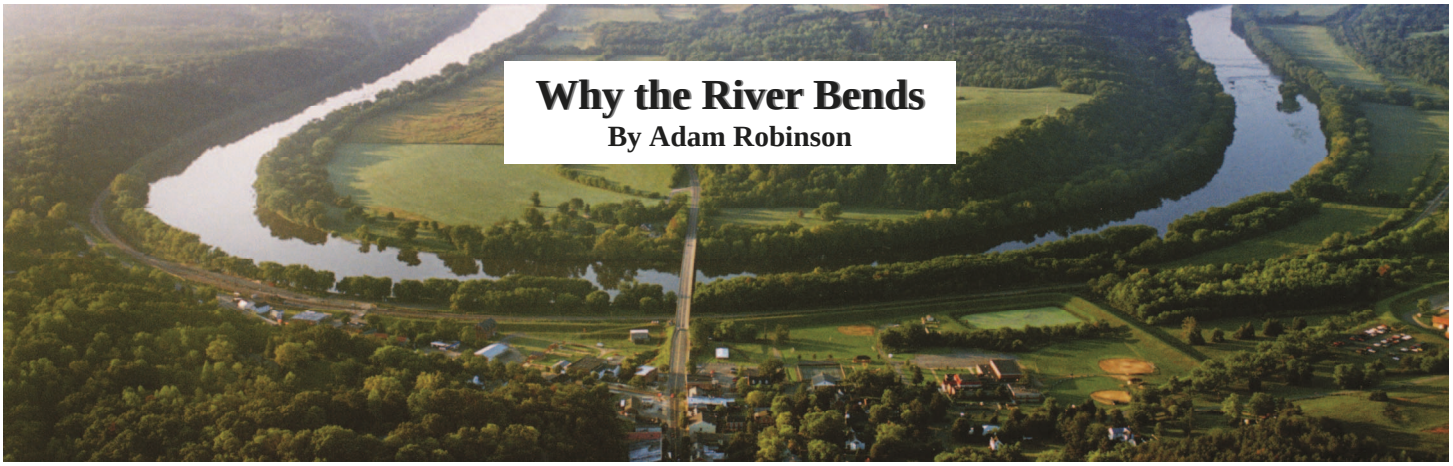

Why the River Bends

By Adam Robinson

The Horseshoe Bend of the James River. Photo by Robert Llewellyn.

The magnificence of the James River gives metaphors pause. To navigate its waters as fireflies gather on the cusp of a July evening, to thread a course through an autumn colonnade of poplars dipped in molten gold, is to understand why this river carries the lifeblood of Virginia within its embrace. And if you listen carefully, beneath the river's roar you might hear whispers of another time, voices of Monacan Indians and batteau captains and canal engineers, for the James River is a river flowing through time as well as space. After all, the foundations of Virginia's history are built upon this river.

So, too, is the history of the town of Scottsville. Scottsville finds itself upon the Horseshoe Bend, an isolated meander of the James River, bounded for many miles to the east and west by relatively straight stretches of river. And while steep cliffs border the James River throughout much of the Piedmont, the Horseshoe Bend boasts gentle slopes on its northern and southern shores. The town's placement on this geographical oddity is no coincidence. Scottsville's early settlers, the Monacan Indians, were drawn to the area's fertile floodplains and the natural ford at the Horseshoe Bend. And when Albemarle County was established in 1744, the area that would one day become Scottsville was chosen as the location of the county's courthouse, due to its position on this convenient ford of the river.

Scottsville's location on the shores of the Horseshoe Bend situated the town as the northernmost point on the James River and at the end of the shortest route between the James River and the fertile fields of the Shenandoah Valley, allowing the town to prosper as a transshipping port. During the nineteenth century, farmers carried their produce across the Blue Ridge Mountains on the Staunton and James River Turnpike, which terminated at Scottsville. These goods were then transferred to a Richmond-bound boat on the James River and Kanawha Canal.

