ROCK STARS

J. Tuzo Wilson

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Tuzo Wilson lived for ideas, and those he created were weird and wonderful. Many were wrong, but some were marvelously right. And, until his death in 1993, he never stopped creating ideas.

The Early Years

He was the first child, born on October 24, 1908, in Ottawa, to the former Henrietta Tuzo and John Armistead Wilson. His mother's name, Tuzo, came from her father's distant Angevin Huguenot ancestors, who landed in Virginia in the seventeenth century. Henrietta was a remarkable and adventurous woman who loved mountaineering. Mount Tuzo in western Canada was named after her because she and Christian Bohre were the first to scale its peak. She had met her future husband, John Wilson, while attending the camp of the Alpine Club of Canada near Banff in Alberta. John, a Scottish engineer, was to play an important role in the development of civil aviation in Canada. Thus, a love of the outdoor life and world travel was instilled in their son, John Tuzo Wilson.

When Tuzo was 17, he had the good fortune to become field assistant to the famous Everest mountaineer Noell Odell who, recalled Tuzo, "showed me the wonders of field geology." Tuzo enrolled in physics at the University of Toronto, but he soon switched to a double major in physics and geology, and in 1930, he considered himself to be Canada's first-ever graduate in geophysics.

A scholarship then took Tuzo to Cambridge University, ostensibly for graduate work in geophysics. However, he quickly found that the university had no clearly organized department, and, after being baffled by Harold Jeffreys' high-powered mathematical lectures, he decided to take an assortment of lectures in geology and physics that appealed to him, and he completed a second B.A. degree.

This was followed by a stint at the Geological Survey of Canada (GSC), where Tuzo worked on Sudbury rocks with the GSC's director, W.H. Collins. Collins, presumably responding to Tuzo's tremendous drive and ability, recommended that he take a Ph.D. in geology at a leading university in the United States. Tuzo was accepted at Harvard and MIT but chose to enroll at Princeton because "it offered the most money, and because Professor R.M. Field said that he hoped to start teaching geophysics there." At Princeton, Tuzo met future giants Harry Hess, Maurice Ewing (visiting from Lehigh), and George Woollard, but Field "failed to bring anyone to Princeton to teach us geophysics." So the young Canadian completed his Ph.D. at Princeton by carrying out geological mapping in the Beartooth Mountains under the nominal supervision of Professor Taylor Thom. During this thesis work, he made the first recorded climb of Mount Hague, shining as his mother had in the mountains.

With the outbreak of World War II, Tuzo left the job he'd had at the GSC since graduating from Princeton and joined the Canadian Army as an engineer. He spent four years overseas before returning to Canada as a colonel and director of operational research. In this capacity, he organized Exercise Musk Ox, which he described in 1982 as "the first and still the most extensive motorized expedition ever to cross the Canadian Arctic."

Following his demobilization, Tuzo was appointed professor of geophysics at the University of Toronto in 1946. In the next 14 years, he built a considerable reputation, clarifying the structures of the Canadian Shield with the help of the newly flowering field of geochronology. Here, he applied ideas initially derived locally, perhaps, to Earth at large. He pointed out that the age divisions he could see in the Canadian Shield were probably features of all the major shields of Earth. He wrote about continental growth, and not merely for the North American continent. He adopted Jeffreys' theory of mountain building on a contracting Earth and rejected the idea of continental drift. By the late 1950s, Tuzo was famous but also controversial—something of a maverick and a promoter of ideas, some said, that made them uncomfortable. Not only that, the contraction hypothesis he promoted so strongly was turning out to be inadequate.

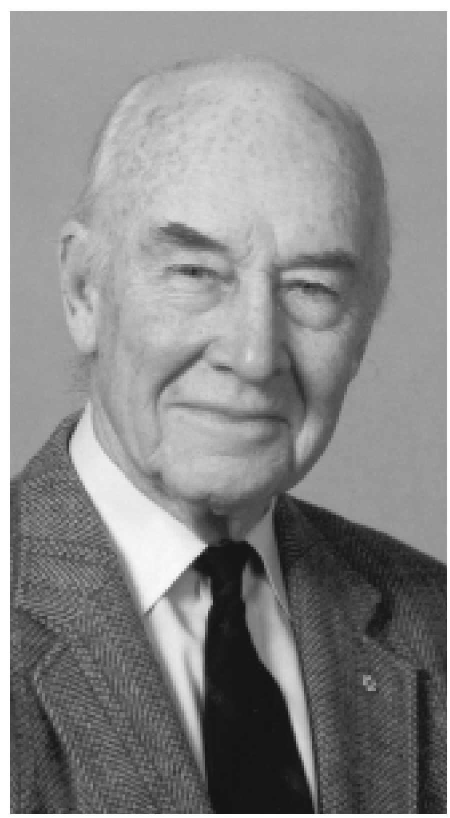
The Climactic Years

It was at the University of Toronto that Tuzo reacted brilliantly by admitting to himself that he was wrong about a contracting Earth and by wondering if Dietz, Hess, Irving, and others might be right about continental drift. And remarkably quickly, at an age (about 50) when very few scientists have come up with great ideas, Tuzo recognized that Earth was a highly mobile place. Years of global, large-scale thinking had prepared him to take geology forward in a dramatic fashion.

