of sites would be easiest to find. Campsites? Lithic scatters commonly found on dry land? No, he decided, not robust enough to easily locate and photograph on a drowned coastal plain.

Fishing sites came to mind. Some sites he has examined over the years contained fish weirs—large structures designed to corral fish and make them easier to catch. They are big enough to show up on sidescan sonar, a common tool for underwater archaeologists, the University of Victoria associate professor recalled thinking. Even choked with sediment and sticking up only ankle height, there should be a good chance of detecting one with an Automated Underwater Vehicle in deep water. The idea appealed to him, so he went on line to see what types of AUVs were out there. "The first one that came up was a bright yellow one," he recalls. To his amazement, it sported a UVIC logo. He confesses, "I had no idea my institution had an AUV."

Found, a probable paleo fish trap under 375 ft of water

Returning home after the October 2013 Paleoamerican Odyssey conference in Santa Fe, Mackie contacted the university's Mechanical Engineering department, which had the AUV previously used for finding a shipwreck off Canada's coast. Mackie left a brief message: "You don't know me. I have no money, but I have a great idea. . . ." Surprisingly, Mackie's concept got the green light. Within a couple of months a research project "all fell together." Mackie gives the lion's share of the credit for success to Alison Proctor of the UVIC Mechanical Engineering Department, an expert in AUV work. "Couldn't have done the work without her!" says Mackie. Funding for the AUV work was provided by the Ronald Ramsay Trust Fund, UVIC Engineering.

The area Mackie planned to explore lay off the southern tip of the archipelago of 138 islands 130 km offshore from the British Columbia mainland formerly known as the Queen Charlotte Islands, now Haida Gwaii. The southern one-third of the archipelago is the Gwaii Haanas National Park Reserve/Haida Heritage site (known simply as Gwaii Haanas), the home of the Haida people for millennia. Detailed sea-floor maps identified hot spots for potential sites along a network of three submerged river channels and tributaries in Juan Perez Sound off Haida Gwaii.

In August 2014, Dr. Proctor at the controls "flew" the 3½-m-long, $1.5 million AUV on an 8-day flight above the sea floor. In flight the AUV surveyed a transect of the sea floor 100 m wide at a resolution of about 50 cm. In all, the team surveyed 125 km of transects and discovered what may be a 13,700-year-old rock-wall fish weir at a depth of about 122 m. That's about 14 m above the Pleistocene low stand of 145 m. If confirmed, possibly this year, it will be the oldest fish weir in the world—pushing back the earliest human occupation in the Canadian Northwest to a startlingly early date and giving a boost to a West Coast route of entry to the Americas, one of several hotly debated theories on how, and when, people first entered the New World.

It's noteworthy that in 1998 Fedje and Josenhans discovered a stone tool on the sea floor 60 m higher and 1 km distant from this probable weir. For Mackie, their study was "a breakthrough and an inspiration."

"We have some very suggestive-looking pictures," Mackie says with cautious excitement. "We have at least one potential stone wall. It's not ideal, but it doesn't look super geological. It's very narrow and at right angles to a small creek, analogous to hundreds of fish weirs we've seen." From the information available today it looks to Mackie like a probable weir. Sidescan pictures from the AUV, unfortunately, lack the resolution needed to confirm cultural features.

Based on the team's understanding of sea levels as measured by numerous data points used to establish a baseline for variations in sea level over the years, the weir was last above water about 13,700 years ago—part of a lush landscape that provided a migration route for game animals and people, suggests Mackie. But researchers must verify the find, which Mackie says won't be easy. "It will have survived sea-level rise," he explains, "but probably its original structure has been reorganized a bit over the years." It would be ideal to find wooden stakes associated with it, but he doesn't hold high hopes of finding any other artifacts there. Because of the depth, they need to use a Remotely Operated Vehicle (ROV) to examine and photograph it more clearly. "But just pictures of a potential fish weir aren't going to cut it," he realizes. "We need something unequivocally cultural." A return to the site this year is Mackie's target if he can obtain an ROV (another expensive research tool). He also hopes to take soil samples along the submerged intertidal zone and associated terraces adjacent to the suspected weir.

