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Montana Gamma

University of Montana Western

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Origin, Distribution, and Early Exploitation of the Marcellus Shale Gas Play in New York and Pennsylvania

By **MATTHEW F. DIETERICH**

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Matthew F. Dieterich is a Robert W. Sledge Fellow for 2013-14.

Introduction

Hydrocarbons are trapped inside the Marcellus Shale Formation. Located in New York, Pennsylvania, West Virginia, and Ohio, the Marcellus Shale Formation, or gas play, contains an estimated 363 trillion cubic feet of recoverable natural gas (Esch, 2008). While scientists have been aware of the vast amounts of hydrocarbons located in the Marcellus Shale for decades, previous recovery technologies proved uneconomical until recently.

Through a combination of hydraulic fracturing and horizontal drilling technology, unconventional sources of natural gas, such as the Marcellus Shale, have been made economical. As a result, previously uneconomical natural gas reservoirs across the United States have been made available for exploration and production, and the Marcellus Shale gas play has developed into one of the greatest economic resources in the United States. Figure 1.0.1 shows the current shale gas plays located in the United States. Furthermore, due to the rapid pace of unconventional resource development across the United States, an increase in scientific research is required for responsible production.

4 MARCELLUS SHALE GAS PLAY

The origin, distribution, and early gas exploitation of the Marcellus Formation provide valuable insight into current and future hydrocarbon development in the Appalachian Basin. In this report, depositional history, formation characteristics and properties, and natural gas quantities of the Marcellus Shale are explored. By investigating the aforementioned topics, the review here sheds light onto the unique characteristics of the Marcellus Shale Formation.

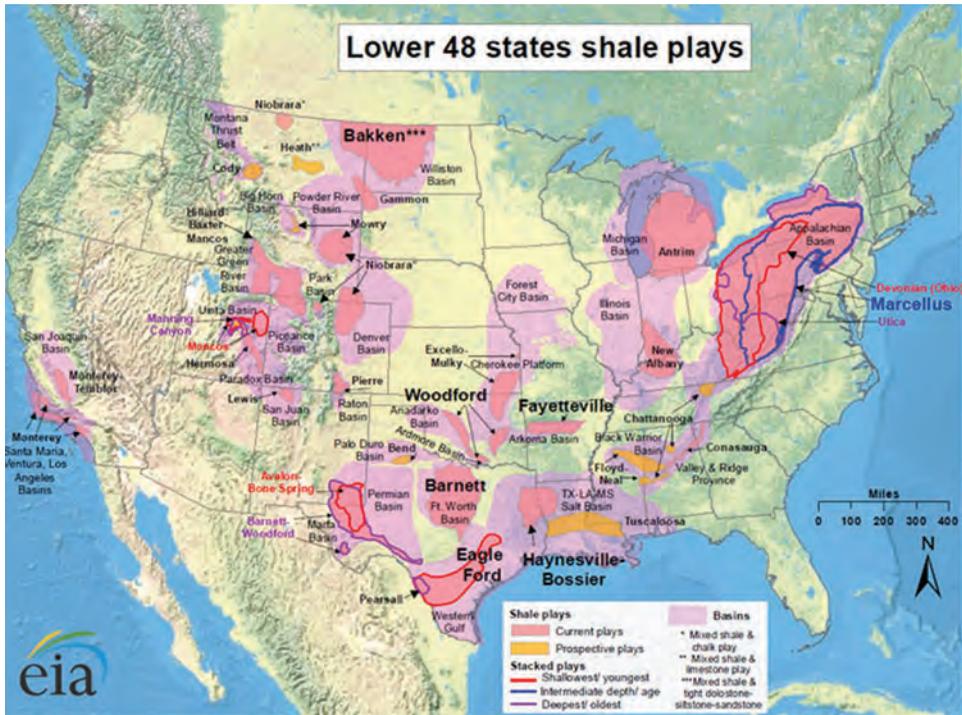


Figure 1.0.1: Shale gas plays located in the United States (Lower 48 States shale plays, 2011).

Background of the Marcellus Shale

Shale is a sedimentary rock that is formed when fine-grained, clay-like particles deposit in a low energy watery environment, and are subsequently compressed and turn into rock. Sediment, or loose particles, such as those in mud, silt, and clay, combines and compacts over time forming shale. The sediment comes from preexisting rock, or other earth material, and includes all solid particles derived by weathering, or minerals from solutions such as sea water containing chemical elements and minerals extracted from water (Monroe et al, 2007). Of particular interest throughout this report is the Marcellus Shale Formation, which is a sedimentary rock formation located beneath portions of Ohio, New York, Pennsylvania, and West Virginia.

The Marcellus Shale Formation underlies the majority of the Appalachian Basin region. Deposited during the Paleozoic Era, specifically the Devonian Period, the Marcellus Shale is approximately 390 million years old, and the formation acquired its name in 1839 from the city of Marcellus, NY, where it outcrops (appears at the surface).

During the Devonian Period in Earth's history, sediment accumulated at the bottom of shallow seas located in present day Appalachia and compacted over millions of years to form what is now the Marcellus Shale. The shallow sea that deposited the shale contained organisms, which mixed into the sediment. Over time, much of the organic matter trapped inside the shale compressed and was heated forming natural gas.

Origin of the Marcellus Shale

Prior to the assembling of the supercontinent of Pangaea during the late Permian Period 250 million years ago, Laurentia was a subcontinent and formed the ancient geological core of North America, known as the North America craton ("United Plates of America," 2012). Geologic factors sculpted the North American craton through plate tectonics and mass wasting. Between 700 and 400 million years ago, sediment deposition blanketed much of the North American craton. To this end, the North American craton was periodically flooded by shallow seas and, as a result, widespread layers of sediment were deposited. The Marcellus Shale was deposited during this time in the Devonian Period, approximately 400 million years ago. Figure 1.2.1 represents the distribution of landmasses, mountainous regions, shallow seas, and deep ocean basins during the early Devonian Period.

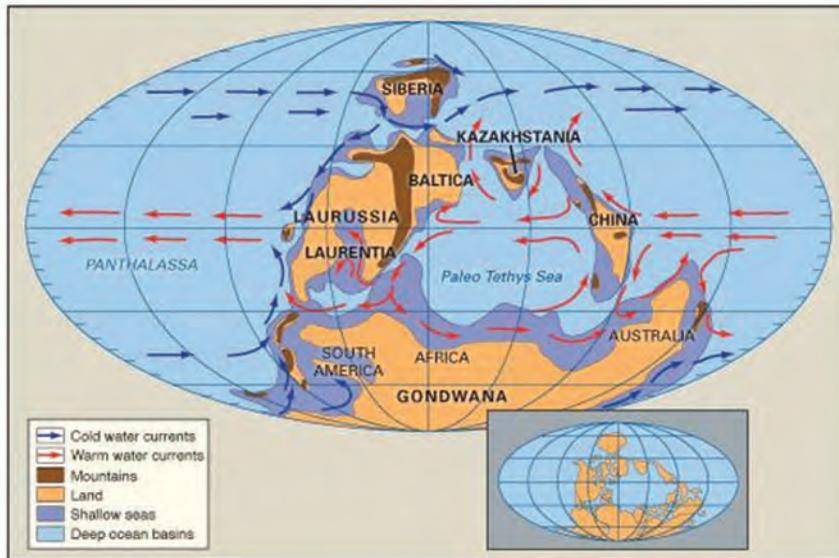


Figure 1.2.1: North America craton during early Devonian Period (Panthalassa, 2012).

In addition to Figure 1.2.1, Figure 1.2.2 and Figure 1.3.4 further illustrate the shallow sea locations that covered regions of the Appalachian Basin and allowed for Marcellus Shale deposition.



Figure 1.2.2: Paleogeography of Laurentia with shallow sea locations allowing for Marcellus Shale deposition (Blakey, 2009).

Geology of the Marcellus Shale

Marcellus Shale is classified as a dark shale; commonly known as black shale, or carbonaceous shale. Due to the high concentration of organic matter trapped in the sediment, Marcellus Shale appears darker than most shales. The Marcellus Shale is the lowest unit of the Devonian Period Hamilton Group (~417 to 355 million years ago). Due to fluctuating sea level during deposition of the Marcellus Shale, lighter shales and limestones interbedded among the black shales. Deep water, lacking oxygen for decomposition of organic matter, resulted in portions of the Marcellus Shale becoming black, while shallower conditions allowed for the development of limestone regions. Furthermore, due to the fine-grained particles and fine layering, or lamination, of sediment during deposition, the Marcellus Shale has low permeability. Briefly, the percentage of void space in a rock is known as the porosity, and permeability represents the ability of a trapped fluid to flow between void spaces in the rock (“The Marcellus Papers: Why the Geology Matters”, 2011). Figure 1.3.1 illustrates the stratigraphy of the Mississippian and Devonian.

The cyclic nature of sea level rising and falling throughout the Devonian Period caused low-lying continental regions to fill with water and form shallow seas. For example, what is now New York, Ohio, Pennsylvania, and West Virginia previously was home to a shallow sea (Figure 1.2.2). Rivers and streams carried sediment, such as clay and silts, which emptied into the basin. Figure 1.3.2 shows the depositional environment which created the Marcellus Formation and additional Hamilton Group members. Organisms living in the sea, such as algae and plankton, would die and fall to the basin floor and then mix with the sediment.

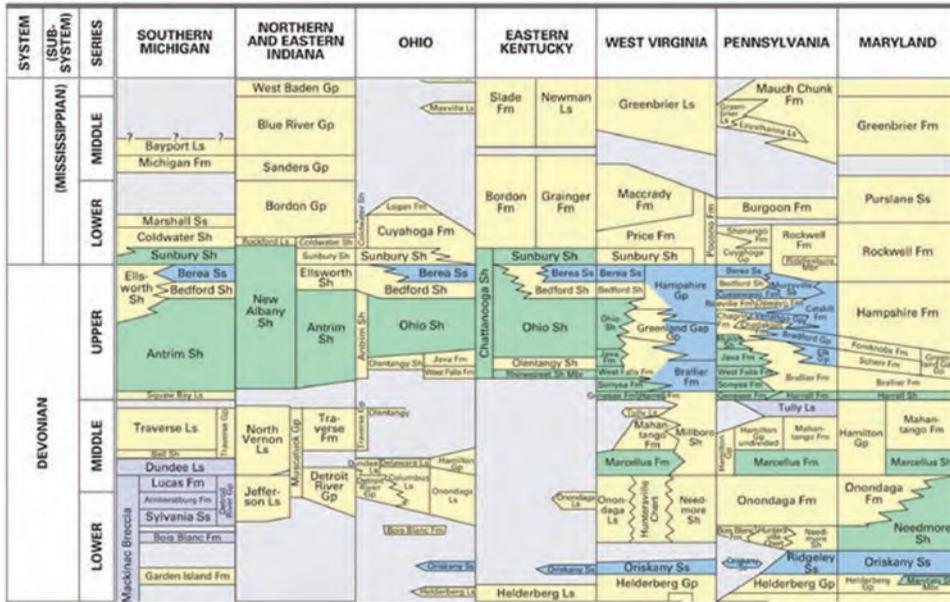


Figure 1.3.1: Stratigraphy of the Mississippian and Devonian (Wickstrom et. al., 2005).

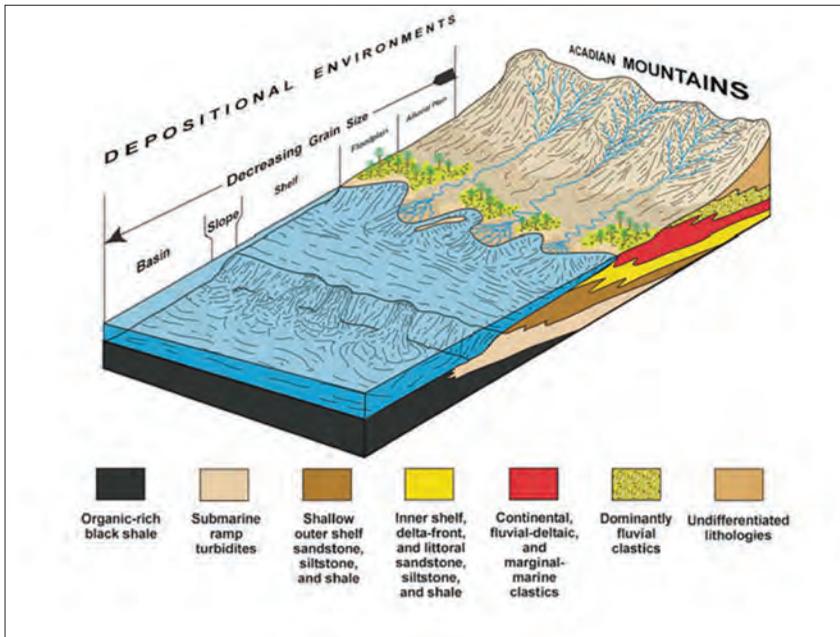


Figure 1.3.2: Depositional environment which created the Marcellus Shale (Harper et al., 2010).

