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The Map that Changed the World: William Smith and the Birth of Modern Geology

Simon Winchester. New York, NY: HarperCollins Publishers Inc. 10 East 53rd Street, New York, NY 10022, 2001. 325 pp, maps, diagrams, illustrations, suggested reading list, index. Hardcover. USA \$26.00 Canada \$39.50 (ISBN: 0-06-019361-1).

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Simon Winchester has a knack for digging up beautiful stories from the lost pages of history books. My introduction to Winchester came in the same delightfully surprising manner in which he spins his tales. I literally stumbled across Winchester's work one night in a dimly lit Nepali tea-house, tripping over a well-worn travelers copy of his remarkable description of the creation of the *Oxford English Dictionary*. As I carried that chronicle throughout my travels, Winchester's eye for historical detail and penchant for anecdote caused me to wonder, "Why I had never heard this story before?" Really, a mental institutionalite wrote

the definitions quoted at keynote speeches and in term papers across the world? That book, *The Professor and the Madman*, succeeds in bringing vivid life to the creation of one of the most important, and commonly taken-for-granted, books of our time.

Winchester's most recent opus, *The Map that Changed the World*, succeeds in much the same way. Here, Winchester replaces the dictionary for something far more familiar to me, a geologic map. I must admit my bias here; I was excited to read this book from the moment it landed (again by chance) in my hands. If Winchester's writing had me excited about something as mundane as the dictionary, how could I *not* like this new tale about the creation of the world's first true geologic map? Bias aside, I loved this book. Even if you are not versed in the intricacies of geology, Winchester is able to describe the detail and significance of this map, entitled (in appropriately English fashion) "Delineation of the Strata of England and Wales with part of Scotland exhibiting the Collieries and Mines, the Marshes and Fen Lands Originally Overflowed by the Sea, and the Varieties of Soil According to the Variations in the Substrata, Illustrated with the Most Descriptive Names." Instead of repeating this loquacious title again, I will borrow a page from Winchester's account and subsequently refer to it as "the map". The map is one that defined the field of geology, marked a paradigm shift in scientific inquiry, revolutionized the coal industry which drove the industrial revolution in early 19th century England, and is the theoretical basis for the billions of dollars spent on modern petroleum exploration. While this wonderful cartographic element of the story is not to be understated, the true complexity and brilliance of the map is found through Winchester's riveting account of

its cartographer, William Smith (1769-1839). The artistic mastery and scientific endeavor contained within the map was entirely the product of this singular man. Winchester's tale follows William Smith from the depths of a debtors prison, back to his childhood fossil digging days in Oxfordshire, across his young apprenticeship as a canal digger, and arrives at his peaceful retirement by the sea in Scarborough. His story is very readable throughout and supported by wonderful anecdotal tangents, that enliven the life, work, and historical context of William Smith in way that can only serve to honor one of history's great scientists and cartographers.

In Winchester's tale, we first meet this great scientist and cartographer as he emerges from a debtor's prison, penniless, hopeless, and thoroughly crushed by the conservative society of early 19th century England. In a time that should have been the pinnacle of Smith's career, he finds himself stripped of his due glory as the "father of modern geology," robbed of his priceless fossil collection, and thoroughly disconnected from the map he spent his lifetime creating. This paradoxical injustice was a product of the certitudes of religious dogma and class structure that defined Smith's world. Through this injustice, Winchester gives the reader a glimpse of what is to come in the book. More importantly, he uses this paradox to speak volumes about the historical context of Smith's life and work. Thus, in the first chapter, Winchester shows the reader the importance of Smith's work; it was to eventually crumble the foundations of English society. It was not Smith's original intention to begin this Copernican revolution, he was just a curious and innovative blacksmith's son from Oxfordshire. Smith was only revolutionary in that he innately possessed what is now known as a scientific method.

As Winchester continues, we find that this natural-born “revolutionary” talent first sprouted when Smith was a young lad in Oxfordshire. Upon the death of his father when he was eight, Smith was brought up on his uncle’s farm. He began to notice peculiar stones around the farm, stones that looked like remnants of living creatures. While there were others that had made the same observation, the idea of fossils was heresy to late 18th century England. Nevertheless, he was acutely aware that others silently held the belief that fossils were actually remnants of animals that existed long before the genesis of the world set by the biblical scholar James Ussher. As Winchester points out, scientists of the late 17th and 18th centuries were beginning to erode the certitude of biblical knowledge. This slowly changing atmosphere of scientific inquiry allowed the young Smith to accept and examine the fossils he found in his boyhood home. Smith’s study of fossils and their geographical distribution had begun and became the foundation for his great map.

While Smith is now credited as the father of modern geology, Winchester’s account characterizes Smith as a geographer through and through. The young Smith landed his first job, a surveyor, through his recognized talents for observation and geometry. Smith was schooled in the ways of surveying and cartography, and quickly became respected in the field. In a seemingly pre-destined coincidence, his first major job was a commission to survey a path for the Somerset coal canal. Smith’s love of fossils had found a practical application, and his new home of Rugborne Farm, Somerset is now christened “the birthplace of geology.” It was his geographical training and talent that led Smith to the discoveries that marked the birth of geology

on Rugborne Farm. Winchester notes his “uncanny ability to perceive the spatial geometry of the world beneath his feet” (p. 89). While deciding which coalfields to put on the canal, Smith became aware of a possible order to the spatial arrangement of the coal strata. He noticed that the strata above and below the coal layers were remarkably similar across the different mines in the area and began to sketch three-dimensional maps of what he saw and learned from the miners. Smith’s major breakthrough was connecting his knowledge of fossils to the stratigraphy he saw beneath his feet. He found that fossils were a way to make sense of the strata, and most importantly, be able to unmistakably map their distribution. Geology was born, and the map had its key theoretical foundation.

