The Erie Canal’s 200th Anniversary and the Map that changed the New World - Pioneering Geology Mapmakers across the Atlantic*

Charles A. Sternbach¹

Abstract

We draw historical analogy between Simon Winchester’s story of William Smith (the first geologic map of England, 1815) with Amos Eaton (the first geologic map of NY and the New World (1818 cross section and 1822 map). Both pioneering efforts share similarities: canal digging creates fresh outcrops, need for geoscientists to evaluate local resources, canal pathways provide vital access to move fuel for the Industrial revolution and manpower to open isolated regions. Amos Eaton was a traveling lecturer who founded the Rensselaer School for Engineering (RPI, 1824). Like William Smith in England, Eaton suffered many hardships in his personal life. Field work and applied science differentiated the American model of education from pure science education of European traditions. Early graduates founded many state geological surveys in the US which provided energy, critical resources, paving the way to an improved way of life. Many AAPG Eastern Section members will remember Gerald M. Friedman, a modern day Amos Eaton, and a keeper of the flame for practical geoscience education.

¹President AAPG 2017-2018 and Star Creek Energy Company, Inc., Houston, TX, United States (carbodude@gmail.com)
The Erie Canal’s 200th Anniversary and the Map that changed the New World
---Pioneering Geology Mapmakers across the Atlantic

by Charles A. Sternbach
President AAPG, 2017-2018
Outline

• William Smith, British geologic hero, ignored but redeemed at the end (1769-1839)
• Simon Winchester, story teller about Wm Smith, author of The Map that Changed the world 2001
• Winchester built on the work of smith Historian Hugh Torrens
• Amos Eaton, American Scientist, innovative educator, field geologist (1776-1842) contemporary of Wm Smith
• The Story of Amos Eaton rarely told
The British start Geology Field Mapping
The British Team

William Smith, Geologist  1769-1839

John Cary, Mapmaker  1754-1835

Charles Lyell, Geologist  1797-1875
William Smith

- Canal Digger, Mapped England’s geology for 20 years
- Somerset Coal Canal important transport for Industrial Revolution in England
- Recognized importance of fossils
- 1815 map in England, 414 subscriptions, 350 copies produced, 120-130 believed still in existence
Somerset Canal
Fossils, Jurassic Poundstones

Poundstone (sea urchins)

Jurassic Outcrop Belt
The 1815 Smith Map of England

Highlights

- Map showed color patterns not points
- Shading carried the information
- Allowed for projection of layers or strata into 3 dimensional space
William Maclure

Map of Appalachians 1809, 1817

Wernerian System

- **Class I: Primitive (brown)** – Crystalline rocks comprising much of the Appalachian Piedmont and Blue Ridge provinces, now known to be Paleozoic and Precambrian.
- **Class II: Transitional (red)** – Tilted, folded and deformed sedimentary strata that form a narrow band within the Appalachian Mountains, the Valley and Ridge province, now known to be Paleozoic and Triassic.
- **Class III: Flötz or Secondary (blue)** – Flat-lying sedimentary strata that form all of the Appalachian Plateau and interior lowland west of the plateau to the Mississippi, now known to be Paleozoic.
- **Class IV: Alluvial (yellow)** – Poorly consolidated to unconsolidated sediment of the Atlantic and Gulf coastal plains, including the Mississippi embayment, now known to be Cretaceous, Tertiary, and Quaternary. By coincidence, yellow is still the standard color on geological maps for Quaternary alluvium.
An Intermediate Step

Cross Sections

William Maclure

- Wm Maclure (1763-1840) made first geologic map of the Eastern US 1809
- Used Wernerian system
- Believed US would remain agricultural society, opposed Erie Canal
The American Team

Dewitt Clinton, Governor  1769-1828

Stephen Van Rensselaer, Patroon  1764-1839

Amos Eaton, Scientist, Educator  1776-1842
It starts with geological mapping

• William Smith worked out geology of England based on canal exposures facilitating industrial revolution (Simon Winchester) 1815
• Similar work started in New England after the War of 1812 and mapping into 1820 and beyond
• NY possessed many advantages of geography, plus:
• Collaboration of business men, land owner, government, and science
Amos Eaton highlights

- Eaton career buffeted by extremes of failure and success
- Started out as lawyer, imprisoned for debt (common in those days)
- Taught the jailers son natural science and botany
- Was pardoned for good deeds and fortuitous timing at outset of War of 1812
- Became a lecturer on the circuit
Amos Eaton teaching

- Encouraged scientific education for men and women
- Pedagogical device: students change roles to act as teachers
- Field work and applied science become
- Founded a school and curriculum at RPI 1824 to create a corps of geologists to map NY and the early US
- Many graduates founded State Geological Surveys
Eaton’s 1818 Traverse from Catskills to Atlantic

