Physics and Chemistry of the Earth 35 (2010) 860–867

Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

The moral basis of soil science and geology: What antebellum farmers knew and why anyone cared

Benjamin R. Cohen *

University of Virginia, A237 Thornton Hall, 351 McCormick Rd., Charlottesville, VA 22904, USA

ARTICLE INFO

Article history:
Received 22 January 2010
Received in revised form 3 June 2010
Accepted 28 July 2010
Available online 1 August 2010

Keywords:
Antebellum America
Geology
Georgic ethic
Internal improvement
Rural press
Soil science

ABSTRACT

Soil science and geology had common historical origins in the "internal improvement" era of the early American Republic that sought both cultural and material progress. This paper draws from the rural press, regional agricultural societies, and the first wave of state scientific surveys in that era to discuss the early Republic foundations of those new sciences. It discusses the dynamic and productive circulation of soil-based studies in an era that made it possible for later professional scientific activities to gain influence. It also suggests by way of conclusion that soil scientists and geologists of the twenty-first century can culturally ground their own activities more fully by articulating the purposes of their work as part of broader moral imperatives. To do this, they can treat new calls for sustainability science as a current version of improvement. By recognizing the fundamentally dual aims of sustainability—materially, to achieve the protection of resources and, culturally, to make progress toward more sustainable social structures—soil scientists and geologists can recall the common purpose of their work and avoid the distance from collective cultural activity that professional specialization of the last century and a half has brought.

1. Introduction

Soil science and geology had common origins in an improvement context of the early nineteenth century. During that era, farmers, planters, natural philosophers, and their neighbors together developed new views on the land and new ways to examine and define it. This essay looks to the early American Republic, where I examine the records of farmers and planters to show the vibrant activity into soil manipulation experiments. Mixing anew known fertilizers, identifying new ones, systematically testing the merits of each, producing reports and engaging in debates about them, the small-hold farmers and larger scale planters knew a great deal about their soil and minerals.[1] Their studies did not carry the label "soil science" or "geology" in the professional sense they later would. Yet this setting was witness to an experimental mindset where an active subset of the broader farming class pursued soil and geological studies together.

The early Republic—roughly speaking, the 1790s to the 1850s—provides a particularly useful forum for exploring these origins. During that time, some of the most pressing cultural and political questions were also environmental, soil-based ones. They dealt with land management, soil amendment, crop productivity, rural expansion, and, more abstractly, larger scientific questions about terrain, natural history, and mineral identification. The cultural and political project of building the new Republic required attention to building an agrarian economic system; that economic system in turn required more intimate knowledge about the soil, the minerals, and the terrain. In this, Americans took part in activities concurrent in Europe, Asia, and Africa to increase systematic knowledge of the rural landscape. On the one hand, then, they were asking questions that had been posed for some time by others around the world. Yet on the other hand, they were seeking more knowledge of their landscape for reasons of particular importance to a unique North American setting.[2] While sometimes in conversation with English, French, and Prussian natural philosophers and advocates for geological and pedological activities, most American

* Tel.: +434 982 2004; fax: +434 924 4306.
E-mail address: bcohen@virginia.edu

[1] This article is drawn from Cohen (2009a), where readers can find a fuller analysis of the activities discussed here. Interested readers might also refer to Worster (1994), Valenčius (2004), and McNeill and Winiwarter (2006) for further analyses of the science-environment nexus as understood through attention to agriculture and the soil. McNeill (2003) notes that soil science has received limited attention from environmental historians, a lacuna that scholars in the years after have begun to fill. Along with the aforementioned sources, Stoll (2002) offers an example of that more recent environmental history scholarship into the cultural place of soil in the early Republic.

[2] Scholars addressing the history of soil science in particular have discussed efforts in ancient Rome (Olson, 1943; Winiwarter, 2006), medieval Europe (Cooter, 1978), pre-Columbian South America (Williams, 2006), Prussia (Van der Ploeg et al., 1999), Russia (Evtuhov, 2006), Britain (Fussell, 1969), France and its colonial holdings (Feller et al., 2008), and Romania (Petrina, 1995), to name a few.

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doi:10.1016/j.pce.2010.07.033

efforts for "systematic agriculture" were generated from experiments on their own lands and with ideas developed from those activities (Rossiter, 1975; Marcus, 1985; Cohen, 2009a). They were developed within a cultural framework of American improvement, one that was co-constituted by the moral goal of making a better society (cultural "improvement") and the material goal of improving the health and thus productivity of the land.

The original symposium that spawned this issue of *Physics and Chemistry of the Earth* brought together historical, philosophical and sociological discussions of soil science and geology. To maintain the interdisciplinary flavor of that symposium, in this article I ground the histories of soil science and geology in the improvement culture of the early Republic and understand them as histories of science and the environment (see also Haskett, 1995; Landa and Feller, 2009). Specifically, this article explores the combination of science and agricultural improvement through the examples of the rural press, regional agricultural society activities, and state scientific surveys of the antebellum years. The purpose is to help explain why soil science and geology were pursued and how the improvement context was common for both sciences.

