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Author's Preprint Copy

The Buried Wealth of South Jersey: The Great Marl Region

Jim Alexander

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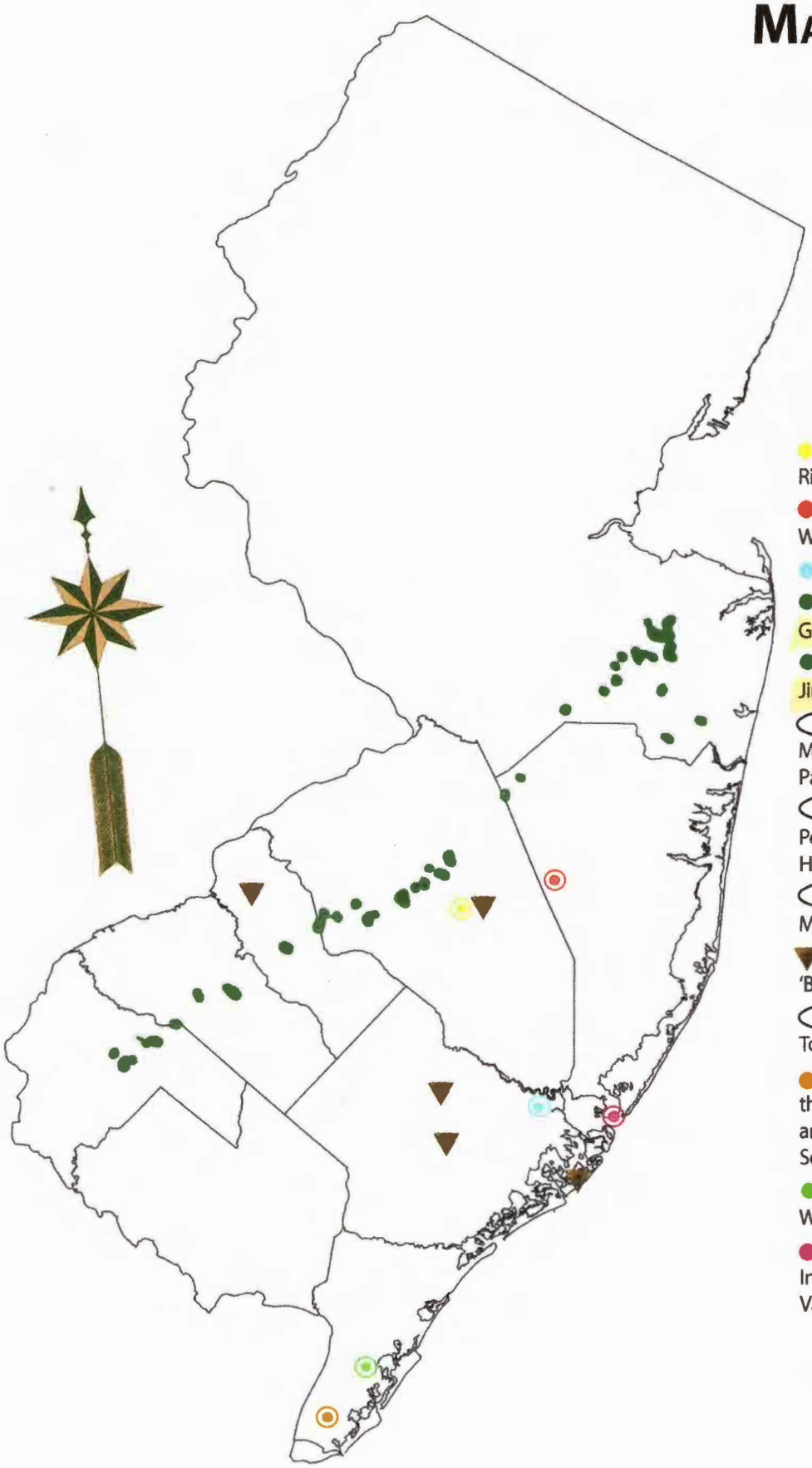


"A View of a Section of the Marl Bank now being worked by the Pemberton Marl Company."[1]

The Buried Wealth of South Jersey:[2]

The Great Marl Region

Jim Alexander

Close examination of this 1859 map of Burlington County[3] reveals the words "Great Marl Region" in the area near Lumberton, Vincentown and Medford. While this area was one of the first cited in published journals as a source of marl in New Jersey, the actual region encompassed a larger part of central and South Jersey. Marl played an important role in agriculture and local railroads, largely in the nineteenth century.