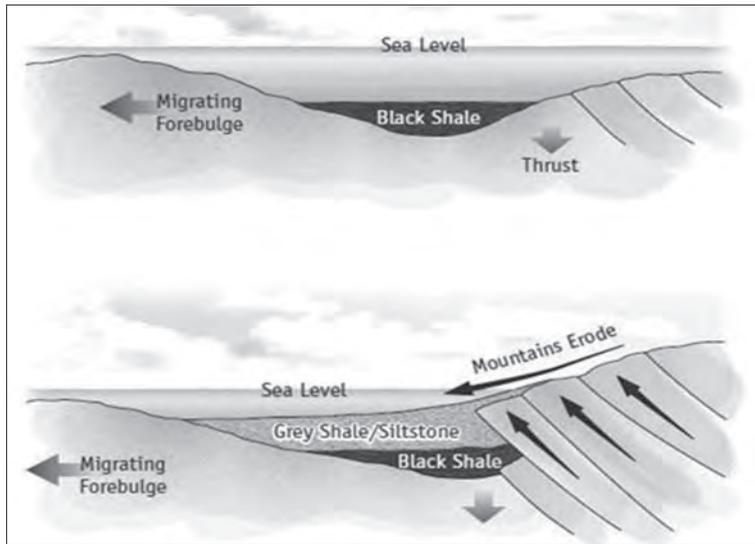


Figure 1.3.3: Marcellus Shale sediment deposition (Ettensohn, 1994).



Figure 1.3.4: illustrates the shallow seas which once covered the Appalachian Basin (“The Marcellus Papers: Introduction to the Marcellus Shale, 2011”).

At the bottom of the basin, low-oxygen content preserved organic matter from decomposition that normally would occur under oxygenated conditions. The anoxic environment and high organic content at the bottom of the sea allowed black shale to develop.

In Figure 1.3.3, a black shale is shown as the first to be deposited in the basin. Subsequently, a lighter shale is shown deposited on top of the black shale. As a result of higher oxygen content in shallower waters, organisms could readily decompose yielding the lighter

shale color prior to lithification. Note in Figure 1.3.3 the process of mountain weathering, erosion, and transportation carried sediment to the sea forming the shales.

During Marcellus Shale deposition, basin-bottom organisms such as clams, corals, and trilobites were not common in the basin. As a result, environmentally unsuitable conditions have been theorized to exist at the time of Marcellus Shale deposition due to sparse fossilized macroscopic organisms within the shale (“The Marcellus Papers: Why the Geology Matters”, 2011). In contrast, other stratigraphic layers of the Hamilton Group of which the Marcellus Shale is a member, show rich macro-fossil evidence. This evidence of sparse macro-fossil life during Marcellus deposition suggests the majority of organic matter in the shale came from small planktonic organisms.

Organisms such as trilobites and coral thrived in the oxygen-rich environment above the Marcellus Formation. Oxygenated waters allowed for decomposition and elimination of dead organisms in sediment above the Marcellus Shale, while the deep-sea depositional environment and low-oxygen-content regions promoted the preservation of planktonic organisms. Therefore, because the Marcellus Shale environments constrained decomposition, it is the major black shale member of the Hamilton Group with commercial natural gas potential.

Distribution of the Marcellus Shale Formation

The shallow sea, which deposited the Marcellus Shale and additional Devonian formations, deepened towards the southeast and resulted in a basin orientating towards the south. To illustrate, in upstate New York, outcrops are exposed due to the stratigraphic orientation of the rock layer, and southern Marcellus Shale beds are at depths that reach approximately 5,000 feet.

As seen in Figure 1.4.1, bed thickness ranges throughout the Marcellus Shale Formation from a few feet to over 350 feet (Hill et al., 2004). The Marcellus Shale thickness increases

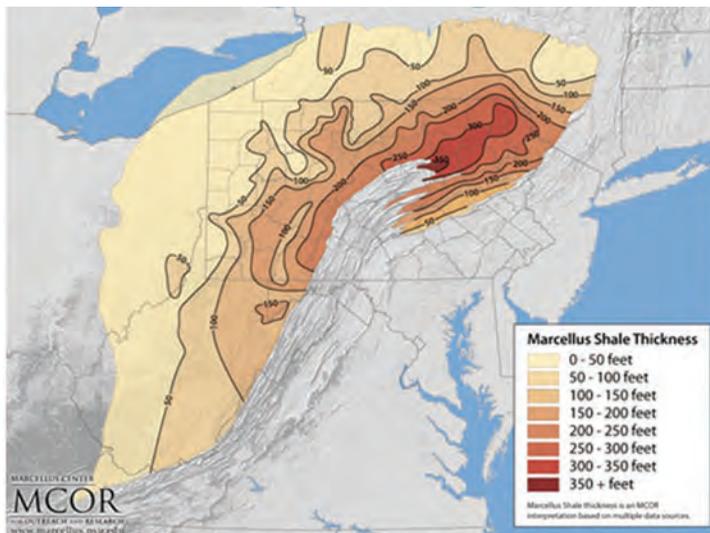


Figure 1.4.1: Marcellus Shale thickness (Penn State University, 2010).

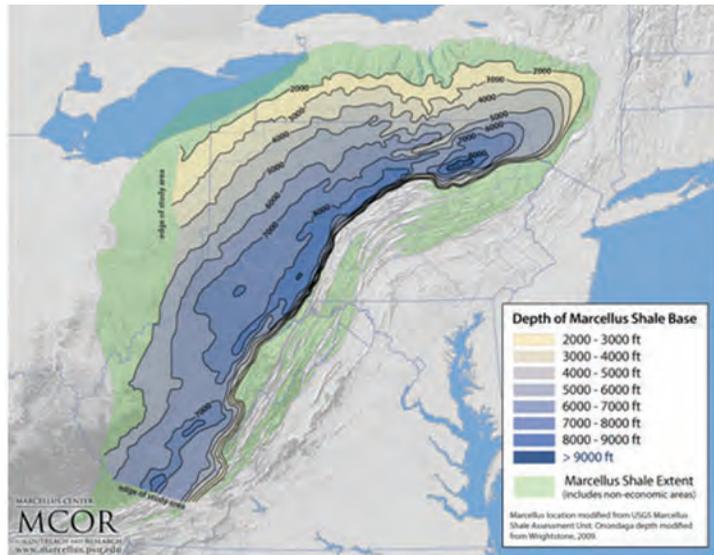


Figure 1.4.2: Depth to Marcellus base from Earth's surface (Penn State University, 2010).

towards the east as seen in Figure 1.4.1. Across the entire Appalachian Basin, depth to the Marcellus formation increases to over 9,000 feet, and the majority of the formation depth is more than 5,000 feet below the surface. Figure 1.4.2 illustrates the depth in feet to the Marcellus Shale. The formation spans 600 linear miles from New York to West Virginia and covers an aerial extent of 54,000 miles (Mayhood, 2008).

Porosity and Permeability

The Marcellus Shale, and shales in general, exhibits low permeability compared to other sedimentary rocks, such as sandstone, which may exhibit high porosity and permeability. These two rock properties are extremely important during hydrocarbon extraction; especially because the goal is to allow fluid flow from pore spaces and low pressure regions of the formation. For example, due to the fact that sandstones commonly have higher porosity and permeability than shales, fluids are able to flow in the direction of low pressure to create pools exploited with conventional hydrocarbon extraction techniques. On the contrary, fluids trapped in shale have their movement restricted and remain trapped proximal to their original pore space location. Therefore, unconventional methods for extraction such as horizontal drilling and hydraulic fracturing are required for hydrocarbon recovery. Figure 1.5.1 illustrates porosity and permeability in sandstone and shale. Note the significant difference in grain size between the shale and sandstone. Also note in Figure 1.5.1 the increased permeability of the fractured shale. The gas industry induces fractures in the Marcellus Shale via hydraulic fracturing to increase permeability of fluids. Figure 1.5.2 further illustrates the associated porosity and permeability between shale and sandstone. Shale is represented at the top with low permeability platy bedding, and sandstone is at the bottom with high permeability large grains cemented together.

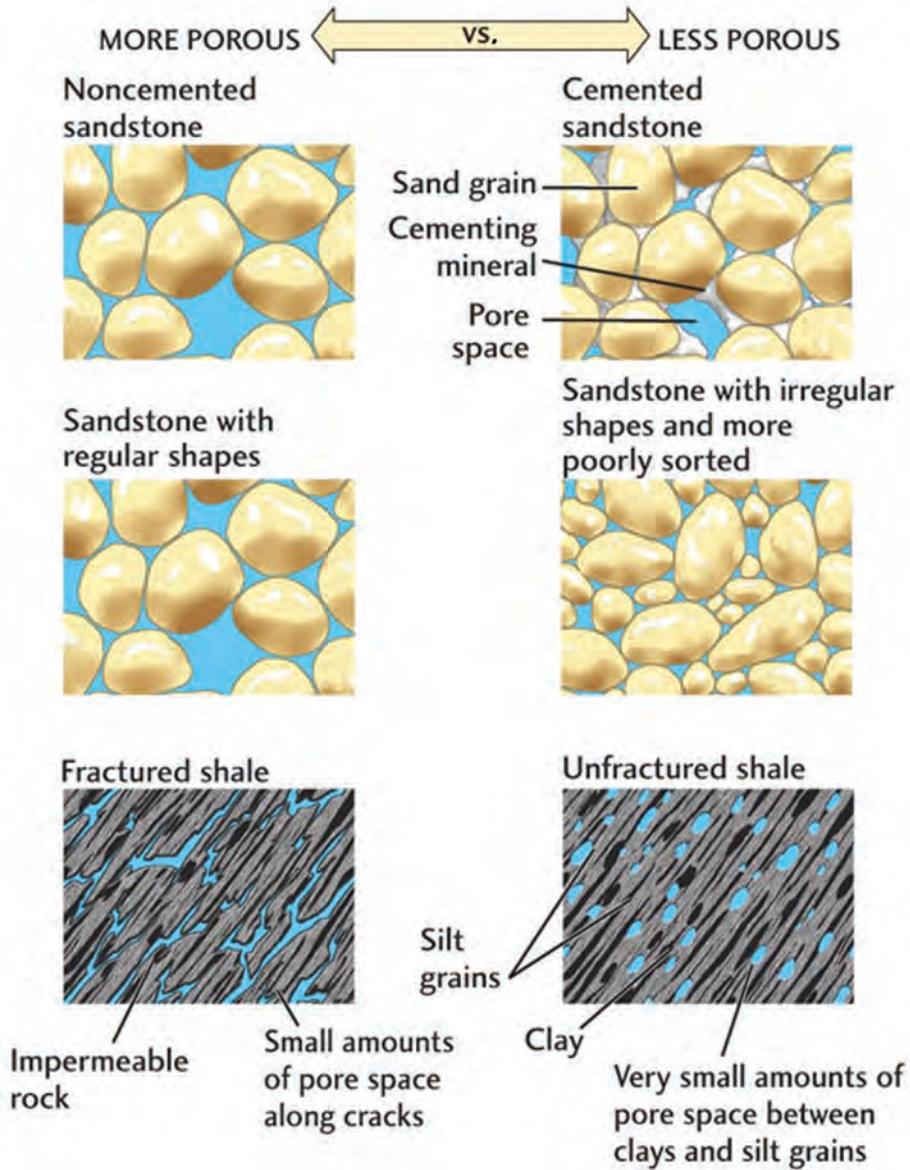


Figure 1.5.1: Understanding porosity of sandstone and shale (Schott, 2011).

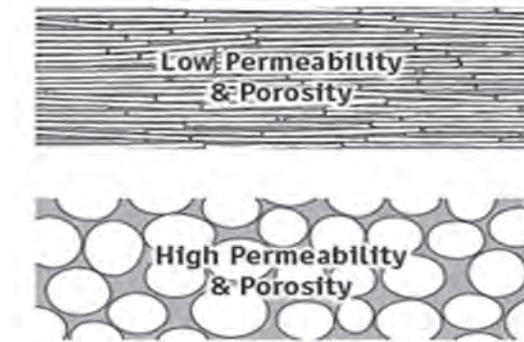


Figure 1.5.2: Visualizing grain sizes associated with permeability and porosity. Shale is depicted on top and sandstone on the bottom (“The Marcellus Papers: Why the Geology Matter”, 2011).

Shale has fine clay-size particles that are barely visible to the naked eye; while sandstone has larger visible particles, frequently of quartz. Furthermore, until shale is fractured, permeability is nearly nonexistent compared to sandstone, where natural void spaces are often connected throughout, and fluids can migrate to zones of lower pressure.

Marcellus Shale Properties

Several properties of the Marcellus Shale Formation change from east to west, and north to south. For example, the west side has a greater organic content, although it is shallower and thinner. The east side is deeper and thicker, containing higher quartz content, which increases brittleness of the shale. Northern regions of the Marcellus Shale are slightly geopressedured, while the southern portion is underpressured (Sumi, 2008, p. [3]).

The Marcellus Shale’s porosity ranges from 0–18 percent, and permeability is very low at values ranging from 0.2×10^{-8} to 5.5×10^{-8} miliDarcies (“The Marcellus Papers: Why the Geology Matters”, 2011). On the contrary, hydrocarbon-bearing sandstone commonly exhibits porosity ranging from 10–30+ percent (“Rock properties: Porosity and density”, 2010). In order to extract natural gas economically, permeability cannot decrease to below 10^{-9} miliDarcies. Therefore, due to the low permeability, the Marcellus Shale is classified as a “tight shale”; which requires unconventional drilling methods for production. Although the Marcellus Shale is classified as a “tight” shale, natural fractures are present in the formation, which provide increased regions of permeability for fluid migration. Such natural fractures, or joints, are significant to any successful hydrocarbon extraction. Moreover, to successfully extract quantities of natural gas, horizontal drilling methods are implemented to transect the natural vertical fractures in the shale.