500 miles from the Catskill Mountains to the Atlantic Ocean
Longest Geologic Transect of its day
Geography and the Erie Canal
Isaiah Bowman, Yale and President of John Hopkins, Noted: Ridge road as Lake Ontarios Former southern shoreline and the Mohawk River would have provided drainage to the Atlantic Ocean.
Views of the Helderberg Escarpment
Map of the Grand Erie Canal
Profile of the Grand Erie Canal

Note temporary “rise”
Over Middle Section
Erie Canal Motivating Factors

- Key to Uniting the United States
- Settling of the Interior difficult, food land locked, economic drivers
- Political reasons to expand into the interior
- Scientific curiosity, what are the resources of NY and New England?
- Looking for more coal, found salt and construction materials
The Erie Canal: 1817 to 2017, 200 years

- First proposed in 1780’s, re-proposed 1807, delayed by war of 1812, construction begun in 1817
- Also known as “Clinton’s Folly” and “Clinton’s Big Ditch”
- Pathway from Great Lakes to Atlantic Ocean
- Originally 363 miles long with 36 locks
- Maximum height above MSL 571
- 95% Faster and cheaper than barges pulled by animals
- Fostered population surge in W. NY and interior
- Peak year 1855 33,000 commercial shipments took place
- Still open
Wall in NY State Museum, Albany
Mohawk Falls
Pathway to Mississippi River, Chicago Cross Roads
Gerald and Sue Friedman Historical Geology Library at RPI contains Smith And Eaton Maps
Field Work, The Hudson Flotilla, 5 trips on the Erie Canal (1822-1824)

1) Fall of 1822, Recon Mission, sedimentary “transition” rocks of Werner classification
2) Spring 1823, “broad alluvion”, glacial drift
3) Summer 1823, mineral search for salt (food preservative), gypsum (fertilizer) & coal (fuel)
4) Winter 1823, fill in data points away from canal, rock sets for patrons,
5) Spring 1824, Discovery of sunken forests (due to glaciation), teaching along the way
Eaton’s Journals, Map and Cross Section
Eaton’s Journals, Map and Cross Section
Rock types and fossils
GEological Profile
EXTENDING FROM THE
Atlantic to Lake Erie

Running near the 43° N. L. and embracing 9 degrees of Longitude. Taken 1822 & 3 under the direction of the Hon. Stephen Van Rensselaer.

By Amos Davis.

[Diagram showing geological profile with various locations labeled]
The NY MAP, 1830
The NY MAP, Explained
REGIONAL RANKING 1: NEW YORK

High profile oil seep at Cuba, gas production at Fredonia

NY Geological Survey 1836-1843: >200 references to oil and gas

Oil reported in 8 counties

Carburetted hydrogen reported in 14 counties

Good market access

Thanks to Ray Sorenson
Map Comparison (roughly to scale)
Links to England

- 1818-1836 Eatonian Era in the US
- Several visits by Charles Lyell to US
- Lyell and Eaton visit in 1841 (1 year before Eaton’s death)
Educational Legacy link to today

- RPI founded in 1824
- First civilian Engineering education outside of West Point
- Applied Education in contrast academic or “pure” science
- Defines American educational values over European
- Emphasis on laboratory and Field exercises
- Pedagogical approach: students teach
Amos Eaton and the Geological Imperative

- Geology was the science that enabled New Yorkers to cultivate power through the knowledge of place
- New York’s example: science was a key to effective natural resource exploitation
- This created a burgeoning of social investment in scientific authority
Rensselaer Grads leadership roles at least 11 State Geological Surveys

- Michigan, Douglass Houghton
- N. Carolina, Ebenezer Emmons
- New Jersey
- Virginia
- New York
- Pennsylvania
- Ohio
- Delaware
- S. Carolina
- Wisconsin
- Iowa
Emmon’s or Logan’s’s Line
Morgantown, WV  September 26,  2017 AAPG | Eastern Section Annual Mtg.

Ebenezer Emmons
1779 - 1869

A pioneer of nineteenth century geology

Remained graduate of the first class of 1826
Remained Professor of Geology 1836-1840
State Geologist, New York Geological Survey
The first State Geologist of North Carolina 1851

Created the standard for American stratigraphic surveys
and established the local stratigraphic and structural
geology now known as the "Taconic System." The Taconic
frontal fault, which extends from Canada through
southern New York, runs through the Enterprise
campus and is known as the "Emmons' Line."

Wrote classic texts on geology and other aspects of natural
history. Named the Adirondack and Taconic Mountains.
Acquainted the public with those regions through his writings.

