

Tuzo Wilson in China

Tectonics, diplomacy and discipline during the Cold War

William S. Kearney

2012-2013 Penn Humanities Forum Andrew W. Mellon Undergraduate Research Fellow

University of Pennsylvania

Honors Thesis in Science, Technology and Society

Supervised by John Tresch



## *Table of Contents*

Acknowledgements	2
Abstract	3
Introduction	4
Boundaries: national and disciplinary	7
The Canadian experience	11
Chinese geophysics and geology to 1958	13
The International Geophysical Year	15
The first China trip	18
A side trip to Taiwan	22
Plate tectonics	25
The second China trip	30
The self-conscious scientific diplomat	35
References	39

## *Acknowledgements*

This project formally began as the final research paper for STSC 152, Chinese Science, and I am grateful to the instructor, Dr. Ian Petrie for his guidance in the formative stages of this project. Dr. Jonathan Moreno then supervised this thesis as I turned it from a research paper into a research plan, and he was especially helpful in securing funding for my archival research in Toronto. Dr. John Tresch then took over as my official advisor. Throughout my research, the comments of Dr. Steve Phipps of the Earth and Environmental Sciences department helped me conceptualize just what plate tectonics means to a geoscientist.

I must thank the other professors who led me to the study of the history of science and the history of the earth sciences in particular. Dr. Nathan Ensmenger sat with me through the first throes of my involvement in the history of science and technology, overseeing my transformation from someone with a vague interest in Welsh mining history to a historian of the geosciences. Dr. Jim Endersby's course on the history of evolutionary biology saw me do my first real historical research on the historiography of geoscience and geoscientists which is the overarching theme of this paper.

The staff at the University of Toronto Archives and Records Management Services were exceedingly patient with an undergraduate who walked in one day and said he was interested in Tuzo Wilson's international scientific work, a topic which takes up most of their 11.71 meters of Wilsoniana.

The Penn Humanities Forum, which funded my archival research, deserves special

recognition both for its generosity and for the great and, in my eyes, successful experiment in cultivating young scholars of the humanities.

Lastly, I thank my fellow students and family members who have had to deal with what was an often erratic and obsessive interest in the man of Tuzo Wilson.

## ***Abstract***

Canadian geophysicist John Tuzo Wilson's transform fault concept was instrumental in unifying the various strands of evidence that together make up plate tectonic theory. Outside of his scientific research, Wilson was a tireless science administrator and promoter of international scientific cooperation. To that end, Wilson travelled to China twice, once in 1958 as part of the International Geophysical Year and once again in 1971. Coming from a rare non-Communist Westerner in China both before and after the Cultural Revolution, Wilson's travels constitute valuable temporal and spatial cross-sections of China as that nation struggles to define itself in relation to its past, to the Soviet Union which inspired its politics and to the West through Wilson's new science of plate tectonics. In so constructing these cross-sections, Wilson acts as a cartographer of science, mapping the tectonic shifts during the Cold War which revolutionized his understanding of the Earth, of politics, and of the discipline of geophysics.

## ***Introduction***

John Tuzo Wilson (1908-1993) was a Canadian geophysicist known for his idea of transform faults, instrumental to the theory of plate tectonics, and for the Wilson cycle which describes the repeated opening and closing of the oceans due to plate tectonics. Outside of that scientific work, Wilson was a tireless science administrator and promoter of international scientific cooperation. He served as the president of the International Union of Geodesy and Geophysics (IUGG) from 1957-1960. Furthermore, he was elected to serve as a Canadian delegate to the meeting of the International Geophysical Year (IGY) to be held in Moscow in July and August of 1958 as the IGY was winding down. It was on that trip that Wilson had his first opportunity to visit China. Instead of flying home west from Moscow, he took the Trans-Siberian Railway eastward and crossed into China, leaving three weeks later by way of the British possession of Hong Kong. After leaving the People's Republic of China, Wilson visited first the Republic of China on Taiwan and then Japan before finally returning to Canada. He would return to mainland China in October of 1971 after the Canadian government recognized the People's Republic. On each trip, he toured scientific institutes, factories, and tourist sites and met countless Chinese scientists and scientific administrators. The narratives of his travels of his 1958 and 1971 trips were published as *One Chinese Moon* and *Unglazed China*, respectively, and his travels in Taiwan and Japan were recounted in his survey of the International Geophysical Year, *I.G.Y: The Year of the New Moons*.

Wilson's travelogues constitute valuable information on the state of Chinese science

under the rule of Chairman Mao. Wilson arrived in 1958 at the beginning of the Great Leap Forward, Mao's ambitious plan for economic development, and in 1971 at the end of the Cultural Revolution, the anti-revisionist political and social campaign which Mao led to restore his power after the collapse of the Great Leap Forward. In both trips, Wilson went to both the large and old coastal cities of Beijing (formerly Peking), Shanghai, and Guangzhou\* (formerly Canton) and to the quickly developing interior. His two books recount the immense political, social and geographic changes which the Chinese scientific community faced during the early decades of Communist rule.

This story is complicated by the exponential trajectory that Western geology took during this same time period. Between 1958 and 1971, Western geologists and geophysicists including Wilson established the fundamental tenets of the unifying theory of plate tectonics. On Wilson's first trip, he had no more than the rudimentary data which would later turn into plate tectonics. In 1971, on the other hand, he came with a theory which, if not complete, was fully formed and self-consistent. Because of the turmoil that the Chinese scientific community underwent during the late 1960s, plate tectonics had not made its way into the Chinese scientific consciousness. Political and diplomatic isolation from the West and from the Soviet Union after the Sino-Soviet split in 1960 translated into scientific isolation for the People's Republic of China. Furthermore, the Cultural Revolution put an emphasis on science that was both "red and expert" – science

---

\* Where possible, I have used the pinyin system to transliterate Chinese characters. However, because Wilson's trips took place before the switch from the Wade-Giles system to pinyin, I have kept certain names in the Wade-Giles system so as to prevent confusion between this paper and Wilson's text. Where necessary, as with these city names, I have given the names in both pinyin and Wade-Giles.



which was ideologically acceptable. Isolation and ideology did not result in complete stagnation as Wilson saw upon his return in 1971; Chinese scientific institutions still existed and were expanding even though politics had disrupted much of their scientific work. However, isolation and ideology meant that Chinese scientists had only a limited awareness of the scientific revolution that was taking place in the West. The talks Wilson gave throughout his trip in 1971 gave the Chinese scientific community its first experience with plate tectonics. In some ways, then, Wilson can be read as a modern Matteo Ricci, the Jesuit missionary who brought 16<sup>th</sup> century European science to China. Wilson was well aware of that comparison, noting that he was “stamped with the same frank [that of international science] that had served Matteo Ricci, Benjamin Franklin, and Sir Humphrey Davy” in their diplomacy.<sup>1</sup>

As a diplomat, geoscientist, and traveler, Wilson's career is defined by the revolutionary construction and deconstruction of maps. These maps need not be only physical, cartographic objects; instead, they may also be abstract sets of relationships between actors, institutions and phenomena. As a geoscientist, Wilson helps to make the most fundamental of changes to the map of the Earth. With the advent of plate tectonics, no longer is the world map an accurate picture of the Earth in perpetuity. Instead, oceans open and close in the Wilson cycle while the continents shuffle around the surface of the Earth. As a scientific diplomat and promoter of international scientific cooperation, Wilson redraws Cold War geopolitical relationships not between the superpowers of the United States and the Soviet Union, but between two neighboring satellites of those superpowers: Canada and China. Wilson's experience as a traveler unites both of these

---

1 J. Tuzo Wilson, *One Chinese Moon* (New York: Hill and Wang, 1959), 259.

mapping projects as it allows him to interact with Chinese communities which are making their own maps of politics and science. His travels provide a transect across the various communities from old colonial-era observatories in Shanghai to recently constructed geophysical institutes in Lanzhou. Because he visits several of the same institutions at two key points in the history of the People's Republic, Wilson's travels are also a cross-section through the stratigraphy of Chinese science, allowing his readers to trace the changes which political, economic and scientific forces wrought on the Chinese scientific community. The rhetorical project of Wilson's popular writings is to unite his large-scale maps of geopolitics and plates with the small-scale cross-sections of his travels. In so doing, not only does Wilson reveal useful factual information about Cold War Chinese science but he also develops an ideology which allows him to reconcile his observations of science under totalitarianism with his Western democratic ideals.

