ALLEGHENY COLLEGE

History 610
Senior Project

Gettysburg Through a Lens of Terrain and Topography

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Department of History

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Abstract:

The use of terrain to a commander’s advantage in military situations has an extensive history to it. However, the specific concept of military geology, or the use of geologic understandings in military analysis, both historical and current, is a relatively unexplored and modern invention. The Battle of Gettysburg is a prime historical example of the impact geologic formations and processes can have on military actions. Through examining four examples — the multi-ridge system crossing the battlefield, the defense of Little Roundtop, the usage of Devil’s Den, and the importance Cemetery Ridge played — these impacts can be drawn out to provide a stronger understanding of the Battle of Gettysburg, as well as other past, present, and future battles.

Introduction:

As musket balls dashed overhead, a line of soldiers extends into the woods along the right but ending to the left, wearing blue wool and cloth coats, ducking down behind the cover of nearby trees or their hastily constructed wooden fortifications. Some of the soldiers in the line get lucky and happen to find a large boulder or outcrop to crouch behind, as many of the soldiers simply hide behind their chosen cover being near to or completely out of ammunition for their muskets. As shouting from down the hill facing southeast continues and another wave of shots ring out, a mustached man wearing a nicer navy-blue overcoat stands up, drawing his sword from its scabbard, and calls for bayonets to be attached; announcing that a last-ditch charge will be enacted. As the order "ran like fire along the line, from man to man, and rose into a shout", they begin their charge down the wooded hill towards their primarily grey adorned adversaries, stunning them and creating a mass retreat as the grey wearing forces rout under the pressure of the right wheeled charge saving the nearly broken line for the time being[1].

This is the story of the defense of Little Round Top by Colonel Joshua Chamberlain, a college professor from Maine, and the 20th Maine division of the Army of the Potomac, who saved the Union forces' left flank on July 2nd, 1863, or the second day of the Battle of Gettysburg. This story not only represents the brave actions of a selfless group of men who were willing to sacrifice their lives to

[1] Glenn LaFantasie, "Joshua Chamberlain and the American Dream." in *The Gettysburg Nobody Knows*, ed. G. S. Boritt (Oxford: Oxford University Press, 1999), 38.

protect the lives of their fellow soldiers but also represents the conditions faced while in combat on the ground of the battle; a heavily wooded and hilly terrain that had little to no topsoil to construct the typical fortifications of the time and covered with orchards and farmland providing few pre-existing man-made fortifications. This battle is commonly referred to as a turning point of the American Civil War and has become one of the most sacred battlefields in American history, while also becoming one of the premier sites of the usage of terrain by a commander.

The use of terrain and topography to a commander's advantage in military situations has an extensive history to it. From siege warfare to modern-day military positioning, the effects of geologic processes on the terrain of a battlefield have played a substantial role, though one that until relatively recently has been unexplored in academic pursuit. It is my contention that the Battle of Gettysburg during the American Civil War is a prime case study for the impact these geologic processes can impart on the outcome of a battle and military operations in general. A result of this contention, as I will demonstrate in the coming chapters, is that the Battle of Gettysburg is a perfect location to demonstrate how terrain affects the forces on it from the neutral perspective of the terrain, rather than using the perspective of the soldiers and how they interacted with it.

In this pursuit, I will investigate an element from each of the three days of the battle to show a variety of effects that the underlying geology of a battlefield can have on the above-ground actions. The first day, July 1, 1863, will focus on

the multiple ridge system present across the northwestern side of the battlefield across which John Buford slowly retreated his Union forces. The second day, July 2, 1863, will focus on two connected parts of the battle, the Defense of Little Round Top and the role Devil's Den played. These two elements will show the effects underlying geology can have on the creation of defensive positions. The final and third day of the battle, July 3, 1863, will focus on the famous Pickett's Charge and the ways the geology of Cemetery Ridge made the outcome of the charge significantly worse for the Confederate forces participating.

Briefly, before continuing, throughout this work, I will at times use the terms terrain and topography interchangeably. These two words in essence have the same meaning, the arrangement of the physical features on a stretch of land. The main difference between the two is in the level of detail often attributed to them, with topography typically being far more in-depth. However, the geology of a location is different from either of these terms as the geology ranges from the features present on the surface to those deep beneath it. To simply put it, terrain and topography are created by geology and geologic formations. The study of geology is an extremely diverse field, and the use of its practices can have many benefits to assist in a variety of aspects of life. As a result of this, an additional goal of this paper will be to show how having a better understanding of the underlying geology of an area of engagement can greatly assist a commander. This applies to multiple actions that a modern-day military commander could take, from where the best location to construct a forward operating base is, to knowing where a targeted strike would destabilize terrain.

* * *

The Battle of Gettysburg has been covered by thousands of authors since it occurred and in a multitude of different ways. Approaching the analysis of military conflicts from a topography angle is also not unheard of either, as the use of the terrain on a battlefield by a commander dates back to the ancient times of at least the Greeks and Persians, likely even earlier. The use of geologic practices in understanding a battlefield by military leaders is relatively modern, however. One of the first recorded times of a commander using geologists to assist him in better approaching a battlefield occurs during the Napoleonic Wars. In 1813, Professor K. A. von Raumer analyzed the terrain and geology around the Silesia region for a General von Blucher of Prussia, who would go on to defeat Napoleon's forces at the locations analyzed by Raumer, during the battle of Katzbach.[2] These geologists were used to estimate the locations of battles, as terrain plays a large factor in where armies can maneuver, locations that geologically create thin choke points, can accommodate significant plant growth, or are constantly muddy flood plains are places where an opposing force may not attack at all or may be unable to use their artillery, as an example. An additional enhancement that using geologists provided were improvements to the supply lines that were vital to being able to enact a military campaign.

That was only the first recorded instance, however, since then the use of geologists has been sparse but consistently increasing as approaching the

[2] George A. Kiersch and James R. Underwood, "Geology and Military Operations, 1800–1960: An Overview," in *Military Geology in War and Peace*, ed. James Underwood Jr. and Peter Guth (Boulder: The Geological Society of America, 1998), 5.

modern-day, with the level of their usage in both the world wars, increasing in differing but equally important ways. An example of this advancement of geologists was in the preparations for the invasions of Normandy on D-Day in World War 2, in which geologists snuck onto the beaches prior to the invasion to collect soil samples, which were used to determine where the beaches were stable enough to support an invasion sizes force and the requisite equipment.

The term “Military Geology” has been applied to this field of geology for at least the last century, but 1962 is one of the first times it was applied to a published work focusing on Gettysburg. This work was done by Andrew Brown, a geologist who worked with the US Geological Survey, in an article for the July-August 1961 issue of *Geotimes*, a new magazine published by the American Geological Institute.[3] This work was one of the first published with the goal of focusing on geology’s importance to the battlefield, since then however many more works have been completed with this goal in mind. This includes a work from Peter Doyle, a professor at University College London, who in 2006 wrote an article for the July-August issue of *Geology Today*, focusing on the impacts that the geology present under the Gettysburg battlefield had on specific elements, such as maneuverability or field fortifications, that are key in any battle.[4]

[3] Andrew Brown, *Geology and the Gettysburg campaign*. (Harrisburg: Commonwealth of Pennsylvania, Dept. of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, 1962).
[4] Peter Doyle, “Military geology and the battle of Gettysburg, July 1863,” *Geology Today* 22, no. 4(July-August 2006): 142-149.

Works that focus on geology's impact on the Battle of Gettysburg are only a small part of the work that has been completed surrounding it, with many multitudes more worth of work surrounding the battle and overarching campaign. These works range in the complexity, length, and depth of their study. Books are one of the most common ways that additions to the conversation surrounding the Battle of Gettysburg arrive, with two of the most preeminent books being *Gettysburg* (2003) by Stephen Sears, which investigates the Gettysburg campaign as a whole and the implications of it, and a series of three books (1987, 1993, 2001) by Harry W. Pfanz which each investigated a day of the battle. These works are only a handful of the most commonly referred to works, there are many more works from historians such as Carol Reardon, Gary Gallagher, and so many more[5]. All of these works however take a different approach than I will in this paper, focusing on the soldiers who lived the battle and the acts they took instead of the elements of the battle that existed regardless of the side that controlled them; focusing on picking out the stories of specific soldiers rather than creating a unified experience for those who likely suffered under close to identical conditions.

The battle, similar to almost any military conflict, is not without historical controversy. This ranges from small debates over the exact location of a group of soldiers or who was present at a given time at a specific location, too much larger debates over whether a commander took much longer than expected to attack or

[5]Carol Reardon and Tom Vossler, *A Field Guide to Gettysburg: Experiencing the Battlefield through Its History, Places, & People* (Chapel Hill: The University of North Carolina Press, 2017). Gary W. Gallagher, *The third day at Gettysburg & beyond* (Chapel Hill: University of North Carolina Press, 1994).

