

Glacier GRANDEUR

Alaska's glaciers are a spectacular force of nature

By Eric Lucas



Imagine a sheet of water

the size of a small city. It's made of long, winding ribbons, and broken tabs, of ice. Its cool-hue colors range from aluminum to cerulean. Immense forces cause it to flow down a narrow valley and fold over a small ridge just outside Juneau, Alaska, and finally crumble into a slushy lake.

That's the Mendenhall Glacier—one of the most visited glaciers in the United States—and I'm standing atop its lower end under an intense spring sun with freshets of water gushing past my feet.

A glacier such as the Mendenhall is, in one sense, a geologic object—a *monomineralic rock*, to cite a term sometimes used by glacier scientists. It's also a 13-mile-long river of ice that's actually moving downhill at a distinct rate, twisting and bending around stone mountains, gathering rock debris as it scrapes past. A glacier is composed of water, a malleable substance whose various phases—gas, liquid, solid—are intrinsic to the shape of Earth's landscape. Since all forms of water can move, standing on a glacier with water running all around me leads me to wonder if one might ever actually see a glacier move.

"Nah, not possible," says our guide, Corey Denton, who has spent years scrambling along Alaska's glaciers. "Understandable you would ask, but no way can a glacier's movement be seen."

No way? Ice in the Mendenhall moves ("flows," glaciologists say) downhill about 525 feet a year. That translates to about 17 inches per day, which equals ... Oh, it's moving just a little faster than about one-hundredth of an inch each minute.

That's plenty stable for hiking about its



FRANS LANTING / FRANS LANTING STOCK

THE BARNARD GLACIER (above), in Wrangell-St. Elias National Park, is striped with the debris it accumulates as it flows down the mountain, merging with other, smaller glaciers.

KAYAKERS (previous spread) paddle the ice-laden waters of Barry Arm in Prince William Sound, near the Barry, Cascade and Coxe glaciers.

surface, so Denton leads us, four glacier trekkers, onward and upward, crampons gripping the ice, to peer into a crevasse that marks a spot where the glacier's huge tabs of ice have separated. Here, we are quite close to the inner workings of the glacier, which include deep glacial ice not yet softened and fragmented by melting. With sunshine slanting across the ice, it's a translucent gem whose exact hue defies vocabulary—it is more vivid than teal, more translucent than turquoise, more intense than beryl, much greener than

azure. You cannot liken it to any sea ice or snow or ordinary ice or, in fact, any other material on Earth.

It is, of course, just water, good old H₂O, flung from the oceans to mountain heights as water vapor and then snow, compressed by time and gravity into a unique crystalline structure that, while superficially solid, is flexible in a fashion glaciologists call *plastic*.

"To be exact, glacial ice is at the far end of the visco-elastic spectrum," explains Shad O'Neel, a research geophysicist with



MATT HAGE

THE HARDING ICEFIELD TRAIL (left) winds four miles through Kenai Fjords National Park to a spectacular view of the icefield.

THE EXIT GLACIER (below) descends from the Harding Icefield, adjacent to Prince William Sound.

the United States Geological Survey (USGS) in Anchorage. O’Neel, an expert on calving glaciers—those glaciers where large chunks of ice break off from their terminal faces and fall into the sea or a glacial lake—is based at the Alaska Science Center; he calls glacial ice a “viscous fluid,” like honey.

Most visitors call it “amazing.”

Glaciers are among Alaska’s best-known and most popular natural attractions. There are thousands of glaciers in the Great Land. No one has created any exact count, partly because of definitional uncertainties: Where is the dividing line between glaciers and the icefields from which so many originate? The Mendenhall, for instance, is an outfall finger of the Juneau Icefield, a massive sheet of alpine ice that covers 1,700 square miles in the mountains along the Alaska/Canada border. Up there, ice ranges from 800 feet to nearly 3,300 feet thick—although, as massive as that seems, it was once immensely larger. The Juneau Icefield, like the half-dozen or so other major icefields in Alaska, is a remnant of the Earth’s last major glaciation about 10,000 years ago. Back then, much of southern Alaska was covered in a continuous ice sheet that left only small margins along the ocean coast. Today, perhaps as many as 40 glaciers emanate from the Juneau Icefield, which is also the *accumulation zone* (another glaciology term) where prodigious snowfalls compact into glacial ice.



