Union College *A Magazine for Alumni and Friends* | WINTER 2008

UNION COLLEGE

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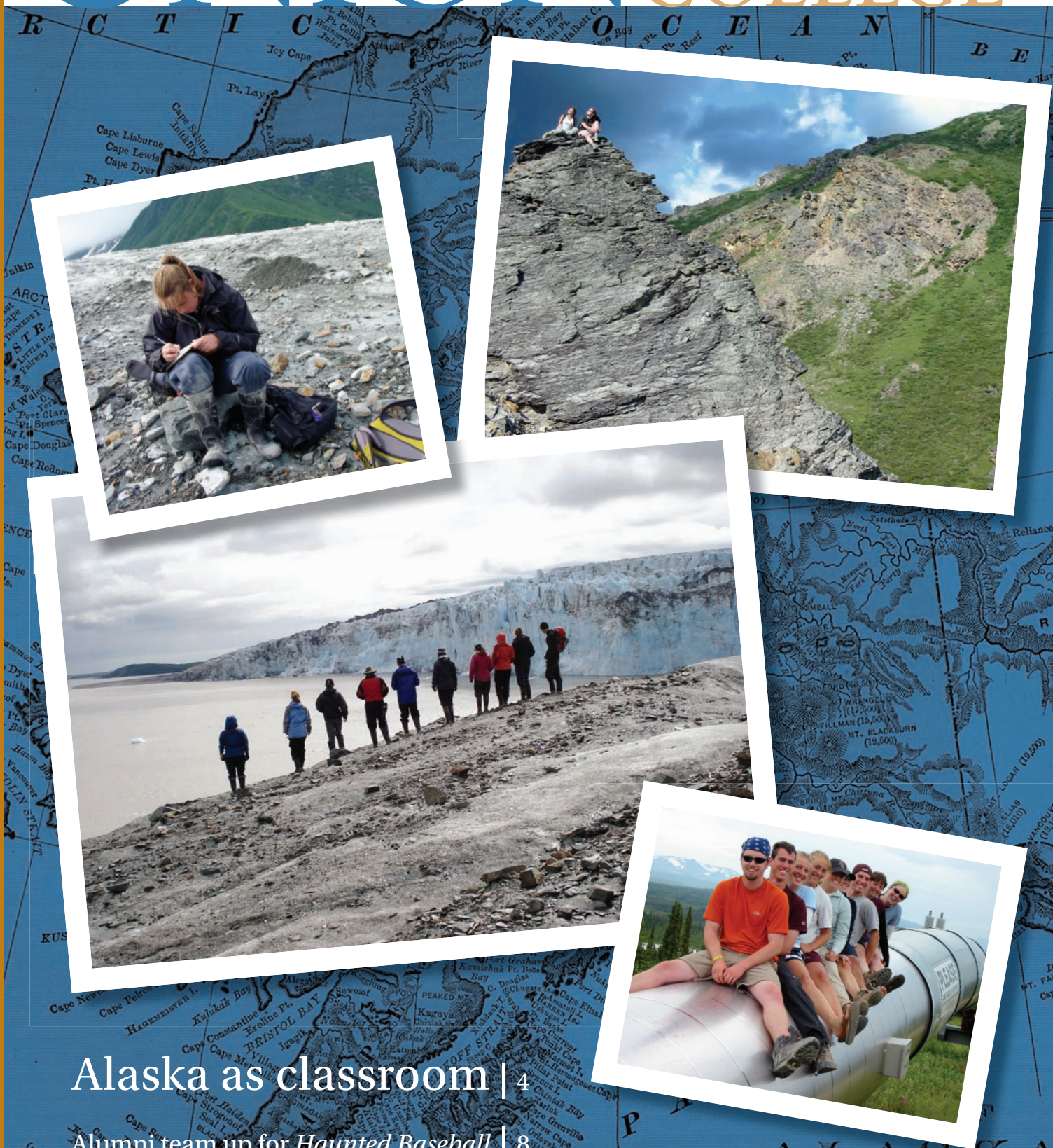

Alaska as classroom | 4

Alumni team up for *Haunted Baseball* | 8

Wold family makes their mark on campus | 14

Alaska as classroom

Students look down at the Copper River from the terminus of Childs Glacier, near the city of Cordova.

Above, students sit on the Trans-Alaskan Pipeline near the Richardson Highway. At middle, two students sit atop a rock peak near the Savage River in Denali National Park. Below is Professor Garver, a veteran of teaching geology lessons in places like Alaska.