The prize: proof that boat people colonized the Americas

Although finding the potential fish weir is a definite highlight in Mackie's research, it's just another chapter in ongoing research for Canadian researchers who have been exploring the Gwaii Haanas archipelago for more than two decades with support from Parks Canada, the University of Victoria, the Park Reserve, and the Tula Research Foundation. By closely studying changes in coastline shapes and sea level over time, analyzing countless numbers of soil cores, and creating detailed sea-floor maps using the latest in sonar technology and computer modeling, Canadian archaeologists are opening new avenues for understanding ancient human activity along the Pacific Northwest coast. Their successes have researchers from Baja Mexico to Alaska focusing renewed energy on finding early submerged sites, the Holy Grail for archaeologists seeking to bolster support for a hypothesized West Coast entry into the Americas.

Working in a land of many coastlines are Drs. Mackie, Duncan McLaren, and Daryl Fedje, former archaeologist with Parks Canada and now a part-time assistant professor at UVIC (his footprints appear large across Gwaii Haanas after decades of unraveling its prehistory). Together with their colleagues, they have produced mounds of data and recorded hundreds of sites along the archipelago. Their contributions constitute a singular corpus of literature that illuminates ancient lifeways along the storm-tossed Canadian Pacific Northwest Coast and motivates other archaeologists to seek coastal sites. They also acknowledge work being done by two coauthors farther south, Loren Davis of Oregon State University in Corvallis and Amy Gusick, formerly with the University of California–Santa Barbara and now archaeologist for HDR Inc. in San Diego (**MT 24-3,** "Putting muscle into coastal-entry research").

People at home in a harsh, changing environment

Harvesting a treasure trove of artifacts and evidence from the Gwaii Haanas archipelago, the research shows a broad mosaic of ancient people hunting bears, fishing, and tapping a wide range of marine resources at the terminal Pleistocene. The fish weir, if verified, would enormously march backward in time the onset of that occupation, says Mackie. He hopes that coastal sites at least 15,000 years old will eventually be found.

At the very least, the breadth of research on the Gwaii Haanas archipelago resolves the uncertainty of a decade ago, when there existed no conclusive evidence of substantial maritime adaptation along the Northwest coast before 5,500 years ago. "There were earlier sites," says Mackie, "but poor preservation made interpretation difficult, and so it was considered unproven whether there was substantial marine resource use before that date." Now a new family portrait of First Americans is emerging. "What we have," Mackie tells us, "is a far more ancient people living large across an enormously challenging landscape, people who seem to have nearly limitless capacity for adaptation and survival."

Contrary to previous views, Mackie is convinced these were a people "comfortable with marine resources at a very early time in a part of the world where the environment is pretty challenging. We aren't talking about nice warm water here. This is cold and turbulent water, and yet people were very comfortable with it as they adapted to what was a dynamic, quickly changing environment."

How the environment changed over time has taken archaeologists years to divine, and the literature suggests that the theory that pictures boatloads of immigrants from Asia paddling down the West Coast into the Americas has a way to go before it is firmly established.

Canadian archaeologist Knut Fladmark is most often associated with the West Coast–entry hypothesis and the use of boats by people moving south out of Asia into the Americas (**MT 14-1,** "Fladmark, still a coast-route champion, decries archaeology's terrestrial bias"; **MT 15-3,** "Boats or footprints? Archaeologists urged to consider watercraft"). Attempts to investigate his suggested route, however, have been frustrated by evidence drowned under fathoms of water when continental glacial ice melted and raised the sea level. Then there's the storm-tossed Pacific coastline itself, where high-energy waves erode potential sites and chip away at coastlines.