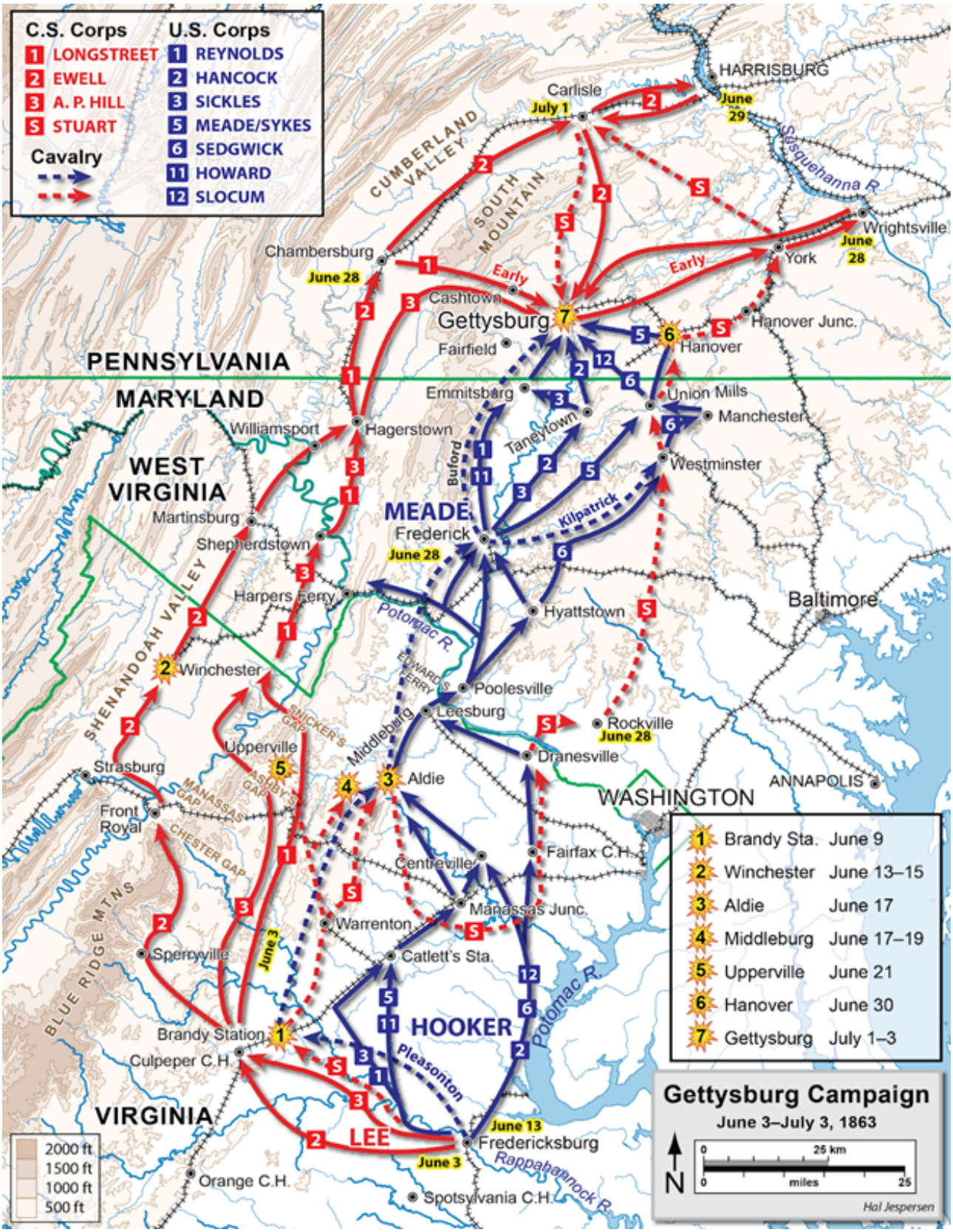
should have when he did not. I intend to avoid directly addressing these controversies wherever applicable, as I do not aim to add to the debate of many of the heavily contested aspects of the battle. In the few locations where I will address topics of debate, such as the decision to not attack by Lt. Gen. Ewell near the end of the first day, this work will strive to provide an additional viewpoint from which to approach the debate.

The Who, Why, and What

Speaking of this history, before continuing to the battle itself, some details will greatly assist in putting the battle in context both in the moment, but also in the war as a whole. The American Civil War began on April 12th, 1861 after the secession of eleven states and with the firing of artillery on Fort Sumter in the harbor of Charleston, South Carolina. This would be the start of a just over four-year-long conflict which would pit brother against brother, sometimes literally, and result in over six hundred thousand dead, with some estimates reaching over 1 million deaths related to the American Civil War[6]. It is argued regarding what reasons the succession and then the war started, but a general consensus points towards the issues of state's rights and slavery being the primary igniting factors.

Zooming in on the topic of this work, the Battle of Gettysburg is not a random occurrence but was the result of a near month-long march north through the Shenandoah Valley of Maryland and West Virginia. It was in June and July of

[6] Drew Gilpin Faust, *This Republic of Suffering: Death and the American Civil War* (New York: Alfred A. Knopf, 2012) xi.



Gettysburg Campaign: "Map by Hal Jespersen, www.cwmaps.com."

1863, or two years into the war, that the Gettysburg campaign and battle would occur. The campaign would move through the Shenandoah Valley, a significant topographic and geological location in western Maryland and West Virginia, and north into Pennsylvania. This campaign was the farthest a major Confederate force had and would ever get into Union territory, and consequently, when the Confederate and Union forces met, oddly, the Confederates were on the northern side of the battlefield, while the Union forces were on the southern side. It was on June 30th that a Confederate force would spot a small Union force moving into Gettysburg, and then would engage them on July 1st. Neither Major General George Meade, the commander of the Union forces, the Army of the Potomac, nor General Robert E. Lee, the commander of the Confederate forces, the Army of North Virginia, had originally intended to engage at Gettysburg, as the town provided little strategic value, both wishing to begin an engagement at a different location. Upon the battle beginning, however, both generals engage with their full forces upon their arrival, with the terrain and underlying geology providing advantages and disadvantages to both generals.

The Where and When

Before diving into the specific details of how the geology present impacts the battlefield, it is important to cover a basic understanding of geology and geologic processes. This will only be a cursory introduction, as to understand the way that geology and military actions interplay, one does not need extensive knowledge of geologic vocabulary. Though it is important to note the level to which these two facets can work together is expansive and the aspects of

geology that could affect military actions are wide-ranging. As an example, the difference in composition of one rock versus another, say the difference of a few percentages of iron in its composition, can have a massive effect on features of the rock, such as its ability to be eroded.

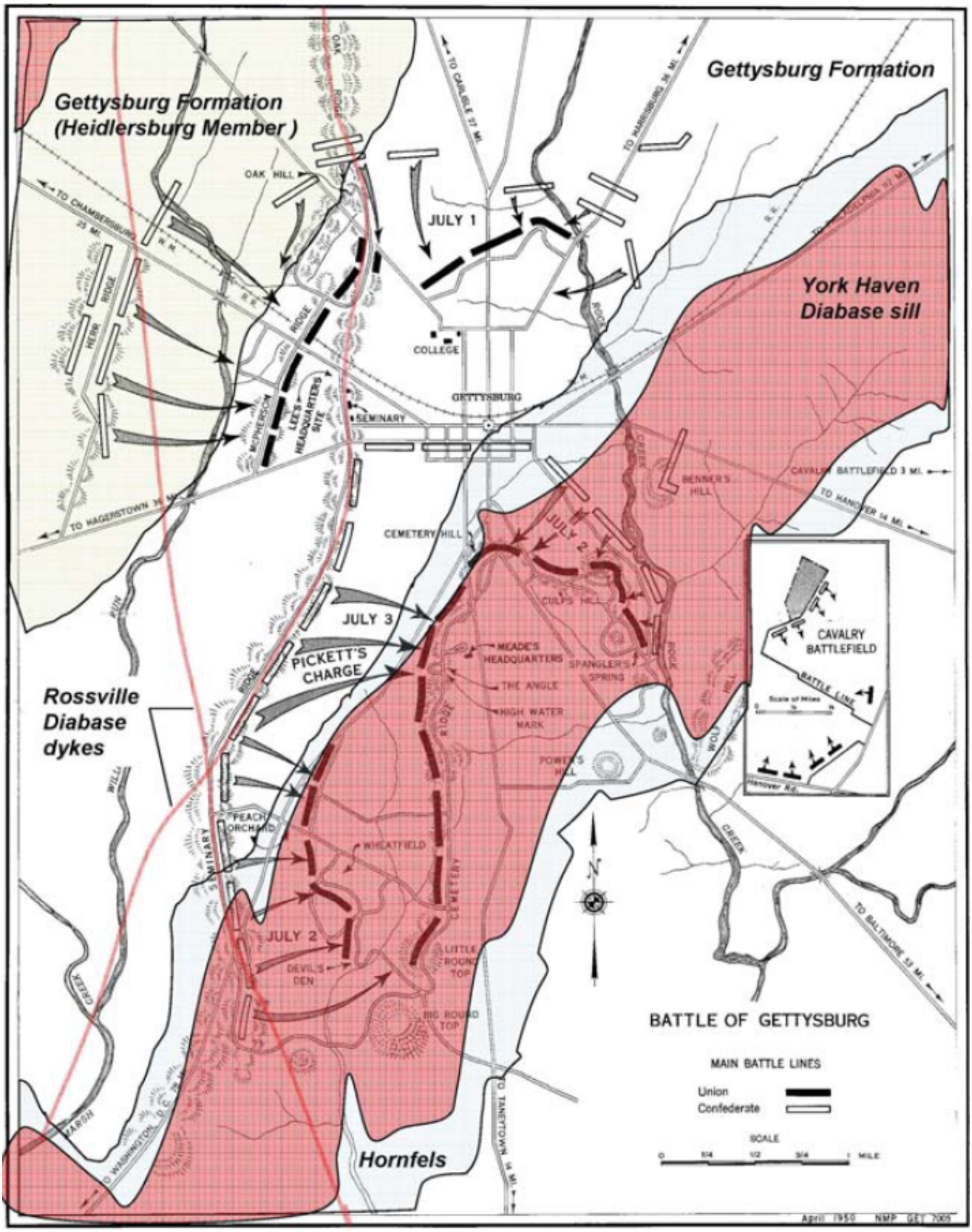
For this investigation, however, nothing quite so complex will be needed, only the basic three rock types and a brief grasp of some geologic processes will be required. Geology is of course the study of rocks, and as a result, there are three basic rock types: igneous, which come from the Earth's core; sedimentary, rocks made of other rock pieces; and metamorphic, changed via heat and pressure versions of the other rock types. On the Gettysburg battlefield, the only rock types that play a significant role are igneous and sedimentary rocks. For this work, the igneous rocks will be the main focus, as they have a far more noticeable impact than the sedimentary. There are of course names to every rock, and on the Gettysburg battlefield, the igneous rocks are a type of rock known as a diabase. They make up two formations of rocks, the York Haven Diabase sill and the Rossville Diabase dykes. A formation is a grouping in which every rock was created around the same time in history, and as a result, has a very similar chemical composition and underwent the same modifications, such as heat and erosion.

