William Smith: The Man That Changed the World

Michael Raiwet
Jason Cosford
GEOL 240: Historical Geology
April 10, 2013

William Smith was known to be skilled in many areas, he was a capable cartographer, he was a successful canal engineer and a well regarded surveyor. But it is his contribution to the scientific field of geology that will keep him in the history books for some time to come. His understanding of the geology and the stratigraphy throughout England gave Smith a unique talent that gave himself the ability to eventually produce a fairly precise geologic map of England that rivals competing maps created almost 200 years since. Simon Winchester's The Map That Changed the World, gives great detail into Smith's life and will be the main source of this paper. This essay will take a look at Smith's early life, focusing on his early discoveries and developments that ultimately led to him becoming a geologic luminary of his time.

To have a better understanding of William Smith, it is valuable to the to appreciate the zeitgeist of the 18 th century in which he was born. England, and much of the world, would have been very much a conservative, controlled primarily by the church. As Winchester describes it, "The origins of the planet, just like the origins of mankind, were assumed to be fixed, uncomplicated and divinely directed" (40). The Earth, as it was calculated by genial Irish prelate James Ussher, was no more 6000 years old (Winchester, 37). And yet, change was on the horizon. This was the dawn of the Age of Enlightenment, and although its spread throughout the Europe was not hastily, and it would have expansion into rural communities would be even slower still. Rural communities such as the hamlet of Churchill in Oxfordshire, where on March 23, 1769, William Smith was born to John Smith, a skilled mechanic and blacksmith, and his mother Ann Smith (Winchester, 36).

Smith shares a few important inventions with the year of his birth, 1769. Likely, the most notable of these was the grant of patent for the first condensing steam engine, by inventor James Watts (Winchester, 42). The benefits of the Industrial Revolution were beginning to take shape, using machinery and organized labour in unison to rapidly manufacture products and complete projects at a rate that simply was not possible before. As Winchester explains, "Iron production was on the way to doubling every twenty years when Smith was born, and coal was too" (Winchester, 42). He continues, "if the industrial world was accelerating out of all imagination; then so also, and as an obvious corollary, social change was underway as well" (Winchester, 43). All of this, as well a further advancements in agriculture, healthcare and literacy around the time of Smith's birth and childhood contributed to an England that would prove fitting for the ideas Smith would someday present to the world.

After the death of Smith's father at the age of eight, Smith was primarily brought up by his uncle, also named William (Winchester, 5354). His uncle, who Smith affectionately referred to as "old William", is thought to have treated young William reasonably well, however was either not able

to or not willing to spend much money on the boy (Winchester, 84). Winchester suggests, “He was exasperated, it seems, with what he regarded as his nephew’s effete habits–which by the time he was seventeen had extended beyond collecting brachiopods and echinoids to carving sundials in slabs of another local rock, the oolitic limestone of the Middle Jurassic.” (84) As a curious young man, Smith had great interest in reading, but found difficulty affording books for his studies and had to resort to ask his uncle for an advance against his will (Winchester, 8485). One volume he was able to purchase, The Art of Measuring, written by Daniel Fenning, introduced him to “...the skill that would become central to him for the rest of his adult life–the basic principles of surveying” (Winchester, 85).

It was while Smith was carrying The Art of Measuring one afternoon in Churchill that he met Edward Webb, a man who would play an important role in Smith’s life. Edward Webb, a surveyor was brought to town and hired by local squires and wealthy farmers to have the local fields allocated privately and farmed efficiently (Winchester, 85). Webb, impressed by the young man hired him as an assistant. This being the autumn of 1787, Smith was now eighteen, and although he was informally educated, he had a profession and a job (Winchester, 86). According the Winchester, “It took him only a few months to master the basic skills” (86). By the following summer, Smith was given the opportunity of completing a job by himself, after one of Webb’s older assistants miscalculated the area of some allotments he surveyed, which caused the owner’s to order the wrong size for a fence (Winchester, 86). In 1791, Smith was sent by Webb to the village of Stowey and was to make a valuation survey of an estate that had recently been left in a will to a local coal mine owner named Lady Elizabeth Jones. It was in this region of England that Smith would remain for the next eight years of his life working for his patron and later for the Somerset Coal Canal Company. As Winchester reveals in his biography, it was during this time that Smith would make his great geologic discovery (Winchester, 8990).