It is no secret that the Horseshoe Bend has profoundly shaped the history of the town of Scottsville. Yet determining the forces that have molded the evolution of the James River, determining why the river bends at Scottsville, is a more elusive question. To seek answers to such a question requires that we attempt to connect the ephemeral threads of human history to the enduring legacies of natural history, a history as deep as time itself. We must venture beneath Scottsville's streets and sidewalks, beneath the sands and gravels of the James River's bed, to unravel the mysteries hidden within the ancient rocks of the Piedmont.

Scottsville's story begins 500 million years ago, at the dawn of the Cambrian Period. The town rests atop sediments deposited at the bottom of a shallow sea on the edge of North America, near the coast of the ancient Iapetus Ocean. Over the next 200 million years, Africa and North America began to migrate toward one another, slowly narrowing the Iapetus Ocean until finally crashing together with enough force to build the Allegheny Mountains, whose peaks thrust higher than the Himalayas. The fabled supercontinent of Pangaea was born.

The continental collision squeezed the Earth's crust like a tube of toothpaste, forcing rocks deposited at the bottom of ocean trenches into the light of day and radically metamorphosing the loose shale in the area that would one day become present-day Scottsville. The metamorphosed shales beneath Scottsville are known as the Hardware metagraywacke. These rocks are gray-green and very hard where freshly exposed, but weather into crumbling, tan clay. Meanwhile, ancient ocean trench

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material can be found to the east of Scottsville near present-day Shores, in a rock formation known as the Shores Complex. The Shores Complex is composed of metamorphosed shale intermingled with green-hued igneous rocks known as greenstone.

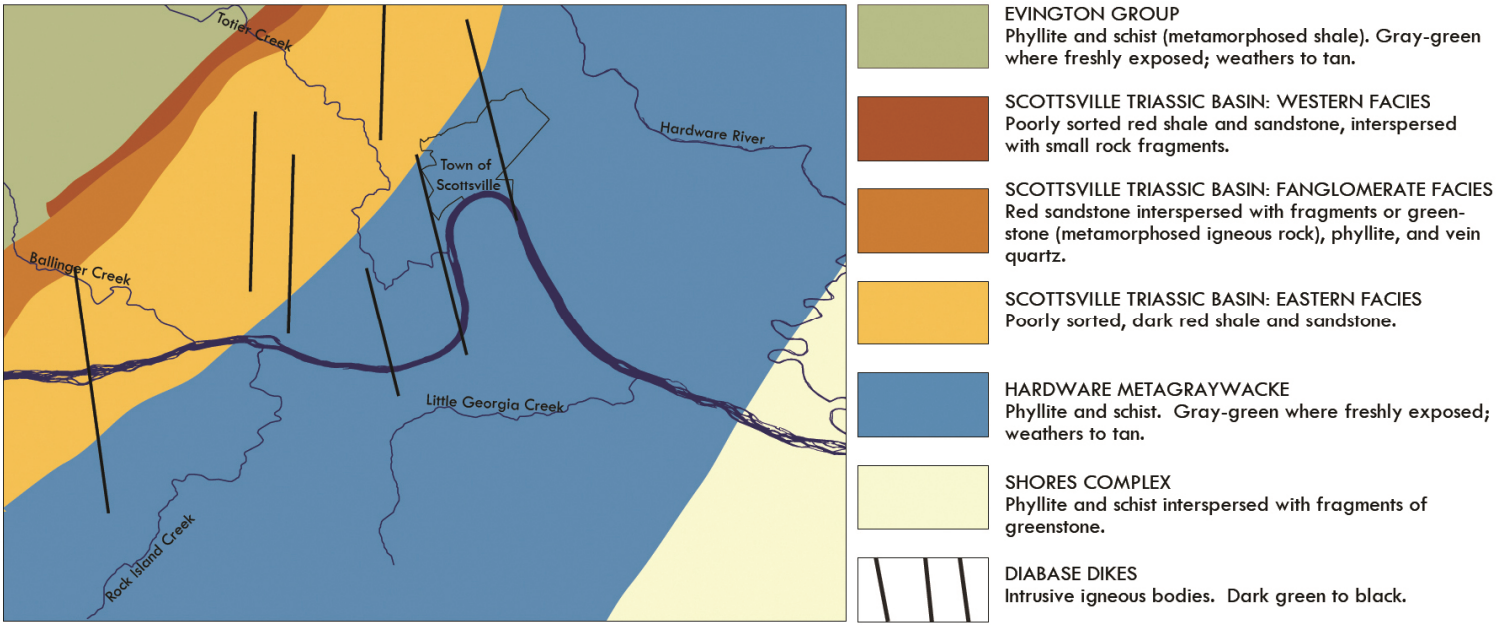
But this union of the continents would be, geologically speaking, very short-lived. As the dinosaurs took their first steps, the continents broke free of their moorings, roaming free across the primordial oceans. 250 million years ago, during the Triassic Period, Africa and North America drifted apart and formed the beginnings of the Atlantic Ocean. As the continents receded, the sudden reduction in tectonic pressure caused North America's continental crust to expand. This expansion caused the crust to buckle and crack, forming a chain of rift valleys along the eastern margin of North America.