### ***Boundaries: national and disciplinary***

Science is done on multiple scales from the individual scientist in his laboratory to a national scientific community to large-scale international scientific endeavors. A national conception of science accepts the proposition that context matters in the development of science. In particular, it recognizes the immense influence states can have on science. It thus subsumes any distinct local communities of scientists into a broader one identified with the boundaries of the nation state.<sup>2</sup> A national conception of science attempts to make meaningful distinctions between national communities.

Considering science as international forces us to broaden the scale of inquiry to incorporate interactions between these national scientific communities. As such, it is an extension of the national conception of science. The IGY lends itself to such a perspective: delegates from individual nations – often explicitly sent by their respective national academies – formed the Special Committee for the International Geophysical Year (Comité Spécial de l'Année Géophysique Internationale, CSAGI) in hopes of fostering international scientific cooperation. Tuzo Wilson hoped that such cooperation would lead to “easing tensions” between superpowers. However, the IGY – like Edward Sabine's Magnetic Crusade and countless colonial ocean-going expeditions from which it drew inspiration – also became a stage on which the great

---

2 Mark Walker, “The ‘national’ in International and Transnational Science,” *The British Journal for the History of Science* 45, no. 3 (2012): 359–376.

powers could play out scientific rivalries.<sup>3</sup> Such conflicting ideologies of international science demonstrate the complex interplay between science and geopolitics which an international conception of science elucidates. International science is in many ways a consequence of national science: the international scale can exist only because there are various national sciences which compete and cooperate with each other.

However, both national and international perspectives on science miss important aspects of scientific practice. Scientific knowledge, for example, is not automatically constrained by national boundaries. For example, geophysical phenomena take place without regard to any kind of artificial borders. The geomagnetic field pervades the entire earth, earthquakes can be detected by seismographs far from the epicenter of the earthquake, and space physics phenomena such as the Van Allen radiation belts exist in outer space beyond the easily delineated national borders of the Earth's surface. This was one of the motivations behind the initiatives for international scientific cooperation like the IGY, the International Polar Years before it, and the various attempts to establish systematic geomagnetic measurements in the 19<sup>th</sup> century. No one nation's scientific community could even hope to measure much less to understand such global phenomena, necessitating such big cooperative endeavors. Also, flows of scientific information often take place outside the control of the nation-state or any national scientific community. International scientific journals, conferences and organizations provide one such forum for the diffusion of scientific knowledge; the informal interactions of scientists who travel internationally as Wilson did provide another. These phenomena need to be explained without

---

3 See the later section on the International Geophysical Year for a more complete discussion.

the reference to the nation-state which characterizes national or international science. This transnational perspective focuses on the flux of people, material, and scientific knowledge without regard to borders.<sup>4</sup>

Yet transnational history is not simply a broadening of international history to consider those actors who work independently of the nation-state. By deemphasizing the importance of the national boundary, it provides a means to recover the history of regional and local scientific communities. These communities, such as the provincial Chinese geophysical institutions which we will encounter later, may not play an important role in the scientific production of the nation-state, but their history can nonetheless elucidate important aspects of the development of scientific communities. Tuzo Wilson as an individual scientist can cross borders and move around within nations. In doing so, he exchanges scientific information on scales from the international down to the individual. Thinking about Wilson's travels from a transnational perspective allows us to access all of those scales rather than privileging just one or two of them. The transnational perspective means we must think about Wilson's travels in terms not only of Chinese or Canadian science nor of international scientific cooperation and competition. Instead we must think about how Wilson interacts with many different scientific communities and the role each of these scientific communities plays in the sociopolitical context of the Cold War.

These scientific communities are defined by their participants through the act of boundary-work. Thomas Gieryn invented the concept of boundary-work to explain the function

---

4 Turchetti, Simone, Néstor Herran, and Soraya Boudia, "Introduction: Have We Ever Been 'transnational'? Towards a History of Science Across and Beyond Borders," *The British Journal for the History of Science* 45, no. 03 (2012): 319–336.

of ideologies within scientific communities.<sup>5</sup> Boundary-work consists of the rhetorical strategies which scientists use to delimit their social role from other competing interests. Gieryn illustrates his concept through historical examples. Of his three examples, two, the Victorian British scientist John Tyndall and a National Academy of Sciences Panel on Scientific Communication and National Security, provide arguments for science similar to those which will crop up in Wilson's writing. John Tyndall was a vocal critic of religion in the years following the publication of Charles Darwin's *On the Origin of Species*. In one notable instance, Tyndall challenged the Church to substantiate the effect of public prayer in a scientific manner. In doing so, Tyndall makes science into “not-religion” and religion into “not-science.” Science is practical, empirical, skeptical and objective where religion is poetic, metaphysical, dogmatic and subjective. Tyndall sets up the boundary between science and religion to expand scientific authority into realms previously controlled by religion. Tyndall does the same thing to mechanics, this time claiming that science is a nobler form of experimentation than engineering, providing practical benefits as a by-product of the pursuit of knowledge.

Boundary-work explains how Tyndall can reconcile these two seemingly contradictory ideologies: that science is simultaneously practical, making it a better source of authority than religion, and pure, making it better than mechanics. Boundary-work considers each of these ideologies primarily as rhetoric which Tyndall deployed when he needed. When he faced off against the Church and public prayer, science provided practical technological benefits where

---

5 Thomas F. Gieryn, “Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists,” *American Sociological Review* 48, no. 6 (December 1, 1983): 781–795.

religion could only provide poetic comforts. When confronted by the enormous influence of industry in Victorian Britain, Tyndall made science intellectual and cultural while mechanics was grubby and profit-seeking.

Gieryn makes another example out of the Cold War National Academy of Science Panel on Scientific Communication and National Security. The Panel uses similar ideologies of pure and applied science as Tyndall, but rather than trying to expand the authority of science, the Panel attempts to preserve the autonomy of science from government interference while maintaining government interest in funding science. Scientists resented governmental restrictions on scientific communication, so they claimed that they were interested in basic, pure research which the government should not restrict because the American government depended on scientific as well as military superiority. That same scientific superiority which justifies scientific independence from government simultaneously justifies government funding of science. Once again, seemingly contradictory arguments are made by scientists to deal with their own professional strains and interests. These same arguments will crop repeatedly in the Cold War in both the West and the East as scientists including Tuzo Wilson tried to negotiate a delicate geopolitical climate. The tension between national interests, international organization and the global phenomena of geophysics forces Wilson to deploy different and sometimes inconsistent legitimating strategies to the various audiences of 20<sup>th</sup> century science: fellow scientists, governments, the literate public. Boundary-work is fundamentally a cartographic process: just as Wilson redraws a political and a geoscientific map, his boundary-work lays down disciplinary

boundaries during a period when the relationship between physics, geology and geophysics was in turmoil.

### *The Canadian experience*

The Canadian scientific community found itself after World War II at a paradoxical confluence of center and periphery. Officially a colony of Great Britain and unofficially a colony of its powerful southern neighbor, the Canadian scientific community existed on the margins of American and British science. However, because of its location on the shortest flight paths from American and Soviet air and missile bases to the other superpower, the Canadian Arctic became one potential stage on which a future American-Soviet conflict would play out, forcing the Americans to pay close attention to the region by establishing radio and research stations throughout the Arctic. Though the two countries were allies, the Canadian government and scientific community saw American interest in the region as a threat to the sovereignty of Canada over the sparsely-populated Arctic. The Canadian response was to institute a scientific program which reasserted both Canadian claims over the Arctic and the fundamental "nordicity" of Canada.