Geology Professor **John I. Garver** issued this first-hand report from Alaska, the "rough, wild and remote tectonic playground" where 10 Union students joined him and Professor Jaclyn Cockburn last June on a three-week research expedition to track clues left by earthquakes, tsunamis and volcanoes.

The shovel slides into the muck, revealing alternating layers of peat and ocean sand. The layers are subtle clues left by a tsunami in 1964. Professor Jaclyn Cockburn and I are with a group of Union students on Kodiak Island off the southern coast of Alaska and we've uncovered tectonic gold.

"Living on the Edge" is a mini-term research course that has brought Union students to Alaska to study geological hazards in a place where tectonic plates collide. Earthquakes, tsunamis and volcanoes account for some of the most catastrophic hazards that result from tectonic activity. Humanity is learning some tough but simple lessons about responding to these events. Part of the reason we are in Alaska is to study mitigation options and teach students fieldwork skills that may someday help society better prepare for geological catastrophes.

Alaska is a rough, wild and remote tectonic playground. There are major fault lines and rumpled mountain ranges driven by the ongoing collision of the tectonic plates. Alaska sits on a subduction zone where oceanic plates are forced below the continental edge, producing volcanoes that define dramatic topography. Like the San Andreas Fault in California, Alaska also has a major fault line where two plates slide past one another.

In 1964, Alaska was shaken by the second biggest earthquake ever recorded, a magnitude 9.2 on the Richter scale. This event resulted in some of the most dramatic tectonic movements the modern world has ever experienced. Like the Sumatran earthquake in 2004, a huge block of ocean floor was displaced upwards, shifting enough water to spread tsunami waves around the globe. Large swaths of land moved upward and landed in a nearly equal area dropped downward. Part of our task on this mini-term is to find clues of these tectonic undulations.

Geologists are no strangers to work in difficult conditions, and work on Kodiak Island is no exception. As we prepare for our first hike around the island's Middle Bay, students load their packs, affix bear bells, and pull on rubber boots. The idle chatter comes to an abrupt halt, when our host, Gary Carver, gets out his 12-gauge shotgun, and loads it. At this point, students start to pay attention, very close attention. Gary gives students a lesson on what to do if they encounter a Kodiak bear, one of the biggest bears in the world. The main point is, don't panic, stand your ground and don't run.

With our new understanding of Kodiak bears, we head out across the salt marsh on Middle Bay. In the flats of the salt marsh, we find sand, muck and peat. Below that is another series of sand, muck and peat. The sand is puzzling. There is no sand obvious anywhere on the modern salt marsh.

The layers are clues left by a terrifying tsunami. In Middle Bay in March 1964, the train of tsunami waves stirred up offshore sediment, and carried that sand inland and covered the otherwise placid coastal estuary.

In 1964, a number of people got caught in the waves and

Part of the reason we are in Alaska is to study mitigation options and teach students fieldwork skills that may someday help society better prepare for geological catastrophes.

Above, Sarah Tonry '10 takes notes as Professor Jacklyn Cockburn lectures on the debris-covered ice of Childs Glacier.

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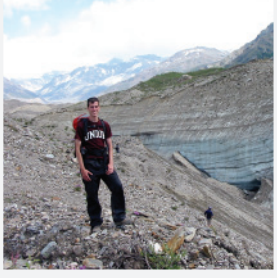

Above, students hike along a ridge in the Arctic tundra of Denali National Park. At middle, instructor Gary Carver shows students layers of peat and sand in soil from Kodiak Island's Middle Bay. Below, Jon Campano '09 stands on the recently exposed ice of Castner Glacier.

died because they didn't know that tsunamis arrive as a train of waves, not just one big one. As we dig deeper, it is clear that this wasn't the only time Kodiak has been hit by major waves, and the diagnosis for the people of Kodiak Island is grim if history repeats. And this seems like a certain conclusion from our analysis.

The Sumatran earthquake and subsequent tsunami in December 2004 was a humbling example of how major earthquakes that rupture the ocean floor can generate monstrous and deadly waves. We have the scientific knowledge to tackle many of these hazards. We have engineering solutions for warning systems. We have safe designs for buildings, bridges and other infrastructure. We hope this trip will help students see important links between science and society.

After the Kodiak marsh, we move on to the heart of the dramatic landscape of the Central Alaska Range. In the village of Mentasta Lake in south central Alaska along the 400-mile Denali fault, we encountered a community that had no emergency plan in place despite having sustained a violent earthquake in 2002. A visit to the village became a lesson for Amanda Kern '09.