These two formations are what is known as igneous intrusions, quite simply igneous rock that has intruded through other layers of rock. Intrusions do not have to break the surface, as can be seen at Gettysburg, where the York Haven sill rests just below the topsoil. The more important part is how the

igneous rocks intruded, which commonly follow two patterns, sills and dykes. A sill is an intrusion that advanced through a fracture between two layers of rock. This commonly forms a large single slab of igneous rock; think the western bank of the Hudson River in New York City. A dyke, or dyke system, functions differently, pushing through layers of rock, normally following a fracture. Under the battlefield, the Rossville Diabase dykes crosscut the York Haven formation, creating the ridge known as Seminary ridge, and from it the line upon which the Confederate forces present that on the second and third day stood. The York Haven sill alone also created the hills and ridges upon which the majority of the Union forces' primary defensive line for the second and third day stood. Locations such as the Round Tops, Cemetery Ridge, and Culp's Hill all were created by this formation. As is visible in the Geologic Overlay of Gettysburg Battlefield on the next page.

As we have now covered the who, what, when, where, and why of the Battle of Gettysburg let us move into the how of the battle — how the battle preceded; how the underlying geology impacted it; and how each commander and their forces approached the terrain to which they had access. We begin with the first day, July 1, 1863, and the meeting of two opposing scouting forces at a small town of merely 2,400 citizens, equivalent to only 1% of the men who would meet there in combat over the next three days, known as Gettysburg.[7]

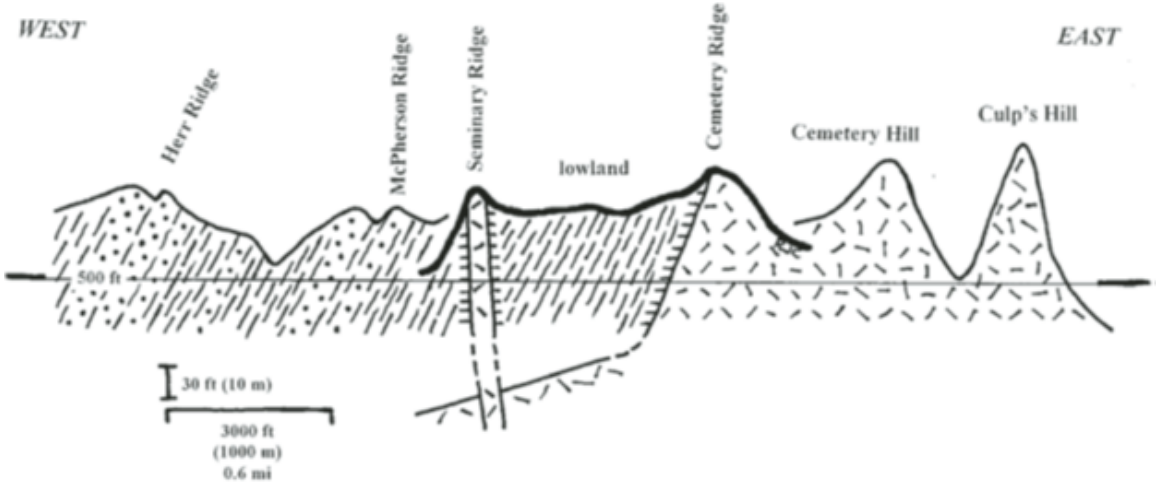
[7] Stephen W. Sears, *Gettysburg* (Boston: Houghton Mifflin, 2003) 154.



Geologic Overlay of Gettysburg Battlefield: Peter Doyle, "Military geology and the battle of Gettysburg, July 1863," *Geology Today* 22, no. 4(July-August 2006): 143.

The First Day: The Battlefield That Shouldn't Have Been

The first day of the Battle of Gettysburg, July 1st, 1863, is often overlooked in popular culture due to the lack of any events that would catch the eye of a common onlooker. What this interpretation however leads to is an absence of common knowledge as to the significant role that the first day would play in the battle, as well as resulting in many eccentricities of the first day being overlooked. Due to the lack of singular key events on the first-day historians are provided a clearer view into the impacts that the leadership of Confederate and Union forces can have on the outcome of a battle. For this work however the first day allows for an exploration into both the role that large geologic formations can have on the topography of the battlefield in addition to providing a framework through which the importance of an element known as vantage can be explored.



Geologic-topographic cross-section of the battlefield, highly generalized; vertical exaggeration approximately ×20; lithology symbols standard for diabase, hornfels, shale, sandstone; drawn across Herr and McPherson Ridges (left), Seminary Ridge–lowland–Cemetery Ridge (center), and Cemetery and Culp's Hills (right; center segment displaced south relative to the other two); vertical scale altered at depth to show relationship of dike to sill; drawn by Cuffey from U.S. Geological Survey 7.5′ topographic quadrangles (Fairfield on left, Gettysburg on right); level datum is 500 ft above mean sea level.

Before continuing, an overview of what engagements occurred on July 1st, 1863 and just preceding it. Before the arrival of any forces at the small town of Gettysburg, a campaign led by General Lee and the Army of Northern Virginia had set out in May of 1863 through the Shenandoah Valley intending to penetrate past the Union line into Pennsylvania, possibly as far as Philadelphia. The role that the Shenandoah Valley plays in military strategy throughout the American Civil War cannot be understated, however, discussion surrounding the important role that the Shenandoah Valley and the geologic forces that created it will occur far more in-depth in Chapter 3. As July 1st came closer both Confederate and Union forces approached toward the crossroads town known as Gettysburg, a small town of perhaps 2,400 population with little importance. Uniquely for the eastern front as forces converged on Gettysburg, the Confederate forces approached from the North of the town while the Union forces approached from the South, originating from the Potomac River.

It is at this point that it is important to note that while General Lee had not selected a specific location where he wished to engage, he did intend to fight in the Gettysburg-Cashtown area, as he believed that his communication lines were at risk if he did not secure that region[8]. General Meade, however, fully intended to fight at a place known as Pipe Creek; near to the town known as Taneytown and a full 12 miles south of Gettysburg. General Meade believed at Pipe Creek he would have favorable terrain along which his engineers and artillery could find

[8] Harry W. Pfanz, *Gettysburg - The First Day* (Chapel Hill: University of North Carolina Press. 2001), 21.

strong defensive positions[9]. While General Lee had not selected a specific location upon which he wished to attack any strong contingent of Union forces, there are reports that he believed that any large Union force was 20 to 30 miles south of Gettysburg[10]. The beliefs of both generals would lead to neither expecting for Gettysburg to turn into the exceedingly large battle that it was, and it was nearly by fluke that it would grow to the size that it became.

The combat on July 1st was between two relatively smaller divisions of forces compared to that of which would occur over the next two days, and the ground which the Confederate forces would obtain on that day would be the largest amount of territory at the Battle of Gettysburg gained by the Confederate forces. Throughout the day the Confederate forces would push the small contingent of Union soldiers from a multi-ridge system, present on the western side of Gettysburg. This multi-ridge system is primarily created by the Rossville Diabase dykes. A dyke system, due to the erratic nature of their intrusion, will commonly create multiple ridges that are layered, either horizontally creating strips of ridges separated by valleys or a singular ridgeline which is broken up by valleys. At the Gettysburg battlefield, both types of ridges can be seen because of the Rossville Diabase dykes; however, the first day was primarily fought on the horizontal layering.

The ridges and hills which were fought along on the first day are Oak Hill, Herr Ridge, McPherson Ridge, Oak Ridge, the northern part of Seminary Ridge,

[9] James Stuart Montgomery, *The Shaping of a Battle: Gettysburg* (Philadelphia: Chilton Co., Book Division, 1959), 44.
[10] Ibed, 43.

and a location known as Barlow's Knoll. A ridge system for a contingent of armed forces can prove both a boon and a detriment depending on how it is used, and this leads to the previously mentioned discussion regarding the importance of what is known as vantage. The dictionary defines vantage as a position that affords a good view of a location. Militarily the meaning of vantage becomes slightly more complicated. Simply it refers to having one's forces at a typically elevated location which allows for observation without exposing one's self[11]. However, an elevated location has a multitude of connected factors that can play into how useful one's vantage point or high ground is. From a commanding perspective having a higher position over your opposition's forces provides a far better viewpoint from which you can not only command one's forces but also gives a more accurate perception to a leader of the size and or actions of the opposing force. The directly impacting factors range, but one of the most common factors is that by standing on higher ground you are requiring the opposing forces to march uphill to engage you, resulting in them having to expend more energy than if they were able to charge downhill or march across a flat plane.