Coping with constantly changing shorelines

Nor are all coastlines the same, cautions Mackie. The Gwaii Haanas terrain, sea-level changes, and occupation sites have been greatly affected by glaciation, which has created a land of many coastlines—a crenulated, irregular landscape with numerous environmental niches that lured human populations since the Pleistocene. Even in the case of fairly regular coastlines farther south, in Oregon and California, for example, many ancient shorelines and near-shoreline sites are deeply submerged and subject to constant ocean turbulence. Without exceptionally detailed ocean-floor mapping, soil analysis, and other expensive hard science and computer modeling, it's easy for archaeologists to become pessimistic about their chances of finding needles in a seemingly mountainous haystack. "Doing hard science, particularly underwater, on a social-science budget is difficult," Mackie admits.

Nevertheless researchers in Oregon and California, coauthors of Mackie's *Paleoamerican Odyssey* paper, are working on it and enjoying limited success. "We don't have anything offshore in state or federal waters as yet," says Dr. Davis. Funded by a federal contract intended to support possible offshore energy development, he and other researchers are creating highly detailed maps and predictive models for Oregon, Washington, and California along the outer continental shelf to a depth of 135 m, "what we think is the depth of the last glacial maximum." Creating these maps and models has been an experience, like the Pacific Ocean, sometimes turbulent. Computer programs to examine 10-m-square "tiles" of sea floor took eight hours to run because of their detail and complexity, Davis recalls. It wasn't long before they overloaded personal computers used to process data. "It actually melted the graphics card on our computer," Davis says with undisguised surprise. "I never thought I could find the limits of a personal computer."

Detailed maps and models show some of the "highest of the highest" possibilities for finding sites. They also paint a portrait of a paleolithic shoreline vastly different, says Davis, from "today's straight, boring coast." Researchers are discovering more streams etched across the ancient landscape than suggested by present shorelines, and numerous ancient estuary systems are also appearing—all magnets for early people. It appears that in the past "there was much more diversification" of landscape, he says.

The difficulty and expense required to test the models make for hard-won gains. Nonetheless researchers are sometimes happily surprised. For example, Davis tells of finding extensive submerged ground-based fishing banks off the coast. These low-lying mountains would have been a barrier to the Pacific, and behind that shield are ancient bays and estuaries. One submerged bay in particular on the central coast of Oregon, roughly between Newport and Heceta Head, has caught his interest. "Smaller than San Francisco Bay and bigger than San Diego Bay," he describes it with undisguised excitement. He identifies it as a prime target for further detailed research, possibly with robotic underwater vehicles, once scientists iden-

tify the highest probability areas. Discussions are currently underway with National Oceanographic and Atmospheric Administration (NOAA) scientists to conduct underwater archaeological research in the area by underwater drones, possibly in 2016, using sea-floor maps he and other researchers have produced.

25 **Look first for sites on shore**

Very old sites found onshore along the Oregon coast are the incentive to test for even older sites offshore. For instance, people lived at the Indian Sands site in Curry County more than 10,400 years ago (**MT 22-1,** "Late Pleistocene Occupations on the Oregon Coast"). The site is endangered, however, by coastal high winds that are deflating the sands above the shoreline and threatening to obliterate evidence of occupation.

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Ancient sites also appear farther down the coast in California. The Channel Islands off Santa Barbara hold vast potential for Pleistocene-age finds (**MT 25-4,** "A Story of Ancient Mariners"). Dr. Gusick points out two significant finds: The Arlington Spring skeleton site on Santa Rosa Island near Santa Barbara (**MT 22-1,** "Arlington Springs—the story isn't over yet"; **MT 21-4,** "First lady of the New World: Arlington Springs woman"), a coastal site occupied nearly 13,000 years ago; and work being done by Jon Erlandson at Daisy Cave on San Miguel Island (**MT 26-4,** "A story of ancient mariners"; **MT 13-2,** "Living on the Rim"), which has yielded evidence of cordage use about 10,000 years ago.