The Association of American Geologists, which later
became the American Association for the Advancement of
Science, was founded in his home in 1840.
Kindred RPI Geology Professors

Amos Eaton, 1776-1842

Gerald M. Friedman, 1921-2011
“Keeper of the Flame”

Gerry Receives the AAPG Sidney Powers Medal, Houston 2000

Remembering Gerry

**MEMORIAL**

Gerald M. “Gerry” Friedman 1921-2011

by Charles A. Steinschneider, Houston, Texas

Gerald M. “Gerry” Friedman passed away in his sleep on November 29, 2011, at the age of 90 years old in New York City. He was an AAPG member since 1958.

**AAPG**

Receiving the Sidney Powers Medal in 2000, Gerry was a consummate geologist, researcher, and professor. He authored more than 357 papers and 10 books. He was active in all three AAPG divisions and served as AAPG vice president in 1984. In addition to being a board member, he was honored by AAPG with Honorary Membership, Distinguished Educator Award and Distinguished Service Award. He was a Trustee Associate.

**Publications**

Gerry wrote geologic papers that shaped the thinking of generations of geoscientists. His textbook Principles of Sedimentology, co-authored in 1978 with John E. Sanders of Columbia University, sold almost 20,000 copies. The two authors also made available thousands of free copies to faculty, supported a private printing in China, Korea, Taiwan, and Indonesia; and supported a translation into Chinese. Principles of Sedimentary Deposition, Petrography and Sedimentology, co-authored with John E. Sanders and D. E. Kopaska-Merkel in 1992, built on the scope and success of the first textbook and was widely adopted for undergraduate and graduate students.

**Journals**

Gerry founded three geologic journals of international stature: Carbonates and Evaporites, Earth Sciences History, and North Eastern Geology and Environmental Sciences. While editor of the Journal of Sedimentary Petrology (now Journal of Sedimentary Research), he had the task of guiding that journal through the boom of the 1960s and 1970s.

**Personal**

Gerry was born in 1921, in a quiet section of Berlin. He moved to London in June 1938. He always felt that one of his greatest accomplishments was escaping WWII Germany. His schooling at Cambridge and then the University of London was especially hard because he had to educate himself to pass the entrance exams in English and Physics, which he did with high honors, after working long hours as a baker and wartime firefighter. On graduation, he worked for J. Lyons and Company briefly, and one of his co-workers was Margaret Thatcher. Gerry then immigrated to the United States, where he received his PhD from the University of Rochester in 1950.

In addition to AAPG awards cited above, these include the SEPM (Society for Sedimentary Geology) Twenhofel Award, AAPG’s John T. Galey (Eastern Section) award, New York’s James Hall Medal, American Geological Institute’s 2005 Legendary Geoscientist Award; Helga D. Heidelberg Award in Energy from the Institute for the Study of Earth and Man at Southern Methodist University, and citations as Honorary Member in AAPG, SEPM, IAS (International Association of Sedimentologists), the Geological Society of London, and Sigma Gamma Epsilon. Gerry also received an Honorary Doctorate in geology from Heidelberg University, only the third individual to do so in its 600-year history.

**Early Life**

Gerry was born in 1921, in a quiet section of Berlin. He moved to London in June 1938. He always felt that one of his greatest accomplishments was escaping WWII Germany. His schooling at Cambridge and then the University of London was especially hard because he had to educate himself to pass the entrance exams in English and Physics, which he did with high honors, after working long hours as a baker and wartime firefighter. On graduation, he worked for J. Lyons and Company briefly, and one of his co-workers was Margaret Thatcher. Gerry then immigrated to the United States, where he received his PhD from the University of Rochester in 1950.

In addition to AAPG awards cited above, these include the SEPM (Society for Sedimentary Geology) Twenhofel Award, AAPG’s John T. Galey (Eastern Section) award, New York’s James Hall Medal, American Geological Institute’s 2005 Legendary Geoscientist Award; Helga D. Heidelberg Award in Energy from the Institute for the Study of Earth and Man at Southern Methodist University, and citations as Honorary Member in AAPG, SEPM, IAS (International Association of Sedimentologists), the Geological Society of London, and Sigma Gamma Epsilon. Gerry also received an Honorary Doctorate in geology from Heidelberg University, only the third individual to do so in its 600-year history.
Remembrances
Oaklawn Cemetery, Troy NY

Amos Eaton, with General Stephen Van Rensselaer, founded the Rensselaer School in 1824, later Rensselaer Polytechnic Institute. A philosopher of higher education, he revolutionized instruction away from the liberal arts tradition into a laboratory method of applied preparation for solving society’s problems. He was also a strong proponent of higher education for women.
Sidney Powers
Acknowledgements

- Hugh Torrens, William Smith Historian
- Simon Winchester, “The Map that Changed the World, 2001”, popularizing author
- Peter Wigley, William Smith Historian
- David I. Spanagel WPI Professor, “De Witt Clinton and Amos Eaton” 2014
- RPI Librarian/Historian