told *Science*. If so, Dragon Man and his kin would displace Neanderthals as modern humans' closest known relative.

Ni says he chose to publish in the little-known journal *The Innovation*, part of the Cell family of journals, "because they promised that they can handle our submissions very fast and will respect our choice of novel research methods." Others are less respectful. "When I saw this analysis, I nearly fell off my chair," Hublin says. He and others question how the team concluded that the skull—which lacks a lower jaw—is closely related to the Xiahe lower jaw.

They also question Li's overall classification of the skull as a new lineage, close to modern humans. "It's premature to name a new species, especially a fossil with no context, with contradictions in the data set," says María Martinón-Torres, a paleoanthropologist at CENIEH, the national center for research on human evolution in Spain. Paleoanthropologist Marta Mirazón Lahr of the University of Cambridge calls the find fascinating, but says she's "skeptical of the statements about humans' long-lost sister lineage."

Instead, she and others say, Dragon Man is probably a Denisovan, an extinct cousin of the Neanderthals. To date, the only clearly identified Denisovan fossils are a pinkie bone, teeth, and a bit of skull bone from Denisova Cave in Siberia, where Denisovans lived off and on from 280,000 to 55,000 years ago. But the enormous, "weird" molar from the new skull fits with the molars from Denisova, says Bence Viola, a paleoanthropologist at the University of Toronto, who analyzed the Denisova fossils with Hublin. The link with the Xiahe Cave jawbone, if correct, would strengthen the case, as a protein from that fossil as well as ancient DNA in the sediments of the cave strongly suggest it was a Denisovan.

The authors concede that their critics have a point. "I think it probably is a Denisovan," says Chris Stringer, a paleoanthropologist at London's Natural History Museum and co-author on two of the papers. DNA analysis of the new skull could resolve the issue. But the team says it does not want to risk destroying the tooth or other bone to get DNA or protein.

If the new skull is indeed from a Denisovan, the team's claim to have found the closest human ancestor would crumble. DNA studies have established that Denisovans and Neanderthals formed sister groups, more closely related to each other than to *H. sapiens*. But Dragon Man would still be a landmark fossil. Viola hopes researchers can analyze its DNA, so that "I can finally look into the eyes of a Denisovan." ■

Researchers hope this black-footed albatross chick, settling in on Guadalupe Island, will return here to breed.

CONSERVATION BIOLOGY

Black-footed albatrosses find a new home across an ocean

International project offers a model for tricky translocation of seabirds threatened by rising sea level

By **Rodrigo Pérez Ortega**

On the morning of 16 June, Snowflake spread its wings and let the strong, cold wind of Guadalupe Island help it take a first flight away from its nest. But this was not the first time the young black-footed albatross had soared above the North Pacific Ocean: Five months before, as an egg, Snowflake had been flown more than 6000 kilometers on a commercial airline—in economy plus seating—from Midway Atoll northwest of Hawaii to the remote Guadalupe Island in Mexico.

Snowflake's own flight, just 3 days before World Albatross Day, marked a milestone in a binational project of the United States and Mexico, aimed at keeping the birds safe from the rising sea levels that threaten their survival. On Midway, they "were destined to drown," says Julio Hernández Montoya, a conservation biologist with the nonprofit Island Ecology and Conservation Group (GECI), who helped lead the effort.

Now, with nesting sites on higher ground, the albatross will be more resilient to environmental threats, says Axel Moehrenschlager of the Calgary Zoo. "One of the things that's really, crucially wonderful is that you're putting more eggs in more baskets," he says. Moehrenschlager, who chairs the translocation specialist group at the International Union for Conservation of Nature (IUCN), calls the project "potentially groundbreaking." Three projects have moved albatrosses within the United States and Japan. But this first transfer of a seabird species between nations "is exactly the type of approach that we need on a global level," he says.

He and other conservation scientists caution that translocations are not first-line interventions for saving species—but sometimes, they are the only option. In the past 30 years, he notes, there has been a 30-fold increase in translocations of species ranging from corals to elephants.

Albatrosses, top predators in the ocean's food chain, can spend years without touching land and fly thousands of kilometers in search of food. But they return every year to mate and nest in the islands where they were born. About 95% of the world's black-footed albatrosses (*Phoebastria nigripes*) nest in the Hawaiian islands; Midway Atoll, in a remote part of the state, is home to close to 21,600 breeding pairs, about one-third of the global breeding population.

PHOTO: © GECI/J.A. SORIANO

These 3-kilogram seabirds nest on low-lying sandy beaches—vulnerable to sea level rise and flooding. During a 2011 tsunami, 30,000 albatross nests were lost on three atolls, says Eric VanderWerf, a bird biologist with the nonprofit Pacific Rim Conservation. IUCN lists the seabirds, as well as their close cousin, the Laysan albatross, as near-threatened. A 2015 study estimated that a 2-meter sea level rise and storm waves—possible in the next century under many climate change scenarios—would flood up to 91% of black-footed albatross nests on the Eastern Island of Midway Atoll.

"It is alarming that the rate of habitat loss could really impact them," says Michelle Hester, a seabird biologist at Oikonos, a nonprofit that studies Pacific ecosystems.