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Davis and Gusick credit Mackie and his Canadian colleagues with spearheading Pacific coastal research by finding and sampling paleolandscapes—much of it, surprisingly, not underwater. The end result is quite impressive: more than 600 sites within Gwaii Haanas alone, which Mackie is confident date to a narrow window around 10,700 CALYBP, when sea level was similar to today. "This is a large sample of Pleistocene sites," he declares, "especially for the Americas."

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Mackie cautions that deciding where to look for ancient sites is crucial. A multiplicity of factors—relative sea level, shape of the landscape, and shoreline complexity—affect the "coastal geometry" to be considered. Specialists in geoarchaeology, the marriage of soil science, geology, and cultural anthropology, are indispensable in finding ancient sites on land or under water.

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30 **Glaciation is the spanner in the works**

Context, in this case geophysical context, is everything. Glaciation looms large in the history of the changing landscape of the Canadian archipelago, including Gwaii Haanas and surrounding territory, for its role in shaping the ancient shoreline and today's shoreline. Shaping results from a complex interaction among forces: isostatic rebound (the rise of ice-depressed ground after glaciers melt), tectonic (normal mountain building) forces, and eustatic forces (sea-level rise). The impact of these forces varies with the contours of the landscape and therefore creates uneven changes in area. Researchers seek the "sweet spot" between extremes for potential sites. It's what Mackie's colleague, Dr. McLaren, calls "the coastal plain which was never drowned," where the complicated mosaic of natural forces balanced each other out and created relatively water free Pleistocene-age sites. McLaren has explored Dundas Island near Prince Rupert, and Hakai to the south, examples of ancient above-water sites on essentially undrowned remnants of paleo-age shorelines close to modern shorelines. Such areas are desirable because they're easily accessible and involve digging on land rather than underwater, although in some cases only for short periods during tidal fluctuations.

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Kilgii Gwaay is a stellar example of regional intertidal sites (**MT 24-3,** "Early bear hunting and ceremony on the Northwest Pacific Coast"). In a small south-facing cove on a small island of southernmost Haida Gwaii, about 10,600 years ago a summer camp was occupied that left shell-rich cultural deposits and evidence of other activities. According to Mackie, "It's a fairly large site with a lot of different activity areas and different preservation and site formation processes, even within a single beach." The site was under water until recently. Field work from 2000 to 2012 recovered more than 6,000 lithic artifacts in intact deposits, including distinctive unifacial tools and a few bifacial tools, but no microblades. Mackie credits his colleagues Fedje and McLaren with much of the work done there. Researchers also found bone, wood tools, and hearth material. Remains of marine animals including albatross, seals, sea lions, ling cod, rockfish, and halibut are compelling evidence for Mackie that these ancient people were proficient at living off the sea and had boats. As we might expect of scientists, however, not all researchers agree that early people would have been comfortable in a Northwest marine environment or would have risked travel by boat in the cold north Pacific Ocean (**MT 15-2,** "First Americans probably were not marine specialists, scientist argues").

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According to the paper of Mackie et al., "Kilgii Gwaay appears to be a summertime base camp for logistically organized people who routinely used watercraft and employed a variety of organic technologies in pursuit of their fully maritime adaptation." Prior to 11,000 years ago, it was likely a freshwater pond in a remote saddle valley in Haida Gwaii's interior. But the landscape didn't remain static. As the sea level rose, the occupants constantly abandoned campsites as the landscape was drowned. Mackie emphasizes that "Kilgii and the 140 intertidal sites are, literally, underwater sites that have been re-exposed after 10,000 years of being up to 15 m below modern sea level." Understanding how people moved across a changing environment is crucial to finding sites, Mackie tells us. Variables that account for the likelihood of campsite relocation must be factored into predictive models if sites are to be found and interpreted.

