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# Tuzo: The Unlikely Revolutionary of Plate Tectonics

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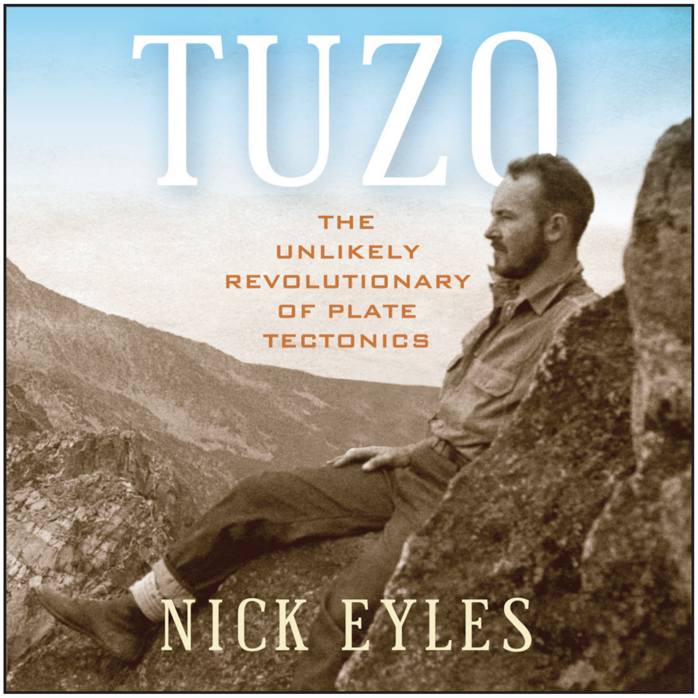
# REVIEW




## Tuzo: The Unlikely Revolutionary of Plate Tectonics

**Nick Eyles**

*Published by: University Toronto Press*
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*Purchase price: $48.95 (CND, Softcover)*
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This book presents a long overdue appreciation of the geologist J. Tuzo Wilson and his profound contributions to the development of our understanding of plate tectonics. It describes how, as a teenager, Tuzo worked as a junior geological assistant one summer doing field mapping north of Lake Superior. He enrolled at the University of Toronto to study physics and mathematics. His continuing summers of fieldwork, with the Geological Survey of Canada, however, stimulated his interest in geology and he managed to arrange to take a combined Physics and Geology program, thereby instituting a program that persists to this day. After graduation, he obtained an MA from Cambridge University and a PhD from Princeton, carrying out a fairly conventional field-based study of an area in the Beartooth Mountains of Montana. On returning to Canada he joined the Geological Survey of Canada as an assistant geologist, conducting field-based mapping studies over three seasons in Nova Scotia, northern Quebec and the Barren Lands of the Northwest Territories.

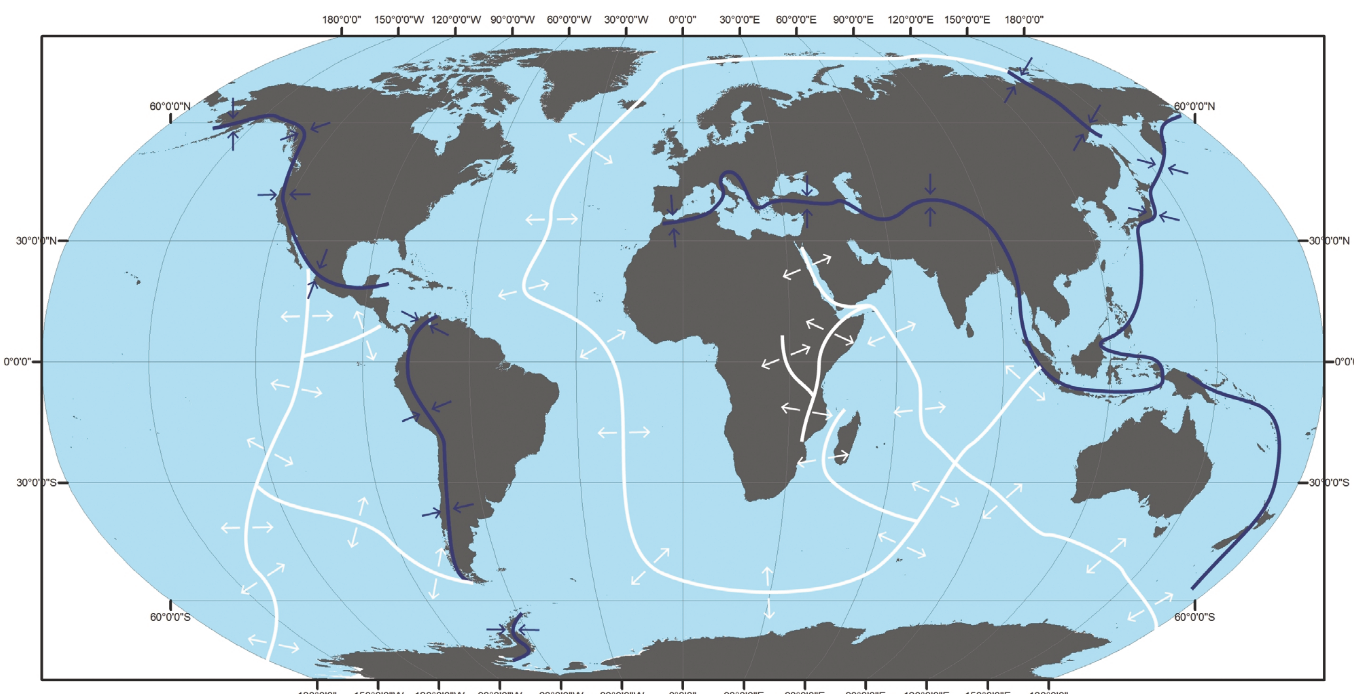
At the outbreak of war in 1939 he enlisted in the Royal Canadian Engineers. Tuzo spent much of the war based in Britain and later Sicily, making use of his geological expertise to train soldiers in the drilling, tunnelling and explosives techniques that would be useful in the war effort, and in the analysis of aerial photographs to identify enemy positions and develop maps of battle fronts. Although he wished to become actively involved in the war effort in Europe, he was transferred back to Canada in 1943 to take up a position as director of Army Operational Research, in which position, among other things, he launched a spirited program to prepare the Canadian Armed Forces for high-latitude combat. This program gained added impetus when the war with Germany was replaced by the Cold War. Tuzo remained with this program until 1946, when he took up an academic position in the Department of Physics at the University of Toronto. Over the next 15 years, Tuzo conducted research in the Canadian Shield, concentrating both on the application of the newly developed radiometric dating techniques and on the application of aerial photography to the elucidation of structural divisions and glacial history. Throughout this period, Tuzo remained a confirmed 'fixist'; i.e. an opponent of the 'mobilist' theory of continental drift first proposed in detail by Wegener in the early part of the twentieth century but largely rejected by most of both the geological and geophysical communities.