Canadian geographer Louis-Edmond Hamelin invented nordicity as a way of ranking Northern environments. Under Hamelin's criteria – latitude, temperature, population and accessibility for both people and communications – the Canadian Arctic was by far the most nordic region on Earth. This ranking was not least because of certain ionospheric phenomena



only present at high latitudes which disturbed radio communications throughout the Canadian Arctic, isolating from those few people who ended up there. Recognizing both the international strategic importance and the distinct Canadian nature of these phenomena led Frank Davies to develop an ionospheric research program under the auspices of the Canadian Defence Research Board.<sup>6</sup>

Another project of this Canadian Arctic military-scientific complex was Exercise Musk Ox in 1946. Planned in large part by Tuzo Wilson, still a colonel in the Royal Canadian Engineers, Musk Ox was a combination scientific, technical and training expedition and show-of-force. A massive moving force was sent through the depths of the Canadian Arctic to test military equipment and methods and to perform scientific observations of the Arctic. The government was interested in the former because of the World War II landings in Northern Europe and the Soviet winter victory over the Germans.<sup>7</sup> It was clear that in any future war between the new superpowers the ability to fight in the cold would determine the outcome of that conflict. Wilson as a geophysicist was particularly interested in the Arctic for “In comparison with the rest of the earth [the polar regions'] human, economic and biological aspects are of less importance, but in geophysical matters their position near the pole gives them unusual interest.”<sup>8</sup> However, Wilson's support of Musk Ox was not limited to its scientific potential: in arguing for more Canadian exploration of the Arctic, he deployed a geopolitical argument, saying that “Most

---

6 Jones-Imhotep, Edward, “Communicating the North: Scientific Practice and Canadian Postwar Identity,” *Osiris* 24, no. 1 (January 2009): 144–164.

7 Tuzo Wilson, “Exercise Musk-Ox, 1946,” *The Polar Record* 5, no. 3-4 (1947): 14.

8 Tuzo Wilson, “Report upon Science in the Canadian Arctic,” University of Toronto Archives, John Tuzo Wilson, B1993-0050/006 (08).

of the Canadian Arctic is at present a scientific vacuum which other countries have always shown a willingness to help to fill.”<sup>9</sup> Wilson hoped that Musk Ox and other Arctic exploration represented a “slow awakening to the potentialities, the grandeur and the responsibilities that their vast Arctic possessions entail.”<sup>10</sup> The Canadians, Wilson argued, needed to take responsibility for Arctic science and thus for Arctic geopolitics or the Americans would be glad to do both. For Wilson, doing science – in particular earth science – in a place represented sovereignty over that place would form an integral part of Wilson's thinking in his China years. Furthermore, the kind of big, government-supported science which Musk Ox represented would color his political interpretation of China as well, making this conservative Canadian colonel far more receptive of the Maoist scientific enterprise than might be expected.

---

9 Wilson, “Exercise Musk-Ox, 1946,” 25.

10 Ibid.

### ***Chinese geophysics and geology to 1958***

China has a long history of inquiry in natural science: in geophysics, for example, the Chinese possess perhaps the longest and most detailed record of earthquakes of anywhere in the world.<sup>11</sup> However the nation had no formal geological institutions of its own until 1912 after the Xinhai Revolution led by Sun Yat-sen.<sup>12</sup> Prior to that year, Western-style earth science was done in China by Western geologists and by their Chinese subordinates. Science in the 19<sup>th</sup> century centered around colonial observatories such as the Jesuit observatory at Zikawei, Shanghai, and the Hong Kong observatory in the British colony.<sup>13</sup> These observatories played important roles in supporting the overseas colonial enterprise through their roles as weather stations. To do that job, they became clearinghouses for the geophysical data produced by the ships which passed through the port cities of China. These observatories persisted through the Revolution and formed a basic scientific infrastructure upon which post-Revolutionary geoscientists could build.

Over the several decades following the Revolution, Chinese geology advanced quickly, largely owing to both the practicality of the science and the relative simplicity of geological fieldwork compared to other more capital-intensive sciences. The development of Chinese geological institutions in this period had substantial impacts on the country's reception of plate

---

11 Tuzo Wilson, "Mao's Almanac: 3,000 Years of Killer Earthquakes," *Saturday Review*, February 19, 1972, 60.

12 Dajian Zhu and Homer Le Grand, "Plates, Politics and Localism: Geological Theory in China," *History and Anthropology* 11, no. 2-3 (1999): 291.

13 P. K MacKeown, *Early China coast meteorology : the role of Hong Kong* (Hong Kong: Hong Kong University Press, 2010).

tectonics. In contrast to the West, Chinese geologists were initially receptive of Wegener's continental drift theory. Because of the relative youth of their institutions, anti-drift ideas were not so deeply rooted.<sup>14</sup> The most significant of Chinese geologists in this period was Li Siguang (also known as J.S. Lee) who was an early adopter and creator of mobilist theories. Li developed what he called “geomechanics theory” which incorporated the ideas of Wegener into a framework that explained the large east-west trending structures which defined China's geology in terms of horizontal movement.<sup>15</sup>

Diplomatic changes associated with the rise of Mao's Communist regime reoriented the geological community. Geologists facing political pressure looked towards the Soviet Union for new theoretical bases.<sup>16</sup> Specific Russian geological settings led Russian scientists such as V. V. Belousov to consistently underestimate the importance of horizontal land movements. Just as Li Siguang had developed his geomechanics to deal with the specific geological circumstances of China, Russian scientists developed broadly “verticalist” theories to explain Russian geology.<sup>17</sup> While in this Russocentric phase of Chinese geology, Chinese scientists did not take these verticalist theories unquestioningly. Instead the theories were modified to allow limited horizontal crustal movement as had earlier Chinese mobilist theories such as Li's. It was into this theoretical environment that Wilson stepped on his first trip to China.

---

14 Zhu and Le Grand, “Plates, Politics and Localism,” 294.

15 Ibid., 296.

16 Ibid., 297.

17 Ibid., 298.



### ***The International Geophysical Year***

The formal motivation for Wilson's voyage to China was his involvement with the International Geophysical Year. Lasting from June 1957 to December 1958, the IGY coordinated scientific activity in several fields of earth science across the globe. The IGY grew out of the International Polar Years held in 1882-1883 and 1932-1933. These endeavors had coordinated the previously haphazard and nationalistic exploration of the poles to produce more valuable science for the resources which were being poured into polar exploration. In 1950, physicist Lloyd Berkner proposed another Polar Year to James Van Allen's living room full of scientists. A combination of Cold War geopolitics which created interest in the wide swaths of empty and unexplored territory in the Arctic and Antarctic, technical developments which provided new observational tools to geophysicists, and timing – the year of 1957-1958 was expected to be a sunspot maximum, prime observing time for magnetic phenomena in the atmosphere – led to Berkner proposing that the 50 year interval between the previous Polar Years be shortened to 25 years.<sup>18</sup> The International Council of Scientific Unions took up the idea and expanded it from the atmospheric phenomena studied during the last Polar Year to include research of the entire earth. The IGY was designed to solve the transnational problem of geophysics: global phenomena need global observation. To do so, the IGY's program consciously evoked the *Magnetischer Verein*, a short-lived group of magnetic observatories coordinated by Carl Friedrich Gauss in Germany in the 1830s.<sup>19</sup> The organizing scientists in each case set out to coordinate observations of

---

18 Sydney Chapman, *IGY: Year of Discovery: The Story of the International Geophysical Year* (Ann Arbor: University of Michigan Press, 1959), 101.