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Onshore sites are an attainable goal 34

Although Mackie hasn't abandoned hope of finding submerged sites to bolster the West Coast–entry hypothesis, he emphasizes the need to keep looking for above-water sites. "The underwater stuff is interesting, sexy," he admits, "but the best chance of finding sites is going to be with tried-and-true archaeological methods on land. Find something, dig it up carefully—traditional solid archaeology." Indeed, in recent years tantalizing sites have been found in the West that appear to be

of pre-Clovis age: The Manis Mastodon site in a marshy area on Washington's Olympic Peninsula, at nearly 14,000 years old (**MT 28-2,** "The Manis Mastodon in Context"); Ayer Pond on Orcas Island at 13,900 years old (**MT 26-3,** "Pre-Clovis Butchers of *Bison Antiquus*"); and Paisley Caves in central Oregon, with its possible 14,200-year-old human coprolites and projectile points topping 12,800 radiocarbon years old (**MT 28-2,** "The Western Stemmed Tradition points from Paisley Caves: Older than Clovis"; MT 25-4, 26-1 "Paisley Caves"). These sites promise a shining potential for coastal research. But look above the sea first, Mackie emphasizes, and pinpoint suspected submerged sites so the huge sums of money it takes to test them will be well spent. After decades of Canadian research, Mackie is convinced that an early entry to the Americas along the Pacific Coast is more than a possibility. It's clear to him that "these people had boats, particularly around Haida Gwaii, which is as remote as it gets."

When researchers set about making detailed maps and predictive models for finding potential sites, they must be careful, he counsels, not to sell Paleoamericans short. "We shouldn't limit our ideas of what these people were capable of," he says. "They appear to have had few limitations. Rather than thinking what could these people have done, we should be thinking, What couldn't they have done? I think that is going to help with building models and eventually finding more stuff."

–George Wisner

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Suggested Readings

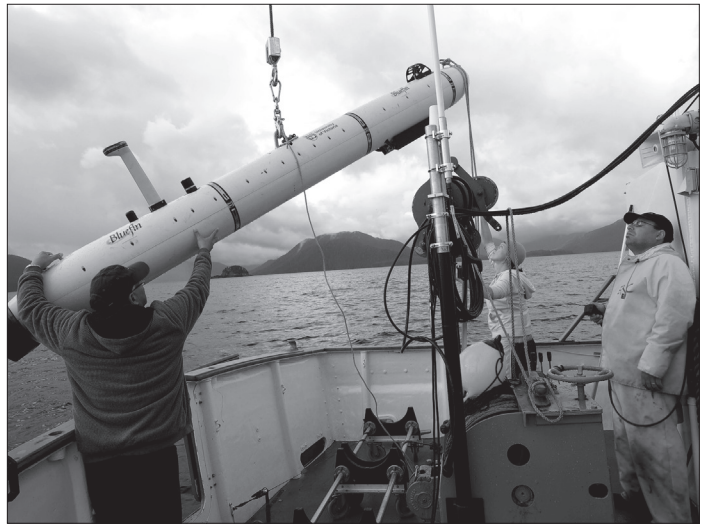
Fedje, D. W., and Q. Mackie 2005 Kilgii Gwaay: An early maritime site in the south of Haida Gwaii. In *Haida Gwaii: Human History and Environment from the Time of the Loon to the Time of the Iron People,* edited by D. W. Fedje and R. W. Mathewes, pp. 187–203. University of British Columbia Press, Vancouver.

Mackie, Q., L. Davis, D. Fedje, D. McLaren, and A. Gusick 2014 Locating Pleistocene-age submerged archaeological sites on the Northwest Coast: Current status of research and future directions. In *Paleoamerican Odyssey,* edited by K. E. Graf, C. V. Ketron, and M. R. Waters. Center for Study of First Americans, Texas A&M University Press, College Station.

McLaren, D., D. Fedje, M. B. Hay, Q. Mackie, I. J. Walker, D. H. Shugar, J. B. R. Eamer, O. Lian, and C. Neudorf in press A post-glacial sea level hinge on the central Pacific coast of Canada. *Quaternary Science Reviews* (2014), http://dx.doi.org/10.1016/j.quascirev.2014.05.023.