Since those early years, the histories of soil science and geology have followed common patterns of specialization that led the two forms of environmental science into separate professional activities. One consequence of that specialization has been the production of discipline-specific terminology and references. References to soil, geology, and science in the antebellum years, for example, were more loosely construed and generally used than they would be today. This was so not just for the language of the practitioners, but for the names of their studies as well. Terms like systematic agriculture, the science of agriculture, and agricultural chemistry were less distinct during that era than they would later become. The soil science I refer to in this article was likewise less precise.

Another consequence has been the resulting ends-means relationship between science and culture. In modern professional settings, scientific pursuits are often cast as ends themselves. Scientists seek goals internal to their disciplines and professional communities, at least primarily, rather than a means to some other end, such as cultural improvement. Research agendas are frequently aimed at improving technical calculations, providing more refined instrumental readings, or articulating more specialized versions of the already specialized subsets of soil and geological scientists. Certainly this is a tendency of modern specialization, not a universal law; it is not always the case today, nor has it always been the case historically. Efforts after the founding of the Cooperative Extension Service in 1914, for example, and Hugh Bennett's work with the Soil Conservation Service in the 1930s found scientists aligned more clearly with an applied, practical agenda that was dictated by broader cultural concerns (Rasmussen, 1989; Henke, 2008; Helms, 2008). Yet, as represented by the differences between soil science, agricultural chemistry, crop science, geology, agronomy, mineralogy, biogeochemistry, and more—and as evident in the unprecedented 2008 joint meeting of the Soil Science Society of American, Geological Society of America, Crop Science Society of America, and American Society of Agronomy—research goals today are often geared towards audiences of other sub-specialists within, not beyond, science.

At the end of this article I return to comments on the future of soil science and geology to speak to the opportunity for them to again re-conceptualize activities as means to ends other than themselves. I argue that although the dual moral and material contexts of the history of soil science and geology were shaped by a particular nineteenth century improvement ethos, that dual context remains relevant for future pursuits of soil and geological sciences in the twenty-first century. This is because scientists today might also reengage their own sense of pursuing means to ends other than further professional development. We might see the sciences as shaped by and contributing to larger cultural notions of progress and environmental improvement for our time.[3]

2. Background: science, environment, culture

But first, antebellum America, where three factors—a unique cultural framework of American improvement, an agricultural environment, and a shift in science that historians have called "the second scientific revolution"—shaped the pursuits of soil science and geology. In those decades, an active and influential cohort of early Republic Americans was enthusiastic about "systematic" pursuits of agriculture. Having worked for decades to observe and coordinate fertilizer procedures and land management practices, the "era of systematic agriculture," as one New England advocate wrote, was fully upon them by the early nineteenth century (Adams, 1824, 33; also see Cohen, 2009a, Chapter 1). Later studies dedicated to similar efforts would be labeled scientific and directed through institutional structures of experimenting, funding, and researching, but in the fields of the early Republic they were part of the everyday life of an agrarian world.

The cultural framework of innovation and progress was characterized by a complicated zeal for "internal improvements." Practical appeals for "internal improvements" in the United States were a subset of broader efforts that followed the Enlightenment's fabled values of progress, rationality, and knowledge production. In the US, advocates put a practical emphasis on the philosophical principles. Roughly spanning the 1810s to the 1840s, the politically characterized "era of internal improvements" saw canals, turnpikes, and railways offer the promise of better economic, transportation, and political structures, mostly to transform the products of the land more effectively into saleable goods (Larson, 2000). These were state level efforts, with New York's Erie Canal (1825) perhaps providing the paradigmatic example (Sheriff, 1997). Some scholars have referred to this time period as the transportation revolution; some have called it the market revolution; some have called it the era of scientific surveys (Millbrooke, 1981). Each was part of what can be collected under the rubric of internal improvements.

Yet the zeal for improvement was complicated, I note, because improvement referred to a range of things beyond just better transportation and more attention to soil fertility. Some proponents also promoted the more efficient exploitation of enslaved people (while others promoted abolition); improvers also sought the appropriation of new, western territory from native Americans (even as others questioned westward migration); still others were motivated to "improve" labor management, as with the more effective control of a population of agricultural laborers. These less ennobling undercurrents must be seen as part of the same world and ethos that champions would herald as progressive.[4]

No matter the name or the morally contentious character concealed under it, though, almost all improvement efforts involved attention to agricultural lands and the agrarian life. In this sense, and against stereotypical characterizations of American history that cast industrialization and agrarianism as opposing political economies, early industrial efforts were consistent with the goal of processing and distributing agricultural products (grains, produce, animals, fibers) from land to market. Within that dynamic forum,

[3] In this, my point resonates with several authors in Warkentin's (2006) edited collection. See, in particular, Addiscott (2006), Gregorich et al. (2006), and Showers (2006). See, among others, Hillel (1992) and Montgomery (2007) for fuller explorations of soil and socio-historical conditions. Also see Cohen (2009b) for more exploration of the historical connections between environmental ethics and soil science.

[4] For a flavor of some of these narratives see Stilgoe (1983) and Thornton (1989).