In the mid-1800s, railroads were a new phenomenon. Reports of three early train trips help unfold the story of a natural resource called marl, and its effect on South Jersey's agriculture and development. The first trip, while passing through Mount Holly on May 21, 1869, ended in tragedy:

TERRIFIC EXPLOSION OF A LOCOMOTIVE IN MOUNT HOLLY—LOSS OF LIFE—A HORRIBLE SCENE.[4]

> A train operated by the Camden and Amboy Railroad . . . left Vincentown, hauling 19 cars. . . . James Allen had arranged to catch a ride in the engine's cab.
>
> As the train passed through Mt. Holly, the engine's boiler blew up. The engine made a tremendous bound into the air, descending with great force, breaking ties, bending rails, and scattering pieces of machinery in every direction. As it struck the earth, it made a revolution or two, and another spring into the air, finally lodging in the creek, a distance of fifty yards from the explosion. The track, for some distance, was plowed up, the rails wrenched from the ties and bent and broken in pieces, and the cars thrown together in a confused mass.
>
> Job Gaskill, engineer, and Charles S. Platt, fireman, were thrown upon the side of the track, dreadfully mangled and scalded, and died.

It seemed curious that Allen had ridden in the cab of the locomotive, but further research determined that he worked as a construction engineer for the Camden & Amboy Railroad, and the train's nineteen cars were carrying 100 tons of marl,[5] thus no passenger cars were included.

> John A. Sailer, conductor, was thrown under the wrecked cars, covered with marl, but was dug out and survived.

Luckily too, Allen survived, because he had missed the train. He had actually laid out the route of the Vincentown Railroad, and, at the time, was working on the plans for the nearby Mount Holly, Lumberton, and Medford Railroad, which would open for business less than a year later. Both short-line railroads were expected to thrive on marl-hauling revenues.

Marl—The Miracle Product

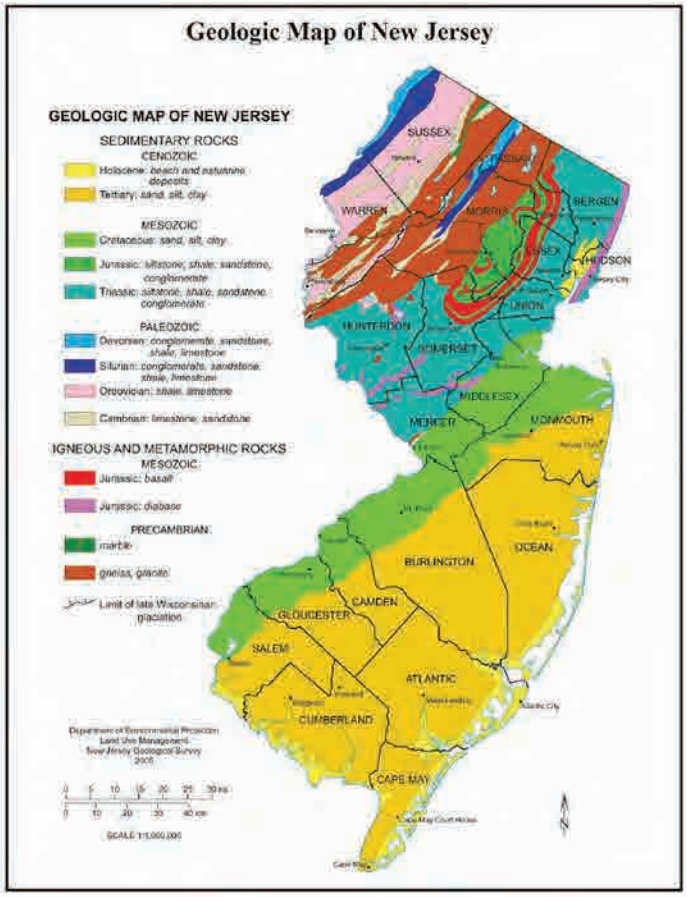
But what is marl anyway? Simply put, it is a clay and silt composition especially rich in potash (6 – 7%), with varying amounts of phosphorous, lime, iron, and other minerals. Definitions of marl vary, depending on country and region.[6] In New Jersey, marl typically involves prehistoric sediments along the edge of what was the Atlantic Coastal Plain, geologically referred to as having evolved in the Cretaceous period, millions of years ago.[7] As the shallow waters above the seabed along the shoreline evolved and eventually became dry land, layers of material containing marine fossils and dissolved minerals and organic matter were laid down, likely involving the action of algae, and covered to varying degrees by soil and sand.[8] (For additional information, see companion article "The Coming of the Great Marl Region.")