QUENTIN MACKIE

Duncan McLaren excavating in a small coffer at Kilgii Gwaay.

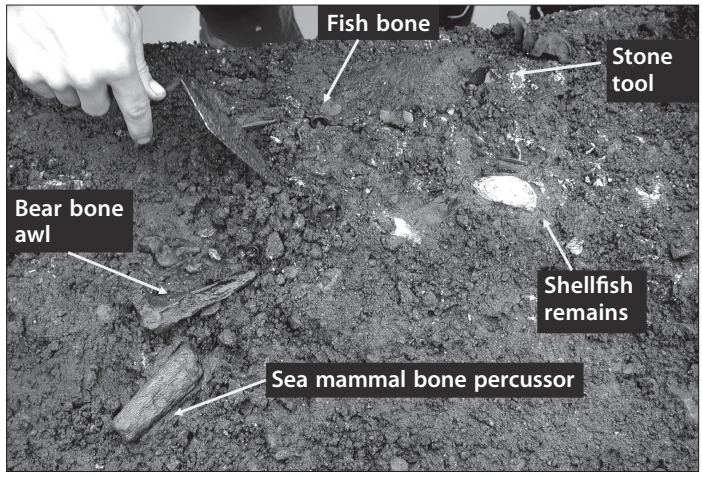


QUENTIN MACKIE

The Bluefin AUV coming aboard the Parks Canada vessel *Gwaii Haanas II,* August 2014.