It is also far easier to shoot both accurately and at a distance down a hill or from a higher position than it is from a lower position. Imagine standing at the edge of the roof of a building and looking down towards the ground. You would be able to see most if not all of the ground leading up to the edge of the building, and if you took a single step back few of the available sightlines would disappear.

[11] Peter Doyle, "Military geology and the battle of Gettysburg, July 1863," *Geology Today* 22, no. 4(July-August 2006), 146.

Now imagine standing at the bottom of the same building and looking up towards the roof, if someone was standing right at the edge you would be able to see most of them, but if they took the aforementioned step back, they would almost completely disappear from view. A building is of course a far sharper angle than a hill, but the methodology is still the same for the advantage that being on higher ground can provide for the vantage aspect.

Another element that would not come into play at Gettysburg but can often play a role in the significance of vantage is the Sun. No matter where a military force is moving or positioned, having the sun at one's back provides a multitude of benefits, such as fully illuminating the opposing force providing a clearer target for a soldier to aim at, while also oppositely impacting the opposing force via the creation of glare and thusly obscuring the force which has the sun behind them. If a military force on flat ground intends to use the sun behind them for an assault or intends to receive an assault while the sun is behind them, they are limited to either the extremely early hours or extreme late hours of the day, and the benefit is short-lived. When a military force, however, can position themselves on top of a hill or ridgeline it both extends the time that the sun is behind the force as well as changes the time of day which the sun is behind the force. Both of these allow for an offensive or defensive action to occur during the day rather than at the brink of dawn or night. Also, especially during the American Civil War, combative engagements would go on for multiple hours. By being able to extend the time at which the sun favors a force, it can provide a benefit for an entire battle rather than a small portion.

Returning to the previous discussion of vantage leads to viewing how the Union forces present at Gettysburg on the first day of the battle fought. They used this multiple-ridge system to their advantage throughout the first day. The Union would slowly retreat across the ridges throughout the day until they found themselves at Cemetery Ridge, Cemetery Hill, and Culp's Hill; a defensive position that would go on to found the core of the Union line for the rest of the battle. Their retreat across the ridges is what should be focused on, however, as they provide a clear example of the crucial role that topography and terrain play when it comes to this key element of vantage. While most of the ridges that the Union forces retreated along were normally little more than swells, the usage of them allowed for the smaller Union force, of approximately 22,000 men, to take only around 1,000 more casualties than the larger Confederate force, of approximately 27,000 men[12].

An additional side-effect of retreating along a multi-ridge system, that the combat of July 1st represents on a small scale, is the need for maneuverability. The ability of a commander to maneuver their army effectively and quickly is key on both a singular battlefield and along a front of a war. When a commander is unable to make a maneuver that they would prefer to take or must move far slower than they intended, it can lead to the effectiveness of the fighting force dropping significantly. Ridge systems are one of the best scenarios for a defending force due to the time that can be bought by the defenders when moving backward along ridge tops, thus allowing for critical supplies to escape or

[12] James Stuart Montgomery, *The Shaping of a Battle: Gettysburg* (Philadelphia: Chilton Co., Book Division, 1959), 85.

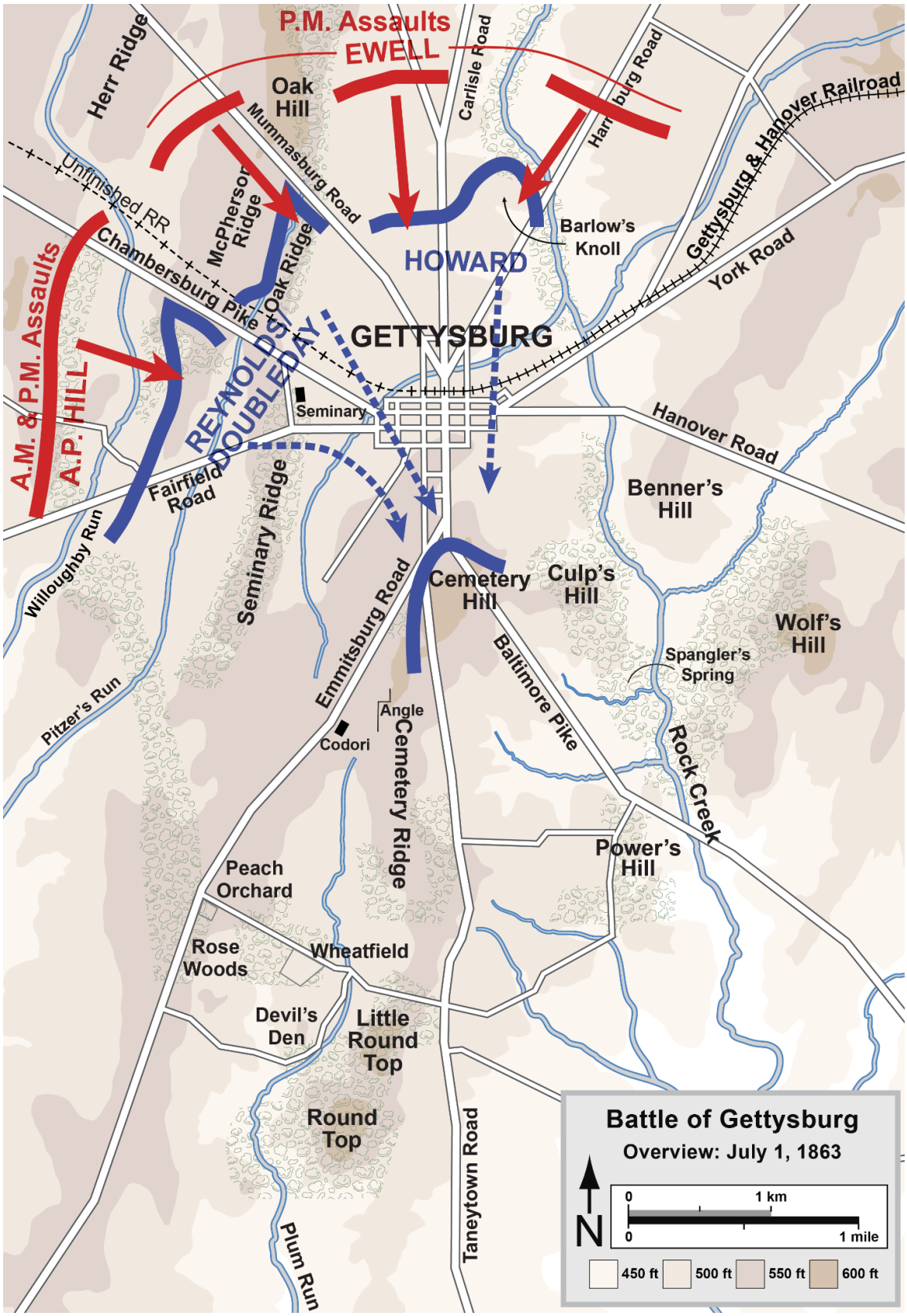
time to be bought allowing for reinforcements. Conversely, when a commander has to attack into a ridge system it can take far longer to achieve victory if the attack becomes mishandled, especially if the attacking force must move supplies with them over each ridge.

By examining the Union's retreat along the ridge system present at Gettysburg and the Confederate forces attack from an after-the-fact perspective a commander can uncover two failures within the Confederate attack that would have either improved the situation or won the battle. The first is the need to flank an enemy completely, with the goal of cutting off the retreat of their supplies. This blunder is more evident during the second day, where if the Confederate force's right flank wrapped all the way around the Union forces would have been surrounded with no escape and no supply lines.

The second failure that occurred on July 1st, at approximately 3 pm, was the let-up of attacks by Confederate forces[13]. While it is more tiring for an attacking force to fight uphill over and over, it is key for a commander to not back down when his opponent is clearly on the run with no reinforcing forces nearby. As can be seen at the Battle of Gettysburg, when General Ewell of the Confederate forces decided to halt his attack it allowed for Union forces to entrench themselves along Cemetery Ridge, Hill, and Culp's Hill. These locations were some of the best defensive locations on the battlefield, and because the Union forces were allowed to entrench in them it allowed for the rest of General

[13] Gary W. Gallagher, "Confederate Corps Leadership on the First Day at Gettysburg: A.P. Hill and Richard S. Ewell in a Difficult Debut." Essay. In *The First Day at Gettysburg Essays on Confederate and Union Leadership*, edited by Gary W. Gallagher, 30-56. (Kent, Ohio: The Kent State University Press, 1992), 34.

Meade's army to arrive forcing a massive battle between the Army of the Potomac and the Army of Northern Virginia. It is from here, however, we move into the second day, July 2nd, 1863, with all of the forces having arrived or arriving and preparing for a day of battle.



Gettysburg Battle Map Day 1: "Map by Hal Jespersen, www.cwmaps.com."