Tuzo's mind had a fascinating way of solving problems. Unlike most physicists, who find their solutions via mathematics, Tuzo solved problems almost entirely with visual images and then presented the solutions in extremely clear prose. He had a remarkable ability to look into the heart of extreme complexity and see simplicity itself. The nearest mind that I can think of to compare with Tuzo's was that of Michael Faraday who, instead of integrating differential equations to calculate the electric field, imagined a charged particle to be an octopus with tentacle-like lines of force reaching out into the space around it.

To solve the problem of the origin of the Hawaiian Islands, for example, Tuzo imagined someone lying on his back on the bottom of a shallow stream, blowing bubbles to the surface through a straw. The bursting bubbles were the Hawaiian Islands, and they lay in a line because they were swept along the surface by the moving stream. Thirty years later, leading geophysical theorists use supercomputers to solve horrendous equations that Tuzo "solved" in the visualizing region of his brain.

Tuzo's great paper describing this, "A Possible Origin of the Hawaiian Islands,"



J. Tuzo Wilson in his 80s.
Photo courtesy of Delroy Curling.

was rejected by the leading American geophysical journal in 1963 on the grounds that it was completely at variance with the latest seismic studies of the region. Undeterred, he sent it to the Canadian Journal of Physics, where it was immediately published because, I suspect, the editors didn't know what else to do with anything so devoid of mathematics.

His second great, yet simple, idea was that of transform faults. Again, Tuzo's approach was visual and non-numerical. And yet it was devastatingly definitive in what it predicted. It did not give us an equation, such as $E=mc^2$, or say that the magnetic field near a wire is proportional to the current flowing through it. Tuzo's transform fault concept said to earth scientists that they were living in a looking-glass world. For earthquakes occurring underwater and in the middles of oceans, he predicted that the rocks everybody believed had moved right to left during the earthquake had moved left to right, and vice versa. This was a wonderful geometric test for the existence of continental drift and plate tectonics. If the rocks moved as Tuzo said, continental drift was a racing certainty. If they didn't, Earth was a far more static place. Wilson capped his transform fault paper (1965) with a stunning synthesis of what we now know as plate tectonics.

In 1967, Lynn Sykes of the Lamont Geological Observatory examined the motion of rocks in 10 earthquakes on two mid-ocean ridges and found Tuzo's predictions were correct in every case. His announcement of this went a long way in convincing people that continental drift had not only occurred in the past 200 m.y., but was going on under our feet today, at the rate at which our toenails are growing.

Interestingly, in his very last paper, which appears not to have been published, he merges his beautiful Hawaiian plume idea with geophysical exploration. He gave the preprint to me in late 1992, just before I was to leave Toronto for six months. In his irrepressible style, Tuzo entitled it, "On Migrating Mountains and a Revolution in Earth Sciences."

Among many other ideas, he pointed out in the paper an association between bonanza gold deposits in the United States and rising plumes, which he claimed underlay the continent. The manuscript I have is incomplete, but in the very sentence where it halts is contained the quintessence of Tuzo Wilson: the word "ideas." Said he, "These great faults may or may not have plumes associated with them, but the *ideas* gained in Nevada suggest that even without plumes, large faults may provide channels bringing ores from far greater depths of origin than has been previously considered." He had stamped December 4, 1992, on the manuscript, and in his familiar script had written "Thanks, Derek! Tuzo. Nearly done now!" Four months later, I received in Capetown a message that on April 15, 1993, he had died of a heart attack.

Extraordinarily powerful—mentally and physically—to the end, Tuzo had in later years been happy and successful as principal of Erindale College at the University of Toronto, where he and his wife, Isabel, entertained thousands of students and visitors. After stepping down from this position, he was, at 65, appointed director-general of the internationally renowned Ontario Science Centre, a position in which he reveled, with his magnetic personality and gift for popularization.

Further Reading

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"Rock Stars" is produced by the GSA History of Geology Division. Editorial Committee: Michelle Aldrich, Robert Dott, Robert Ginsburg, Gerald Middleton (editor of this profile).

J. Tuzo Wilson in his early 60s, sailing his Chinese junk on Georgian Bay. Photo courtesy of Susan Wilson.

J. Tuzo Wilson in preparation for the International Geophysical Year in 1957, examining a gravimeter with Jack Jacobs and Ron Farquhar. Photo by MacLeod-Gilbert A. Milne & Co.