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The USGS estimates that today the total area in the Great Land encompassed by glacierized ice is about 35,000 square miles—an area slightly larger than Austria. The vast majority of that total is contained within the mountain ranges that ring the Gulf of Alaska, including the Chugach and Wrangell–St. Elias ranges, where storms deposit dozens of feet of snow every year.

If an area larger than Austria seems impressive, O’Neel wants us to keep in mind the overall prevalence of freshwater ice (glaciers, as opposed to frozen seawater) on Earth—about 90 percent of it is in Antarctica, about 10 percent in Greenland, and less than 1 percent everywhere else, including Alaska.

“That’s a pretty staggering fact when you step out on the Bagley Icefield [in Wrangell–St. Elias National Park] and it seems like the surface of the moon, and it’s only a fraction of less than 1 percent of the ice on the planet,” O’Neel says.

EXPERIENCING ALASKA’S glaciers is fairly easy. While reaching the Bagley Icefield typically requires arduous wilderness trekking or transport by helicopter or light plane, dozens of other Alaska glaciers can be reached by short walks or by brief excursions by boat or plane. Many glaciers are near or within major cities or tourist destinations. There are the Portage and Matanuska glaciers, near Anchorage;

numerous glaciers at Denali National Park; the Worthington, in the mountains above Valdez; the Exit Glacier, reached by a short hike near Seward; and the massive Hubbard Glacier in Yakutat Bay, a favored stop for cruise ships. Small-boat day cruises out of Seward and Valdez make glacier-viewing a major facet of their itineraries, and a multitude of aircraft operators offer flight-seeing around glaciers—some even landing on the ice or snowfields.

Glacier Bay National Park and Preserve, in particular, is one of Alaska's best-known visitor destinations. More than 400,000 visitors journey to this World Heritage Site each year to witness its seven tidewater glaciers. The visitor center is in Gustavus, a half-hour flight from Juneau, and virtually all the park's visitors avail themselves of a scenic boat trip up the 65-mile-long fjord.

The Mendenhall Glacier is perhaps the most popular of all Alaska glaciers. Close to half a million visitors a year come to the U.S. Forest Service Visitor Center, a facility

across the lake from the foot of the glacier, which is itself just 13 miles from downtown Juneau.

And here, inside the center, you can clearly see the glacier move. Not with the unaided eye, of course. Instead, an astounding time-lapse video created by science journalist James Balog shows, over a three-year span, how the ice is flowing downhill while its face is simultaneously retreating.

Ice in the Mendenhall moves down from its accumulation zone 13 miles uphill at the aforementioned 525 feet a year, so the ice at its foot is anywhere from 80 to more than 200 years old. But like the vast majority of glaciers—in Alaska and around the globe—climate change has put the Mendenhall in retreat, melting back 540 feet last year. (To watch this video, visit www.extremeicesurvey.org.)

“What I like best about the Mendenhall is that it's always different,” says Forest Service naturalist Laurie Craig. “It's moving. It calves chunks of ice almost daily.

The light and weather and shape change.

“Calving is one of nature's grandest dramatic moments,” Craig adds. “It's loud, it's huge, it's blue, it's ancient—it appeals to so many aspects of human wonder.”

Calving is, indeed, grand—to see a tower of tons of ice peel away from its glacier and collapse into the water is spectacular, sudden and irrevocable. And, as is so often the case when humans are viewing nature, our perspective is influenced by our own sense of time.

Consider the notion of speed.

Then think of the word “glacial.” In ordinary usage it means ponderously slow: “Legislation works its way through Congress at glacial speed.” As it happens, while I'm at the Mendenhall visitors center, I bump into Cathy Connor, a geology professor at the University of Alaska Southeast, and we wind up discussing abstractions such as time and speed. To a geologist, glaciers are not moving at that linguistic “glacial speed” at all.