Tectonic processes, in combination with heating and compaction, altered the Marcellus Formation to create fractures. Fractures in the Marcellus Shale were created as a result of continents shifting, earthquakes, volcanic activity, and the Alleghany Orogeny. Furthermore, pressure was generated in the fluids trapped within the Marcellus Shale during conversion of organic matter to hydrocarbons, which caused separation of the shale across vertical planes, also creating joints. Two jointing patterns exist in the Marcellus Shale known as J1 and J2. The J1 set runs east-northeast and is the most relevant to hydrocarbon extraction. The J2



Figure 1.6.1: Marcellus Shale jointing (Harper, J. A. & J. Kostelnik, 2010, [50]).

set runs north-northwest through the Marcellus Shale and has been filled in with minerals. As a result, the J2 set is typically not a pathway for natural gas flow (The Marcellus Papers: Jointing and Fracturing in the Marcellus Shale, 2011 p. [3]). Figure 1.6.1 illustrates jointing sets in an outcrop of the Marcellus Shale.

Formation of Natural Gas in the Marcellus Shale

Petroleum and natural gas are hydrocarbons; that is, they are composed dominantly of hydrogen, oxygen and carbon atoms (Monroe et. al., 2007, p. [219]). Hydrocarbons form when the remains of microorganisms, such as algae, settle on the seafloor where little oxygen is present, thus preventing decomposition. As additional sediment layers accumulate, they are pressurized, heated, and transformed into petroleum or natural gas. The quantity of natural gas present in the Marcellus Shale is determined by the amount of undecomposed organic matter, which is measured by the total organic carbon (TOC) present.

Natural gas forms via one of two mechanisms, either by biogenic or thermogenic transformation. Biogenic natural gas occurs at or near the earth's surface and is produced when microorganisms chemically transform organic matter into methane. Thermogenic transformation produces natural gas when organic material, located deep below the earth's surface, is exposed to high pressures and temperatures ("What is Natural Gas?", 2011).

The Marcellus Shale is its own source rock, meaning the natural gas formed in-situ, and did not migrate from a separate rock layer into the Marcellus Formation. Natural gas molecules adsorbed onto the organic matrix of the Marcellus Shale and may desorb from the matrix and migrate into natural fractures (Harper, 2008, p. [9-10]).

Early Natural Gas Extraction in Appalachian Basin Shale

Fredonia, New York was home to the first well drilled targeting Devonian shale gas, or natural gas, in the United States in 1821. Citizens of Fredonia noticed bubbles seeping up from the Canadaway Creek bed, and shortly thereafter, William Hart dug the first well to capture the gas (“Natural Gas in History”, 2012). The first Fredonia well was only 27 feet deep and produced enough natural gas to illuminate a lamp equivalent of two candles (Harper et al., 2010). In 1850, the well depth was increased to approximately 70 feet and produced enough gas to fuel 200 burners. To capture additional natural gas, in 1858 a second well was drilled to over 200 feet and provided enough gas to last 35 years (Harper, 2008, p. [2]). From the first wells drilled in Fredonia, NY during the 1800’s, a surge in gas exploration began along the Lake Erie shoreline.

Later 19th century wells were drilled to a depth of 1,000 feet or less and many wells could produce gas as shallow as 30 feet. By the 1930’s, oil and gas companies were extracting significant quantities of natural gas from the Lower Devonian Oriskany Sandstone in New York and Pennsylvania. During the drilling for Oriskany Sandstone hydrocarbons, wells had to penetrate through the Marcellus Shale, located a few tens to hundreds of feet above the Oriskany formation (See Figure 1.3.1). Upon passing through the Marcellus Shale, companies frequently had to shut down for multiple days due to strong flows of natural gas. At that time, the Marcellus intrigued the drilling industry, until it became clear that the gas flow could not be sustained, as gas flow quantities quickly diminished once the initial surge ended. Therefore, the industry as a whole began to ignore the natural gas located in the Marcellus Shale because production amounts could not be sustained with conventional vertical well technology.

Shortly after the United States energy crisis of 1973, energy shortages and increased natural gas prices led the U.S. Department of Energy to fund a multistate cooperative program called the Eastern Gas Shales Project (EGSP) that spanned the Appalachian, Illinois, and Michigan basins (Harper, 2008, p. [3]). EGSP had two purposes, first was to determine the extent, thickness, structural complexity, and stratigraphic equivalence of all Devonian organic-rich shales throughout the basin; and second, to develop and implement new drilling, stimulation, and recovery technologies to increase production potentials. Upon completion of the EGSP, it became clear the Marcellus Shale contained large quantities of natural gas. As of the last 10 years, advances in drilling technology have allowed for the recovery of hydrocarbons trapped in shale gas reservoirs (Figure 1.0.1) such as the Marcellus Shale.

Quantity of Natural Gas in the Marcellus

Terry Engelder, Ph.D., professor of Geosciences at The Pennsylvania State University, calculated the quantity of Marcellus Shale natural gas in the Appalachian Basin. Using a tier system based on geology and production data, Engelder ranked the 117 natural gas bearing counties in five states across the Appalachian Basin. He implemented a six-tier ranking system in combination with the power-law rate decline from Chesapeake production data to calculate a 50 percent probability that the Marcellus will ultimately yield 489 trillion cubic feet of natural gas (Engelder, 2009). According to Engelder, at present consumption rates in the United States, the Marcellus Shale alone can meet the country’s natural gas demands for more than 20 years.

Summary

The Marcellus Shale gas play contains unique characteristics such as natural jointing, high organic content and significant formation thickness, which provides the gas industry with a major hydrocarbon reservoir. Through the industry's utilization of hydraulic fracturing and horizontal drilling, the Marcellus Formation has rapidly developed into one of the largest producing unconventional gas plays in the United States. During the last 50 years, advances in drilling and recovery technology have allowed deep geologic formations, such as the Marcellus Shale, to produce economical quantities of hydrocarbons. This trend in exploitation of previously uneconomical hydrocarbon bearing formations will undoubtedly continue. Ultimately, the Marcellus Formation has the potential to play a vital role in shale gas reservoir development across the United States through increased geologic knowledge and advanced drilling technologies.

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Incidents in the Life of a Slave Girl: A Window into North Carolina Slave Experiences

By **AMY SNYDER**

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Amy Snyder is an H. Y. Benedict Fellow for 2013-14.

Incidents in the Life of a Slave Girl is both one of the great abolitionist works and a key record in North Carolina slave women's history. In some ways, the narrator, Linda Brent, is very different from most North Carolina slave women; in others, she is very similar. In both cases, *Incidents* offers entry-points of investigation into slave experiences, especially into the situation of the town slave and the domestic slave, into the female sphere, into master/mistress/slave relations, into slave literacy, and into the situation of the runaway.

Incidents in the Life of a Slave Girl is an autobiographical narrative of the life of "Linda Brent." (For purposes of clarity, when speaking specifically of the narrator of *Incidents*, I will use the term "narrator." Otherwise, I will use "Harriet Jacobs.") The narrative follows her life from a happy childhood, to unhappy adolescence, to motherhood, to flight, to seven years in hiding, and finally to flight for freedom in the North. Jacobs' narrator comments regarding childhood, "I was born a slave, but I never knew it till six years of happy childhood had passed away" (Jacobs 9). Her first mistress taught her "to read and spell," a "privilege" that she recognizes as rare (Jacobs 11). Following the deaths of her parents and her mistress, the narrator finds herself the de facto property of Dr. Flint, who eventually begins the sexual

advances that Jacobs' narrator calls "[the] war of [her] life" when Jacobs is fifteen (Jacobs 19). His wife, though jealous enough to stalk the young woman, offers no practical protection. After warning off a freeman whom she loves, the narrator makes the conscious decision to give herself to a free white man, Mr. Sands, in the hopes that Dr. Flint will retaliate by selling her. He does not. She bears two children by Mr. Sands, a son and daughter, throughout this portion of the narrative mourning her loss of virtue. The addition of the children adds a new dimension to her danger, as she now has to protect them. When Dr. Flint sends her and her children to his plantation, she finally makes a run for freedom. After receiving some aid from fellow slave women and from a white slaveholding woman, she hides herself in the garret of her grandmother's house for seven years. At the end of those seven, circumstances force her to run for the north on a ship, and she succeeds. Once in the north, she attaches herself to a Mrs. Bruce, who eventually buys her freedom from Dr. Flint's son-in-law.

Jacobs' life situation as a domestic servant in town is, in itself, a bit unusual. During the pre-1850 antebellum period of the narrative, most North Carolina slaves, men and women, labored on farms or plantations (Jewett and Allen 194). David R. Goldfield, in an examination of the situation of free and enslaved blacks in southern cities, states that "only one out of ten slaves lived in cities" and that most of those were domestic slaves (126-127). The North Carolina

It is the threat of losing
this position as a town slave
and being sent permanently
to the plantation that catalyzes
the narrator's break
for freedom.

WPA Slave Narratives do include some former town slaves. Mary Anngady of Orange County recalled that she had never lived on a farm or plantation, living instead with her master and mistress in Chapel Hill, North Carolina (*Slave Narratives: North Carolina* 1.13, 34). Another former slave, John H. Jackson of Wilmington, recalled living in town. His mother was "laund'ess for the white folks," and

his wealthy owners forbid the slave children from playing with "free issue chil'en or the common chil'en" when they played in the yard (*Slave Narratives: North Carolina* 2.14 3). However, most of the ex-slaves interviewed in the North Carolina WPA Narratives lived on farms or plantations.

It is the threat of losing this position as a town slave and being sent permanently to the plantation that catalyzes the narrator's break for freedom. According to Eugene Genovese, house slaves often preferred fieldwork to domestic work, an assertion that casts Brent's fear of the plantation in an odd light (331). Leslie Howard Owens's study of slave life, written about the same time, also suggests that domestics being sent to the fields were often brought back to the house, and that "some domestics regularly doubled as field hands" (113). However, the testimony of one former slave, William Wells Brown, sheds some light on why Jacobs'

narrator might so adamantly object to the plantation. Brown, like Jacobs' narrator, was a town slave sent out to the plantation, and he commented on the occasion, "As I had been some time out of the field, and was not accustomed to work in the burning sun, it was very hard" (Goldfield 139). Although Jacobs' narrator works as a domestic on the plantation, she loses the few freedoms and protections that town offered. Her children suffer as well, especially her young daughter, who suddenly finds herself "with no one to look after her" (Jacobs 71). While slaves on the plantation may not have minded being sent back and forth between house and field, for slaves accustomed to town life, the change seems to have had a much greater potential for hardship, underscoring the difficulties of generalizing the slave experience. The narrator herself claims that living in the town offered her some protection from Dr. Flint's advances, since he needed to maintain a good reputation, and Jennie Miller suggests that house-slaves in general may have had less exposure to the outright violence of field slavery, a point that further illuminates the narrator's desire for her children to stay in town ("Harriet Jacobs and the 'Double Burden' of American Slavery").

As mentioned above, slaves in town potentially had more freedom, depending on the duties assigned by the master (Goldfield 124, 128). Although Jacobs' herself does not detail her duties, domestic slaves in town might find themselves delivering messages or shopping for food, stepping for a little out from under their master's gaze (Goldfield 128). John H. Johnson recalled "tot[ing] water for the fam'ly to drink" (*Slave Narratives: North Carolina* 2.14 5). Jacobs' narrator comments that it was "in the street" that Mr. Sands, the white father of her children, "often spoke to" her, suggesting another opportunity that town life gave to a slave (46). Duties that carried the domestic out of the house might also give her the chance to meet and associate with people whom, normally, she would not meet on a daily basis. Occasionally, as in the case of former slave Hannah Plummer, a slave family might actually have a house in town separate from their masters, even if the parents belonged to separate masters (*Slave Narratives: North Carolina* 2.14 178).

The narrator's relationship with her grandmother offers a glimpse into the women's sphere of slave society as the narrator's grandmother fills the role of protector and caretaker. According to Genovese, black men did step in to protect their women, and the potential for the man's retaliation could make the white male aggressor cautious in his pursuit (484-485). Instead of a male protector, however, the orphaned narrator has her formidable grandmother, whom she describes as a deterrent to Dr. Flint raping her outright, since if her grandmother found out, she would destroy Dr. Flint's reputation (Jacobs 27). Her grandmother's formidable personality suggests some elements of the "Mammy" image as discussed by Genovese, a powerful black slave woman who commands some white respect. Her grandmother's role in her former mistress's household had been "officiating in all capacities, from cook and wet nurse to seamstress" (Jacobs 9). Her grandmother's excellent reputation in the town leads to her personal freedom, although it does not protect her from her children being sold away from her. Her grandmother also functions as a moral standard. One of the most painful moments in the narrative occurs when the narrator admits to her grandmother that she is pregnant out of wedlock, and her grandmother temporarily disowns her. Later, once the narrator has gone into hiding, her grandmother becomes her children's caretaker, as well as the guardian of her hiding place. Similarly, former slave Clara Cotton McCoy of Orange County recalled being raised by her grandmother after her mother's literal death (*Slave Narratives: North Carolina* 2.14 65). Deborah Gray White also discusses the role of older women in slave communities,

commenting, “Old women...were in a class apart. By virtue of their greater experience, wisdom, and number of children, old women commanded the respect of the young,” (115) and the narrator’s grandmother demonstrates that role.