Smith’s brilliance can be appreciated from many different disciplines and trades. He was one of the most influential canal builders of his time, a civil engineering whiz. He made a substantial side income draining and irrigating farmers’ fields across England, garnering a reputation as a man who could seemingly make water move uphill. Moreover, he was quickly becoming a cartographer of note. Smith’s ventures into cartographic design arose from a necessity to display three-dimensional geologic strata variations across the land surface. His use, choice, and manipulation of color led to the cartographic principles of geologic maps that are still visible today. Smith defined a color for each strata, and many of the color schemes have carried over into modern geologic maps. Smith’s cartography was as creative and brilliant as the geology for which he is more readily known. His original geologic map not only made use of hand-applied color, but he applied the color in a way to be darker where the strata outcrop occurred, then

fade in color towards the next outcrop.

While Smith excelled in many disciplines, all his work was directed at the creation of the map. The canal building, irrigation projects, and cartography were all directed at collecting and manipulating stratigraphic data to produce the map. Smith’s desire to produce the map was unquenchable. He was fully aware of the profoundly important nature of his research, and spent his life’s work in pursuit of the map. His extensive travels, professional connections, and cartography began to bring Smith a sizeable income. His post as the head canal digger for the Somerset canal was one that not only brought him income, but also respect. He bought a small estate outside Bath, found a wife, and began to share his ideas with newfound friends that made up the upper crust of Bath intellectual society. Just as his work was challenging socially accepted norms, Smith’s life was defying his born societal class. His travels now also frequently took him to London, where he acquired another mortgage on a flat. Smith seemed well on his way to the recognition he deserved, and had every indication that his soon to be completed map would be a thriving success.

However, the same society that seemingly accepted Smith as one of their own, was the one to disown him, plagiarize him, and relegate him to the debtor’s prison where Winchester began his story. The proximate causes for Smith’s demise are many and give this great man an all too human character. He lost his job with the canal company after a tiff with his boss, his wife became ill, and he had two mortgages to pay. However, it is strikingly obvious to the reader, and to Smith himself, that after publishing the map, he should never want for money again. English society

knew the worth of the map all too well, and that is precisely why they robbed him of it. Smith had begun socializing with the elite of London, with a group that called themselves the Geological Society of London, but he did not recognize their motives for dealing with him. At its founding the Geological Society held the belief that "the theory of geology is in the possession of one class of men and the practice in another" (p.228). To the Society, Smith's field-worn hands clearly gave him the mark of the practicing class. A man of the practicing class could not be trusted to produce a map of such importance, and the Society would not accept Smith's brilliant map. Rather, they began producing their own map, which when produced was strikingly similar to Smith's. Smith knew he had been plagiarized, but by this time he was penniless, and imprisoned. It is no wonder that when let out of the debtor's prison by the few sales of the map he did have, he left London in disgust.

Unlike many historical figures, Smith was lucky enough to stick around long enough to see his work appreciated. Young scientists inspired by Smith had ousted the elite of the Geological Society and called Smith out of retirement to accept the accolades due to him. He was awarded the Wollaston Medal (the Nobel Prize equivalent for geology), given a royal pension, and granted an honorary doctoral degree. Smith's work had shaken the foundations of British society and amid the rubble, Smith and his work stood tall. The map was now the foundation of a science and a new paradigm that would inspire Darwin and others.

My account of the story fails to include the anecdotes and historical narrative that Winchester provides. His writing brings life to this great story of a visionary man and the timelessness of one map. As he tells us in a footnote,

his story is directed toward the reader who needs no knowledge of Smith, geology, or cartography. Other, more exhaustive works are available, and Winchester even provides a suggested reading list for those inspired to learn more about William Smith and the birth of modern geology. Winchester succeeds admirably in writing this book towards his general audience, it is a delight to read, and completely readable in the course of a trans-continental journey to a conference. While the reader is sure to take away scores of facts and bits of knowledge, the book reads like a favorite novel. I admire Winchester as a writer, his work succeeds in being academic, yet his presentation is cherished by a general audience. Moreover, *The Map that Changed the World* is a singular work from Winchester's library. Winchester himself was trained as a geologist at Oxford and claims William Smith as his hero. This personal connection shines through in the book, adding another level of enjoyment above all his books. In one interlude of the book, we follow Winchester as he retraces his hero's footsteps and discoveries of the geographic distribution of Jurassic rocks. The interlude is a microcosm of what makes this book special, it reads like a delightful travelogue, following our native guide past his youthful stomping grounds. Yet somehow, in the course of splashing through waves on the English channel, or chipping a stone off a cliff in blustery Lincolnshire the reader learns the foundations and complexities of geology.

While I highly recommend this book to anyone, geologists, geographers, cartographers, and scientists in general will find it a delightful and relaxing read. As an added bonus for cartophiles like myself, the hardcover version which I reviewed contains a full color 23"x27" replica of Smith's

great map folded up into the dust jacket. Even without Winchester's lovely narrative, the map is a cartographic wonder and historical treasure. The hand applied colors, shading, annotation, and calligraphy of the cartographer himself make this map a treasure to be held as a piece of art. However, cartography is an art and a science. The greatest praise for Winchester's book is that it succeeds admirably in describing the science, and the scientist that produced such a singular and historically important cartographic work.