“The Pacific Plate is moving at roughly

the same speed your fingernails grow,” Connor explains of the tectonic mass that butts into the continental coastline in Western North America. “That’s nearly 2½ inches a year, a speed that seems microscopic to us but represents a massive force that causes earthquakes. So, the Mendenhall Glacier is moving about 6,000 times faster than the Pacific Plate moves.”

A glacier’s flow is a result of two

WHEN YOU GO

While a number of Alaska’s glaciers are accessible to those willing to take a short hike—such as the Worthington, near Valdez, and Exit, near Seward—you may have a much richer experience by utilizing one of the many glacier excursions offered by knowledgeable guides and tour operators.

In Seward, **Kenai Fjord Tours** sails through Resurrection Bay to the Northwestern Fjord, where three tidewater glaciers amaze passengers while the cruise captain offers information about the ice. Along the way, visitors are almost certain to see sea lions, porpoises, sea otters, whales and mountain goats; www.kenaifjords.com.

At KFT’s sister company, **Seward Windsong Lodge** just outside Seward, experienced guides offer interpretive hikes up to the nearby Exit Glacier in Kenai Fjords National Park. The comfy lodge is one of the Kenai area’s best, with sensational Alaska cuisine in its Resurrection Roadhouse restaurant; www.sewardwindsong.com.

In Valdez, **Stan Stephens Glacier & Wildlife Cruises** is the granddaddy of them all, with decades of experience sailing in Prince William Sound to the various glaciers arising in the Chugach Mountains, including the massive Columbia. Stephens’ boats are roomy and very stable; the captains offer thoughtful and comprehensive commentary; www.stephenscruises.com.

In Juneau, guided hikes to the Mendenhall Glacier are offered by **Above & Beyond Alaska**, an outdoor-adventure company whose guides have many years of experience leading adventurous tourists to the glacier; www.beyondak.com. Juneau’s **Alaska’s Capital Inn** is a delightful, small heritage inn, built in 1906, just above the city’s downtown. The inn offers travelers hearty breakfasts and decades of Juneau experience; www.alaskacapitalinn.com.

Virtually all of **Alaska Airlines’** flights from the Lower 48 to Anchorage or Juneau are in effect glacier sightseeing excursions. On the way into Juneau, along the famous Gastineau Channel airport approach, the immense Taku Glacier is often visible. Coming into Anchorage from the south, the approach overflies Prince William Sound and its many adjacent glaciers. For more information on flights and vacation packages to Alaska, visit alaskaair.com. —E.L.

different mechanisms.

The first derives from the viscous nature of the ice: Think of the vast alpine icefields (which are, like the Juneau Icefield, known as *accumulation zones*) as if they were honey on a plate: Tilt the plate, and the fluid oozes down the slope. In the high, rugged mountains of Alaska, the ice oozes down valleys, and the weight of new snowfall—which often exceeds 30 feet a year in Alaska’s coastal ranges—on the icefields continues to push more ice into the valleys.

What’s more, all that ice slides. “Like a board sliding across a tilted table,” O’Neel explains. If there is running water beneath the glacier, as there often is, it slips downhill even faster.

The steeper the slope, and the more water on which the glacier can slide, the greater its speed.

And glacial “speed,” it turns out, is a highly variable thing. Some glaciers do creep, with a flow measured in dozens of yards a year. Some virtually gallop. That’s what the Columbia Glacier did in the northwest corner of Prince William Sound in the 1980s. After pretty much staying put on top of a terminal moraine in Columbia Bay for decades, the glacier began to both speed up and retreat radically around 1980. Over the course of the decade, it was flowing (forward movement) as much as 100 feet a day, yet the glacier lost more than 5½ miles in overall length.