The narrative also reveals two polar-opposite pictures of the white mistress and master. Jacobs begins the account with her early life and her kindly first mistress. Her descriptions of more play and little hard labor, and of loving her mistress, find parallels in the historical record. Former slave Melissa Williamson recalled being raised by her mistress after her mother died when she was very young (*Slave Narratives: North Carolina* 2.14 411). Scholars suggest that the young slaves usually had little hard labor, even on plantations, with doting masters and mistresses (White 94; Genovese 512). In the North Carolina WPA Narratives, several former slaves also reference this. Mary Anderson, who belonged to a large slaveholder in Wake County, described the master making certain that the “little colored children” were healthy and well-fed (*Slave Narratives: North Carolina* 1.13 21-22). Ida Adkins recalled her master giving presents to the slave children, and later, when the “Yankees” came through, she saved his and the mistress’s lives (*Slave Narratives: North Carolina* 1.13 9-12). Lucy Ann Dunn, also of Wake County, described her duties as a young house-girl, saying, “I fanned flies offen de table an’ done a heap of little things fer Mis’ Betsy, Marse Peterson’s wife” (*Slave Narratives: North Carolina* I.13 279).

Brent is curiously quiet about her duties as a child, teenage, and adult domestic slave, perhaps because most of them had little bearing on her indictment of slavery.

Henrietta McCullers, in describing a good mistress, comments that her mistress allowed her slaves to have “co’n shuckin’” and “candy pullin’s an’ sich” (*Slave Narratives: North Carolina* 2.14 73). Although Viney Baker of Durham County recounted her master whipping the children, the general consensus of the North Carolina WPA Narratives seems

to be that most masters and mistresses treated their youngest slaves tolerably well. (*Slave Narratives: North Carolina* 1.13 71). In this light, the narrator’s assertion that her early life hardly seemed like slavery seems not only a plausible but likely occurrence. It should be noted, however, that many of the former slaves interviewed in the WPA Narratives still lived near their former masters and may have presented their masters/mistresses in a more positive light to avoid recriminations.

Brent is curiously quiet about her duties as a child, teenage, and adult domestic slave, perhaps because most of them had little bearing on her indictment of slavery. Elizabeth Fox-Genovese describes the usual duties of a child as caring for young children, light cleaning and serving, and generally serving the mistress. They might also sleep in the room of their master or mistress to be at their beck and call and to make fires in the morning (152-3). Former slave

Jacobs Manson recalled having to scratch his master's head until he went to sleep (*Slave Narratives: North Carolina* 2.14 97). Such slave children could, for all practical purposes, be raised for domestic services (Fox-Genovese 152-153). Jacobs' narrator does mention the practice of slave children sleeping in the same room as the master, though in her case, Dr. Flint

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attempts to arrange the situation for his sexual purposes. Ex-slave Betty Cofer's account confirms Fox-Genovese's accounts of the duties of adult female domestics. They included all things food-related, from the kitchen to the smokehouse to the garden. They took care of all sorts of cleaning and household production, including cloth production and general sewing (*Slave Narratives: North Carolina* 1.13 165-

175; Fox-Genovese 137-138). A New Orleans sale flyer from 1835 also mentions female domestics working as a "ladies' maid" (White "Female Slaves" 116, fig. 100).

Jacobs' narrative centers on the risks that Genovese and Fox-Genovese discuss, of working in the house with a bad mistress, namely the constant close contact with the master and mistress that allowed them to see and punish the smallest things (Fox-Genovese 165; Genovese 333-337). Jacobs' narrator encounters this risk most acutely when Dr. Flint develops a sexual interest in her, and when his wife, the opposite sort of mistress to the narrator's first, takes to stalking Brent out of jealousy. The narrator finds herself completely unable to escape the constant pressure. Dr. Flint's methods as described by Jacobs correspond with Genovese's description of planters and overseers who tended to focus on "attractive single girls...using a combination of flattery, bribes, and the ever-present threat of force" (Genovese 422-423). Former slave Willie McCullough recalled that the young slave women preferred by the master often "were given special privileges," including better living quarters and less work (*Slave Narratives: North Carolina* 2. 14 78). Dr. Flint employs all of these methods at different times and in varying degrees, from the time Brent turns fifteen to her first flight. Although Genovese also suggests that outright rape was probably not as common as usually believed (422-423), Miller disagrees, commenting, "More often than not, the master or white man who instigated sexual activity with a slave woman succeeded in violating her completely" (34-35). Victoria E. Bynum recounts one such case, an Orange County slave woman raped and impregnated by each of her master's sons (17-18). Bynum also recounts the case of Lucy Parham of Granville County, who gave birth to her master's child at age fourteen, younger even than Brent (37). Fox-Genovese considers it unlikely that Jacobs "actually eluded her master's sexual advances" (392), a potential divergence between the narrator and the author. (Male domestics could also experience some of the awkwardness of close proximity as in

the case of former slave Henry Bruce. As a young boy, his “unclad mistress” called him into “her bedroom merely to pour additional water for a bath” in Owens 115).

Jacobs pays particular attention to Mrs. Flint’s reaction to her husband’s infidelity, commenting that “[s]laveholders’ wives feel as other women would under similar circumstances” (Jacobs 30). Mrs. Flint dedicates great time and energy to discover whether or not the narrator or Dr. Flint is the true culprit. She aids the narrator on one occasion, but for the most part does very little, eliciting the comment that the “mistress, who ought to protect the helpless victim, has no feelings towards her but those of jealousy and rage” (27), indicating a belief that the mistress should have done more. Former slave Willie McCullough commented that the master’s favorites sometimes “broke up families by getting the marster so enmeshed in their net that his wife, perhaps an older woman, was greatly neglected,” placing some of the blame, as Mrs. Flint does, on the slave girl. (*Slave Narratives: North Carolina* 2. 14 78). Practically speaking, there seems to be little the mistress could do. Bynum, in considering divorce cases, concludes that “[t]he extremely harsh nature of abuses cited by divorce petitioners makes it clear that women viewed the dissolution of marriage as a last resort” (76). Loren Schweningen agrees, commenting that in North Carolina, women typically only sought divorce after a combination of abuse and infidelity (138). As women could only obtain a divorce or separation by special act of the North Carolina Grand Assembly, it was hardly a practical measure (129). Schweningen also comments on the beliefs of the time, specifically that most women believed they ought to obey their husbands, and most men believed they ought to have total control over their wives (136-7). Even so, husbands did well to exercise discretion (Bynum 36, 96-7). Despite the relatively little Mrs. Flint could do about her husband’s infidelity, according to the narrator, his standing as a doctor required prudence and “some outward show of decency” (Jacobs 27). That Mr. Sands finds out about Dr. Flint’s advances anyway testifies to Schweningen’s comment that in the towns and on the plantations, keeping illicit sexual activities secret was difficult (142), but the master might even have more than his reputation to worry about. Former slave Jacob Manson recalled a mistress actually shooting her husband dead after they fought over his “sweetheart” (*Slave Narratives: North Carolina* 2.14 97-96).

Jacobs’ literacy, and her narrator’s, in and of itself, is not as unusual as commonly believed. The speakers of the North Carolina WPA Narratives (including Louisa Adams, Jane Arrington, Charity Austin, and Lizzie Barrington in Part 1, Vol. 13. Also Jane Lassiter, Chana Littlejohn, and Parker Poole in Part 2, Vol. 14) comment consistently on their masters’ not wanting them to learn to read and write, or even to touch a book, but Janet Duitsman Cornelius suggests that fairly large numbers of determined slaves did learn to read even after the anti-slave-literacy laws were put into effect (63). Genovese comments that since the laws against slave literacy were practically unenforceable, some white slaveholders, especially children, did teach select slaves to read and write (563). Former slaves Jane Arrington and Reverend Squire Dowd agree that it was the children, not the adults who taught slaves, usually their playmates, to read (*Slave Narratives: North Carolina* 1.13 48 and 263-269). Former slave Chana Littlejohn of Warren County recalled an older slave woman, who had learned from one of the white children, keeping other slaves informed about the Civil War’s progress (*Slave Narratives: North Carolina* 2.14 57-58). Cornelius also cites the example of Charity Jones, whose mistress “taught her to read and write as part of her instruction in house management,” and Reverend Squire Dowd, whose mistress taught the slaves in Sunday

school (76-77). Jacobs' narrator is taught to read as a child by her kindly mistress, though she teaches herself to write (11, 28). Genovese also suggests that black efforts played a much larger role in slave literacy than white efforts (563), and, according to Cornelius' study, being able to read the Bible was an important motivation to learn to read (73). Jacobs demonstrates both of these when she teaches an old black man to read the Bible (61).

Jacobs' literacy goes beyond simply reading and writing, however. She displays an excellent command of standard written English, in vocabulary and grammar, largely lacking the dialect found in the North Carolina WPA Narratives, although she occasionally places "slave dialect" into the mouth of one enslaved character. She differentiates the dialect via a phonetic spelling that resembles some of the "dialect" found in the WPA Narratives. Fox-Genovese suggests that slave children in the house could pick up white manners and language, perhaps contributing to Jacobs' lack of "dialect" (155). John Hope Franklin and Loren Schweninger, in discussing the

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trends of characteristics in runaway slaves point out that most "runaways were generally articulate and well-spoken, which could give them an advantage in running away (225), and Jacobs would clearly have been one of those articulate runaways. Jacobs' use of standard written English probably made her text more accessible

to Northern readers than a text written with more phonetic, oral English. Beyond even her excellent command of standard written English, however, Jacobs portrays slavery as "a crime against woman's essential nature—her natural yearning for virtue, domesticity, and motherhood" (Fox-Genovese 375-6). According to Fox-Genovese, Jacobs grounds this portrayal in the Northern, not Southern, ideal of "true womanhood." Fox-Genovese considers the narrative's structure around the Northern ideal as a "crafted representation" in which the precise "facts," factual or not, are less the point than the overall message of the degradation that slavery was to black women (392). Jennifer Rae Greeson comments also on the parallels between *Incidents* and the urban Gothic fiction of the North, suggesting that Jacobs used the structures of the urban Gothic to make her story more accessible to and compelling for her Northern audience (277-309). Jacobs was not merely literate in the sense of reading and writing, she was apparently well read enough to employ Northern literary ideals and norms in her narrative.

Fox-Genovese comments, "Harriet Jacobs was as exceptional in the fact of her flight as in her account of it" (394). At most 20% of slave runaways were women (White "Ar'n't" 70, Genovese 648), perhaps because most women of an age to run had children who needed them (Genovese 649), a point which Jacobs' narrator makes again and again, even though she does run. Franklin and Schweninger set the percentage of female runaways in North Carolina, from 1838 to 1860 at 14% (211). That Jacobs' narrator, a mother of two, ran for

freedom at all sets her apart from most of her fellow slave women. However, in other ways, Jacobs' narrator does fit scholars' finds on runaway trends. Franklin and Schweninger's study indicates that from 1838-1860, 68% of women runaways were in their "teens and twenties" (212); Jacobs was twenty-nine. According to Genovese, most runaways ran in response to a particular threat (649). For Jacobs' narrator, that threat is her children being "broken in" on the plantation (Miller 37); she recognizes that if she leaves, Dr. Flint may sell her children out of spite, giving their father a chance to purchase them. Jacobs and Genovese agree on the terrors of the swamps (Jacobs 71; Genovese 650-51). Genovese also comments that runaways received most of their "assistance from other slaves, free Negroes, and black abolitionists" (654). Jacobs' narrator receives help from her grandmother and from fellow slave women. Genovese suggests, however, that runaways might receive help elsewhere when their masters were known for cruelty (654). Jacobs' narrator does receive help from one white slaveholding woman, perhaps accounted for by the general knowledge of Dr. Flint's attempts to seduce her. William Henry Singleton, a former slave from Craven County, North Carolina, offers another extraordinary childhood runaway story; as a seven year old, he fled his new mistress in Atlanta and made his way all the way back to Craven County, North Carolina, sharing with Jacobs' narrator the aid of a white woman (36). As mentioned earlier, Jacobs clearly demonstrates the command of language that Cornelius mentions. Cornelius also lists other characteristics of most runaways, including resourcefulness, determination, and intelligence, all of which Jacobs' narrator demonstrates time and again.

One of the key conflicts present in *Incidents* is the narrator's anguish over her children. Slave women who ran sometimes did leave their children behind. Cornelius mentions two slave women, Eliza and Lucretia who each had to leave behind two children when they ran (71-72). White tells the story of Louisa Bell of Virginia, who chose to leave her children and was "consumed by thoughts of her children," especially her six-year-old son, to the end of her days ("Female" 107). The slave women's community could enable a mother to trust in her children's physical care, at least, since even if children did not have a female relative nearby, as Jacobs' narrator's children do, other women would undertake their care (White "Female" 106, 115). Even so, many women runaways chose to take their children with them, causing one Underground Railroad leader, William Still, to comment that "Females... undertook three times the risk of failure that males are liable to" (White "Female" 106).

