

COMMENTARY

The J. Tuzo Wilson Geodetic Monument: A Truly Unique Installation With A Now-Uncertain Future

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On June 21, 2024, the Government of Ontario announced that the Ontario Science Centre (OSC) in Toronto, originally opened in 1969, would close to all visitors (Ontario Science Centre 2021; <https://www.ontariosciencecentre.ca/important-announcement>). This difficult decision was prompted by an engineering report that identified issues with the roof of the building related to the material known as reinforced autoclaved aerated concrete, which is prone to long-term deterioration through interaction with moisture. The decision has predictably proved controversial and other opinions (e.g. Lam 2024) held that full closure was unjustified. More recently, the Architectural Conservancy of Ontario (2024) requested that the building (designed by renowned architect Raymond Moriyama at the start of his career) be designated under the Ontario Heritage Act as an outstanding example of the so-called “brutalist” architectural style and for its many unique features. Among the attributes noted in their lengthy document is the unusual installation known as the J. Tuzo Wilson Geodetic Monument, which honours one of Canada’s most famous Earth Scientists. The future of this is but one of many questions that arise from unexpected closure of the OSC, but it is one of particular concern to the Earth Sciences community.

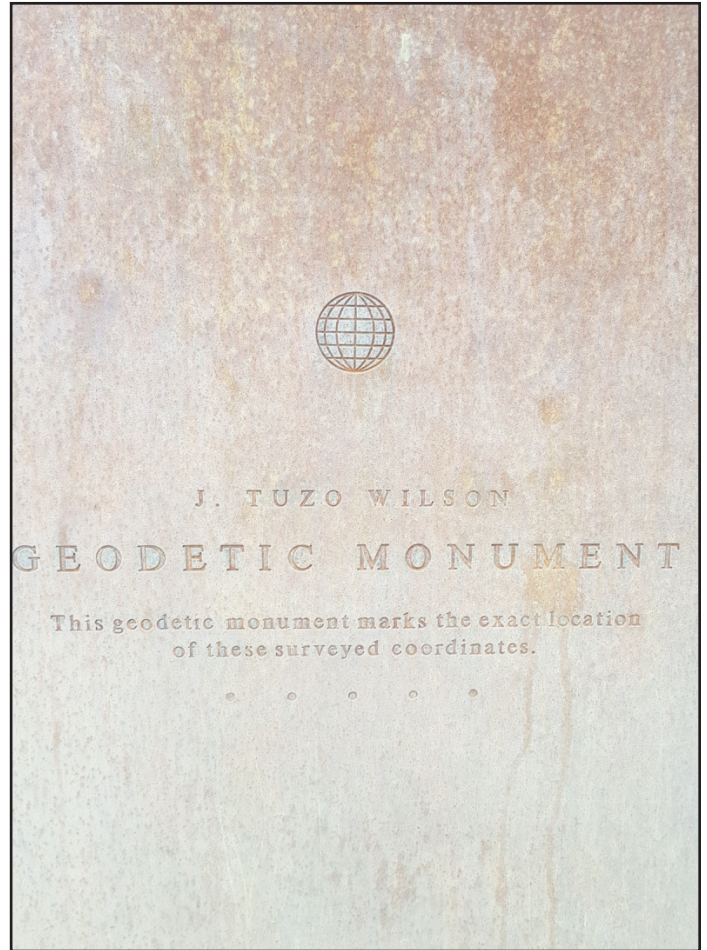
Dr. J. Tuzo Wilson was the Ontario Science Centre’s third Director General from 1974 to 1985. He passed away in 1993 at the age of 84. In tribute to Dr. Wilson, a new exhibit was unveiled on May 3, 2001, on the plaza leading to the newly renovated entrance of the Science Centre. In attendance that day was his wife Isabel, daughters Susan and Patty and family. Since then, millions of visitors have walked past this unique exhibit depicting the relentless travel of the North American tectonic plate. The monumental tribute to Dr. Wilson is a massive, corroded steel ‘spike’ rising several metres above the plaza created by the Science Centre to commemorate Dr. Wilson for the revolutionary change he brought upon the world’s understanding of how Earth’s invisible interior works. Visitors are

invited to imagine that the spike is driven deep into the Earth’s mantle and therefore fixed, unlike the Earth’s dynamic surface. That foundational understanding today explains both the slow and sudden geological events that command our attention.