19 Ibid., 103.

phenomena which occur across political boundaries. The IGY also owed much to Edward Sabine's Magnetic Crusade, which performed and correlated global observations of geomagnetism throughout the British Empire. A grander version of the Humboldtian science performed by the colonial Chinese observatories, the Magnetic Crusade relied on the infrastructure of colonialism to support the collection of data. It was thus tied intimately to British colonial ambitions and achieved government support because of that connection.<sup>20</sup> The experience of the Magnetic Crusade belies the fundamental tension in international scientific projects: international science as a concept is formed only with reference to national science and thus recapitulates national ambitions and animosities just as easily as it binds nations together in the pursuit of knowledge. The rhetoric about the IGY used by scientists including Wilson is therefore infused with the kind of self-contradictory ideology which those scientists use to negotiate the complicated boundary between Cold War conflict and the ideal of scientific cooperation.

Key to the International Geophysical Year's success was intense public interest in the science being done. Much of that interest centered on the exploration of outer space, culminating in the *Sputnik* satellites of the USSR and the *Explorer* satellites of the United States. The Space Race was a fundamental part of the Cold War, and its technologies and . Nevertheless, the scientists involved in the International Geophysical Year publicly hailed the cooperation between scientists across the Iron Curtain. Tuzo Wilson claimed that:

---

20 John Cawood, "The Magnetic Crusade: Science and Politics in Early Victorian Britain," *Isis* 70, no. 4 (December 1, 1979): 518.

The fact is, I can think of no more homogeneous group in the world than its senior scientists. They avoid discussions of topics extraneous to their own subjects which might engender bad relations. Many of them have met before; they all have acquaintances in common; they read each other's papers, they write each other letters.

Among themselves they debate and argue vigorously, but the divisions between the debaters on scientific subjects are not on national lines. They are anxious to strengthen their reputation for knowledge and can do this only by exhibiting their discoveries.

Jealous of their stature as scientists before international gatherings, they strive to subdue the heat of emotions and try to gain respect by the logic rather than by the vigour of their arguments. Naturally, these men are loyal to their native countries and to their convictions and faiths. Debate upon these matters has its proper place, but this is not at scientific meetings. Scientists everywhere are suspicious of those who endeavour to substitute propaganda for learning and logic.<sup>21</sup>

Wilson's broadly pacifist and internationalist sentiments appear to have been shared by the other scientists leading the IGY. President of the Special Committee of the International Geophysical Year, Sydney Chapman, noted that "The planning and execution of the International Geophysical Year was marked by a most co-operative and harmonious spirit among the scientists of the 67 nations associated with it . . . despite differences of race, creed, or political organization."<sup>22</sup>

While the IGY faced its fair share of behind-the-scenes political intrigue,<sup>23</sup> the one

---

21 Wilson, *One Chinese Moon*, 5.

22 Chapman, *IGY*, 107.

23 cf. Adrian Howkins, "Melting Empires? Climate Change and Politics in Antarctica Since the International



political stumbling block of the IGY which its leaders publicly acknowledged revolved around China. The People's Republic of China refused to participate in the IGY if the Republic of China (Taiwan) was allowed to participate. Since the CSAGI would not refuse participation to any country, mainland China withdrew from the IGY and did not contribute any data to the official program, though Wilson would see the instrumentation and institutions which had been set up for the Chinese IGY program in use during his 1958 trip.<sup>24</sup> Wilson went to China tasked by the International Union of Geodesy and Geophysics to inquire into the strengths of the respective geological communities of the PRC and Taiwan.<sup>25</sup>

---

Geophysical Year,” *Osiris* 26, no. 1 (January 2011): 180–197.

<sup>24</sup> Chapman, *IGY*, 107–8.

<sup>25</sup> J. Tuzo Wilson, *Unglazed China* (New York, Saturday Review Press, 1973), xii.

### ***The first China trip***

On August 24, 1958, Tuzo Wilson entered China by way of Moscow and the Trans-Siberian Railway. His journey formally began in Beijing where he was greeted by the man to become his interpreter and guide for the next three weeks, Mr. Tien Yu-san, and Drs. Lee Shan-pang (Li Shanbang, often credited as S.P. Lee in scientific literature) an internationally-known seismologist, and Chow Kai, a geodesist. Wilson had been worried that the Chinese government would appoint a professional guide to watch their imperialist guest and was pleasantly surprised to meet a scientist whose papers he had read. His guides also got lost in the Hotel Peking, confirming that they certainly weren't used to herding foreigners.

The next day, at Wilson's first formal dinner with Dr. Pei Li-shan, secretary-general of the Academia Sinica, he encountered the first of many references to Dr. Norman Bethune over the course of his interaction with China.<sup>26</sup> Bethune was a Canadian medical doctor who served with the Communists during their fight against the Japanese in the late 1930s and who had died in China of an infection received while treating battlefield casualties. His major accomplishment was introducing blood transfusions to the Chinese. For his support during the war, he is honored by the Chinese, and the memory of Bethune was inextricably linked to Chinese opinions of Canada. Wilson would find that Bethune provided an icebreaker for any conversation in China. The memory of Bethune was so pervasive in China that on his second trip, he came prepared with postcards of Bethune's birthplace.<sup>27</sup>

---

<sup>26</sup> Wilson, *One Chinese Moon*, 72.

<sup>27</sup> Wilson, *Unglazed China*, 12.

Wilson then began the substantive portion of his travels, visiting the Institute of Geophysics and Meteorology which had been founded in 1928.<sup>28</sup> In 1935, he was told, fifty meteorological stations and two seismological stations (one of which was set up by Jesuits) existed in China. Since then, their geophysical facilities had expanded to 1500 meteorological stations and thirty seismological stations.<sup>29</sup> The Institute's library impressed him, containing up-to-date versions of both Russian and Western scientific journals as well as copies of the fifty journals published by the Chinese themselves.<sup>30</sup> He also visited the vaults of the Institute where Dr. Lee's seismographs were kept. He noticed several Chinese versions of Russian seismographs as well as seismographs of Lee's 1951 design which were cheap and simple, designed for quickly establishing seismological stations which the Communist government began when it came to power.<sup>31</sup>

In his tour of the Institute of Geophysics, Wilson noticed the most conspicuous element of Communist rule over the scientific community. Wall posters were hung throughout the halls of all of the institutes which he visited. These posters were covered with political criticism of the administration of the institute. Wilson assumed that these posters grew out of the need to employ technically-qualified but perhaps politically-unconvinced people as the directors of scientific institutes. The posters then ensured that the Communist party line was followed by administrators without compromising their authority.<sup>32</sup>

---

28 Wilson, *One Chinese Moon*, 79.

29 Ibid.

30 Ibid., 78.

31 Ibid., 79.

32 Ibid., 81.

The Central Geophysical Observatory outside Beijing was Wilson's next stop. There he saw the geomagnetic and solar observatories doing work which would have been part of the IGY. Since China had planned to participate in the IGY until the admittance of Taiwan, they carried on with the work they had already planned without communicating their results to the IGY's World Data Centres.<sup>33</sup> The seismographs of the Observatory were once again of Russian design but Chinese manufacture. Dr. Lee said that of the twenty-three active seismological stations in the country, thirteen of them had these same seismographs.<sup>34</sup> Lee then explained how earthquake reporting works in China: 150 seismologists at these 23 stations compile data into preliminary reports which are telegraphed to the Institute of Geophysics from where seismic bulletins are issued. The Institute gives reports on large earthquakes to the government grading them into twelve classes based on damage; however, Lee suggested that the Chinese might switch to the Richter scale in the future.<sup>35</sup>

Still in Beijing, Wilson visited one of the two Institutes of Geology. The one he visited was, like the Institute of Geophysics and Meteorology, under the control of the Academia Sinica and focused on geological research. The other was under the Ministry of Geology and focused on practical matters like mapping. Once again, he saw laboratories filled with instruments mostly from the Communist bloc including the Soviet Union, East Germany and Czechoslovakia but he did see one X-ray machine from Japan and an American geiger counter.<sup>36</sup> The libraries of this

---

33 Ibid., 96–7.

34 Ibid., 97.

35 Ibid., 98.

36 Ibid., 124.

Institute also firmly convinced him “that many of the Chinese scientists not only spoke Western languages, but also read a great deal of recent geological literature from all over the world.”<sup>37</sup>

Communist China, despite being diplomatically unrecognized by the United States, was still clearly connected to scientific communities in the West through transfer of scientific technology, sharing of journals, and perhaps most importantly, the education of Chinese scientists in the West (Dr. Lee, for instance, had studied at the California Institute of Technology<sup>38</sup>).