Jacobs' narrator's success in escaping to the North sets her apart from most female runaways. According to White, female runaways tended more toward temporary truancy than to running north, ("Female" 107) as when Hannah Plummer's mother hid in the woods for three weeks after a particularly bad beating (*Slave Narratives: North Carolina* 2. 14 180). Most of the runaway accounts in the North Carolina WPA Narratives also end in the runaway being caught, as in the case of Lizzie Baker's father and Alice Baugh's cousin. Baker's father "run away so bad dey sold him several times" *Slave Narratives: North Carolina* 1.13 68). Her father's running away, "livin' in de woods," sounds more like truancy than an attempt to run north. Baugh's cousin's master caught him with bloodhounds and sold him once he was healed from his beating. Baugh also describes a group of "Issue Frees," free blacks and runaway slaves who made a home for themselves in the woods and actually raised families there (*Slave Narratives: North Carolina* 1.13 84-85). Interestingly, Frank Freeman recounts the story of his father, a successful runaway who actually returns to the plantation. After a beating from his "young master," he escaped to Johnson County, living as a free man for four

years. When he returned, his “Old Marster” simply sent him to the fields (Slave Narratives: North Carolina 1.13 321-2). Laura Sorrell recalled her mother’s escape story, of running not North, but to another county and working for another white man (*Slave Narratives: North Carolina* 2.14 296). Incredible as the escapes of Singleton and Jacobs’ narrator are, the WPA narratives, and scholarly opinion, contend that the experience of the “average” runaway was rather different.

In concluding her reading of *Incidents*, Fox-Genovese states that

“...Jacobs herself emphasizes the exceptional over the typical in her self-representation. She endows herself with a special pedigree of physical, mental, and moral comeliness. She distinguishes herself from the other slaves among whom she lived, especially in her capacity to rise above her condition” (394).

Jacobs certainly was extraordinary, but her narrative is more than merely the story of a remarkable woman. Sometimes agreeing, sometimes disagreeing with scholarly generalizations, *Incidents in the Life of a Slave Girl* works in tandem with such sources as the WPA Narratives to provide readers and scholars with another window into the varied antebellum slave experiences.

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Pain au Chocolat

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The grass was irritating the sensitive skin on her bottom, so she slid onto the shawl beside her. She continued to talk to the two men confidently, more confidently than she would have been able to had she been wearing clothes. The weight of those petticoats, skirts, and hats on top of all the social rules constricted her. But to hell with sashes and societal conventions, she thought. If I want to picnic in the buff, I'll do it—and I'll do it proudly.

Looking again at the canvas, Chloé couldn't help but imagine what the woman must be thinking. Neither the woman's face nor her body was especially stunning, yet her self-assured expression and posture made her one of the most beautiful women Chloé had ever laid eyes on. More of Edouard Manet's paintings surrounded her, on the gallery walls, inviting other people to understand their beauty. His brush strokes, figure compositions, and bold color choices drew her in, and for a few minutes, Chloé became a part of that world. She was sitting in the grass with them too, eating a handful of grapes while they discussed the nature of truth. Although she was at work, an employee for the Musée d'Orsay, Chloé lived inside the paintings she was paid to watch and protect.

Meanwhile, the tourists who hurried from room to room of the museum talked loudly, barely glancing at the walls before returning to their blather. Chloé saw perfect people coming to life on the canvases. Yet, to her, few people ever stopped talking long enough to get a glimpse into the perfect worlds around them.

On her way home on the metro, she called Marc to ask if she could come over. His stop was only one before hers at La Courneuve Aubervilliers. When she arrived at his apartment building, a modern-looking, five-story structure, she buzzed number 314 on the pad.

“Yeah, Chloé, is that you?”

“Let me in. It’s cold.”

His apartment door was already propped open when she reached the top of the stairs.

“How was work today?” Marc asked, smiling when Chloé walked in the room.

“Long,” she replied, throwing herself down on the couch dramatically.

When she sat up, a good-looking man stood before her. Light, wavy strands of hair fell on either side of his face down to his jaw line, the rest of his hair pulled into a tiny knot on the back of his head. Thick facial hair, though it was meant to look unkempt and free, showed evidence of manicuring above the lip line and in front of his ears. Square-rimmed glasses framed his eyes, and he either didn’t have any eyelashes or they were too short and light to be seen. Corduroy pants rolled up to the ankle and a thin African print tee created a carefree, artistic

look. One glance at his apartment told a different story, though; high, whitewashed ceilings and a view overlooking the conservatory grounds indicated that he had money. Sometimes, when the windows were open, Marc and Chloé could hear the symphony practicing in the afternoons.

Marc was a graphic designer, freelancing for a couple of marketing

companies in the area. He specialized in eye-catching product packaging and insidiously simple logos. Over the last two years, Marc’s designs had received a reputation for increasing a product’s sales by over fifty percent, and companies compensated him well for his work.

Chloé went to the kitchen and uncorked a bottle of Côtes de Provence from the fridge and poured a full glass for both of them. Within minutes, Chloé’s cheeks began to feel flushed; she had eaten only a small slice of Brie and three crackers all day. Settling in even more comfortably into the couch, she leaned her head back, enjoying the swirling fog in her head as it made its way throughout her body.

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Before long, Chloé led Marc to his bedroom. She always enjoyed the first few minutes when she could see how much Marc desired her. Her pleasure mounted as he kissed and touched her hungrily, but before he could undress her, she got up to switch off the lights.

“Please can we keep the light on?” Marc pleaded with her like he did every time. “I like to see your body when we’re together.”

“No, I don’t look good today.”

“That’s not true. You’re the sexiest woman I know. Every part of you is beautiful.”

“Not today,” she replied. “I’m ovulating; it makes me feel so bloated.” Chloé hadn’t actually had a period in five weeks. “Besides,” she said, “I ate a big dinner before coming over. It makes my stomach stick out.”

“*Ma petite chou*, we have nothing to hide from each other,” Marc said sitting on the bed. “See,” he noted, looking down unabashedly at his nakedness.

“Next time,” Chloé replied. “I’ll be ready next time.” Already, she was thinking of excuses to use for their subsequent encounters. It wasn’t that Chloé actually thought she was fat; rather, she felt as though there were some standard, some level of potential that just hadn’t been met yet. She could always be better.

When she was ready to leave, Chloé grabbed her leather cross-body bag to check the contents to make sure she had her phone, wallet, and keys. After making certain that she had everything, and while she waited for Marc to finish in the bathroom, she walked over to the door. When Marc saw that she was about to leave, he grabbed his own set of keys, so that he could walk her to the metro station. He didn’t like her to walk by herself in the dark.

Chloé asked Marc what his plans were for the rest of the evening and Thursday. Aside from a design for the new packaging for *La Vache Qui Rit* that needed to be completed and sent out, he would be free by Friday night. They made plans to spend that evening together.

Under the naked light bulb at the top of the stairs leading down to the metro, they said their goodbyes. He kissed her softly, open mouthed, and she returned the kiss with a series of small dry pecks.

She sat alone on the red plastic seat, while the train sped and bumped along. Six minutes later, the train came to a stop at *Le Bourget*.

As she exited the metro station, she could see her apartment building peeking over the top of the *bureau de poste*. Five years ago, she had been fortunate enough to find a small studio apartment she could afford located in a fairly safe, residential neighborhood.

Her flat, despite its small size, felt open and roomy. Chloé had gone to a lot of trouble to section off the room as best as possible. Area rugs had been carefully placed on the floor, one for each of the living spaces. A dusty rose-colored piece of carpet peeked out from beneath her stylishly-made bed. A gift from her aunt and uncle for her twenty-eighth birthday last year, her duvet was simple and white, with tight Celtic knots woven throughout in a soft grey thread. It was not the kind of thing she would have picked out for herself, but Chloé loved how orderly and clean it always looked. At the foot of the bed, a tall wardrobe held every article of clothing she owned—except for her shoes, which were stored on tiny racks beneath the bed.

A smaller rug was snuggled up in the corner under a high-backed wooden chair. The chair was upholstered in a light brown linen fabric, complementing the wood stain. A metallic floor lamp had been placed beside the chair to create a cozy reading area. The kitchenette was off to the left of her bedroom and came equipped with an oven/stove unit, a microwave, sink, and refrigerator. And even though there was room for one, she didn’t have a dining table.

Art prints that she bought for forty percent off in the gift shop were tacked up on all the available wall space above and beside her bed. Her favorite, another of Manet's works, hung in the center. Olympia, the porcelain-skinned courtesan, lay confidently on the bed, unashamed of her bare body. To Chloé, this was the ideal: to be poised, certain of who she was, assured of herself.

When Chloé walked inside, she took off her wool jacket and hung it with her purse on the coat rack behind the door. After being with a man, she always bathed as soon afterwards as she could. Chloé pulled off her riding boots and walked into the bathroom. While she disrobed, she turned on the taps to let the water heat up because it took nearly two minutes for the heater to get going. Steam was filling the room as Chloé stepped into the tub and lowered herself into the hot, shallow water. She inhaled the thick, humid air in deep, relaxing breaths as she sank into the water. Chloé always bathed because she perceived showers as yet one more manifestation of the fast-paced, in-and-out, temporary nature of modern society—a society unable to bask in true beauty, even for a moment.

As she reached for her sea salt scrub, Chloé thought about Marc, the way he touched her so tenderly. Grabbing handful after handful of the thick grainy oil, she exfoliated the surface of her skin, using the tips of her fingers to rub small circles, growing bigger and bigger until her flesh was nearly raw. Chloé had decided years ago in university that pink skin meant clean skin. After a quick washing of her long, dark brown hair, Chloé rinsed off and drained the tub.

Yet instead of grabbing a towel to dry off with, Chloé stood on the fuzzy bath mat, beads of water rolling down her body, quickly soaking the carpet fibers. Directly in front of her, on the back of her bathroom door, hung a full-length mirror.

Chloé sighed as she looked at the naked body reflected back at her. Yes, she was glad Marc hadn't seen her tonight.

Looking down at her thighs, she pinched the inside skin in her fists and decided that she would need to lose about a kilogram to keep her thighs from touching at the top. She slouched, and her previously flat stomach folded over, causing a line to appear just over her belly button. With a sigh, she straightened her posture. Her body was all wrong. It looked self-indulgent, not relaxed, sensual, alluring. "That's got to go," she said to herself. Chloé used to do vigorous core workouts and abdominal exercises to try to tone up her belly, but she never saw the kind of results she wanted. What she needed to do now was get her diet under control.

And then there were her breasts. Once so perky and firm, they seemed to be getting smaller and droopier. She cupped the flesh in her hands and lifted her breasts to an unrealistic height, giving her the kind of cleavage only attainable with an exceptionally supportive push-up bra. She dropped her arms to her sides.

In the back of her mind, Chloé knew she was beautiful; men had always given her attention and complimented her appearance, and her girlfriends expressed how they envied Chloé's slender frame, thick brown hair, and deep dimples in her cheeks. However, no voice was powerful enough to be heard over the one inside her own mind.

The wet strands of hair continued dripping water, keeping Chloé from ever getting dry. She shivered at last, turned away from the mirror, and pulled out a dry towel from the cabinet beneath the sink. Chloé walked over to her wardrobe and got out her nightclothes. Her favorite feeling was the sensation of putting a fresh pair of panties on after bathing, when the cool cotton is still tight from the wash.

As she slipped under the duvet and sank into the mattress, Chloé realized how exhausted her body was. She didn't even pick up the copy of *Aline et Valcour* from beside her bed, waiting until another day to finish the story of the lovers on the island of Tamoé.

At nine o'clock, her alarm went off. Chloé tried to open her eyes, but before she was able to, pain shot through her temples when she tried to lift her head. Chloé lay back down on the pillow, and slowly managed to ease herself into a sitting position in bed. Fifteen minutes later, she was able to stand and make a cup of green tea with lemon. The tea helped take the dizziness away, but more than anything, Chloé was hungry. Yet if she was going to stick with her resolution and lose the last three or four kilos, she could eat none of the food in her pantry. But Chloé did need to eat something before she felt sick again, especially before going to work that afternoon.

She tossed on her coat, pulled on a pair of boots, and threw a red scarf around her neck as she walked out the door. Just a block away was the small grocery stand, *Frais*. She decided that she would get a stalk or

two of celery, a bundle of carrots, and a head of lettuce—if it looked fresh today. Ten minutes later, for just over two euros, Chloé walked away with a sack full of calorie-free options. But as she walked back home, making the full circle around the block, she smelled Paul's Patisserie.

Ten minutes later, for just
over two euros, Chloé walked
away with a sack full of
calorie-free options.

“Damn!” she muttered. She had forgotten that she could not walk back this way without passing her favorite bakery. Chloé hadn't let herself go in for weeks, because when she did go inside, she couldn't resist buying fresh *pain au chocolat*, hot baguettes, almond croissants, fruit tarts, and *mille feuille*.

Chloé looked at her bag of raw vegetables, and then sniffed the air again. Her stomach turned over itself as the promise of rich, warm flavors seemed just within reach. She walked inside the bakery.

When she got home and laid out the spoils of her trip on the counter, she was giddy with excitement. Not only did she know how absolutely delicious each bite would taste, but the pastries themselves were a delight to look at. The bright slices of fruit on top of the tarts, the golden bread crusts, and the chocolate drizzle over the cakes called to Chloé.

Chloé picked up the warm *pain au chocolat* and brought it to her lips, readying herself for the indulgence. The buttery crust flaked off into a hundred pieces in her mouth, and as she chewed, the second flavor emerged—the chocolate center. Chloé smiled.

She spat the mouthful out into the trash. And then she took another bite of the pastry. Chewing and spitting until the entire thing was an unrecognizable lump in the trashcan.

