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Richard Cowling Taylor: Founder of Appalachian coal geology

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ABSTRACT

Richard Cowling Taylor (1789–1851) was a British-born American geologist, generally specializing in the coal geology of the Pennsylvanian system and in the Triassic coals of Pennsylvania and Virginia. While he long clung to older, disproved age assignments and made some mistakes in structural geology, therefore missing coal-bearing synclines beyond the immediate study area, he did pioneer the use of cross sections of coal basins and made advancements in the uniform expression of geologic maps. His work in the western end of Pennsylvania's Southern Anthracite field, Broad Top coalfield, and the North-central coalfields and in Virginia's Richmond Basin provided valuable insights into the exploration and development of those areas in the 1830's and 1840's.

1. Introduction

Biographies of Richard Cowling Taylor have been published in the posthumous second edition of his book, *Statistics of coal* (Taylor, 1855; reprinted from Academy of Natural Sciences, 1851), and by Torrens (1999). While some background of Taylor's life and career is necessary, it is not the purpose here to extensively recount those details published by other authors. Rather, the objective of the present work is to discuss Taylor's contributions to Appalachian coal geology.

Richard Cowling Taylor (18 Jan 1789–26 Oct 1851) was born in Hinton, Suffolk, England. Taylor learned surveying and drafting from Edward Webb, Gloucestershire, who also taught William Smith, and later worked with Smith in surveys of the Bristol coal field and a harbor in South Wales in 1811. Torrens (1999) notes that Taylor may have left England because of the 1828 failure of the British Iron Company, which had already forced his cousin Philip Taylor into French exile, but also because of the property in Northampton County, Pennsylvania, that had been willed to his cousin Richard Taylor, a printer.

Upon coming to the US, his first assignment was to survey the path of a proposed railroad from Philipsburg, Centre County, to the Philadelphia Canal. In 1832, he conducted the surveys for the proposed Tioga Railroad in north central Pennsylvania (discussed below). After moving to Philadelphia in 1834, he met Isaac Lea, one of the principals of the Dauphin and Susquehanna Coal Co., and was given the task of exploring their 42,000-acre (17,000-hectare) property in the mountainous terrain of the southwestern Southern Anthracite Field. Torrens (1999) notes that Taylor travelled over 50,000 miles (80,000 km) in his US surveys from 1830 to 1849.

He was a founding member of the Geological Society of Pennsylvania and, in 1840, the Association of American Geologists and Naturalists, the forerunner of the American Association for the Advancement of Science (AAAS).[1] In the Academy of Natural Sciences (1851) obituary, it is noted that his extreme efforts in the completion of the first edition of *Statistics of Coal* in 1848 led to exhaustion and near-death illness, although his death in 1851 is said to have been after a sudden illness.

In this paper, a review of several of the Appalachian coalfields (Fig. 1) studied by Taylor is presented.

2. Broad Top coal field, Bedford County,[2] Pennsylvania

The Broad Top coal field, containing Pennsylvanian coals, occupies a syncline to the east of the main bituminous coal field of the Alleghany Plateau. Mining in the coal field apparently dates to shipments of coal for blacksmithing in the later 1770's, if not earlier, although the iron industry in the region relied on wood-derived charcoal until the forests were depleted in the late-1850's (Rainey and Kyper, 1982, p. 18-19). As a result of his survey of the coal field, he assigned the coals to:

> ". . . their true position among the grauwacke, or, as they are commonly denominated, the transition rocks; and in referring in all cases, from the Potomac to the Susquehanna, the boundary between the secondary coal field and the transition series

[1] By 1888, with the AAAS gradually de-emphasizing geology, the Geological Society of America grew from the Geology and Geography Section E of AAAS (Mirsky, 1988).

[2] At the time of Taylor's (1835a) investigation, Bedford County also included what is now Fulton County, to the east.

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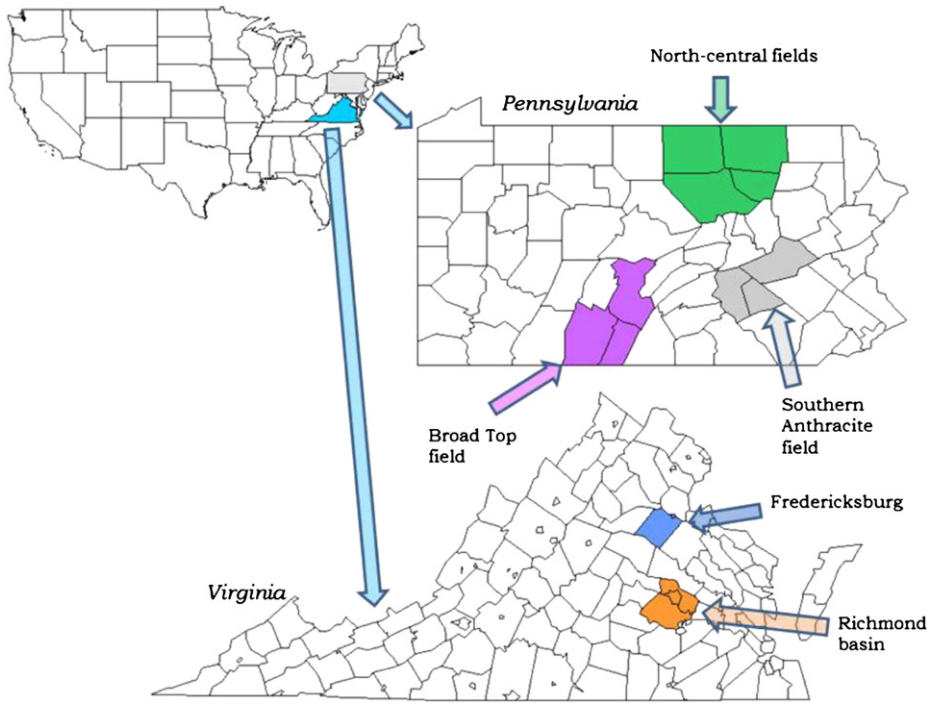