These rift valleys quickly began to fill with sediment from the eroding Allegheny Mountains. At the same time, magma rose from the bowels of the Earth to exploit the fractured landscape, lacing the rift sediments with a latticework of molten rivers known as dikes. The eroded remains of one of these rift valleys, the Scottsville Triassic Basin, can be found directly to the west of Scottsville. The easternmost rocks of the Scottsville Triassic Basin consist of dark red shale and sandstone. The westernmost rocks of this rift valley compose a rock formation called the Fanglomerate facies. Rocks of this formation are extremely hard and consist of fragments of greenstone and quartz within a matrix of red sandstone. The remains of igneous dikes run through much of the Scottsville Triassic Basin, colored dark green to black.

As the James River surges out of the Blue Ridge Mountains and into the Piedmont, the river seems to become a living organism, adapting its behavior to its geological environment. When the river flows through rocks that are highly resistant to erosion, its slope steepens, its course straightens, and its channel widens. As the James River encounters resistant bedrock it often splits into multiple channels, dividing its course around islands of rock and becoming what is known as a braided river. When the river flows through rocks of weaker resistance, the river behaves in an opposite manner: its slope becomes gentle, its course becomes more sinuous, and its channel narrows. Within areas of weakly resistant rock, the James River becomes what is called a meandering river, curving and twisting across the landscape in a fluid ballet.

Nowhere are these differences in river behavior more pronounced than in the area surrounding Scottsville. To the east and west of Scottsville, the James River flows for many miles in a straight course defined by frequent rapids and extensive braiding. Yet at Scottsville, the river suddenly swings widely into the Horseshoe Bend, its channel narrowing and becoming extremely sinuous. Although most river bends are accompanied by a number of nearly identical meanders, the Horseshoe Bend stands alone.

The reason for these differences in behavior, and for the anomalous existence of the Horseshoe Bend, is due to the varying erosional resistance of rocks in the Scottsville area. The rocks of the Scottsville Triassic Basin, the Fanglomerate facies in particular, are highly resistant to erosion. Similarly, the greenstone that partially composes the Shores Complex is also very



Geology of the Scottsville Area. Illustration by Adam Robinson.

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resistant to erosion. But the Hardware metagraywacke underlying Scottsville is the least resistant rock in the area, quickly breaking down into particles of silt when exposed to weathering. Because the James River flows through weakly resistant rocks at Scottsville, but flows through strongly resistant rocks to the east and west, meander formation is encouraged in the Scottsville area and discouraged to the east and west.

While the weakly resistant Hardware metagraywacke creates a geologic context in which a bend in the river is likely to form, the actual formation of the Horseshoe Bend may be due to fractures in the rocks of the Scottsville area. These fractures were formed 250 million years ago, as the crust of the North America expanded in the absence of the continent's union with Africa. Many of these fractures run in a northwest direction and are filled with dikes, those ancient remains of rivers of magma that once flooded the rift valleys of prehistoric North America. The swooping curves of the Horseshoe Bend perfectly parallel these dikes. Rivers, like dikes, are lazy creatures, always preferring to follow the path of least resistance. Major fractures in a rock formation offer a convenient avenue for any flowing liquid, and the James River seems to be taking advantage of the same structural weakness once exploited by streams of molten rock.