Wilson's then went to Xi'an (formerly Sian) near the center of China. Here he went to Northwest University where he saw yet more seismographs, this time of the 1951 design of Dr. Lee as well as one Russian-designed, Chinese-manufactured instrument<sup>39</sup>. The libraries held many of the same journals that he had seen in Beijing, but the Western journals were often bound, multilithed copies of ones held elsewhere in the country with recent issues more likely to be multilithed.<sup>40</sup> From Xi'an, Wilson went just slightly further west to Lanzhou (formerly Lanchow). Lanzhou as he described it was in the process of building itself into a new “Golden city of the west.”<sup>41</sup> He visited the Lanzhou science centre, which was, like much on Lanzhou, under construction, and the Lanzhou Geophysical Observatory, built for the IGY.<sup>42</sup> At the University of Lanzhou, Wilson noticed students working with American electronics textbooks prompting the comment that, “The science in this wild and madly growing outpost of Asia is,

---

37 Ibid., 125.

38 Wilson, *Unglazed China*, 53.

39 Wilson, *One Chinese Moon*, 178.

40 Ibid., 179–80.

41 Ibid., 199.

42 Ibid., 205–6.

thought limited by man-power, reasonably up to date both in technology and theory.”<sup>43</sup> From Lanchow, a train took Wilson to his final stop in Canton and then across the border to Hong Kong and the West.

Wilson ends his account of the whirlwind tour of Chinese science with some “Broad thoughts from at home.”<sup>44</sup> In this chapter he confronts the image of Communist China presented to North Americans. The brutal slave state envisioned by the American press was simply not visible to Wilson. This propaganda campaign Wilson saw as born out of a willful ignorance of China. That ignorance, Wilson claimed, was unsustainable: the Chinese were developing quickly and neither the scientists or the politicians of the West could afford to ignore those developments. Furthermore, Wilson saw the Chinese pursuing neither Confucian ideals nor even radical communism but Western science. The West, according to Wilson, should behave as a proper model for the developing world, cultivating a peaceful humanism cognizant of both the utility and the destructive potential of science.

---

43 Ibid., 213.

44 Ibid., 245–62.

### *A side trip to Taiwan*

*One Chinese Moon* does not explicitly mention Wilson's mission on behalf of the IUGG, and in the preface of *Unglazed China*, Wilson maintains an aura of secrecy around that mission, perhaps to avoid embarrassment with his hosts in both China and Taiwan. However, in his story of the International Geophysical Year, *IGY: The Year of the New Moons*, Wilson did include a short summary of his entire 1958 trip through China, Taiwan and Japan. Wilson had no intentions to resolve the conflict between China and Taiwan himself, but his observations of Taiwanese science throw light on those he had just made in mainland China.

In Taipei, Wilson went to the headquarters of the Academia Sinica of Taiwan where he was astonished that their headquarters had no physics or geology buildings, and the only building for the natural sciences a chemistry building still under construction.<sup>45</sup> He then visited the headquarters of the meteorological service. He noted that they operated five radiosonde stations and a seismological station equipped with three German Weichert instruments and several Japanese instruments. The latter he claimed had been left by the Japanese when their occupation of the island had ended. Taiwan, however, is subject to many earthquakes and the director of the seismological station desperately needed \$50,000 to purchase more adequate equipment to do his job. Furthermore, Taiwan had no magnetic observatories. He did, however, see a station of the amateur astronomy program of the IGY, Moonwatch.

At the National Taiwan University, a physics professor asked Wilson if he could help him get a new ionospheric sounder since his was “the oldest instrument in the Western world and he

---

45 J. Tuzo Wilson, *I.G.Y.: The Year of the New Moons*, 1st ed. (New York: Knopf, 1961), 235.

was trying to participate in the IGY program.”<sup>46</sup> While the Taiwanese geophysical community was certainly less active than its counterparts in Russia or China, it is significant that the Taiwanese scientist groups himself with the Western world. The IGY was for this physicist and for the broader Taiwanese scientific community a connection to the West deeper than their shared anticommunism.

Wilson was disappointed by what he saw in Taiwan. Propaganda had apparently convinced him that China's best scientists escaped to Taiwan, but his observations in both countries convinced him otherwise.<sup>47</sup> To him, mainland China was undergoing a Renaissance. The Chinese were rapidly advancing because they were actively emulating the West without needing or wanting to participate fully in the Western scientific community. On the other hand, Taiwanese science faltered because its national community did not receive the appropriate support from a Western scientific community of which it believed itself a member.

In making comparisons between the People's Republic of China and the Republic of China, Wilson also wanted to dispel the myths created in the West about China, in particular one in which widespread scientific education of the Chinese would create a nation of dogmatic robots able to destroy the West. Wilson saw communism in China as arising hand-in-hand with nationalism. He believed that the patterns of behavior he saw in China in 1958 were caused not by coercion or Maoist ideology but by a huge wave of patriotism.<sup>48</sup> Wilson hoped that this nationalistic fervor would channel resources towards the science and technology which could

---

46 Ibid., 236.

47 Ibid., 237.

48 Wilson, *One Chinese Moon*, 247.



make China competitive in the global arena. He wanted an open and thriving scientific community in both China and Taiwan for several reasons. Wilson firmly believed in the democratizing power of science and hoped that science would rid both countries of dogmatism and authoritarianism. Furthermore, the rift between the two countries hurt each of them: mainland China because its politics prevented it participating in an international scientific community that included Taiwan and Taiwan because its animosity towards China prevented good scientists, instrumentation and information from reaching Taiwan from either East or West. And lastly, this conflict hurt the rest of the international scientific community for “One cannot do global research by studying only three quarters of the earth, any more than one can settle the affairs of the world by pretending that one quarter of it does not exist.”<sup>49</sup>

---

49 Wilson, *I.G.Y.*, 241.

## *Plate tectonics*

When Wilson returned to the West, he re-entered a scientific community in the midst of its own revolution. The 1950s and 1960s saw British, American and Canadian scientists fit together several streams of observation into a coherent theory called plate tectonics. The history of the theory formally began in 1912 when the German meteorologist Alfred Wegener published his theory of continental drift. For Wegener, evidence of significant climate change over Earth's history and paleontological evidence that single species once lived on what are now multiple continents indicated that the continents had moved over time. Wegener's theory received varying levels of acceptance in the geological community. In the United States, the American James Hall's geosyncline theory and related concepts depended on isostatic adjustment of the continents due to buoyant effects of the higher-density mantle on the lower-density continental crust. These theories dominated American geological discourse and prevented widespread acceptance of continental drift theory.<sup>50</sup> On the other hand, geologists in South Africa and Australia did accept the theory of continental drift, but these scientific communities were separated from the larger ones in North America and Europe.<sup>51</sup> Opposition to continental drift was much stronger in North America than in Europe: Frederick Vine, who would later play a large role in the development of plate tectonics, recalled a lecture during his undergraduate years at Cambridge University in which “continental drift was assumed to be axiomatic.”<sup>52</sup> The resolution to the debate required

---

50 Naomi Oreskes, “From Continental Drift to Plate Tectonics” in *Plate Tectonics: An Insider's History of the Modern Theory of the Earth*, ed. by Naomi Oreskes and Homer Le Grand (Boulder, CO: Westview Press, 2001), 10-11.