Even though Chloé knew she was not allowed to lean on the walls, today she decided that she didn't care. The soles of her feet ached from standing for the last six hours, and there was no one in her section of the gallery this near to closing time. The throbbing in her head was coming back as the ibuprofen wore off. Nonetheless, Chloé never second-guessed whether or not the pain was worth it.

In the canvas on Chloé's left, holding her yellow parasol, Claude Monet's faceless beauty stood in the grass, wind blowing from behind her. Chloé was so fascinated by this painting because every time she looked at it, she interpreted the woman's expression differently. Sometimes the woman looked peaceful and contemplative, but other times she looked lonely; sometimes she seemed sorrowful; most often though, she looked trapped. Images of beautiful women surrounded her, and Chloé studied every canvas with an eerie scrutiny that, Marc had once confided to her, made people feel uneasy when they saw her staring.

Every day, Chloé thought she looked more and more like the kind of woman the Impressionists would have wanted to paint—forever young, always poised and elegant. To Chloé, the way people lived now was simply grotesque. Women walked around the museum in dirty sneakers, pants too tight for them, with hair that hung limply above their shoulders. And the men were just as bad. Chloé once told Marc, "There simply isn't a gentleman in the bunch." With their untucked shirts and polyester backpacks swung over their shoulders, Chloé had actually recoiled once when a particularly disheveled man walked past her in the museum.

Every day, Chloé thought she looked more and more like the kind of woman the Impressionists would have wanted to paint—forever young, always poised and elegant.

She thought that maybe she would meet an artist, a man who wanted to paint her. But not just anyone would have the honor. He would have to understand the sensitivities of women; paint them confidently—but not harshly. Each brush stroke would be powerful, yet soft. Of course, Degas, Courbet, Gérôme, Renoir, Manet, and Monet, they all knew how to treat a lady. They

could encapsulate what it meant to be feminine, beautiful, and alive within the confines of a one-meter by two-meter frame.

Chloé knew exactly what the painting of her would look like, but she also knew that she herself did not yet look like the woman in her fantasy. She decided that she needed a few more weeks before she would feel confident in her appearance. Then again, Chloé could not wait too long or her already aging body would only keep looking older and lose its youthfulness, something she could never get back. Many of the women in the paintings Chloé loved were not especially thin, nor did they all have attractive features, but they had bold confidence that Chloé both envied and found intoxicating.

Right after Chloé saw the last person leave her section, she felt someone behind her.

“Uh, it’s Chloé, right?” asked a small voice as Chloé spun around quickly.

It was Colette, the new intern for the curating department. Easily a head shorter than Chloé, she reminded Chloé of a little fairy. Colette’s short pixie hair, slight frame, soft voice, and easy smile all added to the effect.

“Uh-huh. You’re Colette.”

“It sure is empty up here. Aren’t you ever bored when you’re stuck all by yourself?”

Colette looked sympathetically right into Chloé’s eyes.

“No, I’m not. This is my home. All around me are wonderful people.”

“Oh, so you get to talk to people when they’re passing through and tell them about the art?”

“No, that’s not who I talk to.”

“Oh,” Colette responded awkwardly. “Well, I just wanted to ask you if you’d like to go out with some of us when we get done here. We’re going to Satisfaire for a bite to eat and drinks. We’d love for you to come.”

Chloé had seen the people downstairs before and knew immediately that she had no intention of ever spending time with them. She scrambled for an excuse and decided on using her favorite one, a reason so incredibly vague that it was never questioned.

“Thank you for asking, but I can’t. I have other plans tonight.”

“Okay, well maybe next time, right?”

“Right.”

Colette seemed satisfied with that, and with a beaming smile, she quickly turned her head and flitted out of the room.

Chloé sat down on the bench behind her, trying to remember what she had been thinking about before she was interrupted. Again, she wondered about posing for an artist and how he might paint her.

In her painting, Chloé lies on the bank of a river. She is wearing a clean, white frock, her left shoulder exposed because the sleeve has fallen down. Her hair is pinned up in hundreds of tiny ringlets, braided together on the crown of her head. Beside her is a woven hat laced with blue ribbon. A canopy of trees frames the top and sides of the painting, and Chloé rests on a bed of clovers, propped up slightly by the trunk of a tree. A beautiful face with dainty features and flawless skin, with just a touch of color on her cheeks, she looks directly out at the viewer. Her expression is bold. Chloé is perfect, but she is utterly alone. Everyone else stands together on the other side of the water.

Efficiency of Compressible Gas Gills Carried by the Crawling Water Beetle, *Haliplidae*

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ABSTRACT

Some forms of terrestrial life have developed methods of taking air underwater with them to use as a reservoir of oxygen when spending time submerged. Dissolved oxygen uptake is possible by diffusion of oxygen through the air/water interface that exists as a result of the bubble of air, or “gas gill,” being exposed to the surrounding water (Matthews and Seymour, 2010). Mathematical models have been formulated to describe the efficiency of this diffusion, but much remains unknown about the factors affecting how fast an organism’s gill is depleted (Wichard, Arens, and Eisenbeis, 2002). This paper investigates the efficiency of oxygen diffusion into the compressible gas gills utilized by the crawling water beetle, *Haliplidae*.

INTRODUCTION

Just as marine life is thought to have adapted to life on land, some terrestrial life is thought to have now re-adapted to life in the water (Matthews and Seymour, 2010). To compensate for organ systems designed to obtain atmospheric oxygen, many of these species simply bring air underwater with them.

Some species, such as the running water diving beetle, can remain underwater for weeks at a time (Kehl and Dettner, 2009). These organisms are in fact able to obtain oxygen that is dissolved in the surrounding water even though they lack organ systems designed for extracting dissolved oxygen (Kehl and Dettner, 2009). The reason lies in the interface between the air bubble and the water (Wichard, Arens, and Eisenbeis, 2002); as the organism's respiration depletes the oxygen and adds to the carbon dioxide within the bubble, the partial pressures of the gases become different from that of the water (Matthews and Seymour, 2010). Oxygen diffuses in and carbon dioxide diffuses out of the bubble in order to maintain equilibrium (Matthews and Seymour, 2010).

The most efficient systems that exploit this phenomenon are the tracheal gill and incompressible gill (Kehl and Dettner, 2009). Although the term "gill" is used, it is not an organ that extracts dissolved oxygen but rather an air/water interface that serves to extract oxygen out of the water through diffusion. Both tracheal and incompressible gills prevent the bubble of air (or multiple bubbles, in the case of tracheal gills) from collapsing due to differences in pressure (Kehl and Dettner, 2009). Organisms with either of these structures are thought to be able to remain underwater indefinitely (Matthews and Seymour, 2010). However, species that do not possess such structures for maintaining their air bubble are, depending on factors such as temperature and movement (Giovanni et al, 1999), still able to remain submerged for surprisingly long amounts of time (Matthews and Seymour, 2010). In 1915, researcher R. Ege was the first to suggest that these air bubbles are limited because they shrink with time as a result of the diffusion of nitrogen out of the air bubble (Matthews and Seymour, 2010; Rahn and Paganelli, 1968). They have since been referred to as compressible gas gills.

The amount of oxygen that diffuses into the bubble is dependent in part on the surface area of the bubble and partial pressure differences of gases across the interface (Giovanni et al, 1999; Matthew and Seymour, 2010). For example, Matthews and Seymour (2010) studied the compressible gas gill of the water boatman, *Agraptocorixa eurynome*, who carry bubbles on their abdomens by hydrophobic hairs. They reported that the surface area of the bubble did not decrease with time, and therefore yielded a theoretical oxygen gain of 7.5 times that which was originally in the air bubble. Their findings supported Rahn and Paganelli's model (1968) for gas exchange that described a bubble that did not have a decreasing surface area.

The crawling water beetle (*Haliplidae*), in contrast to the water boatmen, retains a small bubble of air under the posterior coxal plates (Matheson, 1912). This air bubble is different from the water boatmen's because it is round in shape and not maintained (to my knowledge) by hydrophobic hairs. There is therefore some doubt as to whether this relatively tiny air bubble is able to serve as a compressible gas gill that does not decrease in surface area with time. This experiment was designed to investigate whether or not the gas gill carried by *Haliplidae* has the potential to gain many times more oxygen by diffusion than originally present, as is the case with water boatmen.

Two factors that affect the efficiency of compressible gas gills were investigated: concentration of dissolved oxygen (DO) and water depth (Rahn and Paganelli, 1968). If the beetles make efficient use of their air bubble for respiration, they will surface for air less frequently when the DO of the water is higher than when the DO is lower. Additionally, they will surface less frequently when resting just below the surface of the water than when resting in deeper water. This would occur because, according to Rahn and Paganelli (1968), nitrogen

diffuses out of the bubble less quickly when the bubble is held just below the surface of the water than when it is held in deeper water.

METHODS

Approximately 30-40 beetles were collected from the northern pond at the Winchester Medical Center in Winchester, VA as well as another 30-40 from a pond in Hamilton, VA. The beetles were housed in a 10-gallon holding aquarium divided into three compartments that allowed water circulation but kept the beetles from being able to travel in between them. The aquarium contained pond water and was equipped with gravel and rocks covered in algae (to provide food). A 2.5-gallon observation aquarium was divided approximately in two and a platform constructed in a similar manner to the dividers in the holding aquarium. The platform was designed to maintain the beetles at 1 cm below the surface of the water when the aquarium was filled with 10 cm of water (Figure 1).

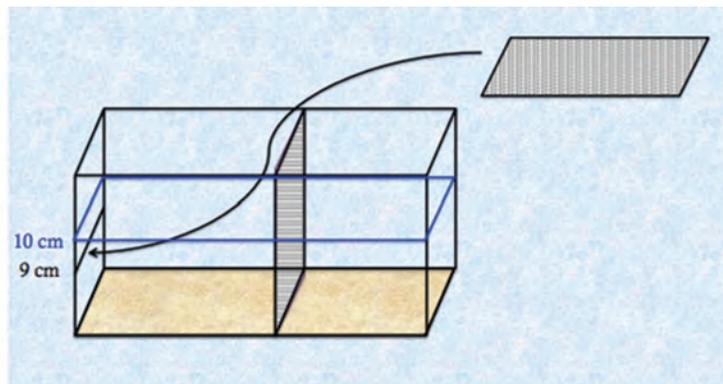


Figure 1. A 2.5-gallon aquarium was used to observe beetles. It was fitted with a divider and removable platform that allowed water to flow freely between all components of the aquarium. The platform was maintained at 9 cm and water at 10 cm. The platform was easily removable. Beetles were observed in the left-hand compartment and DO levels monitored in the right-hand.

Trials were conducted for three levels of DO and two levels of water depth. The platform was placed into the observation aquarium and gravel placed on top. For each trial, conditioned tap water was added to the observation aquarium to a depth of 10 cm, a Multiline P4 WTW Universal Meter placed in the compartment adjacent to the platform, and initial DO and temperature readings taken. Ten beetles from one compartment of the holding aquarium were placed onto the platform. Four subsequent five-minute intervals were spent counting the number of times the beetles surfaced (Trial 1). DO and temperature readings were taken for each interval.

The platform was then turned upside down to allow the gravel and beetles to fall to the full depth of the aquarium (10 cm). Observations for Trial 2 were performed identically as

in Trial 1. Half of the water was then removed from the aquarium and replaced with water of a low DO. This water had been boiled the day before and stored in sealed plastic bottles overnight. A newspaper was placed over the aquarium to reduce the amount of oxygen available to dissolve into the water from the air, and observations performed again for Trial 3. Lastly, an air stone was added the compartment containing the DO meter and allowed to aerate the water for about five minutes, and observations performed again for Trial 4.

Beetles were returned to the same compartment of the observation aquarium that they were originally taken from. Trials were conducted twice a week for three consecutive weeks, and each time beetles were taken from a different compartment of the holding aquarium than the previous observation period. I observed beetles at the same time of day on the same days of the week in order to reduce the effect of factors such as metabolism on oxygen requirements and therefore need for new air. Temperature was kept fairly constant (22 ± 0.6 °C during observations).

RESULTS

The number of times the beetles surfaced was inversely related to DO (Figure 2). The higher the DO, the less times the beetles surfaced for air in twenty minutes, and vice versa. One-tailed t-tests were performed in order to assess the significance of the differences between each trial. There were significant differences in the number of surfaces by the beetles for the comparisons of high to medium DO and high to low DO ($p = 0.012$ and 0.0004 , respectively), but not medium to low DO ($p = 0.19$).

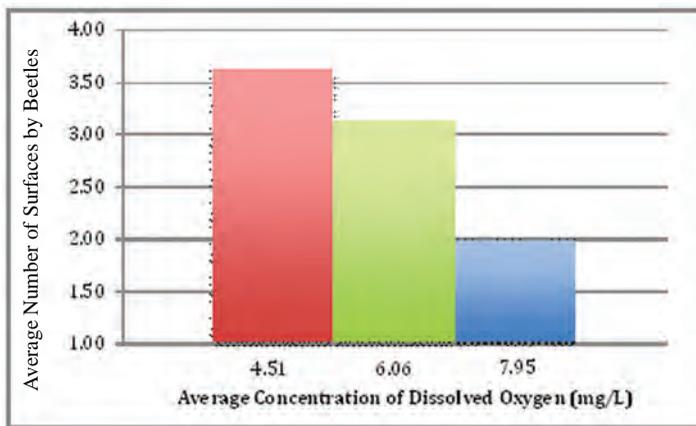


Figure 2. Compressible gas gill function of crawling water beetles (*Haliplidae*) represented by the average frequency that ten beetles surfaced for air in twenty minutes in varying concentrations of dissolved oxygen.