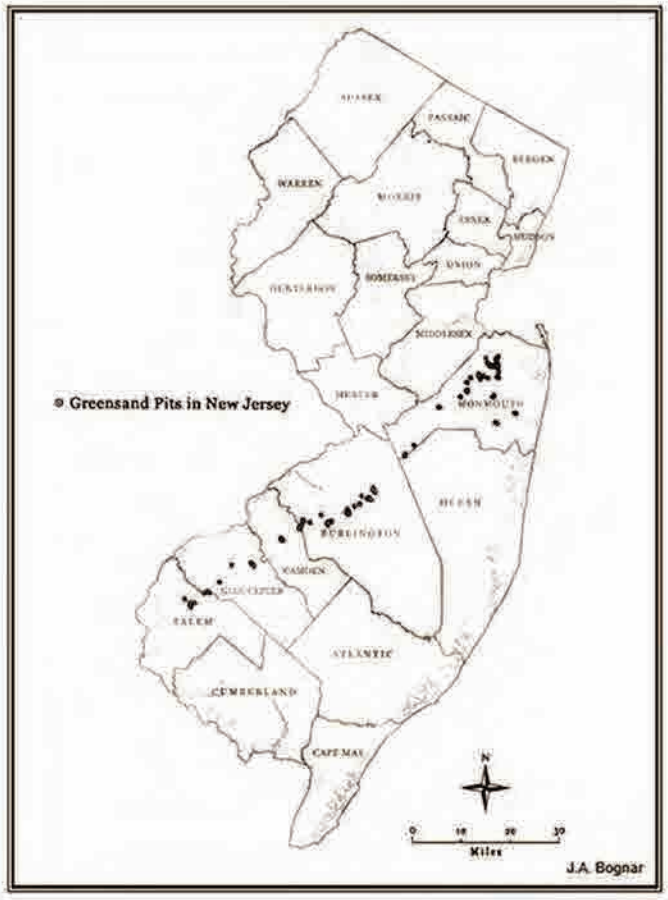
A major characteristic of much marl is its green color, deriving from its iron content. It's often called greensand. Aside from the greensand marl, other colors referenced included clay marl, sand marl, and lime sand or lime-sand marl. Some areas yielded "chocolate" marl, sometimes blue-green and black, but mostly dark green, with different claims for the efficacy of each made, often based on anecdotal observations.[9]

Greensand is ordinarily implied in New Jersey studies of marl, and one major federal government publication was named "Potash in the Greensands of New Jersey."[10]

Being a major source of potassium, potash is an essential element for plant growth. As early as the mid-eighteenth century, the arable soil suffered nutrient exhaustion on many of the country's farms due to poor practices, a problem sometimes simply attributed to "erosion."[11] Despite early techniques such as composting, manuring, and crop rotation, no easy way existed for restoring lost potassium in depleted soil. It required a fertilizer, and marl was the answer!