51 Ibid, 12.

52 Frederick J. Vine, “Reversals of Fortune,” in *Plate Tectonics*, 51.

much more data, which the Second World War would provide.

The development of submarine warfare in the first half of the twentieth century led to increased support from the United States for research into the marine environment, particularly the geology and geophysics of the ocean basins, and that support continued after the war.<sup>53</sup> From this support came two major strands of research. Sea-floor bathymetry, revolutionized by sonar, mapped a massive rift system running throughout all of the oceans called the mid-ocean ridge. Paleomagnetism, the study of the Earth's magnetic field in the geologic record, also emerged. Rocks preserve magnetic histories of the Earth at the time they were formed. On continents, these histories produced apparent polar wander paths. Rocks recorded change in the orientation of the continents relative to the magnetic poles, indicating that either the poles move or the continents move about underneath the poles. That each continent's apparent polar wander path is different indicates that the continents and not the poles move. Most importantly, continental rocks show that the Earth's magnetic field reverses irregularly through time: the north magnetic pole flips to the south geographic pole and vice versa. Maps of sea-floor magnetism generated during the post-war boom in ocean research revealed paleomagnetic "zebra stripes" – bands of opposite polarity roughly parallel to the mid-ocean ridge.

In 1962, Harry Hess, a Princeton geological polymath, published what he called “an essay in geopoetry” to provide a mechanism for continent drift using these new data.<sup>54</sup> In his essay, he proposed what later became known as the sea-floor spreading hypothesis. Hess claimed that

---

53 Oreskes, “From Continental Drift to Plate Tectonics,” 17.

54 Harry H. Hess, "History of Ocean Basins," in *Plate Tectonics and Geomagnetic Reversals*, ed. by Allan Cox (San Francisco: Freeman, 1973), 23-38.

mantle rock erupted at mid-ocean ridges and forced the rock on either side of the ridge apart. This provided a plausible mechanism for continental drift, but Hess was clearly conscious that his hypothesis was just that. In support of sea-floor spreading, Canadian geophysicist, Lawrence Morley, and two Cambridge geophysicists, Frederick Vine and Drummond Matthews, saw that the "zebra stripes" in the sea-floor magnetic data could be produced if the sea floor spread apart from the mid-ocean ridges.<sup>55</sup> As new mantle rock erupts from the ridge and cools, it records the magnetic field polarity at the time that it cools. Magnetic reversals then form the zebra stripes as the new sea floor is pushed away from the ridge.

Tuzo Wilson provided the final conclusive piece of evidence in 1965 when he proposed the transform fault. The mid-ocean ridge occurs in segments bounded by faults which are offset from each other. The crudest explanation of this phenomenon claims that the faults cut through the mid-ocean ridge and pushed the segments apart. Wilson recognized that if the sea-floor was spreading, these faults would move in the opposite direction than if they had simply offset the ridge segments. Seismology showed that these "transform faults" did indeed have the sense of motion indicating sea-floor spreading, confirming Wilson's explanation. By the end of the 1960s, these observations and more had coalesced in the complete theory of plate tectonics. The theory states that the Earth's crust is broken up into plates. These plates are ferried around the earth by forces arising from sea-floor spreading at mid-ocean ridges, which itself ultimately occurs because of convection within the mantle. Old oceanic crust is recycled back to the mantle at

---

55 Fred J. Vine and Drummond H. Matthews, "Magnetic anomalies over ocean ridges," in *Plate Tectonics and Geomagnetic Reversals*, 232-237.

subduction zones where oceanic plates slide beneath other plates. The tectonic forces so generated create much of the landscape and geological events seen on Earth including mountains, volcanoes, and earthquakes.

Wilson uses the scientific instrumentation available to a scientific community as a proxy of that community's vitality. For example, his disappointment in the Taiwanese community comes in large part from the sad state of instrumentation that he observed there. The story of instrumentation in which Wilson is interested is a portion of a larger change in the earth sciences occurring throughout the period leading up to the plate tectonic revolution. Geological theory had been made by field geologists for at least the last 150 years. For instance, the controversy between Adam Sedgwick and Roderick Murchison over the position of certain Welsh stratigraphic units in a global column was worked out over several summers of field work by the two men and by other members of the British geological community.<sup>56</sup> Likewise, during the formative years of the independent Chinese geosciences, Chinese geologists were especially keen to begin fieldwork because it would allow them to prove that they fit the image of gentlemanly Western geologists.<sup>57</sup> Fieldwork was integral to the formation of a national identity in any country because walking around and mapping geological structures provided intimate knowledge of the national territory. On the other hand, the problems that interested the participants in the International Geophysical Year and the early contributors to plate tectonics

---

56 James A Secord, *Controversy in Victorian Geology: The Cambrian-Silurian Dispute* (Princeton, N.J: Princeton University Press, 1986).

57 Grace Yen Shen, "Taking to the Field: Geological Fieldwork and National Identity in Republican China," *Osiris* 24, no. 1 (January 2009): 232.

were not solvable by field methods alone. In the case of the IGY, they were largely atmospheric and space phenomena. In the case of plate tectonics, evidence lay on the sea floor, miles deep in some cases. In both cases, the evidence was not visible to the naked eye. A marine geologist needs sophisticated instrumentation to interpret his chosen geological phenomenon whereas a stratigrapher or structural geologist needs little more than his feet, his mind and a good compass.

It is important to note that the instrumental methods of the IGY and plate tectonics were not new to Cold War era geophysics. Geophysical instrumentation and instrumental science has a history stretching to Gauss's magnetic union and beyond. If one considers the IGY and plate tectonic revolution as a continuous part of this history of geophysics, there was actually little change in the practices of geophysics in the first half of the twentieth century. Incremental increases in the precision and sophistication of instrumentation led to exponential increases in knowledge as instrumentation developed past a threshold beyond which it could produce detailed sea-floor maps, for instance.

The problems which interested Cold War-era geophysicists were transnational problems in that they crossed the boundaries of sovereign territories in ways that other geological structures did not. Outer space, the atmosphere, Antarctica and the sea floor are all supraterritorial spaces. They then require international cooperation to study comprehensively, as the planners of the International Geophysical Year foresaw. However, scientific internationalism is at least partially in conflict with the previously identified instrumentalization in the geosciences. Instrumentation such as satellites and high-resolution seismographic networks has

the potential to overcome limitations in international cooperation. If a satellite can obtain magnetic data over China or a seismograph can detect Chinese earthquakes, then China's lack of participation in initiatives like the IGY is somewhat cancelled. Likewise Taiwan's lack of instrumentation does not nullify its participation in the IGY, for it need not rely on data produced by Taiwanese scientists to do useful research.

### *The second China trip*

Having, over the 1960s, participated in the scientific revolution of plate tectonics, Wilson sought to return to China. His way was paved by a sequence of diplomatic events beginning with the Canadian recognition of the People's Republic in 1970 and culminating in American President Richard Nixon's trip in 1972. In this new diplomatic reality, Wilson's request to the Chinese authorities to allow him to visit China again was granted. In 1971, he and his wife, Isabel, flew from Rangoon in Burma to Shanghai. Their plane was filled with participants in the Afro-Asian Table-Tennis International Friendship Tournament, an event "which loomed as large in the eyes of the Chinese as the Olympic Games do in the rest of the world."<sup>58</sup> On landing in Shanghai, they were greeted by a Comrade Chu, member of the Shanghai Revolutionary Committee. This was their first experience with the aftermath of the Great Proletarian Cultural Revolution which had gripped China for the past five years. Every institution in China from cities to universities was now run by a revolutionary committee.

The Wilsons took a train to Beijing where Tuzo then went to the same Institute of Geophysics that he had visited thirteen years earlier. In that time period, the aspects of the Institute dealing with meteorology and geophysical prospecting had been shifted to government ministries. The remaining members of the Institute were given three directives:

1. That the staff should concentrate on the prediction of earthquakes, because scientific work should serve the needs of the people.