"This experience gave me the chance to take my knowledge in geology and apply it to policy and people. The realization that many communities worldwide are situated in hazardous areas that are virtually unknown to their residents brought home the importance of educating people on how to live with their environment," Kern wrote.

We later moved on to the spot where the Denali Fault passes under the Trans-Alaskan Pipeline. The pipeline is one of the most crucial arteries of the nation's oil lifeline. Completed in 1977, the 800-mile pipe carries about 1 million barrels of oil a day from Prudhoe Bay to Valdez. At the current rate of consumption in the United States, this accounts for about 5 percent of daily usage.

The Denali Fault rips east-west across the Alaskan landscape. Like the San Andreas, this fault allows rock on either side to slide past each other every time there is a big earthquake. In both cases, these faults allow the Pacific tectonic plate and the North American plate to slide past one another. In the Central Alaska Range, the rock sliding by is getting jammed together as it tries to turn a corner, and the collision there has driven rock upwards to form some of the biggest mountains on the continent. Mt. McKinley is more than 20,000 feet high.

Dealing with this tricky spot has illustrated the importance of the interface between science and engineering. In the 1970s when the pipeline was being built, geologists identified a concealed fault line and engineers designed a flexible pipe that could shake freely in the event of a big earthquake. In March 2002, about 25 years after the pipeline was completed, the fault lurched about 8 feet sideways under the pipe, and it shook violently back and forth like a slinky toy. Not a drop of

RESEARCH ON THE KENAI PENINSULA

Sadie Gorman '08 and Monica Tse '08 collect sediment samples.

Four environmental science students with backgrounds in chemistry and geology traveled in July to the Kenai Peninsula in south central Alaska to collect samples and document the impact of environmental change in several large watersheds.

The Alaskan research spanned three weeks and was separate from the "Living on the Edge" mini-term. Each of the four Union students received a summer research grant through the College's Internal Education Foundation. Two students received Surdna Summer Research Fellowships and two were awarded fellowships through the Lee Davenport '37 Summer Research Fund.

"Working in remote, cold regions such as the Kenai Peninsula is important," said Jaclyn Cockburn, visiting instructor of geology and co-leader of the trip."These areas are relatively pristine and thought to be more sensitive to environmental changes, such as climate variability and the influence of contaminants, than some temperate regions such as upstate New York."

Cockburn and Sam Basta '08, an environmental studies major, and Kara Gillivan '08, a geology major, headed to the Kenai Peninsula in early July to collect sediment samples and perform simple water column measurements from glacially fed Skilak Lake through the major glacial melt period of the hydrological season. Chemistry major Monica Tse '08 and biochemistry major Sadie Gorman '08 also completed research on the peninsula.

Basta and Gillivan are using their sediment and summer observations as part of their senior thesis projects.

Basta's research is concerned with characterizing and mapping the accumulation rates in the proximal basin of Skilak Lake. Through investigations of the recent sedimentary record, he hopes to identify zones of higher accumulation that will be targeted for further sampling in future years.

Gillivan will investigate the role recent climate change has played on the dynamics of the Harding Icefield and several smaller glaciers that flow from it, such as Skilak Glacier.

Sam Basta '08 takes a break from fieldwork

Increased glacial runoff may lead to increased sediment loads in streams on the Kenai Peninsula, which may have serious impacts on aquatic ecosystems.

"Being in Alaska this summer gave me an opportunity to see first hand what has happened recently to the smaller glaciers and the watersheds they feed," Gillivan said.

oil was spilled.

"Based on the work of geologists, engineers have placed the pipeline on Teflon slides in areas where it crosses fault lines to allow for the pipeline to move in case of an earthquake. It's cool to see that after the 2002 earthquake all these precautions really did pay off," wrote Kelly Owings '08, an environmental studies major who completed the mini-term in Alaska.

Another part of our agenda for the trip is to train students to sustain themselves in the wilderness. This means students learn to hike, camp, cook using a fire, and get their wet feet, literally. For many, this was the first major experience away from home. For almost all of them, it was the first extended time in tents away from modern conveniences.

As the trip concludes, we're in the Central Alaska Range and the low evening sunlight illuminates the snowy peaks. This trip has been amazing and I think it has been a rewarding and profound experience for all.

A major gift from George Macaulay '50 helped support research in Alaska.