"The potash in the greensand marl occurs chiefly in the mineral glauconite, which is essentially a hydrous silicate of ferric iron and potassium. Nearly all the Cretaceous formations contain glauconite, but only three contain sufficient amounts to be considered commercially important. . . ."[12] The New Jersey Marl Belt contained all three formations. The region was sometimes described as averaging just over two miles in width, wider at the north, and narrower in the south, but later studies indicated it ranged up to 20 miles wide in places.[13] The pattern of its location in New Jersey can be seen in the maps below:





Map at left shows the geologic sections underlying central and south Jersey, with the edge of the central green area denoting the limit to where the ocean once extended across South Jersey. The 1923 map at right depicts the pattern of some key marl pit locations.[14]

Its use as a soil enhancer in Europe dates back many centuries,[15] but its most widespread use in the Mid-Atlantic states began with improved transportation modalities like railroads, which provided the means to ship from the excavation pit to sometimes-distant farm fields.

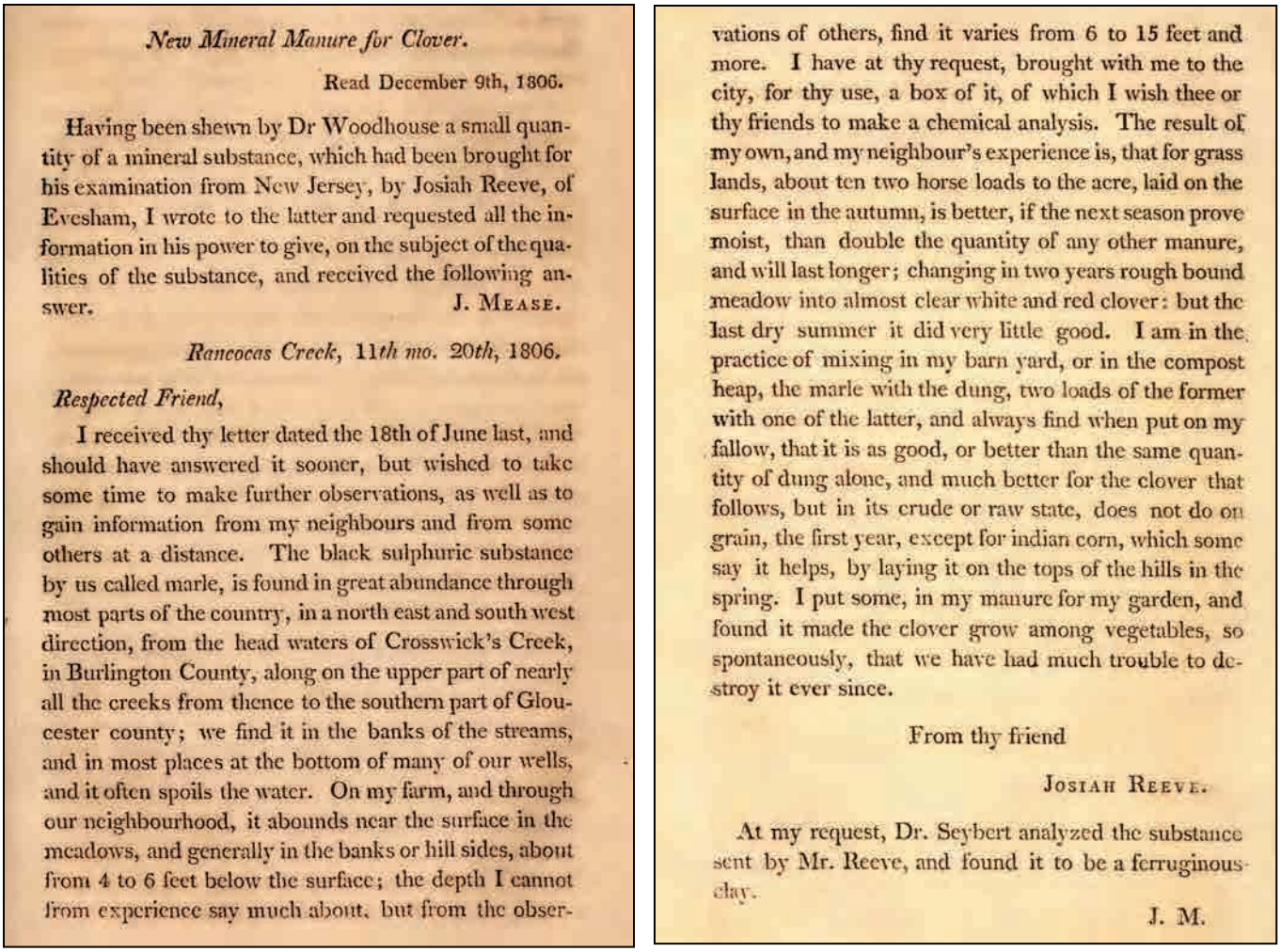
One of the early detailed references to its presence in South Jersey appeared in an 1808 article published in Philadelphia.[16] Two years earlier, Josiah Reeve, an early Quaker farmer in the northern part of what is now Medford Township in Burlington County, had written about this miracle of nature, which existed in a 90-foot-thick deposit under his farm at what came to be known as Reeves Station Road.