The number of times the beetles surfaced was positively related to the depth of the water (Figure 3). Beetles spending twenty minutes in deep water (10 cm) generally surfaced for air more frequently than those spending twenty minutes in shallow water (1 cm). A one-tailed t-test comparison, however, indicated that this trend was not significantly different ($p = 0.22$).

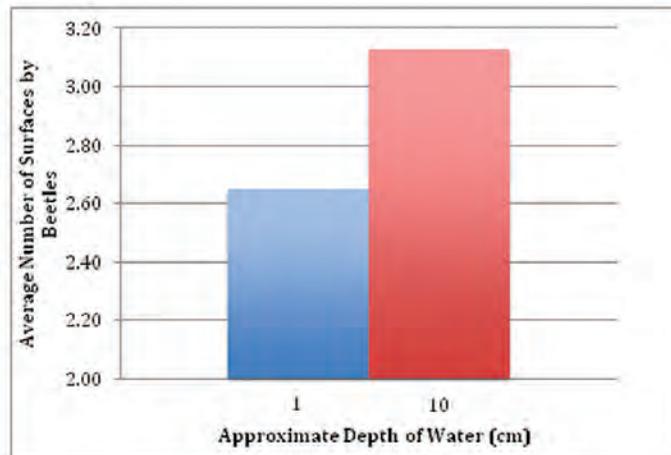


Figure 3. Compressible gas gill function of crawling water beetles (*Haliplidae*) represented by the average frequency that ten beetles surfaced for air in twenty minutes in varying water depths.

DISCUSSION

The need of *Haliplidae* for more oxygen, characterized by the frequency of surfacing to the air replenish gas gills, appears to be dependent on the oxygen available in the water surrounding them. As DO dropped, they surfaced more often (Figure 2). Their need for oxygen also appears to be dependent on their position relative to the surface of the water; beetles resting 10 cm underwater tended to surface more often for air than those resting 1 cm underwater (Figure 3). Both of these phenomena support the idea that *Haliplidae* carry compressible gas gills able to exchange oxygen with the water efficiently enough to affect their need to return to the surface.

A cleaning behavior exhibited by the beetles also supports the apparent efficiency of *Haliplidae* gas gills. While these beetles are resting underwater, they often repeatedly run their hind legs along the bubble. This behavior closely matches a behavior of water boatmen observed by Matthews and Seymour (2010). They deemed it “ventilatory behavior” for its direct effect on whether or not the beetle suffered from hypoxia during observation or not (Matthews and Seymour 2010). The oxygen level in the tethered boatmen’s gas gill was monitored using an optical oxygen probe attached to a Microx TX3 oxygen meter, and a state of hypoxia assumed to be directly correlated with low levels of oxygen in the gas gill (Matthews and Seymour 2010). It is possible that the cleaning behavior exhibited by *Haliplidae* while resting is used to circulate the water surrounding their gas gills and therefore increase gas diffusion.

Despite the possible ability of *Haliplidae* to obtain DO from surrounding water, they still rely heavily on atmospheric air for oxygen. Beetles seen swimming continuously were also generally surfacing more consistently for air than those resting, indicating a greater need for air while moving about (and therefore consuming more oxygen). Additionally, it is noted by Matheson (1912) that *Haliplidae* “prefer shallow pools,” possibly suggesting that

they require a source of atmospheric air in close proximity. When collecting beetles from a pond, they were almost always found in the littoral zone. For these reasons, I don't believe that *Haliplidae* retain a compressible gas gill anywhere near as efficient as those retained by the water boatmen (Matthew and Seymour, 2010).

The limited efficiency of the compressible gas gill in the crawling water beetle suggests that not all compressible gas gills can be modeled similarly. In-depth analysis of the compressible gas gills of *Haliplidae* may be helpful in exploring alternative models, such as those proposed by Rahn and Paganelli and Chaui-Berlinck and Bicudo (1968), that can be used to understand the diverse factors affecting the efficiency of diffusion across the gas gills (Matthew and Seymour, 2010).

By understanding the dynamics of the compressible gas gill, there is the potential that organisms utilizing compressible gas gills may be used as biological indicators of water quality (Giovanni et al, 1999). Organisms that rely on DO as a main source of oxygen will be unable to thrive in an environment with low DO, those of which are often characterized by factors such as high pollution and phosphate levels. Tracking the abundance of organisms utilizing gas gills may therefore give insight to the quality of aquatic environments.

Considering that the intricacies of the *Haliplidae*'s metabolism are unknown and not accounted for, the factors affecting it are one possible source of error in this experiment. For example, the beetles were provided food ad libitum from algae in the water. Those who had eaten immediately prior to being observed might consume oxygen faster than those who had not. Additionally, I did not identify the species of each individual beetle observed, and metabolism might vary from species to species. Some beetles were also housed for longer amounts of time than others because I collected more beetles after some died.

Other sources of error in this experiment should be eliminated for future research. For example, every time I swapped medium DO water with low DO water, the agitation of the water caused unease and therefore increased surfacing of many of the beetles. Also, the DO meter was monitoring the water in the compartment next to the beetles, which is not an entirely accurate determination of the DO immediately surrounding the beetles. During observations, some beetles escaped and could no longer be accounted for. Lastly, there were considerable deviations in the depth of 1cm from observation period to observation period because of the differences in gravel level each time. I'm not confident that it was really at 1cm each time.

Compressible gas gills allow organisms such as *Haliplidae* to obtain oxygen underwater just as traditional gills do, except by a different mechanism. Understanding how those systems can solve the same problem in such different ways is indispensable knowledge key to further understanding of divergent and convergent evolution. In addition, gas gills may hold the answer to the difficulty of underwater travel and may lead to drastic innovations to traditional SCUBA gear. The intricacies of the compressible gas gill are still unknown and further research into the topic can only be beneficial.

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The Arkansas Post Campaign and the Importance of the Civil War West of the Mississippi

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The historiography of the American Civil War has always overemphasized events in the East while virtually ignoring those in the West. The Trans-Mississippi Theater, comprising the lands west of the Mississippi River, was long disregarded as an insignificant backwater. Only in recent decades have the campaigns that shaped the western war been accepted as deserving of scholarly attention. However, they are still usually regarded as isolated events that had no impact beyond the rural fields and thickets in which they were fought. The Battle of Arkansas Post demonstrates the deficiencies of this view. The Arkansas Post expedition is usually presented as only a sideshow of the Vicksburg campaign, but Confederate failures in the Trans-Mississippi earlier in the war created a situation that made this battle a deciding factor in the struggle for Arkansas. The Battle of Arkansas Post was also the climax of the wartime career of John A. McClernand, a Union general whose desire for military glory begat plots and schemes at the highest levels of command. The battle also demonstrates the importance of combined operations by the Army and Navy to the war in the West. The complex causes and effects of the Arkansas Post campaign provide a striking example of the interconnected nature of Civil War theaters and show the importance of operations in the Trans-Mississippi.

Control of the vast river network was a crucial part of both sides' western strategy. The Industrial Revolution had barely touched the South prior to the Civil War. The importance of rivers as a method of transportation in areas where railroads were not yet common cannot be overstated. Historian William Shea explains, "[T]he generation of Americans who participated in the Civil War... viewed navigable bodies of water as highways, not obstacles" (Shea "war" 108). The Union's grand strategy for winning the war rested in part on regaining control of the most important of these highways, the Mississippi River. Early in the war, Lieutenant General Winfield Scott concocted a plan to strangle the nascent Confederacy. The "Anaconda Plan," as it was dubbed, called for a blockade of southern ports and a thrust into the lower Mississippi River Valley that would cut the Confederacy in two. Scott's plan was derided by the media, but President Abraham Lincoln agreed with the aging warhorse, in large part because he recognized the strategic importance of the Mississippi River: "The Mississippi is the backbone of the rebellion," Lincoln declared. "It is the key to the whole situation" (Shea and Winschel 1).

The Confederacy constructed fortifications at vital points along its banks to defend against Union incursions into its waterways. However, they failed to consider the inherent problems of static shore defenses. First, poorly engineered fortifications are vulnerable to naval bombardment. Second, the soldiers manning such positions face the danger of being turned or enveloped by enemy troops moving overland. The latter was demonstrated at Vicksburg in the summer of 1863, the former several months earlier at Arkansas Post (Shea and Winschel 4).

The Union campaign for control of the Mississippi River launched in the spring of 1862 and made rapid progress. A joint operation by Brigadier General John Pope and Commodore Andrew H. Foote took Island No. 10, a Confederate stronghold on the river between Missouri and Tennessee, on April 7. Weeks later, warships from Flag Officer David G. Farragut's West Coast Blockading Squadron entered the Mississippi from the Gulf of Mexico. Farragut quickly captured New Orleans, the largest city in the Confederacy, and Baton Rouge, one of its state capitals. Not to be outdone by their oceangoing counterparts, the so-called Brown Water Navy's Western Flotilla defeated a motley collection of Rebel boats at Memphis on June 6. In just a few months, the Confederacy had lost control of the great river except for a 100 mile corridor between the fortresses at Vicksburg, Mississippi, and Port Hudson, Louisiana (McPherson *War* 58-62; McPherson *Battle Cry* 417-420; Shea and Winschel 10-14).

Vicksburg was too well fortified to be battered into submission by the Navy. The Rebels' "Gibraltar on the Mississippi" would have to be taken by the Army. President Lincoln believed that Vicksburg was the most important Union objective of the war. "See what a lot of land these fellows hold, of which Vicksburg is the key," Lincoln told his military advisors in November 1862. "The war can never be brought to a close until that key is in our pocket" (Ballard 24). The task fell upon Major General Ulysses S. Grant's Army of the Tennessee. Grant began planning operations against Vicksburg in the fall of 1862, but his campaign was temporarily derailed by problems in his chain of command (Shea and Winschel 38-9).

Major General John A. McClernand was a former Democratic Congressman from Illinois whose devotion to the Union cause had earned him a general's commission. As a division commander in the Army of the Tennessee, he had proven himself a capable amateur. However, he disliked serving under Grant and the relationship between the two steadily deteriorated throughout 1862. That summer, McClernand began using his political connections to lobby the

President for an independent command. On a visit to Washington in September-October 1862, McClernand outlined for Lincoln his plan to take newly raised troops from the Midwest down the Mississippi to make an amphibious landing north of Vicksburg. General-in-Chief Henry Halleck did not trust McClernand to command such an expedition, but Lincoln overruled his objections. On October 21, McClernand received orders from Secretary of War Edwin Stanton to make preparations for the campaign. In two months, the fruits of McClernand's efforts had manifested in the form of a sizeable force assembling at Memphis. However, machinations were underway to deprive McClernand of his command (Christ 48; Shea and Winschel 39; Kiper 115-149).

The wording of Stanton's order had explicitly left the application of the troops assembled at Memphis up to the General-in-Chief's discretion. When Grant asked Halleck what he was to do regarding the expedition from Memphis, Halleck assured him that that "You have command of all troops sent to your Department, and have permission to fight the enemy where you please" (Kiper 140; *Official Record Series* 1 17.1 469). Grant promptly sent Major General William Tecumseh Sherman to Memphis to take command. McClernand was still finishing up his work in Illinois, and Grant hoped that Sherman would get the expedition underway before McClernand arrived. "I feared that delay might bring McClernand," Grant wrote frankly in his memoirs, "[and] I doubted McClernand's fitness" (*Personal Memoirs of U. S. Grant* 254-5).

Sherman executed a plan much like the one McClernand had proposed to the President a few months before. The operation was a complete fiasco. The plan called for Sherman's troop transports, escorted by gunboats of Rear Admiral David D. Porter's Mississippi Squadron, to enter the Yazoo River and land at Haynes' Bluff, fifteen miles north of Vicksburg. Grant would hold the main Confederate force's attention at Grenada, some 100 miles away, while Sherman proceeded inland to threaten Vicksburg from the rear. Nothing went according to plan. Grant was forced to pull back from Grenada after Rebel cavalry looted his supply depot and cut his communications. Sherman and Porter, meanwhile, found their progress up the Yazoo blocked by mines and chose instead to land several miles downriver from Haynes' Bluff at Chickasaw Bayou. Sherman's force consisted of 32,000 men: the new recruits from Memphis, a division from Grant's army, and troops reassigned from west of the Mississippi. On December 29, they attacked 6,000 entrenched Rebels under Brigadier General Stephen D. Lee. Forced to advance uphill through heavily wooded swamp, the Federals did not make it far before the attack bogged down. Sherman lost 1,776 dead, wounded, and missing at the Battle of Chickasaw Bayou to Lee's 187. The bloodied Federals pulled out of Chickasaw Bayou on New Year's Day, 1863 (Shea and Winschel 41-55).