Tuzo's conversion to mobilism appears to have occurred on a visit to Hawaii in 1961 when, after hearing a talk by Robert Dietz on sea-floor spreading at mid-oceanic ridges, he went to the Hawaiian peak Mauna Loa. While there he realized that the northwestward increase in

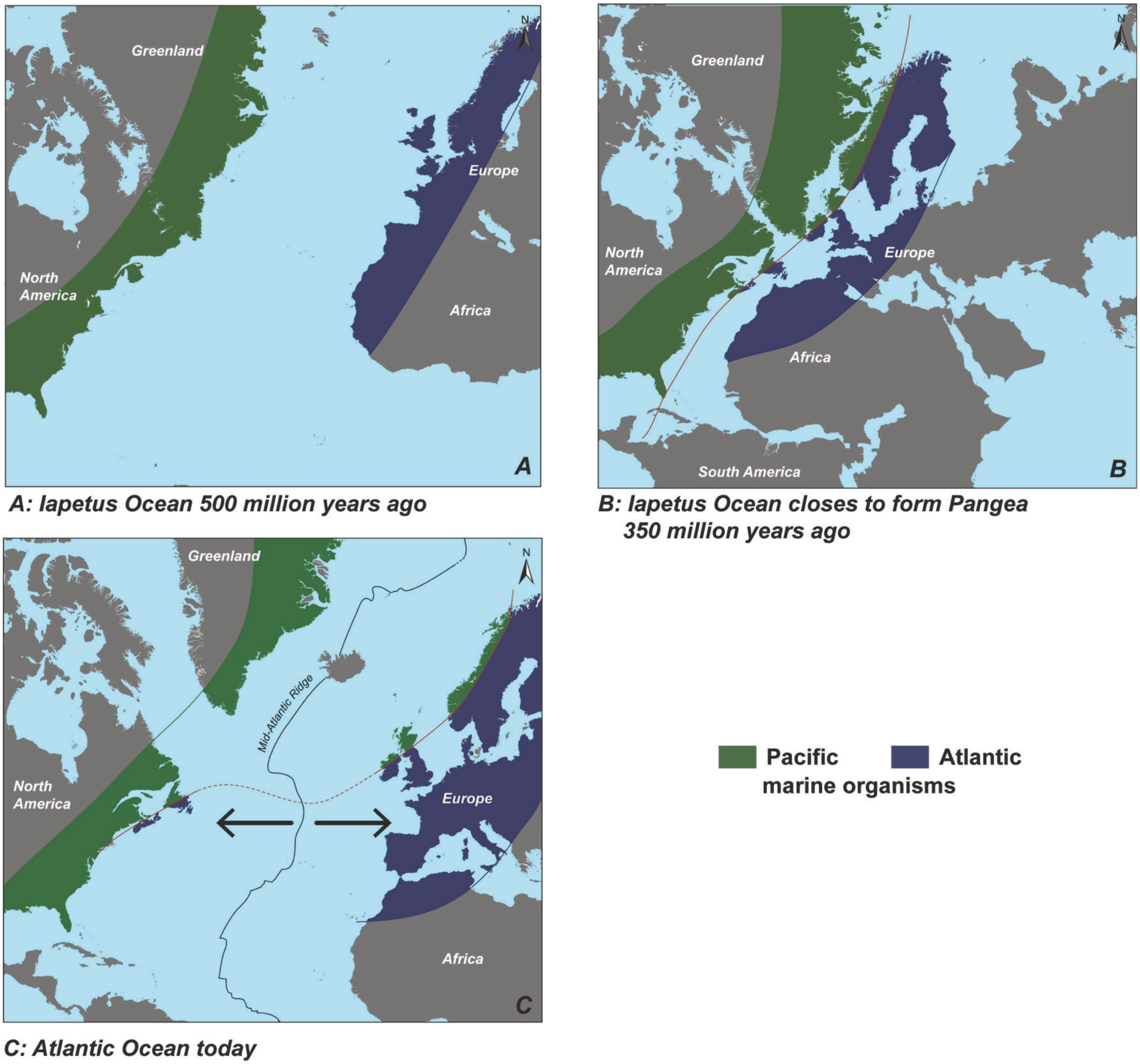
 

Lieutenant John Tuzo Wilson's photo taken in Ottawa in the Fall of 1939 shortly after he enlisted with the Royal Canadian Engineers. Photo credit: Yousuf Karsh.

J. Tuzo Wilson, Professor of Geophysics, University of Toronto, visiting the Ticlio Pass at the highest part of the Cordillera Central in the Peruvian Andes.




Tuzo Wilson's map, published in Scientific American in 1963, (v. 208, p. 86–100), identified a moving Earth's surface with mid-ocean spreading centres (white lines) at the site of mantle upwelling and deep blue lines where these mantle convection currents descended.




Adapted from Tuzo Wilson's 1966 Nature paper *Did the Atlantic close and then re-open?* the panels, A and B, show the progressive closing of a proto-Atlantic (Iapetus Ocean) and then the opening to form the present-day Atlantic Ocean, thus explaining the presence of contrasting shallow marine fauna of Lower Paleozoic time, Pacific- and Atlantic-faunal realms, adjacent to each other on either side of the ocean basin.

ages along the Hawaiian-island chain, suggested by James Dana as long ago as 1840, would be perfectly explained by movement of a Pacific plate over a hotspot. He later developed this suggestion by dating the volcanic rocks all along the chain, leading to a 1963 paper on mantle plumes and hotspots that is one of his three most important contributions to our understanding of global tectonics. From this time onwards, Tuzo was a committed mobilist and he went on to publish a paper in 1966 based on faunal distributions in eastern North America and northwestern Europe, in which he argued that opening of the present Atlantic Ocean had been preceded by closure of an earlier ocean. This argument, now widely accepted, gave rise to the term 'Wilson cycle'. As Eyles points out in his book, this idea was first promoted by Amadeus Grabau who, while a professor at Columbia University, had been a spirited proponent of Wegener's ideas but lost his position at Columbia in 1919 and moved to Peking University. Grabau published

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his idea for a pre-Atlantic Ocean in 1940 but it was ignored at the time due perhaps to the prevailing wisdom that continents did not move. Tuzo's third very significant contribution was to explain how transform faults work, which he published in 1965. The stage was then set for the appreciation of how lithospheric plates move around Earth, bounded by oceanic spreading centres, transform faults and Wadati-Benioff zones. The full picture was put together in several different papers published in 1967.