While the Reeve farm's marl deposits were but one of many locations for extracting marl from the ground and used as fertilizer or shipped elsewhere, Reeve's came to be one of the longest-used marl pits in New Jersey. Reeve prospered during his lifetime, residing in the impressive farm mansion called Locust Shade.

Local farmers, desperate to improve their crops, typically dug material from streambeds or low areas. As early as 1754, one farmer near Mount Holly described spreading 25 loads of "blew mudd" from an old ditch along with unidentified "sandy soil from an inland swamp" on his land, leading to a soil rejuvenating effect.[17]

David Peacock, another farmer in nearby Southampton, received credit in one nineteenth-century publication as having "made the first extensive application of green sand marl, a valuable fertilizer that underlies all this section, is the source of its surpassing fertility, and is by the thousands of tons transported both by rail and wagon long distances to less favored localities." This likely occurred a few years after Reeve's efforts.[18]

Later, an ad from the Vincentown Marl Company proclaimed that its marl had "been carted for many years from the pits in wagons, a distance of ten or fifteen miles . . . many thousand tons per year . . . to the Township of Shamong."[19] Another newspaper article



New Mineral Manure for Clover.

Read December 9th, 1806.

Having been shewn by Dr Woodhouse a small quantity of a mineral substance, which had been brought for his examination from New Jersey, by Josiah Reeve, of Evesham, I wrote to the latter and requested all the information in his power to give, on the subject of the qualities of the substance, and received the following answer. J. MEASE.

Rancocas Creek, 11*th mo.* 20*th*, 1806.

Respected Friend,

I received thy letter dated the 18th of June last, and should have answered it sooner, but wished to take some time to make further observations, as well as to gain information from my neighbours and from some others at a distance. The black sulphuric substance by us called marle, is found in great abundance through most parts of the country, in a north east and south west direction, from the head waters of Crosswick's Creek, in Burlington County, along on the upper part of nearly all the creeks from thence to the southern part of Gloucester county; we find it in the banks of the streams, and in most places at the bottom of many of our wells, and it often spoils the water. On my farm, and through our neighbourhood, it abounds near the surface in the meadows, and generally in the banks or hill sides, about from 4 to 6 feet below the surface; the depth I cannot from experience say much about, but from the observations of others, find it varies from 6 to 15 feet and more. I have at thy request, brought with me to the city, for thy use, a box of it, of which I wish thee or thy friends to make a chemical analysis. The result of my own, and my neighbour's experience is, that for grass lands, about ten two horse loads to the acre, laid on the surface in the autumn, is better, if the next season prove moist, than double the quantity of any other manure, and will last longer; changing in two years rough bound meadow into almost clear white and red clover: but the last dry summer it did very little good. I am in the practice of mixing in my barn yard, or in the compost heap, the marle with the dung, two loads of the former with one of the latter, and always find when put on my fallow, that it is as good, or better than the same quantity of dung alone, and much better for the clover that follows, but in its crude or raw state, does not do on grain, the first year, except for indian corn, which some say it helps, by laying it on the tops of the hills in the spring. I put some, in my manure for my garden, and found it made the clover grow among vegetables, so spontaneously, that we have had much trouble to destroy it ever since.