Although the reasons for the existence of the Horseshoe Bend seem clear enough, our explanation does not take into account the presence of the gentle slopes on either side of the James River at Scottsville. Throughout much of the Piedmont, the James River forms a long canyon bordered by steep cliffs. During colonial times, these steep bluffs presented a significant obstacle to transportation. Yet at Scottsville there exists a convenient breach in these cliffs, allowing settlers to ford the mighty James River and providing a vital corridor for trade. Without this gentle approach to the river, the geographic advantages of the Horseshoe Bend would have been virtually worthless.

The secret behind this mysterious breach in the James River's defenses may lie with small rounded rocks known as river cobbles. Most river cobbles consist of a mineral called quartzite. Quartzite is composed almost entirely of quartz, one of the most weathering-resistant materials on the planet. Because it takes so much energy to break down a piece of quartzite, the James River often carries these rocks many miles from their source.

Geologists use river cobbles to map river terraces, the eroded remains of ancient floodplain sediments deposited when the river flowed at higher elevations. Because only a major river such as the James has enough power to transport and round the edges of such cobbles, if rounded quartzite is present in a given location, then it is likely that a river once flowed through the area. By analyzing radioactive isotopes cached within river cobbles, the age of the river terrace can be estimated. Comparing the age of the terrace with its elevation above the modern-day level of the river yields the rate at which the river has cut down through the landscape.

Engaging in such scientific detective work allows geologists to understand the history of a river's flow, tracking its migration through time and space. From the fleeting perspective of a human being, a mighty river like the James appears permanent, flowing onward toward infinity in an unswerving path. But unlike other geologic phenomena, rivers are quite transient, changing their courses as

A river terrace overlying Hardware metagraywacke near Hatton. Note the abundance of small river cobbles in the upper half of this photo. Photo by Adam Robinson.

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regularly as we change our clothes.

An investigation of the distribution of river cobbles in the Scottsville area reveals that a million years ago, the James River occupied a course half a kilometer east of its present position. Over the next 500,000 years, the river slowly migrated westward, eventually flowing half a kilometer west of its modern location. Since that time until the present, the river has begun moving eastward once again. The river's migration over the past million years has left a broad, flat terrace to the northwest of Scottsville and a similar terrace across the river to the south. These river terraces provide a gentle approach to both the northern and southern shores of the Horseshoe Bend.

In ages past, Scottsville's fortunes were tied much more closely to the James River. The town's location on the Horseshoe Bend ensured its dominance over river trade on the James River and Kanawha Canal, allowing the town to thrive as a river port. But times have changed. By the end of the nineteenth century, the ready availability of cheap fuels such as coal and oil and natural gas had sounded a death knell for the age of the riverboat. Today, America has entered an age in which geographic limits mean little; railroads and highways crisscross the land and tunnel through the mountains, unbridled by topography.

But progress is a fickle thing, and cheap energy will not last forever. As we run out of fossil fuels, we may come to rely once more upon our rivers for trade and transportation. Already, many European countries are beginning to reopen historic canals and waterways in the anticipation of rising energy costs. Who knows? Perhaps Scottsville will one day reprise its role as a major port on the James River, reassuming its mantle as a champion of trade. Only time will tell.

As time marches inexorably onward, the James River will continue to meander its way across Virginia's landscape, eventually leaving the town of Scottsville behind. Yet it will be millions of years before Scottsville must say goodbye to this natural treasure, and with any luck, untold generations of future Scottsvillians will be able to call this river their own. With any luck, the James River will continue to be cherished, will continue to be safeguarded from those who would trespass against its well-being. After all, the James River is as much a part of Scottsville's heritage as its architectural legacy, its people, and its way of life. And as long as the river bends, so it will remain.

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