While formally addressed as Dr. Wilson, Science Centre colleagues, scientific peers and family, then and now continue to think of him as *Tuzo*. A plaque with Tuzo’s likeness and some text affixed to a wall in the Centre would not have sufficed. Instead, a fitting tribute would distil his life’s work to its simplest expression, and in keeping with the Centre’s design philosophy meet fundamental requirements. His science had to be accurately represented. It had to be the real thing, like the lunar rock sample in the Astronomy Hall. Finally, the exhibit had to depict science in a manner relevant to the Centre’s visitors.

A geodetic monument was considered the appropriate way to represent Tuzo’s scientific career. A geodetic monument is a physical marker typically secured into bedrock or embedded in stable ground, in this case an architectural rendering of a giant spike anchored into the Centre’s concrete plaza. A reference point is selected on the monument at which coordinates are measured in terms of latitude, longitude, and height above mean sea level.

To recognize the significance of Tuzo Wilson’s role in creating a paradigm shift in how we understand the tectonic forces that shape our Earth, the Canadian Geodetic Survey (a division of Natural Resources Canada) undertook a geodetic survey in July 1997, after the concrete base of the monument was in place. A GPS receiver was set up over the geodetic reference point in the base of the monument and for 24 hours from 12:56 pm on the 7th July to 1:01 pm on the 8th July signals from dozens of orbiting GPS satellites were tracked. To ensure the highest degree of accuracy a perimeter of 5 m was secured around the GPS station to keep curious visitors and vehicles from interfering with the satellite signals. The coordinates of the geodetic reference point (43°43’0.5061”N; 79°20’18.7745”W) were then transcribed onto the steel spike and the distinctive monument was secured in place above its reference point. Today, it is common knowledge that, on average, the seemingly solid ground of the North American tectonic plate is moving from east to west at about 1 to 2 cm/year depending on location. More specifically, the J. Tuzo Wilson Geodetic Monument is moving westward at about 1.6 cm/yr. Other common tectonic terms, popular with trivia games, include the Pacific Ring of Fire, mid-ocean ridges, subduction zones, hot spots, and transform faults, with the San Andreas



Left. General view of the J. Tuzo Wilson Geodetic Monument at the Ontario Science Centre. The metal structure is intended to represent a spike that is a fixed location with respect to the Earth's coordinate system (think of it as extending deep into the mantle). The disrupted area in the plaza floor represents the 'track' left as a consequence of plate motion to the west accumulated over Wilson's life of 84 years. **Right.** Inscription on part of the metal spike. For reference, the location of the monument at the time of its installation was $43^{\circ} 43' 0.5061'' \text{N}$; $79^{\circ} 20' 18.7745'' \text{W}$.

Fault being a world-famous example of the latter. These planetary-scale phenomena were finally brought together in a unified theory by Tuzo Wilson in the early 1960s. That theory, called Plate Tectonics, is his legacy.

Decades after the initial geodetic survey of Tuzo's monument, thousands of geodetic reference points throughout the North American plate are continuously monitored by GPS revealing new refinements in our understanding of plate motion. The monument is a designated reference point, although it is not actively monitored; a new measurement would demonstrate a small change in its location with respect to the Earth's surface. From many measurements over many years of many such points, we now know that the overall average motion of a plate differs from that along plate boundaries where plates collide and deform in different ways. It is ironic that as Tuzo was assuming his role as the Science Centre's Director General in the early 1970s, less than a decade after the world began to embrace plate tectonics, Ontario students were

still being taught geosynclinal theory from the previous century. Students were learning that continents were fixed landmasses that grew at their margins as sediments filled deep depressions, termed geosynclines, that somehow turned into mountains.