---

<sup>58</sup> Wilson, *Unglazed China*, 4.



2. That they should carry out their work through mass effort, by arousing many people to work closely with them.

3. That they should follow Chairman Mao's directive issued on May 7, 1968: scientific workers and intellectuals must go out to the country and mingle with the workers and peasants. For this reason, some of their colleagues were working in factories and many were in field stations.

Dr. Lee, Wilson's acquaintance from 1958 was now leading the effort to study earthquakes. Twelve major stations with six seismographs each sent their data to the Institute in Beijing while eight smaller stations around Beijing telemetered their data directly to the Institute. Other seismological stations in the provinces had been put under the direct control of the provinces themselves.<sup>59</sup> Lee's work also entailed a great historical project, searching the three thousand years of Chinese literature for recorded earthquakes. Wilson claimed that the general lack of understanding of plate tectonics showed that while the Chinese scientists “have all the Western journals, they do not read them closely,” particularly during the recent years of upheaval.<sup>60</sup> Geomagnetism was still within the Institute's purview, but it appeared that little had changed since the country's abortive involvement in the International Geophysical Year.

The next stop in Beijing was the Institute of Geology where he got a deeper understanding of the actual changes caused by the Cultural Revolution. He was greeted by the deputy director, Chang Wen-yu and a collection of geologists, many of whom had studied

---

<sup>59</sup> Ibid., 50–1.

<sup>60</sup> Ibid., 53.

abroad, including one woman who had worked with Belousov in the Soviet Union. Also he met with members of the revolutionary committee now in charge of the Institute. These included an older man who had participated in the Long March and was the official revolutionary representative on the committee and a technologist who was one of five representatives elected by the “masses” of the Institute. The other four elected members were two graduate students, an administrative worker and a truck driver. Upon their election, the graduate students had promptly been sent away for training in revolutionary ideas. It was realized shortly thereafter that no one on the revolutionary committee knew much about the administration of a large research institute, so they had decided to give responsibility for the scientific work to Chang, who had basically the same responsibility before the Cultural Revolution. According to Wilson, “the system thus seemed to be far less revolutionary than the terminology would suggest. Indeed this year my own university in Canada has just replaced its former board of governors and its senate with a governing council, upon which sit students and faculty, technicians and alumni, besides some government appointees.”<sup>61</sup> Liberal reforms in education in the West were hardly different than those in the Communist East.

Wilson then visited the Factory for Geophysical Instruments which had been under construction when he visited thirteen years previous. As a result of Chairman Mao's May 7 directive, geophysicists now worked hand-in-hand with technicians to build instruments for their research, predominantly seismographs. Wilson believed that these instruments were a great deal better than the cheap and quick designs of Dr. Lee he had seen in 1958. He was impressed that

---

61 Ibid., 59–60.

in a rather primitive factory they managed to make useful instruments for the researchers down the street at the Institutes and commented that the newfound power of machinists in the administration of their factory seemed to keep morale high.<sup>62</sup>

Wilson then gave the first of his lectures on the theory of plate tectonics to assembled Chinese geoscientists. Translated live by McGill University graduate Fu Ch'eng-i, Wilson's talk was enthusiastically received by the attendees. In discussion with the assembled scientists, he concluded that the major obstruction to scientific interaction with the West was communication. Older scientists like Fu and Lee had studied in the West and spoke Western languages. The generations of scientists trained during Communist rule had not been so fortunate and so had no points of reference for the abundance of Western literature to which they had access. Furthermore, Chinese journals had ceased publication during the Cultural Revolution and so intranational communication had also slowed considerably.<sup>63</sup> However, the Cold War disruption of communication was two-way, as Western geologists knew very little about the geology of China.<sup>64</sup>

Wilson visited Peking University where he found an institution far more deeply unsettled by the Cultural Revolution than the scientific institutes he had just seen. There he got a history lesson from Chou P'ei-yüan, professor of physics and vice-chairman of the revolutionary committee. Prior to the Cultural Revolution, the university had been run by Lu P'iao, who was associated with target of much of the Cultural Revolution's wrath Liu Shaoqi, a so-called

---

62 Ibid., 70.

63 Ibid., 66–8.

64 Ibid., 301.

“capitalist roader,” a traitor to the revolution who aims to take China down a capitalist road. Under Chairman Mao's guidance, the university community rose in revolt against Lu. Once the followers of Liu and Lu were expelled from the university, the university suspended operation as the Red Guards and what remained of the students and teachers went out to follow the May 7 directive and become acquainted with manual labor in the countryside. Eventually, the university was reorganized under a revolutionary committee and 2,667 freshmen were enrolled in 1970. Students were selected on the basis of their political awareness from groups of high school graduates who had spent at least two years working with the masses. Meanwhile, professors had been sent to a “May 7 cadre school” to be reeducated. In order to maintain connections between the students and the proletariat, factories which produced such things as pharmaceuticals and fertilizers were run on a scientific basis by the professors in a similar manner to the geophysical instruments factory seen earlier.<sup>65</sup>

Leaving Beijing, Wilson returned to Xi'an, first taking a side trip to Mao's former headquarters at Yan'an (formerly Yenan) now maintained as a museum of sorts. In Xi'an, Wilson visited Northwest University where he saw parallels to the turmoil at Peking University. While in Xi'an Wilson's host, Comrade Wang, expounded on the geomechanics of Li Siguang. Li's theory had received renewed interest during the Cultural Revolution because of his positions within the government, similar perhaps to the experience of Soviet biology under Lysenko.<sup>66</sup> The geologists in Xi'an approved of Li's theory not only because it was a true Communist theory

---

65 Ibid., chap. 8.

66 Zhu and Le Grand, “Plates, Politics and Localism,” 299.

based on dialectical materialism but also because it had been applied to great practical use in mining. From Xi'an, the Wilsons headed to Nanking, capital of Sun Yat-sen and home to the Purple Mountain Observatory. Founded in 1929, the observatory had attempted the same developments that other institutions had followed during the Cultural Revolution. They had started manufacturing their own instruments at a nearby factory with cooperation between scientists and technicians. These instruments included a twenty-five inch telescope used to track the two new Chinese satellites. That same factory also produced both optical and electron microscopes.<sup>67</sup> The final site of the 1971 trip was the astronomical and geophysical observatory at Zikawei outside Shanghai, founded by Jesuits. The observatory's long history meant they had nearly continuous geomagnetic and seismic records from 1874 and 1904, respectively. The seismic observatory was one of the dozen stations run by Dr. Lee from the Beijing Institute of Geophysics, but Shanghai is in a less seismically-active part of China, so the observatory had only seismographs of old German and Russian designs, rather than the new Chinese ones.<sup>68</sup> The Wilsons then flew to Canton along with some of the remaining table-tennis players and then took a train to Hong Kong and the West. Like in his last travelogue, Wilson provided an epilogue.<sup>69</sup> In it, he reiterated his pacifist and humanist sentiments concerning China. He urged communication and exchange between a rapidly developing China and the West rather than propaganda and threats.

---

67 Wilson, *Unglazed China*, 238–41.

68 *Ibid.*, 277–8.

69 *Ibid.*, 291–6.

