

OBITUARIES

Peter Hale Molnar

Peter Hale Molnar, Distinguished Professor at the University of Colorado Boulder, died on 23 June 2022 in Lyons, Colorado. The recipient of the 2014 Crafoord Prize in Geosciences, he was a leading figure in the transformation of geology into a quantitative science. He was exceptional in the breadth of the fields he covered, which included plate tectonics, climate, seismology, tectonics, and geomorphology. He made profound contributions to the understanding of global tectonics and of the influence of tectonic processes on climate. Throughout his career, he insisted that geological phenomena, although often superficially complex, must in their essence be physically simple.

Born on 25 August 1943 in Pittsburgh, Pennsylvania, Peter had exceptional tenacity in all he undertook, which he attributed to both parents. His mother had a ruptured cerebral aneurysm when Peter was two, and his father had to take two jobs to pay the medical bills. An experimental physicist who eventually became executive vice president of Bell Labs, his father instilled in Peter rigor, respect for data, and the merits of simplicity. His mother's steadfast support, despite severe pain and partial paralysis, was echoed in Peter's support for countless younger colleagues.

Peter obtained a degree in physics from Oberlin College in 1965 and a PhD in geophysics from Columbia University in 1970. His PhD was supervised by Jack Oliver, Bryan Isacks, and Lynn Sykes, and although it centered on plate tectonics, Peter became convinced that the field, then only a few years old, was stagnating, and he looked elsewhere for interesting questions. He soon found evidence that whereas the oceans obey the rules of plate tectonics, continents do not. The alignments of relative motions during major earthquakes had provided pivotal evidence that oceanic plates are rigid. In contrast, the major earthquakes in Asia show no such alignment. Instead, their principal axes of strain reveal a coherent pattern, such as would be expected if Asia were a deformable continuous medium.

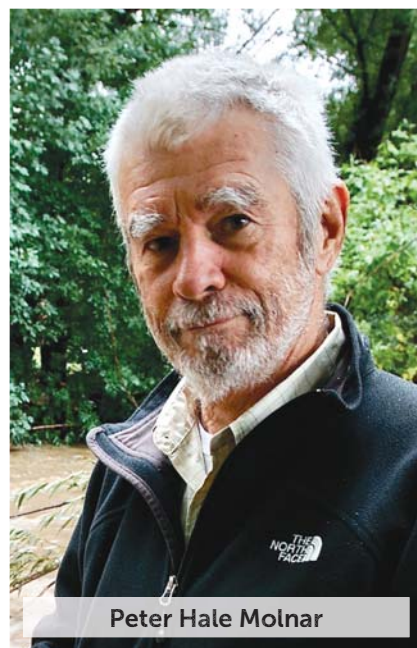
Peter and Paul Tapponnier, in a collaboration starting in 1974, combined

satellite imagery with meticulously re-evaluated seismic data to show that deformation across most of eastern Asia represents a coherent response of the continent to India's penetration into its southern margin. The nature of the deformation depends on the elevation of the land surface: The high Tibetan Plateau is becoming thinner while its lower-lying surroundings are thickening. Peter argued that continents behave as fluids, flowing under gravity. Tibet is the pressure head that transmits, to the rest of Eurasia, the force that India applies to its southern margin. By making geological observations on scales of hundreds to thousands of kilometers and inextricably linking those observations to the underlying physics, that work demonstrated that the dynamics of continents are fundamentally different from those of the rigid oceanic plates.

At around the same time, a belief began to grow that the onset of the ice ages was caused by rapid uplift of mountain ranges. Peter showed that this belief was based on uncritical acceptance of it by some climate scientists, of misinterpretations by some geologists, and of data that were poor-to-false measures of surface uplift. That episode led Peter to focus on two questions, which were to preoccupy him for the rest of his life: What processes caused the global cooling that occurred in the past few million years, and what is the influence of large mountain ranges on the climate system?

Peter's *modus operandi*, once he had identified a problem, was to assemble a diverse group of talented (often early-career) scientists and initiate a meeting, preferably among mountains, to thrash out the means of a solution. The approach would lead to a string of papers with Peter's name buried in the middle of multinational lists of authors. It led to our present understanding of the Asian monsoon and to many other advances in both tectonics and climate. As a result of Peter's influence, many fields of geology—an observational science when he began his career—are now pursued in a rigorous and quantitative fashion.

Peter's door was always open, and he responded with excitement to any new result; an insight that particularly



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pleased him would elicit a stentorian "Holy cow!" that startled all in earshot. Visitors would leave his room usually smiling, often somewhat stunned, and always armed with scribbled equations and an extensive reading list drawn without apparent effort from Peter's encyclopedic memory. Those discussions could move a nascent study to a level that the visitor had not envisaged, and for which Peter would decline credit.

Peter had a formidable exterior, but behind it, as even the newest collaborator found, was someone who enjoyed a glass of wine and a laugh. He relished the scenic and cultural opportunities that arose from studying tectonics all over the world and rejoiced in a large circle of friends and colleagues from around the globe. Peter faced cancer with his characteristic composure and tenacity, enjoying the mountains around his home for as long as he could, listening to classical music, and finishing papers. He sought tectonic beauty to the end and completed a final trip to the Galápagos Islands with close family and friends a few days before he died.

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