“Yes, you could almost see that with the naked eye,” says O’Neel, who has studied the Columbia and other tidewater glaciers on the Alaska coast for more than a decade, as well as inland mountain glaciers and the state’s massive icefields from which most of these derive. The Columbia is also one of the most rapidly retreating glaciers over the last several decades, having lost as much as half a mile a year recently.

“That’s a very dynamic glacier,” O’Neel says.

Indeed, as the day-cruise boat *MV Valdez Spirit* approaches the Columbia, the glacier has calved so much ice into the saltwater that, six miles from its face, captain Amanda Bauer throttles back and

scans the water for a way through. Also in the wheelhouse is Stan Stephens, founder of Stan Stephens Glacier & Wildlife Cruises, whose boat this is. Stephens has been sailing to this glacier for more than three decades, and he's a legend in Alaska glacier circles, both scientific and touristic. He calmly advises Bauer to steer east, beside a ridge of rock recently exposed by the glacier's retreat. As she picks her way through, she grabs the microphone to explain the nautical terms for sea ice:

- Less than three feet tall, above the water line, it's called *brash*.
- Three feet to seven feet, it's *growler*.
- Seven to 15 feet tall, it's *bergy bits*.
- More than 15 feet tall, it's *iceberg*.

We've encountered all four types in the bay. In fact, at three miles out, the slushy brash ice and growler ice is so thick we can go no farther. The crew uses a net to pick up a few pieces of Columbia ice, which passengers use to chill soft drinks.

"It's almost mind-boggling the amount of ice the Columbia puts in the water here," Stephens observes before we turn around, pointing out a medium-size mountain straight ahead called "Twin Peaks." It was also once called "the Big Nunatak," an Inuit word that means "mountain in the middle of a glacier," but the Columbia's retreat has left the mountain standing by itself, and the ice is miles back from what used to be a *nunatak*.

"A decade ago, we'd have been under 2,000 feet of ice here," Stephens recalls, inevitably glancing upward where there is now only sky. The erstwhile nunatak's face shows a *trim line* about 600 feet up, marking the former top of the ice; its shape is rounded by glacial grinding.

I get an even more distinct view of a glacier's capacity for landscape-shaping west of Prince William Sound on a Kenai Fjords Tours cruise through Resurrection Bay south of Seward. Though the immense Bear Glacier in Kenai Fjords National Park no longer reaches the saltwater, it is clearly visible from the bay, and its two arms have peeled away the sides of a medial ridge whose scrapings form, downstream from the ridge, a huge medial moraine on the surface of the glacier. From here, it looks

like gravel and dirt; up close, it is huge boulders, rocks and other debris.

I find an even closer example of glacial landscaping at the north end of Kenai Fjords National Park, following a short hike up to the Exit Glacier. A finger of the same Harding Icefield that spawns the Bear Glacier, Exit is another of Alaska's most accessible glaciers. Unlike Mendenhall, which requires a long hike around its terminal lake to reach the actual glacier, Exit lies at the end of a moderate walk, less than a mile from the park's visitors center. The walk begins in cottonwood forest and proceeds past signs marking the years of the glacier's half-mile retreat during the past century.

Here, on a sunny evening, the glacier's downslope wind brings a slightly metallic smell into the air. The bare-shale ground near the end of the trail, 30 feet from the glacier, is desolate, not yet pioneered by any vegetation. And not far from the trail lies a 10-ton boulder, atop a gray-shale bench, that clearly came from a striated section of cliff 100 yards uphill.

This is a *glacial erratic*, a nonconforming rock picked up by glacial ice and moved. Here, it has not only traveled that 100 yards, it has crossed a 60-foot-deep chasm as if Brobdingnagian landscape designers were at work. Up, over, down.

In fact, a gargantuan landscape designer *has* been at work here. The clean wind is its song. The blue ice is its art. We are the patrons of this natural gallery, and all we need do while visiting is watch and listen, think and learn.

"It's a really exciting time to be a glacier observer," says Shad O'Neel. We can all join that club. ▲

Writer Eric Lucas lives in Seattle's Ballard neighborhood.

GETTING THERE



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