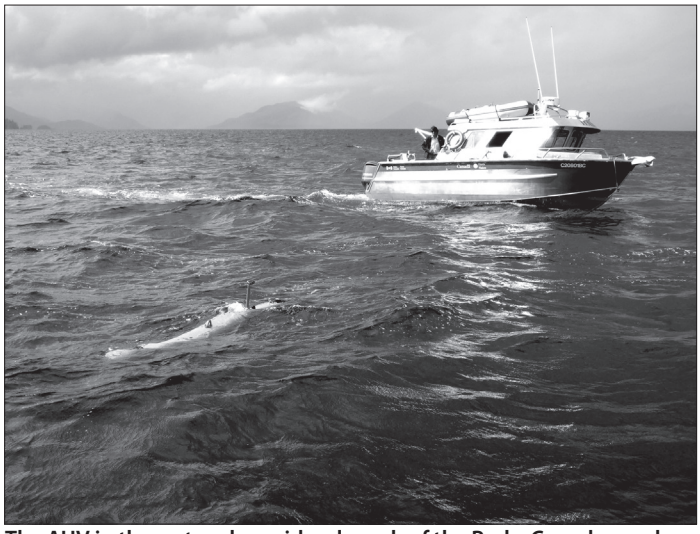
DARYL FEDJE

41 Fragment (1 cm long) of 3-ply braided cord held in hand, 10,700 CALYBP.



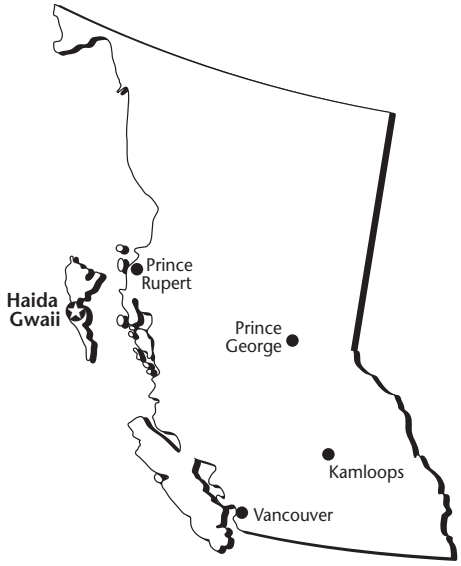
QUENTIN MACKIE

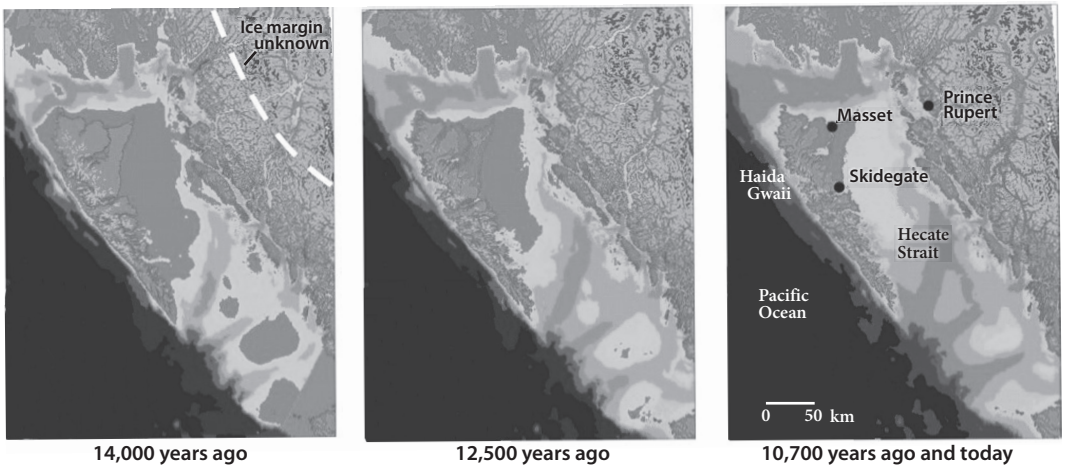
Some of the contents of in situ deposits at Kilgii Gwaay. 43



DARYL FEDJE

42 The AUV in the water alongside a launch of the Parks Canada warden.

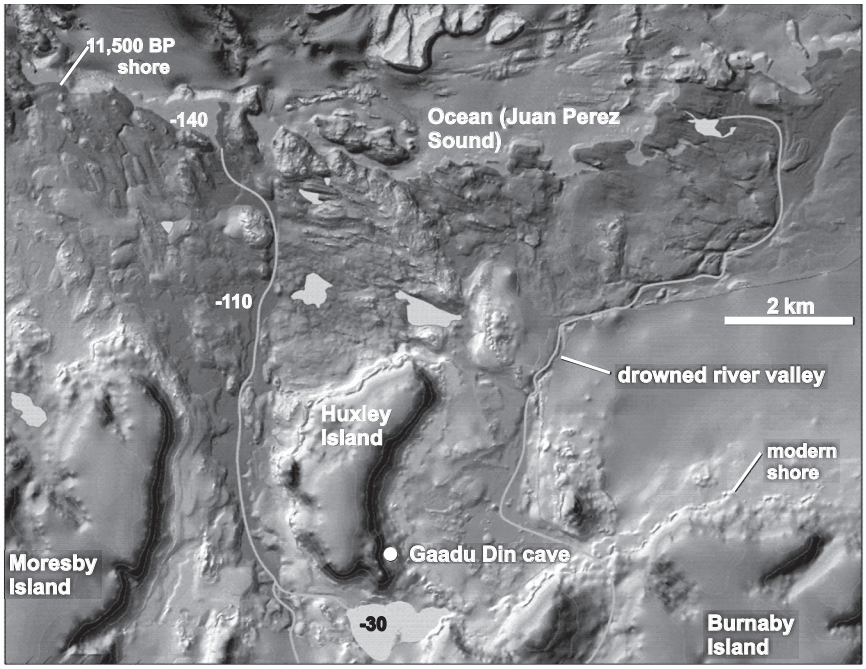




credit?

14,000 years ago 12,500 years ago 10,700 years ago and today

Changes to the shoreline of Haida Gwaii with rise in sea level. 44



credit?

45 Features of the sea floor discovered by AUV survey.

DARYL FEDJE

46 Wooden wedge, direct dated to 10,680 CALYBP.