McClernand arrived at Memphis on December 29 and was surprised, angry, and embarrassed to find that Sherman had already left with his command. He proceeded downriver and met Sherman and Porter at Milliken's Bend, Louisiana, on January 3. The troops on the Chickasaw Bayou expedition had been organized into two corps on orders from Halleck in late December. The new thirteenth corps was to be commanded by McClernand, the fifteenth by Sherman, both part of Grant's command. Grant had written McClernand to inform him of the change in organization, but the Rebel cavalry's disruption of Union communications prevented the message from reaching him. McClernand believed that he had the President's authority to lead an independent command. Sherman acquiesced based on McClernand's order from Stanton. McClernand took command of what he called the Army of the Mississippi

and prepared for his first (and only) operation as an army commander. Another move against Vicksburg was, for the moment, impracticable. Instead, McClelland, Sherman, and Porter planned to take care of a troublesome Confederate garrison on the Arkansas River at Arkansas Post (Shea and Winschel 55-6; *Memoirs of General William T. Sherman* 296).

Control of the Arkansas River was crucial to the western Confederacy. Entering its namesake state near Fort Smith, the river flows east and south through Arkansas before emptying into the Mississippi. The river valley contained twenty percent of the state's farmland and produced much of its food and forage. Further, Arkansas had only thirty-eight miles of railroad tracks and its roads were terrible. This made the river even more important, as it was the Confederacy's only direct link to the Indian Territory. Just as Union control of the Mississippi would cut the Confederate States in half, control of the Arkansas would cut off much of Arkansas and the Indian Territory from the rest of the Trans-Mississippi Confederacy (Christ 5-8).

The Confederate military situation in Arkansas was already bleak at the beginning of 1863. In March 1862, Major General Samuel Curtis had defeated a larger Confederate force under General Earl Van Dorn at Pea Ridge, near the Missouri border. Van Dorn was then ordered to Mississippi, where the Rebels were massing for a strike against Grant in Tennessee. In his enthusiasm, Van Dorn took every Confederate soldier and all of the war materiel in the state with him, abandoning Arkansas to the Union. Curtis marched through the state and set up an enclave on the Mississippi River port of Helena while Confederate authorities scrambled to build a force to defend Arkansas against the Federals. These efforts, supervised by Major General Thomas C. Hindman, went better than anyone could have expected. In only a few months, Hindman had assembled a respectable Confederate force in northwest Arkansas. This force was soundly defeated by Brigadier General James G. Blunt in December 1862 at Prairie Grove. As the New Year began, Hindman's makeshift army was in full retreat toward Little Rock. Confederate morale in Arkansas was at an all-time low and desertions were rampant. The only significant Confederate force remaining in the state was at Arkansas Post (Shea and Hess 286-304; Shea *Fields* 2-12, 250-1).

In September 1862, Lieutenant General Theophilus H. Holmes, commanding the Confederate Trans-Mississippi Department from Little Rock, ordered construction of fortifications to defend the lower Arkansas River Valley against Union gunboats. He placed Colonel John W. Dunnington, late of the Confederate Navy, in charge of the state's river defenses. Dunnington chose to anchor his defense at Arkansas Post. Founded in 1686 by French fur trappers, Arkansas Post was the first European settlement in present-day Arkansas. Strategically located on a hairpin curve in the Arkansas River, the "Old Post" had been the site of various French, Spanish, and American forts. The Rebels impressed local slaves to build a massive square earthwork 100 yards long on each side, eight feet high, and protected by a twenty foot wide moat. Its big guns were shielded by timber and iron reinforced casemates. Trenches were dug on the landward side to protect against envelopment. The fort, christened Fort Hindman, was manned by about 5,000 men under the command of Brigadier General Thomas J. Churchill (Christ 39-44; Bearss 349-51).

On November 16, Brigadier General Alvin P. Hovey mounted an expedition against Arkansas Post from Helena, loading 8,000 troops on transports escorted by the ironclad *Carondelet*. This first Arkansas Post campaign failed not because of the Confederate defenses, but because of the rivers themselves. Historian Edwin Bearss explains, "At this season of

the year, the Arkansas River could only be entered from the White River through a cut-off a few miles above its mouth” (*Official Records Navy Series* 1 18 491-2; Bearss 353-4). The expedition had to be abandoned when the White fell five feet in two days and the river was made impassable by a previously unknown sandbar now only thirty inches below the waterline (Christ 41-2).

The direct cause of McClernand’s expedition to Arkansas Post stemmed from Churchill’s orders for his cavalry to harass Union shipping on the Mississippi. The food and supplies they captured were a blessing to the Confederates, and their loss led to hungry nights for Union troops in the lower Mississippi Valley. On December 28, Rebel cavalry operating out of Arkansas Post captured the steamer *Blue Wing*, “a particularly fat prize” that provided the Rebels with much needed food, ammunition, and coal (Christ 44-6; Bearss 355).

Accounts differ on whether the campaign was devised by McClernand or Sherman. Porter wrote in his memoirs that Sherman recommended the expedition before McClernand arrived from Memphis. Sherman claimed that it took two days to convince McClernand to go to Arkansas Post. However, those accounts were written years after the war, when both men tended to conveniently misremember things. Accounts written at the time show that McClernand decided on the objective at a conference with the commanders at Helena on December 31. A staff officer present at the meeting wrote that “General McClernand thinks it highly important that Old Post be reduced at the earliest day” (Porter 156-9; *Official Records series* 1 22.1 887). Regardless, both generals’ accounts indicated that the capture of the *Blue Wing* was what alerted them to the need to take Arkansas Post (*Official Records Series* 1 17.1 709; Sherman 296).

McClernand’s transports and Porter’s gunboats set out from Milliken’s Bend on January 4. They entered the Arkansas River via the White River cutoff and made slow but steady progress toward Arkansas Post, despite obstructions in the river. Churchill received reports of the approaching Federals on January 9 and began deploying his troops into the trenches running west of Fort Hindman. Colonel Robert R. Garland’s brigade formed to the left of the fort, with Colonel James Deshler’s brigade on Garland’s left. The Rebel battle line ran 720 yards from the fort, ending about 200 yards short of Post Bayou. The fort’s big guns were manned by Confederate sailors under Colonel John Dunnington, the officer who had directed the fort’s construction (Christ 51-72; Bearss 418-0).

The Federals landed at Frederic Nortrebe’s farm three miles downriver and made a difficult march through swampland, reaching the front on January 10. Sherman’s XV Corps deployed roughly opposite the Confederate trenches. The XIII Corps, under Brigadier General George W. Morgan, formed opposite Fort Hindman. The fort’s heavy guns opened up on the Union infantry, complicating their deployment. McClernand asked Porter to run interference. That evening, the ironclads *Baron de Kalb*, *Louisville*, and *Cincinnati*, the timberclad *Lexington*, and the steamer *Black Hawk* moved up the Arkansas and fought a hot duel with the Rebel cannoners. “Our big guns on the fort belch forth death and destruction and the gun boats return the favor,” wrote Samuel T. Foster of the 24th Texas Cavalry (Christ 54-9; *Official Records Series* 1 17.1 703-4; Foster 16). The tinclad *Rattler* moved forward to enfilade the fort, but was heavily damaged by artillery fire when it became tangled in snags the Rebels had placed in the river. *Rattler* withdrew, concluding the first day’s action. The gunboats’ sortie allowed the foot soldiers to reach their positions. Men on both sides of the line hunkered down and waited for the battle they knew would come the next day (Christ 59-61; *Official Records Navy Series* 1.24 107-8).

The gunboats resumed their work on Fort Hindman at 1:00 p.m. on January 11. "They knock the iron off the fort, make [it] fly in every direction. Knock those big square logs about like they were fence rails," Foster recalled (Foster 19). The Federals blasted the fort to pieces; the guns fell silent. "No fort ever received a worst battering," wrote Porter (*Official Records Navy Series* 1.24 108). With the guns no longer a concern, the tinclads *Glide* and *Rattler* and the Ellet ram *Monarch* moved past the fort and cut off the Rebels' retreat (Christ 67-69).

Meanwhile, Sherman's artillery opened up on the Confederate trenches. "It seemed as if the elements were in rebellion and made the earth tremble," wrote one Union soldier (Christ 69). After a fifteen minute barrage, the Federals advanced. The Rebel infantry had not been heavily involved in the battle thus far and were spoiling for a fight. "[W]e gave them a very deadly fire," wrote Deshler (*Official Records Series* 1 17.1 793). Union Colonel Thomas Kilby Smith described it as "a perfect hurricane of shot and shell." The heavy fire forced the Federals to take cover, halting the attack. However, the Rebels' position was untenable. They were grossly outnumbered and under constant fire from both the gunboats and the artillery. Their own cannons had been damaged in the barrage, leaving them little besides small arms with which to return fire. As the Federals prepared to make another assault, men in Garland's command raised white flags. By 4:30 p.m., it was over (Christ 69-76). [In his official report, Churchill claimed that Garland surrendered without orders, while Garland claimed that he had been ordered to surrender by one of Churchill's staff. Garland made multiple requests for a court of inquiry to clear his name, but the War Department declined to investigate the matter.]

Union troops rushed into Fort Hindman. "The inside of the fort presented a terable site [sic]," wrote William Wiley of the 77th Illinois Infantry. "The ground was literally [sic] covered with dead men and horses all cut to pieces and strewn in every direction where our gun boats and batteries had done their deadly work" (33). McClelland arrived and accepted Thomas Churchill's surrender. Dunnington, the Confederate Navy man, insisted on surrendering to Admiral Porter. Deshler, meanwhile, was in a tense standoff with Sherman's infantry, maintaining that he would not surrender without orders. At Sherman's behest, Churchill went to Deshler and said simply, "You see, sir, that we are in their power, and you may surrender" (Christ 76-79; *Official Records Navy Series* 1 17.2 553). The Federals lost 1,092 killed, wounded, and missing. The Confederates lost at least 135 killed and wounded and 4,791 captured, almost the entire garrison. One of the defenders wrote that it was "as fierce an engagement... as has occurred during the war" (Shea and Winschel 58).

McClelland's Arkansas Post expedition was a complete success, but his days as an army commander were numbered. The news that he had diverted troops from the mission to take Vicksburg infuriated Grant. "McClelland has... gone on a wild-goose chase to the Post of Arkansas," Grant fumed in a note to Halleck (*Official Records* 1 17.2 553). Sherman later convinced Grant that the expedition had been worthwhile (and Sherman's idea), but Grant's antipathy toward McClelland was not softened. Grant met the returning transports at Napoleon, Arkansas, on January 20 and sent them back to Milliken's Bend. McClelland was long looked upon poorly by historians, though recent studies have provided a more balanced assessment of the political general. He had done well in the Arkansas Post campaign and was dismayed at being reduced back to a subordinate role. McClelland blamed others for his woes and refused to acknowledge his own flaws. "I believe my success here is gall and wormwood to the clique of West Pointers who have been persecuting me for months," he

complained to Lincoln (Grant 260-1; *Official Records Series 1* 17.2 566). The plot against McClelland was real, but he brought it on himself with his arrogance and bad attitude. He performed well as a corps commander in the Vicksburg campaign, but continuing problems with Grant led to his removal later that summer (Shea and Winschel 152).

The Union Army and Navy conducted several joint operations on western rivers in 1862-1863. Studies of those campaigns often portray the Navy as mere sidekicks. The few accounts of Arkansas Post have largely followed this trend, highlighting McClelland's role while underemphasizing the contributions of the Navy. In truth, Porter's gunboats won the battle. The sortie by his ironclads on the first evening took the attention of Fort Hindman's guns away from the vulnerable Union infantrymen moving in the Rebels' front, allowing the foot soldiers to complete their dispositions. On the second day, the boats pounded the fort into submission and sealed the defenders' fate. The Union infantry never broke through against the Confederate trenches. The Rebels gave up once the fort had been neutralized, a task accomplished solely by the Navy. The importance of Porter's Mississippi Squadron to the Union victory was summed up succinctly by Colonel Dunnington to Admiral Porter at the surrender: "You wouldn't have got us had it not been for your damned gunboats" (Christ 77; Hearn 172).

"Vicksburg is going to be a hard nut to crack, but I think our affair at the Post of Arkansas will help some," wrote Sherman shortly after the battle (Shea and Winschel 58). The campaign was launched to remove the threat to Union traffic and communications on the Mississippi. It accomplished that and a good deal more. The victory was a boon to Union morale, which had plunged after the Chickasaw Bayou debacle. The battle also gave many of the green Midwestern recruits raised by McClelland in the fall of 1862 their first battle experience, a great benefit to men destined to attack Vicksburg. While Arkansas Post did not change the military situation at Vicksburg, it had a profound impact on the struggle for Arkansas. Confederate forces there were already reeling from the defeat at Prairie Grove when the Union captured Arkansas Post and opened the way to Little Rock via the Arkansas River. William Shea explains, "The disasters at Prairie Grove and Arkansas Post... effectively knocked Confederate Arkansas out of the war" (Christ 86; Shea *Fields* 284). The troops captured at Arkansas Post constituted twenty five percent of Rebel military strength in Arkansas, Missouri, and the Indian Territory. Their loss left the Confederacy unable to mount significant opposition to the Union conquest of Arkansas. By the end of the year, the Stars and Stripes flew over Little Rock and most of the state was under Union control (Shea and Winschel 58).

In recent decades, historians have finally begun to show interest in the war west of the Mississippi. However, studies of this area often neglect Arkansas Post, the battle that arguably won Arkansas for the Union. It warrants attention for that reason alone. More importantly, Arkansas Post was the confluence of the campaign for the Mississippi River Valley and the struggle to restore Arkansas to the Union. The Battle of Arkansas Post demonstrates that events in the Trans-Mississippi were not isolated incidents in an insignificant backwater. One cannot understand the complete picture of the American Civil War without understanding the war in the West.

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