In the summer of 1792, Smith climbed down into a dark coal mine called the Mearns Pit in Somerset, where Smith first witnessed the succession of rocks and fossil types (Winchester, 98-99). Smith was not familiar with what was to about see down there and was at first quite perplexed with what he saw. But after awhile and visits to other coal mines he began to notice a familiar and repeating cycle of rock types such as, sandstones, siltstones or mudstones. He noticed fossils that occurred in some successions, but not in others. Perhaps an even more important discovery though, is that these familiar and repeating rock successions could be found in the other mines he was observing. “He understood for the first time that geology was a science requiring observations in three dimensions” (Winchester, 108). In the late 18th century, this would have been quite a revolutionary idea. Certainly this would be a skill that only a few might possess, and having acknowledged this Smith sought to his skill and exploit it.

During the last decade of the 18 th century, many mine companies were investing in canals, which would greatly reduce the costs of transporting coal. Especially around the areas where Smith was now located, where the local geology had been affected by deformations during the Variscan orogeny (Winchester, 78). Smith's growing popularity with the local community and with influential people such as Lady Jones allowed Smith to easily obtain a job for a new established Somerset Coal Canal Company (Winchester, 124). Having this new surveyor position gave Smith the opportunity to advance his concepts for two important reasons. Since he was essentially responsible for the routes that the canals were to be built on, he could view the changes in the strata along the route and as Winchester puts it, "He became uncannily able to perceive the spatial geometry of the world beneath his feet–to imagine, on the basis of what he saw above ground, just what the world looked like underneath" (128). The second reason, happening six months after his hiring, Smith was sent on an expedition by his employers to travel across the country and take an instructive look at how the canals were being built and routed. This journey would last two months and by the time it was through, he would have travelled over 900 miles in England and Wales (Winchester, 130). Smith had discovered these repeatable and predictable patterns that applied to the hills and valleys of Somerset, but now he could test these results on a much wider scale. (Winchester, 130). Smith would stay employed at the Somerset Coal Canal Company until he was "...abruptly and unceremoniously fired..." on June 5, 1799. (Winchester 185). Some have suggested his dismissal may been a conflict of interest with the recent purchase of a house, the Tucking Mill House, which was in close proximity to where the canal was being built (Winchester, 185).

Smith's fascination with fossils began at an early age. Spending his adolescence on his uncle's farm, he was introduced to several different types of fossils. In his region of Oxfordshire, it was customary for the dairymaid who managed the butter scales to use a pound stone, as opposed to some weighted object acquired at a market to measure out the butter they would produce (Winchester, 54). These pound stones were of great interest to young William Smith. For these pound stones were not stones at all, they were fossilized Clypeus ploti, a type of irregular echinoid (Winchester, 58). It would not, during this period, be unreasonable to assume these fossilized echinoids were in fact rocks, for there would have been no plausible theory as to how the fossils of marine animals, which these stones resemble, could find their ways in the fields and the quarries inland (Winchester, 54). In this religious society, which tended to follow the bible quite literally, they saw it impossible for the fossil remains of once living creatures to be found inside the earth, which by all accounts was created before Adam, Eve or any creature alike (Winchester, 67). The only drawable conclusion for many of the 18 th century, was that God had

created these rocks in the forms of creatures similar to how he sometimes creates minerals with unique and attractive appearances (Winchester, 63).

Smith was quite confident in his ability to classify strata, but occasionally would find himself confused among two outcrops that appeared to be exactly the same, but through his understanding could not possibly exist in the areas that they occurred in and still be the same strata. Winchester explains, “In one cutting there may have been a sandstone and in another, half a mile aways, there may have been another that looked identical–and yet, to judge from a dip and strike that did not vary between the two outcrops, logic suggested that the two formations were not the same at all...” (161). But it was fossils that allow Smith to find a solution to this problem. Although the sandstones appeared to be the same, he noted that the fossils inside the sandstones were distinct from each other. “The fossils would be the key to working out what the order was. Using them, one could forecast the precise succession of the beds underground. And if it could be forecast, they could and would be eventually mapped” (Winchester, 111).