Tectonic plate movement and drying paint are equally dull to watch. So how can we depict the cumulative drift of North America towards the west in a clear manner for visitors? This is the second unique feature of the geodetic monument found at the visitor's feet. It shows how the North American Plate would have left a 'wake' of broken concrete as it slowly moved past the immovable reference point represented by the metal spike. The 1.4 m gash in the plaza floor trending towards the west represents the estimated amount of plate motion over Tuzo's life of 84 years. Other comparisons of the accumulation of tectonic motion can be made. For example, Canada has drifted westward about 2.5 m since Confederation. About half a metre of plate motion occurred since the survey was done

twenty-seven years ago. And during the life of the Ontario Science Centre, as generations have known it, a tectonic tear of about 1 m in length would have resulted.

In her remarks at the Monument's unveiling Tuzo's daughter Susan Wilson shared the following with guests.

"I am here on behalf of the Wilson family – particularly my sister Patty Proctor, our mother Isabel Wilson, and Patty's family, Michael, Andrea, here beside me, Eleanor and Caroline, to thank everyone who contributed to this magnificent monument to my father. Thank you. We are very touched and proud that he is remembered here and in this way. We would like you to know that Dad too would have been deeply touched by this gesture and simply thrilled by the cleverness of the monument itself. He would have said that it was "splendid!". Leaving aside totally the matter of it being in his honour, he would have loved the fact that this spike combines a memorial, a sophisticated scientific measuring device, and a science lesson accessible to everyone - all in one compact and striking structure. He would have noted, as do we, that the Geodetic Benchmark, and the visual lesson exemplify two things important to the person remembered; serious geological science and the dissemination of scientific knowledge to everyone, not just to members of the scientific community. He would have loved the fact that this monument is here at the Ontario Science Centre where serious science and the joy of scientific discovery and learning blend so easily together, and where he spent many happy years at the end of his working career. So, on behalf of the entire family, including my father, I thank the Ontario Science Centre and its imaginative staff, the Geological Survey of Canada, and all the corporations and individuals who contributed to the creation of this monument."

As inscribed into the steel monument, "Principal Funding for the Monument has been generously provided by: Canadian Geological Foundation; Earth Sciences Sector - Natural Resources Canada; Stelco Inc.; Roberston and Brenda Davies; Geological Association of Canada; The Cecil and Ida Green Foundation; Isabel Wilson; Susan Wilson."

Tuzo gave his last public lecture at the Ontario Science Centre on February 23, 1992. He titled his presentation "With Zest to Go, in Quest to Know" and over the course of an hour took the audience on a personal journey that spanned three million kilometres and seven continents. He recounted the development of plate tectonics and how it was being furthered by continuing research. His influence over decades is explored in a tribute paper published in Canadian Journal of Earth Sciences, in which he was labelled as "A man who moved mountains" (West et al. 2014). For an impressive and engaging biography of Tuzo's life, research and achievements look for the book, "Tuzo: The Unlikely Revolutionary of Plate Tectonics" by Nick Eyles, published by the University of Toronto Press and widely available. The book was reviewed for Geoscience Canada in 2023.

The permanent closure of the Ontario Science Centre has far-reaching consequences, including the fate of the J. Tuzo Wilson Geodetic Monument. What is to become of this tribute to a Canadian pioneer of Earth Science? One thing is certain; if the J. Tuzo Wilson Geodetic Monument is moved even

a few centimeters from its original position the geodetic monument (CGS #973026) loses its accuracy. It becomes an architectural reminder of the Ontario Science Centre's past. Maybe Tuzo's spike should be relocated to the Department of Earth Sciences at the University of Toronto where he served as its first professor in 1946. Or, perhaps it could be sent to a location that exemplifies his insight. Iceland would be fitting. It is above a mantle plume (hot spot) that coincides with where the North American and Eurasian plates diverge along the mid-Atlantic Ridge. Perhaps it is more appropriate to move this tribute to J. Tuzo Wilson to a place of prominence at what we all hope will be a new and engaging Ontario Science Centre. Its geodetic coordinates would need to be resurveyed. Along with the amount of plate motion representing Tuzo's life, creative ways to depict other significant events, such as plate migration since Confederation and searchable databases of plate motion around the world could also be explored. But whatever its final destiny, this unique tribute to the legacy of a truly remarkable scientist should not be lost.

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