The Second Day: Varieties of Terrain

This chapter turns to the second day, July 2nd, 1863, the events of which show the full strength of the forces present while also providing case studies for a variety of terrain elements and their impacts. To jump to the end, and provide a synopsis of the day, combat occurred throughout the second day at both the left and right flanks of the Union line that had been constructed to a major degree over the night before. Assisted by the arrival of the majority of both Union and Confederate forces that had been unable to participate on the first day of combat. The combat of the day would result in the loss of Union control over the Peach Orchard, Devil's Den, and the Wheatfield territories.

While the focus of the advance from General Lee's Confederate forces on the second day was on both the left and right flanks of the Union army, through this chapter we will focus on the center and left flank of the Union forces, which will consist of an investigation into three locations, the Peach Orchard, Devils Den, Little Round Top. Each of these locations represents not only a different way in which the underlying geology of the battlefield showed a physical effect on how soldiers could maneuver as well as interact with the battlefield, but many of them also are strong examples of how the development of the features that make up the above-ground terrain of these locations can have significant impacts on the effectiveness of an army. It is in this pursuit that our understanding of the effects of the underlying geology on military situations must expand. It is not purely through effects that are visible, like the modification of topography via

large formations such as hills and valleys, but geologic features on a much smaller scale that will lead to major effects on a variety of other physical features that make up the terrain. These effects can be seen where buildings can be constructed across the landscape, where forests will grow be thicker or sparser, as well as where farms and orchards can be constructed.

Before continuing further into these direct examples of the impacts that the terrain can have on a military engagement, a brief chain of events of the day must be provided. Much of the fighting of the day would begin taking place at approximately 4:00 PM with most of it occurring over the next three hours before the falling of darkness across the battlefield[14]. It was not until slightly after the beginning of combat on the left and center elements of the Union forces that the engagement on the right flank of the Union forces would begin. The conflict of the right flank focused on two locations known as Culp's Hill and Cemetery Hill. For this work, however, they create a more complicated narrative that does not add significant development to our discussion and therefore shall be left for continued research into this topic. On the center and left flanks, however, of the Union army, we shall find our focus for this chapter as these consist of the three previously mentioned locations of battle.

One may ask why the start time was so delayed in the day and therefore severely diminished the amount of time combat could occur during. The same person might go and read a few different works about the Battle of Gettysburg, or

[14] Carol Reardon and Tom Vossler, *A Field Guide to Gettysburg: Experiencing the Battlefield through Its History, Places, & People* (Chapel Hill: The University of North Carolina Press, 2017), 205.

even the second day in particular. After having read those works they probably would have come away with three or more differing opinions on why it occurred so late. This question is one of the controversies that surround the historiography of the Battle of Gettysburg, of which many do, and while many factors played into the late start time, negligence of some kind or disagreement on the part of Confederate command is commonly what it has been attributed to.

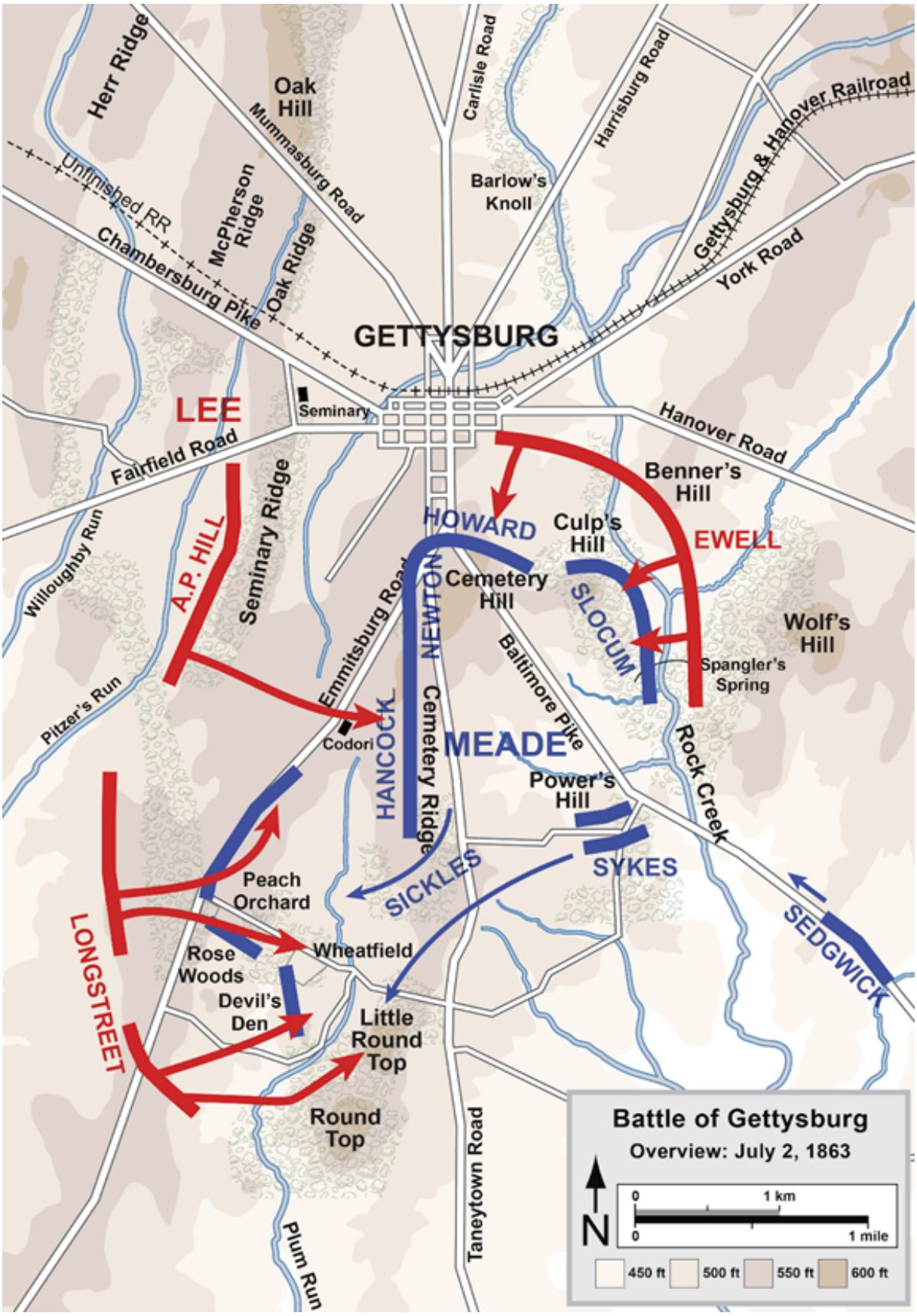
Battle would commence towards the latter end of the day, with the first conflicts between forces appearing at the Wheatfield and Devil's Den locations which began the day controlled by Union forces and then would bleed over to conflict in the Peach Orchard location on the battlefield relatively quickly. After the fall of Devil's Den, the Wheatfield, and to an extent the Peach Orchard one would begin to see conflict progressing its way to the location of Little Round Top. The battle that would occur at the location of Little Round Top was significant not only to the discussion within this paper but also to the Battle of Gettysburg as a whole as Little Round Top was the furthest extent of the Union force's left flank and via the loss of it would lead to a disastrous loss of not only military strength, in manpower and supplies, but in territorial control. From a strategic military perspective, the loss of Little Round Top would open for a collapsing maneuver that has often been attributed to Lee in which he aimed to break the far extent of the enemy forces lines and then collapse inward on the center, much like a hydraulic press[15]. As the day would progress forward the loss of Little Round Top

[15] Harry W. Pfanz, *Gettysburg, the Second Day* (Chapel Hill: University of North Carolina Press. 1987), 113.

would not come as the Confederate advance was halted for the day, leading into a relatively quiet night and the third day of the battle.

After having set out the general timeline that this chapter will follow for the day, it's also important to use this day as a way to understand the scope of the size of the battlefield, as Little Round Top is one of the best modern-day locations to look out from, across the entire battlefield. To begin one can simply imagine standing at the top of a hill of possibly 150 feet of elevation over the rest of the battlefield from which looking south southwest would have the viewer staring across a valley that is approximately one mile across, with a ridge visible in the distance. This ridge is known as the southern portion of Seminary Ridge or Warfield Ridge. This allows us to get into one complexity that is visible across other historical works that investigate the Battle of Gettysburg, in that there are three ridges – Warfield Ridge, Seminary Ridge, and Oak Ridge – that make up the commonly referred to Seminary Ridge. For this chapter, our focus will be on the Warfield Ridge portion of the Seminary Ridge system and any reference to either the Warfield Ridge or the Seminary Ridge is referring to the same location for this chapter.

Returning to the description of the battlefield now, as the viewer continues to rotate to a western view, they begin to look upon the location known as Devil's Den. Devil's Den is a mismatched pile of large diabase boulders of a tan coloration that likely would have been darker than the visible color today, as the effects of erosion and weather have changed them. Next, by rotating one's vision



Gettysburg Battle Map Day 2: "Map by Hal Jespersen, www.cwmaps.com."

to a northwestern view, in the distance, the Peach Orchard location of the battlefield can barely be seen just over a kilometer away.

The construction of orchards and the growth of forests are significant to this day across the battlefield and surrounding countryside, dominating much of the landscape. One of the most significant battles of the second day takes place in what is referred to as the Peach Orchard, aptly named after the orchards that dominated the region. To clarify briefly, the difference between a forested area and an orchard area lies in the complexity of the spacing between the trees. In a forest or wooded area, the locations of the trees are effectively random, while in an orchard they are kept to a grid pattern to facilitate easy harvests. Also, the ground of the forested areas was commonly covered in shrubbery and much rougher terrain, compared to the relatively flattened and cleared of shrubbery.