Smith was very proud of the ideas that he had formulated. But he intended to keep them secret, at least until he could find more evidence and would therefore be more informed and would be better suited defending his theories whilst being able to avoid looking like a fool (Winchester, 132133). Aside from this, he was also concerned about the originality of his ideas. He was not certain the geologic theories that he was postulating were not already proposed by other geologists before him. During a visit to London where Smith was a witness before Parliament, he had some spare time, so he visited a local library to acquired several books in order to either have a better idea what had been regarding the geologic subject dear to him. To his pleasure, he was unable to find anything of the sort. In Smith’s diary, he writes, “Although several authors had noticed thickness of some strate in succession in various parts of the country... none were collated, and for want of comparisons there could not be any reasonings on the subject” (Winchester, 135). Now, Smith could be more reassured that his ideas were valuable, and that, for the the time being, were not yet on record (Winchester, 136).

It was during the summer and autumn of 1795, when Smith would ultimately draw his conclusions and solidify in his mind his hypothesis for stratigraphy. Everyday he would collect more fossils and organize them into a growing collection that would continually confirm and reconfirm his research (Winchester, 164165). It seemed abundantly clear by this point, that a layer of rock could be positively identified simply by the fossils that were to occur inside them (Winchester, 165). In a single sentence written by Smith shortly after this time at the Swan Inn at Dunkerton on January 5, 1796, Smith writes, “Fossils have long been studies as great curiosities, collected with great pains, treasured with great care and at a great expense, and showed and

admired with as much pleasure as a child's rattle or a hobbyhorse is shown and admired by himself and his playfellows, because it is pretty; and this has been done by thousands who have never paid the least regard to that wonderful order and regularity with which Nature has disposed of these singular productions, and assigned to each class its particular stratum" (Winchester, 166).

It is Smith's map of England and Wales that has earned him a reputation in time, a map that would take much of his life and wealth to create. This paper does not go into detail describing that process, instead it discusses a much smaller map, but perhaps just as special. Smith was quite capable of demonstrating a vertical crosssection of the geology, but did not have a method to explain the geology was exposed horizontally. How it was dispersed geographically (Winchester, 173). This would change by the late 1798, while reading the Somerset County Agriculture Report, he observed a map that adhered to exactly to what he would like to accomplish geologically. It was a map that showed the geographical areas of various soils and types of vegetation in the countryside near Bath. But perhaps most important of all, they were coloured. (Winchester, 173). Using a method like this, he could use his graphical skills and his knowledge of what is beneath the surface to produce a new kind of map, a geological map. He began this process, by mapping his surrounding area of Bath, using a map printed in the The Historic and Local New Bath Guide, printed by A. Taylor and W. Nayler, Booksellers. He would superimpose his findings onto this map and with some help by Reverends Richardson and Townsend, they would complete the project by the middle of the summer in 1799 (Winchester, 174176). The map, titled "Order of the STRATA and their embedded ORGANIC REMAINS, in the vicinity of BATH; examined and proved prior to 1799" would become quite successful and popular among the educated classes as far as the East and West Indies (Winchester, 184185). William Smith, born of a blacksmith from a small hamlet in Oxfordshire, would one day become a central figure in the deeper understanding of Earth. His historic map does not begin to describe its significance in the scientific realm. The discoveries that would be follow his research and the research of countless others regarding fossils, would one day allow scientists like Charles Darwin to present their valuable and world changing ideas, such as evolution. Smith's concept for the geologic map is still in use today, and in fact many of the colours he had originally used, such as yellow to represent limestone, has remained the same. His geologic map of England, now applied globally to describe the lithologies all around the globe. Smith's determination, dedication and ability to quickly learn new concepts contributed more to science than most could hope for in ten lifetimes. Citations

References

Winchester, Simon. *The Map That Changed the World*. London, UK: Harper Collins, 2001.