### *The self-conscious scientific diplomat*

Wilson was certainly not a Communist. He cannot be read as a fellow traveler like the American geneticist Hermann Muller who helped introduce *Drosophila* research to the Soviet Union.<sup>70</sup> As a Canadian, neither was he deeply committed to the defense of American overseas diplomacy. He was, however, committed to the overarching ideology of the International Geophysical Year: the belief in the power of scientific inquiry to solve social as well as geophysical problems and rid the world of dogmatism.<sup>71</sup> It is this belief which made the contrast between mainland China and Taiwan so stark for him. Taiwan was the supposedly democratic of the two, but its government either neglected or refused to fund its science to the appropriate degree. The Taiwanese scientific community languished in a liminal state between Communist China which would not support it politically and a Western world which would not support it scientifically

On the other hand, Maoism – and in particular the Maoism of the Cultural Revolution – built a theory of scientific practice in to its ideology. Wilson came in contact with Mao's May 7 Directive on multiple occasions during his second trip. For Maoist China, science for science's sake was directly contrary to the goals of the revolution. It would help create a class of intellectuals separated from the conditions of the proletariat and thus able to act against the interests of the working class. However, Mao recognized the importance of science to the

---

70 Elof Axel Carlson, *Genes, Radiation, and Society: The Life and Work of H.J. Muller*, Ithaca: Cornell University Press, 1981.

71 Wilson, *I.G.Y.*, 238.

development of his country. The May 7 Directive which sent scientists to be reeducated in the country was then a compromise between what was necessary for the country (scientific and technical development) and what was necessary for the revolution (a solid working class).

Wilson was ultimately surprised by this incarnation of Maoism. From the outside, it would appear that the reeducation of scientists would be akin to brainwashing, one of the horrors of Maoism that Wilson expected and inimical to his belief in science as democracy. Instead, he saw that this reeducation did not ultimately lead to much decrease in scientific freedom. The incorporation of scientists into factories by the May 7 Directive led to increased efficiency and the development of a robust instrumentation industry guided by the needs of the scientific community. Indeed, the revolutionary committees quickly learned that it is difficult to maintain a thriving scientific community when revolutionary administrators are unfamiliar with science, thus in the case of the Institute of Geology, administrative matters were left to the scientists with the revolutionary committee reduced to a nominal authority over the institution.

The Communist Chinese response to the potential conflict between internationalization and instrumentalization took the form of an often confusing institutional structure. As we have seen, many different institutions were involved in the practice of earth sciences in China. The government-run Institutes of Geology and of Geophysics were the most clearly overlapping of

these institutions. They had mandates to perform useful geoscientific research and to train new cadres of geoscientists, but their disciplinary responsibility was a more ad hoc construction. The initial existence of each of these institutions has much to do with the split that existed between geophysics and geology in the 19<sup>th</sup> and early 20<sup>th</sup> century. The Institute of Geology was thus tasked with geological mapping and prospecting, the same basic jobs which early British geologists performed. The Institute of Geophysics was given responsibility for geomagnetism, meteorology and seismology – the instrumental earth sciences. By Wilson's 1971 trip, the Institute of Geophysics has been remade, having had its meteorology and geophysical prospecting units spun off into other government departments. It is left primarily with seismology and geomagnetism. However, the overarching goal outlined by the government was not just the measurement but the prediction of earthquakes. This is a job which requires both the long instrumental record which China possessed and the knowledge of the geology of China. No longer could geophysics exist in China separately from geology. Likewise the outcome of the plate tectonic revolution in the West was to unite more closely the two fields, to declare that geology could be explained by physics and that physics could learn something from geology.

That both the Western and the Chinese scientific communities experienced a similar disciplinary unification points not to a purely theoretical change. Had plate tectonics been the driving factor in the unification of geology and geophysics, the Chinese community, isolated from the West would not have seen it. Instead, this unification is the culmination of trends which reached China before its isolation from the West. Prior to this period, geology and geophysics



were separated not by wide chasms in scientific interest but by cultural details: what kinds of data were meaningful to each scientist, where the scientist could find support for the kinds of projects which he wanted. The trends towards instrumentalization of the geosciences, towards vast amounts of data replacing detailed field knowledge and towards a physical, mechanical view of the Earth's surface as well as its interior dissolved these cultural differences.

Wilson, himself, is emblematic of these changes. He was part of the first generation of geophysicists to be formally trained in both geology and physics. His scientific work and contributions to plate tectonics relied on data which the geophysical instrument revolution made possible. His administrative work reflected the big, government-supported science which flourished in the Cold War, West and East of the Iron Curtain. Most importantly, he was a transnational scientist. He took advantage of his position as a scientific diplomat and administrator to interact with scientific communities across the globe. Geophysics has always been a global, Humboldtian science. Wilson reaffirmed that aspect of geophysics, and in doing so provided a vision of science which was oddly utopian. He saw science as not a symptom but a cause of democracy: science, in Wilson's opinion, does not need freedom of thought to work. Instead, it does away with dogmatic thinking and creates the conditions in which democracy can thrive. If the West wanted to democratize the Communist nations, it could and should use international scientific cooperation to beat back anti-Western ideology, killing two birds with one stone. Western democrats would see the spread of their vision of freedom while Wilson and his fellow geophysicists would get a thriving international scientific community. That ideal

community was, beyond all the Cold War rhetoric and boundary-work, Wilson's ultimate goal.

## **References**

Carlson, Elof Axel. *Genes, Radiation, and Society: The Life and Work of H.J. Muller*. Ithaca: Cornell University Press, 1981.

Chapman, Sydney. *IGY: Year of Discovery: The Story of the International Geophysical Year*. Ann Arbor: University of Michigan Press, 1959.

Gieryn, Thomas F. "Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists." *American Sociological Review* 48, no. 6 (December 1, 1983): 781–795.

Hess, Harry H. "History of Ocean Basins." In *Plate Tectonics and Geomagnetic Reversals*, edited by Allan Cox, p. 23-38. San Francisco: Freeman, 1973.

Howkins, Adrian. "Melting Empires? Climate Change and Politics in Antarctica Since the International Geophysical Year." *Osiris* 26, no. 1 (January 2011): 180–197.

Jones-Imhotep, Edward. "Communicating the North: Scientific Practice and Canadian Postwar Identity." *Osiris* 24, no. 1 (January 2009): 144–164.

MacKeown, P.K. *Early China coast meteorology : the role of Hong Kong*. Hong Kong: Hong Kong University Press, 2010.

Oreskes, Naomi and Homer Le Grand, eds. *Plate Tectonics: An Insider's History of the Modern Theory of the Earth*. Boulder, Colo: Westview Press, 2001.

Secord, James A. *Controversy in Victorian Geology: The Cambrian-Silurian Dispute*. Princeton, N.J: Princeton University Press, 1986.

- Shen, Grace Yen. "Taking to the Field: Geological Fieldwork and National Identity in Republican China." *Osiris* 24, no. 1 (January 2009): 231–252.
- Turchetti, Simone, Néstor Herran, and Soraya Boudia. "Introduction: Have We Ever Been 'transnational'? Towards a History of Science Across and Beyond Borders." *The British Journal for the History of Science* 45, no. 03 (2012): 319–336.
- Vine, Fred J. and Drummond H. Matthews. "Magnetic anomalies over ocean ridges." In *Plate Tectonics and Geomagnetic Reversals*, ed. by Allan Cox, p. 232-237. San Francisco: Freeman, 1973.
- Walker, Mark. "The 'national' in International and Transnational Science." *The British Journal for the History of Science* 45, no. 3 (2012): 359–376.
- Wilson, J. Tuzo. "Exercise Musk-Ox, 1946." *The Polar Record* 5, no. 3-4 (1947): 14.———. *I.G.Y.: The Year of the New Moons*. 1st ed. New York: Knopf, 1961.
- . "Mao's Almanac: 3,000 Years of Killer Earthquakes." *Saturday Review*, February 19, 1972, p. 60.
- . *One Chinese Moon*. 1st ed. New York: Hill and Wang, 1959.
- . "Report upon Science in the Canadian Arctic," University of Toronto Archives, John Tuzo Wilson, B1993-0050/006 (08).
- . *Unglazed China*. New York, Saturday Review Press, 1973.
- Zhu, Dajian, and Homer Le Grand. "Plates, Politics and Localism: Geological Theory in China." *History and Anthropology* 11, no. 2–3 (1999): 291–327.