Across the Gettysburg battlefield both of these arboreal-based features are visible, and one simple conclusion that can be discerned through the visualization of these orchards is the lack of fortification that would have been provided by them, especially when compared to a heavily wooded location. The spacing that made harvesting from these trees so straightforward also created large gaps where in-ground fortifications could not be dug due to the root systems that were present just under the topsoil. The trunks of the trees present were not dense enough either to provide any significant defensive positions for forces of either side during the battle. The battle at the Peach Orchard location was not different from this assumption though many of the casualties of the day can also be attributed to the significant amount of artillery that was unleashed

upon the orchard that day, of which the orchard provided little to no protection against.

* * *

The other two locations of import on the left flank of the Union line lie in the intertwined Devil's Den and Little Round Top. Devil's Den above ground appears to be a pile of large boulders, while in reality, it is a cluster of extrusions of the igneous diabase rocks that compose the York Haven sill. This extrusion shows an element that is not highly visible at almost any location across the battlefield, the way that the diabase breaks. At Devil's Den, the outcrops break or erode along smooth, curved layers, similar to an onion-like pattern, rather than the more typical sharp fracture lines[16]. On a small scale, this fracturing provides ample locations for the sharpshooters present at the battlefield to defend or fire upon the location of Little Round Top, while also being very protected against return fire. The superiority of these positions comes from the V shape of the fractures that were common. The V shape would function both as a place to rest one's rifle for improvements to their accuracy, while also creating a shield similar to the pavise of the middle ages; a large person-sized shield that allowed for a crossbowman to safely reload their weapon. This allowed for a sharpshooter to hold their position for much longer than typical. On a larger scale, however, the fracturing created a deadly gorge and exposed low ground in the surrounding area. These factors played a major part in the combat that occurred at and around Devil's Den on the second day.

[16] Peter Doyle, "Military geology and the battle of Gettysburg, July 1863," *Geology Today* 22, no. 4(July-August 2006), 145.

The combat at Devil's Den was one of the first instances of fighting on the left flank that day; occurring before the attack on Little Round Top, close to the beginning of combat for the day at 4:00 pm[17]. Despite this, the fighting would be some of the fiercest and would last over 90 minutes despite the extremely small number of Union forces present with the exchange of control over the gorge area occurring a handful of times. The length and brutality of the combat can be attributed to the previously mentioned gorge, but even more so to the openness of the surrounding area which was covered in boulders and dead trees and shrubbery, creating terrain that was extremely difficult to walk across while providing limited cover from the Union guns on higher elevations. This was a double-edged sword, however, as while it created an extremely defensible location for the Union forces, the boulders would also make forward progression slow yet near-inevitable for the Confederate forces as the boulders would create hardcover for soldiers to move between. Another issue experienced by the Union cannons was that once the Confederate forces had pushed almost to the Union line they were able to find cover which was at a sharp enough downward angle from the cannons that the cannons could not depress their angle enough to continue firing at the soldiers.

* * *

It is at this point that we arrive at one of the most well-known elements to this day, the battle at Little Round Top. Little Round Top is significant to any

[17] Carol Reardon and Tom Vossler, *A Field Guide to Gettysburg: Experiencing the Battlefield through Its History, Places, & People* (Chapel Hill: The University of North Carolina Press, 2017), 222.

discussion for the role that it plays over the second day, as well as the role that has been attributed to it via popular culture surrounding the battle. For this chapter however Little Round Top is the culmination of everything that has been examined so far, combining the effects of vegetation and geologic formations.

A summary of the Little Round Top location before continuing, however, it is a smaller hill that stands at the leftmost tip of the Union line during the battle. The hill at the time was somewhat covered in vegetation, far less than can be seen today, though was rocky and uneven compared to much of the battlefield. Looking right while standing atop the hill will give one a relatively clear vantage point over Cemetery Ridge which is the primary creator of the Union line, more to follow on that in the next chapter. The defenses that were present atop Little Round Top once combat began however were relatively quickly put together defenses as many of the Union soldiers that were defending the hill had only arrived there earlier that day. The battle for the hill would proceed throughout the majority of the conflict on July 2nd, with most of the combat ending at nightfall. An important note however about the position of Little Round Top is that it's importance was only realized upon the exploration of it off handedly by Gouverneur K. Warren, the chief engineer for the Army of the Potomac[18]. Upon his realization of how significant Little Round Top would be for holding the Union's left flank, it was designated to be the primary holding position of the Union forces left flank by General Meade. However, due to the in-the-moment importance of the Devil's Den location downhill from it, created by the

[18] Harry W. Pfanz, *Gettysburg, the Second Day* (Chapel Hill: University of North Carolina Press. 1987), 205.



Gettysburg, Pennsylvania. View of Little Round Top. United States, 1863. July. Photograph. https://www.loc.gov/item/2018672207/.

sharpshooters and guns present there, the combat was delayed from arriving at Little Round Top for an hour or more, depending on the division. This delay was vital in creating the time needed for Union forces to fully arrive at Little Round Top and create elements of fortification.

Approaching Little Round Top from the terrain's perspective opens up to three primary aspects; the vegetation, the extruding geologic formations such as boulders, and thirdly, the height advantage of the terrain. Beginning first with the vegetation, one would find a diverse population of flora covering the hill ranging from a variety of tree species to shrubbery and tall grasses, as can be seen in

the image above. This creates a contrast to the orchard version of vegetation that can be found at the Peach Orchard location, due to the vegetation here creating more complex and closely woven solid cover, such as trees, which rather than being evenly spaced apart grew at a near-random style and typically much closer. In addition to this, the existence of the shrubbery and tall grasses that would not be present in an orchard location create what can be classified as softcover or some form of protection that may not defend someone against projectiles but visually obscures detecting them, creating difficulty in accurately shooting at someone. The combination of these two vegetative covers leads to fewer losses than were experienced at the Peach Orchard location, primarily being connected to the reduction in the effectiveness of cannons against soldiers here. The Peach Orchard would experience approximately 1,300 Union casualties while the fighting for Little Round Top led to less than 700 Union casualties[19].

Next moving on to the extruding geologic formations, similar to what could be seen at the Devil's Den location, Little Round Top was covered in boulders and small outcrops of the underlying rock. This, like the trees, created additional hardcover for the soldiers who were holding defensive positions atop the hill. The primary difference however between this form of hardcover and the wooden forms of cover present exists in the maneuverability of this cover. The benefit of a high number of trees being available at the location in which defenses will need to be set up rapidly lies in that trees can quickly be cut down to create more

[19] James Stuart Montgomery, *The Shaping of a Battle: Gettysburg* (Philadelphia: Chilton Co., Book Division, 1959), 129.

mobile wooden fences or other forms of fortifications. This contrasts with the far more difficult to move boulders and impossible to move outcrops. At a handful of locations across Little Round Top, as was experienced at Devil's Den where the vegetation was relatively lighter, the outcrops created a strong ground upon which union forces could set up their cannons.

Finally, regarding the Little Round Top location, similar disadvantages to the Confederate attackers can be seen as were witnessed on the first day of the battle. This of course exists within the knowledge that the Confederate forces were almost entirely attacking uphill after having marched across hundreds of feet of non-smooth terrain often at times having already been shot at by Union defender forces upon their march forward. While it can be more prominently seen during the first day, many similar elements of attacking uphill apply to the Confederate assault on Little Round Top, including attacking into oncoming fire, adding to the difficulty of shooting accurately, as well as reducing the sightlines of the Confederate forces, due to the angle of their vision. Due to the timing of their attack on July 2nd, however, the Confederate forces were almost always attacking with the sun either directly overhead or at their backs, removing one of the key detrimental factors to attacking uphill.

In conclusion for this chapter, we have explored the many ways this second day shows how different aspects of terrain can impact, through geologic factors and vegetative factors, both an attacking and defending force and how, when capitalized on, can provide a great boon. The second day of the Battle of Gettysburg was a defeat for the Confederate Army of Northern Virginia, despite

their ability to secure a significant amount of land, they were ultimately repelled by the Union Army of the Potomac. Moving forward from the second day, takes us to July 3rd, a day that is relatively infamous both in American Civil War discussions and discussions surrounding the Battle of Gettysburg. For this work, the third day will show us how all of our previously explored topographical and terrain factors, when not utilized correctly by a commander, can lead to devastation for their force.

The Third Day and the March Back

July 3rd, 1863 lives in infamy and is enmeshed in controversy; yet the events of it are one of the more well-known of the Battle of Gettysburg and the American Civil War itself. July 3rd, 1863 is day three of the Battle of Gettysburg, and home to the tragic Pickett's Charge. Pickett's Charge is the name attributed to what was a massive, all-out assault by the Confederate Army of Northern Virginia onto the entire line of the union army of the Potomac. However, this assault had a primary focus of breaking through the center of the union line present on Cemetery Ridge. The assault of approximately 15,000 men would begin near 2:00 pm on that day, after an hour-long cannonade barrage by Confederate artillery. Pickett's Charge went on for an extremely bloody hour, throughout which the Confederate forces would suffer over 5,000 casualties, more than twice the number suffered by the Union defenders, who numbered close to 10,000 strong at the start[20].