VanderWerf teamed up with colleagues from GECI to move black-footed albatross eggs and chicks from Midway to Guadalupe Island, a reserve some 260 kilometers off Mexico's Baja California Peninsula where the species and other seabirds once nested. The Mexican nonprofit has been working on the island for the past 20 years to eradicate invasive species, first removing nearly 50,000 goats and then eliminating nearly 1500 feral cats.

"It fills us with astonishment and joy."
Julio Hernández Montoya, GECI

Hernández Montoya's team had previously tried to get black-footed albatrosses to nest on the island by attracting them with decoys and recorded courtship sounds, but none that visited settled in. At a meeting in 2016 on Oahu, scientists from Pacific Rim and GECI got the idea of reestablishing a new colony in the Mexican island by moving the birds' eggs and chicks before they imprinted on their Hawaiian location; once imprinted, the birds would return there to breed. VanderWerf's team had already successfully relocated black-footed and Laysan albatrosses' eggs and chicks from Midway to Oahu, a higher island in Hawaii. (The two species live and nest close to each other, have somewhat similar behaviors, and face the same environmental threats, including sea level rise and plastics pollution.)

Meanwhile, on Guadalupe, Hernández Montoya's team had been monitoring a growing native colony of Laysan albatrosses, keeping it safe from remaining feral cats on a fenced-off, predator-free peninsula.

After years of planning, dozens of permits from both countries, half a million dollars in funding from several nongovernmental organizations, and extra complications from the COVID-19 pandemic, the teams finally chose 21 black-footed albatross eggs from Midway in January and flew them to Guadalupe Island. There, they met their foster parents: experienced Laysan albatross pairs whose eggs had not been fertilized or had broken. Eighteen Midway eggs hatched in February.

The new parents fed and cared for their adopted offspring, but there's no guarantee the young black-footed albatrosses will learn behaviors specific to their species, such as courtship behavior. But that appears to be innate. To encourage natural behavior, the team planted decoys and played recorded black-footed albatross vocalizations.

Worried about how well Laysan parents would care for the imported eggs, the team repeated the journey across the Pacific in February with 12 1-month-old, fluffy black-footed chicks. Nine reached the island safely. GECI's team hand-reared them and again exposed the chicks to decoys and recorded vocalizations of their species. Scientists monitor the chicks daily until their ash-gray fluff gives way to adult feathers and they fly away; so far, three have done so. Previous research showed that 93% of hand-reared albatross chicks fledged, although there are no data yet on breeding success.

Hester notes that artificially forming a new seabird colony is difficult and has rarely been accomplished. Translocating birds is "a specialized skill," she says, and the work may offer lessons for projects on other birds. "Albatrosses are a really good species to start with," she says, because they tolerate people, nest on land, and take fostering well.

This project's international cooperation sets a precedent, says Brad Keitt, a seabird biologist with the American Bird Conservancy. "That was a big, bold step made by governments and regulatory agencies."

So far, the team is thrilled. "This was a complicated project," VanderWerf says. "Doing all that in the midst of the pandemic … I still can't believe we did it." The effort "was quite a feat," Hernández Montoya says. "It fills us with astonishment and joy."

VanderWerf says the teams are talking about moving other seabirds, perhaps the black-vented shearwater and Leach's storm petrel, to Guadalupe or other Mexican islands that had been "a seabird paradise" until invasive predators arrived. With those predators gone, the islands "have a lot of potential."

As the rest of Snowflake's fellows take wing, the team is planning to bring 80 more black-footed albatross eggs to Guadalupe Island in the next few years. But they won't know how well the project works until Snowflake and the rest of the first batch return in 5 years to start looking for mates. "It will be an important moment when those birds come back," VanderWerf says. ■

MARINE SEISMOLOGY

Ship gauges potential for catastrophic earthquake

Fault structures could reveal whether next rupture in Pacific Northwest will be a repeat of megaquake in 1700

By **Paul Voosen**

At the Cascadia subduction zone, which has generated some of North America's greatest earthquakes, the silence is deafening. Lying off the Pacific Northwest, where a plate of ocean crust dives beneath North America and into the mantle, Cascadia is best known for a mammoth magnitude 9 earthquake in 1700 that sent a tsunami all the way to Japan. But in modern times, it has been ominously quiet, with almost none of the small, daily earthquakes that are common at other subduction zones. Stress building up at the fault seemingly has had no release. "It's just way, way, way too quiet," says Chris Goldfinger, a marine geologist at Oregon State University, Corvallis.

Last month, however, that silence was shattered with the arrival of the *Marcus G. Langseth*, a research vessel that is generating miniearthquakes of its own in a 2-month campaign. On the ship, owned by Columbia University and funded by the U.S. National Science Foundation, scientists use an airgun to blast sound through the water, sending waves into the crust below. A long chain of hydrophones trailing the ship catches echoes from the innards of the 1300-kilometer-long Cascadia fault (see map, p. 14). Other receivers, dropped on the ocean floor and scattered across coastal farmland and woods, listen for reflections from the deeper parts of the fault, which slopes east, down under the coast.

The resulting pictures of the fault, sharper than any collected before, could show whether its silence is cause for alarm. "We've been waiting for this moment for quite a few years," says Kelin Wang, a geophysicist at the Geological Survey of Canada.

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