The Map that Changed the World, by Simon Winchester

Reader's Notes, Additional Glossary of Terms and Discussion Questions

This document and the accompanying GoogleEarth files were developed by Nina Bingham, a rising junior in the Department of Geosciences at Penn State.

Introductory notes

1. Always read the footnotes! They provide copious amounts of anecdotal information that will enrich the story by providing background to many references in the story which familiarize the reader with all aspects of English and scientific history.
2. Be sure to look up terms with which you are unfamiliar. The book is meant to teach as well as entertain and besides an enchanting tale it also provides an ample glossary of geologic terms, a geologic time scale and many illustrations to encourage learning. Take advantage of this resource! The second page of this document includes some terms that are not in the book's glossary that might be helpful as you read.
3. The Discussion Questions and Google Map document are split into sections corresponding to the progression of the plot, using the divisions shown below.

    - Prologue and Chapters 1-3: Early Years/Historical Setting
    - Chapters 4-8: Major Discoveries
    - Chapters 9, 10 and 12: Map Making
    - Chapter 11: Interlude
    - Chapters 13-15: Downfall
    - Epilogue and Chapters 16 and 17: Recognition

Additional Glossary of Terms

- **boulevardier**: a person who frequents the most fashionable Parisian locales
- **Carboniferous coal measures**: the coal bearing beds that date in the Upper Carboniferous; consisting of beds of shales, sandstones and conglomerates intermixed with layers of coal
- **chamfered**: to cut a furrow in (as a column)
- **chimera**: an illusion or fabrication of the mind: an unrealizable dream
- **demimonde**: a group of people who lived hedonistic lifestyles, usually in a flagrant and conspicuous manner
- **Fenian subversive**: A supporter of the Irish Independence movement in the 1800's and 1900's
- **flâneur**: someone who is committing the physical act of taking a stroll most typically because their wealth affords them the time
- **inclination**: in the case of geology…the angle and position of rock (layers)
- **ironstone**: a fine-grained, heavy and compact sedimentary rock mainly composed of carbonates/oxides or iron and clays
- **leviathan**: anything of immense size and power, this references the gigantic sea monster described in the Bible
- **Long barrows**: long trapezoidal raised mounds that are the burial sites of many Celtic, Slavic and Baltic cultures from the New Stone Age (starts 9500 BC); commonly found in southern and southeastern England.
- **Malthusian**: in reference to the British scholar (Thomas R Malthus) famous for his theory on population growth; that populations tended to grow faster than their means of existence unless checked by moral restraint or disaster
- **Mearns colliery**: One of the mines and all of its buildings in the Somerset Coal Field
- **OED**: acronym for Oxford English Dictionary
- **parsonage**: the house provided by a church for its pastor
- **press gang**: a nickname given in reference to impressments occurring in England, which was the act of compelling men into joining the Royal Navy by force and without notice, it occurred from 1664 through the early 1800's
- **Regency times**: the period between 1811 and 1820 Prince Regent ruled as King of England; known as a period of glamour and excess among the aristocracy but also uncertainty
- **stratigraphy**: the study of rock layers and layering, in particular the application of the Law of Superposition (and other geologic principles) to determine relative ages.
- **topography**: the configuration of a surface including its relief and the position of its natural and man-made features
- **Trias**: a layman's term for Triassic, this was a period of geologic time from 251 to 206 million years ago.

*Background information from Wikipedia after verification through other sources
*Definitions from Merriam-Webster Dictionary Online

Discussion Questions

Early Years/Historical Information (Prologue and Chapters 1-3)

Prologue: What information is included in a geologic map, in what ways is this information useful or significant?

Chapter 1. A fundamental concept that underpins the book is relative dating. What does this term mean, and can you describe how relative ages of rocks are determined?

Chapter 2. The word hours is italicized on page 12. Why does Winchester emphasize this word?

Chapter 2. The footnote on page 15 alerts the reader that a significant fraction of the modern United States population still believes in the church-based time scale and Biblical creation of the Earth that was popular during Smith's time - and that this population is growing in size. Are there similarities between the two cultures (economic, political, and social) that could explain the resurgent belief today?

Chapter 3. In what ways does the following question (which was asked during the late 18th century) demonstrate the relative youth of the science geology and the discoveries that have been made since the birth of this science?

> *"What were such sea creatures doing in the middle of a stretch of enclosed pasture, a hundred miles from the nearest shoreline and (considering the height of the surrounding land above sea level) a good three hundred vertical feet above it?"*

Major Discoveries (Chapters 4-8)

Chapter 4. Page 49 has a stratigraphy column of a typical cyclothem. What is a cyclothem? What do stratigraphy columns display? How are they useful?

Chapter 4. What is an orogeny? How are orogenies associated with sedimentary rocks and the coal beds of England (and Pennsylvania)?

Chapter 5. What do you suppose can cause the sharp change in bedding that Smith observed from gently sloping to steeply dipping beds with folds (described on pages 66-68)?

Chapter 6. How did industry affect the progress of geology in Smith's day? Are there parallels today, for example with the Marcellus shale exploration and extraction?

Chapter 7. Smith describes his conversations with the canal company leadership: "… though I was continually talking about rocks and other strata, they seemed not desirous of knowing the guiding principles" (page 96). Does this problem appen in your classroom? What might help bring learners to desire understanding of the guiding principles?

Chapter 8. What is an index fossil and how are the ammonites drawn at the beginning of each chapter relevant to this term?

Map Making (Chapters 9, 10, 12)

Chapter 9. On page 131, Winchester describes the scientific method as the collection of data, development of a consistent mechanistic model, and verified through testing of predictions. How does this description compare with what is taught and assessed in the classroom?

Chapter 10. This section and the latter half of the book focus heavily on plagiarism. What do you teach your students about plagiarism? Does it change your opinions to learn the effects it can have on the plagiarized person's life?

Chapter 12. Speculate on how the process of making geologic maps today differs from the way Smith worked in constructing his initial map of England.

Interlude (Chapter 11)

Chapter 11. Do you remember any specific places in your childhood that had striking geology or where the rocks were important? Do you know whether they were formed through sedimentary processes?

Downfall (Chapters 13-15)

Chapter 13. "The theory of geology is in the possession of one class of men, the practice in another." How does this quote (p. 228) describe the state of geology in Smith's time? How does it compare to your idea of a geologist today? Compare Smith's reception with the Geological Society of London to the community's response to Wegener's ideas on continental drift.

Chapter 13. On page 229 there is a curious argument presented by Greenough that facts should be presented without ruminations and theories. In this case, it meant omitting Smith's fossil stratigraphy from the new map of England. Do you agree with his statement?

Chapter 14. Winchester emphasizes the well-placed connections Smith made that aided him in his work. What are some common qualities of all of Smith's supporters? Do these qualities differ from those of people who today would be considered valued connections?

Chapter 15. "When house and land is gone and spent/Then Learning is most excellent (quoted on p. 263)." Do you agree with this quote in relation to Smith's life? Why or why not?

Recognition (Chapters 16-17 and Epilogue)

Chapter 16. Both London and Scarborough appear to have great influence over Smith's mood and behavior. What defines a place to make it unique? How was the concept of a place important in this book?

Chapter 17. What evidence do we see in the book for a societal shift from a strictly wealth-based recognition system to one that was more focused on education and accomplishment? How was Smith affected by this shift in society's view on its people?

Epilogue: Did you find the book enjoyable even though it was heavily based in scientific discovery? How did the book enhance your understanding of geology?