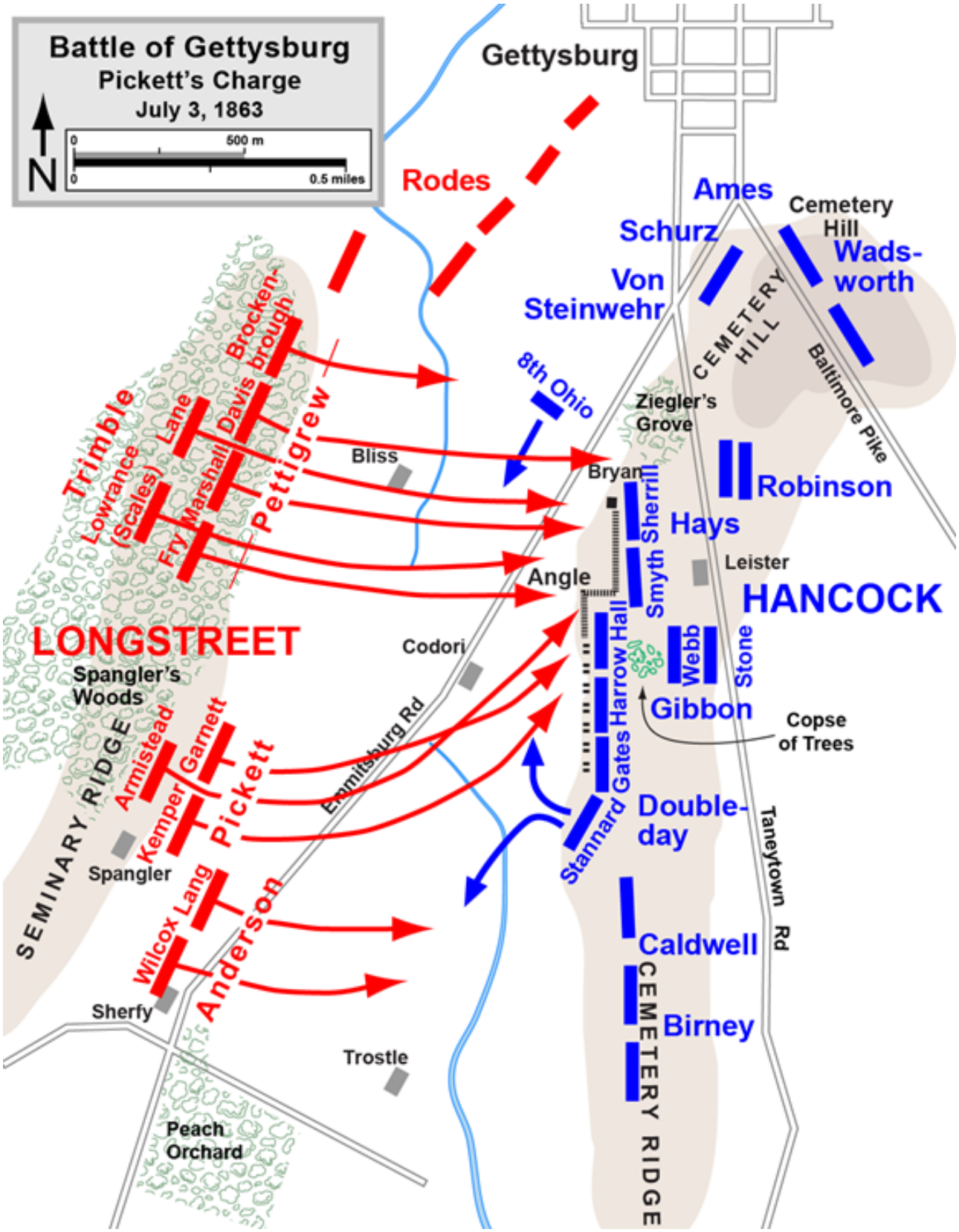
The ridgeline of Cemetery Ridge was home to the core of the Union defensive line, and near the center of it is a copse of trees that would become the target of Pickett's Charge. While no Confederate soldier would make it to the copse, a location just north of it would become known as the high-water mark, or the farthest a Confederate soldier advanced, and just breaks through the Union defensive line held in a section of land dubbed the angle. The angle contrasts

[20] Carol Reardon, *Pickett's Charge in History and Memory* (The University of North Carolina Press, 1997) 6.
James Stuart Montgomery, *The Shaping of a Battle: Gettysburg* (Philadelphia: Chilton Co., Book Division, 1959), 176.

with much of the terrain directly in front of the Union line in that it is a large swath of relatively flat and unimpeded ground, leading to a quick to move across but extremely exposed area, as will be seen later.

Turning to the focus of this section of the chapter begins the near 1-mile march of Confederate soldiers across the lowlands separating Seminary Ridge from Cemetery Ridge. For the first half of their march, they moved somewhat unimpeded, but exposed to Union forces, as until Emmitsburg road the lowlands were somewhat smooth. Due to the distance from the Union infantry for most of this section of the march, only cannons were of concern, and most of the Union cannons were told to hold until the Confederate army approached closer[21]. Emmitsburg road is where everything began to fall apart for those marching, as the Union cannons opened fire with timed charges, a round intended to explode above the enemy and rain shrapnel down onto them, shortly before the Confederate forces made it to the road. The strength of these rounds against the lines of marching soldiers was only increased by the impediment that was Emmitsburg road. The road was not flat with the ground, but rather was a divot between two slightly raised mounds with wooden fences atop them[22]. Upon reaching the first of the two fences, both of which had to be crossed, the Confederate forces were too exhausted in both energy and manpower to topple the fences, forcing the soldiers to climb over each one. While the divot of the road provided some protection, climbing the fences was close to a death

[21] Stephen W. Sears, *Gettysburg* (Boston: Houghton Mifflin, 2003), 401.
[22] Carol Reardon and Tom Vossler, *A Field Guide to Gettysburg: Experiencing the Battlefield through Its History, Places, & People* (Chapel Hill: The University of North Carolina Press, 2017), 392.



Pickett's Charge: "Map by Hal Jespersen, www.cwmaps.com."

sentence, with many sections of the fences reaching the range of the rifleman who was stationed on the Union line.

Briefly turning to the Union's defensive line shows a continuation of problems creating the typical embattlements of the time, with small trenches and foxholes being unable to be dug due to the shallowness of the soil. This led to the fortifications of the Union line along Cemetery Ridge being formed out of local boulders combined with wood and rock fences. Despite the ramshackle nature of their defenses, they would prove quite formidable, providing excellent hardcover against the approaching enemies while rendering relatively protected angles from which to shoot from. Returning to the Confederate advance, as they scrambled over the fences surrounding Emmitsburg road, they would suffer many casualties, but their line would not break, though it is estimated that their line shrank to less than half of its original length by this point[23]. Their problems would continue however as they marched forward. With the smoother ground being left behind and the rougher terrain in front of them, they would begin to slow their advance.

This part of their advance allows for us to explore why having both historical and geological knowledge is key to being able to command or analyze a battle as correctly and effectively as possible. Of the literature focused on Pickett's Charge and July 3rd, 1863, historians commonly note the rough terrain that the Confederate soldiers marched across and how the miniaturized rolling hills leading to the top of Cemetery Ridge had a significant impact. Some

[23] James Stuart Montgomery, *The Shaping of a Battle: Gettysburg* (Philadelphia: Chilton Co., Book Division, 1959), 156.

historians even go as far as to recommend those who are walking around the battlefield to consider the questions of who can I see and who could see me[24]? A geologist however may not think much of a couple of feet of elevation change between these bumps and valleys, considering them to be relatively flat ground. The inverse is also true in many other situations. Many times those who understand or interpret military history attempt to replicate past strategies in their own battles or rationalize why an outcome occurred the way that it did without noticing the differing underlying elements that can completely change the way that a location will function, despite appearing similar on the surface. While this is only one example of the different thoughts that originate from a person's background, it shows why it is key to expand one's breadth of knowledge or to receive advice from a variety of people as a commander.

As the Confederate force continued their march forward, their number would continue to dwindle, shrinking to two or three lines of men not more than a few hundred yards long. The reduction would become increasingly greater as they moved into the range of canister shells from the Union cannons. Canister shells are similar to modern-day shotgun buckshot or birdshot shells in that they would launch tens of smaller projectiles in a cone rather than a singular projectile. These rounds were exceedingly effective due to the exposed position the Confederate soldiers would move into when they attempted to cross over one of the swells.

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[24] Carol Reardon and Tom Vossler, *A Field Guide to Gettysburg: Experiencing the Battlefield through Its History, Places, & People* (Chapel Hill: The University of North Carolina Press, 2017), 377.

For much of their march forward, the Confederate soldiers were harried by cannon fire from Little Round Top on their right flank and from Cemetery Hill to the north. An additional side effect of the small swell and valley system would arise when General Stannard's Vermont Brigade wheeled north facing from the Union line and opened fire directly along the swells and valleys into the side of the Confederate forces. The effectiveness of this bombardment down the equivalent of tubes was only enhanced by the straight-lined formation utilized by the Confederate forces, combining to devastating effect.