Fig. 1. Five coal-bearing regions in Pennsylvania and Virginia studied by Taylor. Key for counties and cities: North-central fields, Pennsylvania: counties clockwise from upper right: Bradford, Sullivan, Lycoming, Tioga; Southern Anthracite field, Pennsylvania: counties from left to right: Dauphin, Lebanon, Schuylkill; Broad Top field, Pennsylvania: counties clockwise from left: Bedford, Huntington, Fulton; Fredericksburg, Virginia: Spotsylvania County with the city of Fredericksburg on upper right side; and Richmond basin: counties from south: Chesterfield and Henrico, with the city of Richmond between the counties.

continuing to older beds, to the main range of the Alleghany mountains.

"In every part where I have examined this mountain from its base upwards, the order of superposition is so apparent, so constant, and so well defined, that it precludes all room for doubt. If there is one case in the entire system of North American rocks, distinguished from the rest by the absence of ambiguity, this is that one."

As a follower of Abraham Werner's (1749–1817) Neptunist theories, in this assignment of age he made a fundamental mistake, repeated in other coalfields, in confounding age with degree of deformation, a mistake to be repeated in his study of the Anthracite fields (to be discussed below). Taylor (1835a) noted that the coal rank was anthracite, an overstatement of the low volatile bituminous rank found in the coal field (Hower, 1978; Levine and Davis, 1984).

3. Richmond Basin, Virginia

Taylor (1835c) called the high volatile bituminous[3] coal in Richmond basin 'one of the most remarkable carboniferous deposits in the United States.' While not able to assign an age, he agreed with William Maclure (1763–1840) (1819, 1824) that formations were older than *[Devonian]* Old Red sandstone: ". . . I am inclined to refer its origin to an earlier epoch than coincides with that of the most ancient portions of the secondary carboniferous groupe *[sic]* of this country." Rogers (1842a, 1884) recognized the Triassic age of the sediments as early as the 1830's, a conclusion Taylor (1855) later acknowledged.

The Middle Carnian (Upper Triassic) sediments, including coals, unconformably overlie the 330+/−8 Ma Petersburg granite (Goodwin et al., 1985; Wright et al., 1975). Taylor (1835c) described the latter relationship in the River pit on the south side of the James River where the 20-foot (6.1-m) thick coal was 'nipped out' ('as on a larger scale an island rises above the waters of an ocean') by the granite.[4] In an attempt to resolve the irregular deposition of the coal, he ventured that the coal had been somewhat fluid and filled irregular spaces in the granite (he was similarly confounded by the nature of a solid bitumen associated with ophiolite-suite rocks at the Casualidad mine near Havana, Cuba, assuming that it was a bituminous coal (Taylor, 1836b; Taylor and Clemson, 1839). In part due to the unconformity, coal seam thicknesses vary considerably, for example from near-zero to 40-feet (12.2-m) thick in the Mill's pits (Taylor, 1835c). The maximum thickness of coal seam included 15 ft. (4.8 m) of partings (Goodwin et al., 1985).

Mining dated to 1750 at the latest, and was the first commercially mined coal in the American colonies (Eby and Campbell, 1944). Hibbard (1990) dates local use to the early 1700's. The Black Heath mine operated from 1788 to the 1860's (Goodwin et al., 1985; Wilkes, 1988). Taylor (1835c) noted that the 'Black Heath [coal] has long commanded the highest price in the market; being esteemed superior to the Nova Scotia coal.' But, he also notes that 'the mine has been on fire for some time,[5] causing a suspension of the works.' Apparently, this was just a temporary suspension of mining as Goodwin et al. (1985) note that, although the burning workings had been sealed off from the active works, a man door between the burning and the active works was opened in order to allow the fire to draw

[3] The rank designation is based in part on contemporary chemical analyses, but also on 1970's and later vitrinite maximum reflectance measurements; the rank nomenclature postdates Taylor in this case.

[4] As noted by Rogers (1842b) and Eby and Campbell (1944), there are instances of coal intruded by igneous rocks in the basin. The miner's name for the unconformable protrusions of the granite into the coal was *troubles* (Lyell, 1847).

[5] Perhaps 'more than a century', as noted by Grammer (1819), in the 'Heth [sic] pits.'