Eyles' book provides a compelling description of the long controversy surrounding the possibility of continental drift, with interesting characterizations of the main players both before and after Wegener, but particularly of the fixists who dominated the discussion, especially in North America, and to whose teachings Tuzo adhered until his Eureka moment in 1961. The book makes very clear how the positions held by well-established Earth scientists successfully suppressed mobilist ideas, perhaps driven by the fact that much of the work that had dominated their careers was in some sense discredited by the new ideas. It also argues that the success of their suppression may have been helped by the generally less-established status of proponents of mobilism.

The book interweaves the development of discussion over global tectonics with the details of Tuzo's life experiences. It shows exceptionally well how the techniques that Tuzo had gained in mineral exploration and mapping prior to the war made invaluable contributions to his ability to assist in the war effort, and also how many of the geophysical techniques that were developed to assist the war effort, by people such as Teddy Bullard and Maurice Ewing, were key to the postwar acquisition of data about the hitherto largely unknown features of the ocean floors in the years immediately after the war. Throughout the book, Tuzo's slightly quirky personality is captured very well, making use of both his own quotes and the reminiscences of his daughters and many people who worked with him at various stages in his career.

The book is very well written, delightful to read and superbly illustrated. Towards its end the book does perhaps get a little carried away, in using our understanding of plate tectonics to suggest we can make firm predictions about how the next supercontinent will form, and in arguing that plate tectonics was essential to the development of life on Earth. I might also have wished that the author had been a little more careful to ensure throughout the book that his non-geological readers understood that the lithospheric plates consist of both crust and a significant part of the uppermost mantle, and that he had avoided characterizing the crust as 'floating' on the mantle when he was explaining the isostatic principle using the iceberg analogy. I would, however, very happily recommend this book, albeit with the equivalent of a minor health warning to non-geologists.

All figures come directly from Nick Eyles' book, *Tuzo: The Unlikely Revolutionary of Plate Tectonics*, with permission from University Toronto Press.