Pickett's Charge was not the only element to the Confederate attack that day. While it will not be covered in this work, there was also an attack on Culp's Hill by Confederate forces which was repelled on July 3rd. It is due to the attack on Cemetery Ridge that while the third day did not have the most casualties in a day during the battle, its casualties were extremely lopsided. As can be seen by inspecting the topography that leads up to Cemetery Ridge, as well as the geology that created Cemetery Ridge, it can in hindsight become apparent that any assault on to the center of the Union line across the lowlands separating Seminary and Cemetery Ridge would end in disaster. Without intending to discount the brilliance of many of the Union Field Commanders and Generals that day, the terrain present turned what would have been a close victory, if not a loss due to the size of the Confederate force, into a decisive victory for the Union.

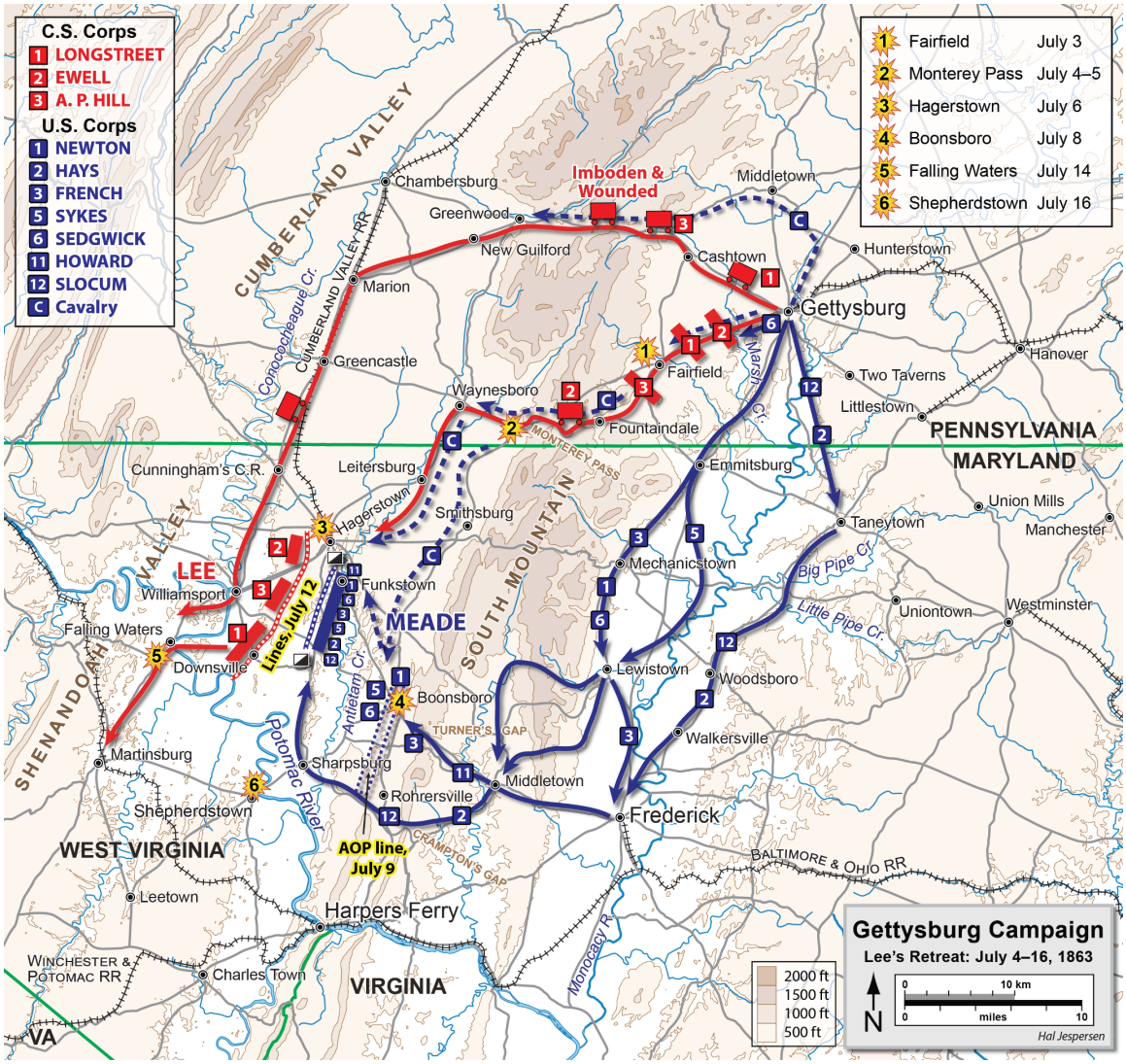
* * *

After the scattered retreat of Confederate forces to Seminary Ridge in the aftermath of Pickett's Charge, General Lee would move into a defensive position

on the ridge over the night into July 4th, 1863. On July 4th, 1863 not much would occur at Gettysburg with both armies moving into holding positions, gathering their wounded, and burying their dead. On the other side of the nation, however, another turning point of the war would transpire as the Siege of Vicksburg would end with a victory by Major General Ulysses S. Grant. As July 4th wound to a close General Lee ordered a retreat into the Shenandoah Valley by his forces intending to return to Virginia. General Meade would follow, but after days of intense and demanding conflict both armies were exhausted, and few conflicts would occur over the retreat.

It is important to in this moment address the Shenandoah Valley. The Shenandoah Valley during the American Civil War played a significant role for the duration of the war, with multiple campaigns from both sides occurring within and through it. The importance to our case study of the Battle of Gettysburg comes from the valleys usage during the campaign to Gettysburg and the retreat after the end of the battle, as geologic formations and terrain not only affect small-scale battles but can greatly affect the actions of armies on the grand scale. The Shenandoah Valley serves as a lane directly to the north beginning in the west of Virginia and ending along the southern border of Pennsylvania. The lane aspect of it is due to its position within the ridge and valley geologic system which primarily makes up the Appalachian Mountains, a mountain range that runs along the eastern coast of North America. The ridge and valley system formed due to tectonic movements millions of years ago, but in its current state exists as a series of valleys and ridges that travel along vertical lines. Importantly

though is the fact that there are few breaks in the ridges, making it overly difficult to cross between the valleys. This difficulty creates a protected location for armies to move relatively unimpeded, though more importantly for General Lee's march to Gettysburg, it provides an element of secrecy to the movement of forces which made it difficult for an accurate prediction of where his target would be. In the process of his retreat, however, it provided a funnel that would allow for a quicker escape in which it would be difficult for chasing armies to become reinforced.



Gettysburg Campaign Retreat: "Map by Hal Jespersen, www.cwmaps.com."

Conclusion

The Battle of Gettysburg is one of the most prominent turning points of the American Civil War. It is also one of General Robert E. Lee's first defeats in battle, and almost certainly his most significant one, having been referred to as his Waterloo. Those three days from July 1st to July 3rd in 1863 are one of the bloodiest battles in American history with near 50,000 casualties combined[25]. All these factors make the Battle of Gettysburg significant to history and the study of military history, but they are not the factors that make the Battle of Gettysburg the prime case study for understanding the impacts that terrain, topography, and geologic formations can have on military actions.

The reason the Battle of Gettysburg is such an ideal case study for achieving a better understanding of the role that these factors can play is due to the variety of factors present across the battlefield. The Gettysburg battlefield contains a multitude of topographic landscape types including flatlands, rolling hills, and ridgelines. The Gettysburg battlefield also has many different types of rock at the surface. The presence however of both primary forms of igneous intrusions, the York Haven sill and the Rossville dykes, on the battlefield results in terrain being present at the surface which both replicates terrain that may be found on other battlefields, yet created under differing circumstances, while also providing a somewhat unique element to the Gettysburg battlefield itself.

[25] John W. Busey and David G. Martin. *Regimental Strengths and Losses at Gettysburg*. (Hightstown, New Jersey: Longstreet House, 2005), 125.

While the Gettysburg battlefield may be one of the prime case studies for the role that natural and preexisting factors can play, that does not address why it is so important going forward for those who wish to better understand military strategic scenarios to have a strong understanding of the impacts to a military force. For a commander in particular it is key to understand this data when it is put in front of them, because when utilized correctly it cannot only reduce the casualties experienced by their force but increase the effectiveness of their force by a magnitude. As an example, if specific areas on a battlefield are underlined by a form of limestone that would erode relatively quickly compared to other areas which consist of a tougher, more resistant form of limestone. As a commander who understands the implications of that, one would be able to better choose the locations where it would be most beneficial for them to go into battle and achieve victory through the manipulation of these natural factors. This can be seen on the third day of the Battle of Gettysburg during Pickett's Charge, where the Confederate forces incurred twice as many casualties due to engaging on terrain that greatly disadvantaged them.

It is also very important moving forward for military historians studying battles throughout history to have a strong grasp of the effects that can originate from the natural factors of the battlefield. Whether or not a commander uses these factors to their advantage or disadvantage, the factors will still impose their effects. As a historian thoroughly understanding how these factors interact with a military force or action being taken can provide a far stronger argument and more complete understanding for why a battle ended the way it did or casualties were

as high or low as they were. A better understanding of geologic factors in the modern world is becoming exceedingly more necessary. Many large scale military operations in the modern world require geologists to determine how the ground will react to an action being taken, ranging from the movement of soldiers to the construction of a forward operating base.

The Battle of Gettysburg is not the only battle in which terrain, topography, and geologic formations play a hidden, or not so hidden at times, role. All military actions throughout history have in some way been affected by these three factors; no matter how small or large the action was. All terrestrial military actions going forward will continue to be affected by these factors in many ways as well. Due to this in the search for the most complete understanding of the world around us and its history, understanding the interaction of people with what underlies their feet is required.



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