



ENVIRONMENT

Mathematician stepping on thin ice

By Deborah Sullivan Brennan

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With a resume of scientific discoveries, and a track record of harrowing Antarctic adventures, University of Utah mathematician Ken Golden has stepped out of the ivory tower and onto thin ice.

Golden, a speaker at this week's national mathematics conference at the San Diego Convention Center, will give a lecture today on polar ice, a topic that has led him to the ends of the earth, and just barely back again.

Over the past three decades, he's traveled on seven voyages to Antarctica and eight to the Arctic, applying his expertise in theoretical mathematics and composite materials to questions about brine inclusions in sea ice, and the role of surface "melt ponds" on the rate of ice loss.

"Our mathematical results on how fluid flows through sea ice are currently being used in climate models of sea ice," he said.

Along the way he retraced the route of the ill-fated 1914 Shackleton expedition, survived a ship fire after an engine explosion, and spent two weeks stranded on an iced-in vessel last fall. To Golden, the thrill of discovery outweighed the dangers of polar travel.

"It's like a different planet," he said. "It's one of the most fascinating places on earth.

It's one thing to sit in your office and prove theorems about a complicated system. It's another thing to go down there yourself. It informs my mathematics."

As a kind of mathematical Indiana Jones, Golden has achieved a rock star status rare among academics. The prestigious research journal *Science* ran a profile of Golden in 2009. Fans lined up for autographs at the conference this week, and are expected to fill his lecture: one of two public events at the mostly technical conference.

"Never in my wildest dreams did I imagine I'd be a math professor signing autographs," Golden said.

Golden first traveled to Antarctica during his senior year in college, along the Drake Passage, a route that Irish explorer Ernest Shackleton pioneered in 1914, after his ship was crushed by sea ice. Shackleton made the rescue trek in an open boat, but Golden said the journey was gut-wrenching even on a modern ship.

"I have very vivid memories of crossing the Drake Passage, one of the stormiest seas in the world, and taking 50-degree rolls," he said.

Golden earned a PhD in mathematics at New York University, and landed in a professorship at the University of Utah, before returning to the realm of ice.

He nearly relived Shackleton's plight on his subsequent voyage in 1998 after the ship's engine was destroyed in a fire. Crews sounded the emergency alarm, and then announced they were lowering the lifeboats, Golden said.

"It's not what you want to hear when you're in the Antarctic ice pack," he said.

After five days on the ice, crews jury-rigged a backup engine and the vessel limped home, he said.

Not dissuaded by the mishap, Golden joined subsequent expeditions to the poles, during which he described breakthroughs in ice equations.

Standing on the ice during a howling Arctic storm one night, he noticed the ground around him turning to slush, and realized “in one particular epiphany,” that that the ice was reaching a percolation threshold, through which brine could flow through freely.

His research on the phenomenon led to his “rule of fives,” which describes the combination of temperature, salinity and saturation at which ice becomes permeable, and helps explain how ice sheets grow.

Golden’s other studies examine the role of “melt pools” in ice, which allow ice to melt faster by reducing the heat reflected.

“Sea ice goes from pure white snow, to a complex, evolving mosaic of ice, snow and meltwater,” Golden said.

Studying that phenomenon can quantify the overall reflectiveness of the sea ice pack, he said, helping close some gaps in current ice melt models.

“Mathematics is normally rather esoteric, but Ken’s work is very applied, and it’s applied to the topic of sea ice, which is of great interest today due to climate change,” said his colleague, Ian Eisenman, a professor of climate science and physical oceanography at Scripps Institution of Oceanography. “I think his work in general is very exciting not only for fellow scientists, but also for the general public.”

Free lecture

Mathematician Ken Golden will deliver a public lecture, including a video of his expeditions as part of the international project Mathematics of Planet Earth 2013.

When: 3 p.m. today

Where: San Diego Convention Center

Cost: Free

More information: utsandiego.com/mathmeeting or utsandiego.com/golden



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