From thy friend

JOSIAH REEVE.

At my request, Dr. Seybert analyzed the substance sent by Mr. Reeve, and found it to be a ferruginous clay.

J. M.

Josiah Reeve's letter to Philadelphia Society for Promoting Agriculture.

from Cumberland County recounted that "... hundreds and thousands of horses and mules are annually employed hauling marl into those sections where the people are not allowed to build railroads to carry it."[20] If the roads improved during winter, boys would be pulled out of school to drive wagons of marl to market.[21]

In fact, local farmers throughout the marl region dug it up from one part of their land and applied it to their growing fields. They would also bid on accessing nearby pits:

> The farmer would purchase, usually at auction, so many yards of marl. He would be permitted to dig as deep as he wished, but the big difficulty was in getting the water out of the ground. It frequently would run in as fast as he could bail it out, and he would have to abandon the pit.[22]

At times, they even purchased adjacent lands simply to access the material. The term "marl lots," as distinct from "building lots," came into play.[23] Newspaper ads indicated that the presence of marl on properties enhanced their value:

> Public sale to be held on ... November 15, 1845 ... situated on the road leading from Eayrestown to Vincentown. ... There is on said farm an inexhaustible bed of excellent marl.[24]

As early as 1816, one publication reported that small boats carried some marl from the Timber and Rancocas creeks as far as Pennsylvania and Delaware.[25] Because marl was heavy and not a concentrated product, however, it was the arrival of small local railroads that allowed it to be transported to wider markets on a significant commercial basis.

Many viewed the results of applying marl to farm fields as nothing less than miraculous. In his 1876 annual report, the State Geologist Cook looked back on its use and proclaimed:

> The marl has been of incalculable value to the country in which it is found. It has raised it from the lowest stage of agricultural exhaustion to a high state of improvement. Found in places where no capital and but little labor was needed to get it, the poorest have been able to avail themselves of its benefits. Lands which, in the old style of cultivation, had to lie follow, by the use of marl produce heavy crops of clover, and grow rich while resting. Thousands of acres of land, which had been worn out and left in common, are now, by the use of this fertilizer, yielding crops of the finest quality. Instances are pointed out everywhere in the marl district of farms which, in former times, would not support a family, but are now making their owners rich from their productiveness."[26]

The Attributes of Marl

Marl was applied to the soil in different ways with some farmers simply spreading it on the surface, while others tilled it into the topsoil. Alternate applications included putting it in small piles across the fields in the fall, relying on the melting snows, and spring rains, to wash it into the ground.[27]

Applied to sandy soil, it firmed it up; applied to clay soil, it reportedly loosened it, even though it had some clay properties of its own.[28]

Different farmers found that particular crops especially benefited from the application of marl. Reeve had observed that it was so beneficial to clover that it became hard to control.[29] Others found it especially useful in growing potatoes, a major Central and South Jersey crop, as seen in the advertisement here.[30]

Some mixed it with manure and composted materials. Results likely reflected, to some extent, the initial soil condition, but there was little scientific evidence to prove which method produced the best results. The Pemberton Marl Company recommended applying 3 to 5 tons of marl per acre to double the hay yield.[31]

When encountered at or just under the surface, marl was not necessarily beneficial, especially when found in thick layers. When dried, it acted like rock, and construction workers complained of broken shovels and augurs. When it absorbed and held water, it created an impenetrable barrier, hampering the spread of tree and shrub roots. Under roads and buildings, it could provide unstable support. An early experiment in paving a road in Pemberton with it proved calamitous. In 1880,

As seen at left, heavy layers of green marl still exist just below the surface in Burlington County.[116] Their impermeability results in poor drainage and ponding on the surface in many areas following heavy rains.

Processed marl for gardening, as seen on left, has a loose, sandy texture, while marl as dug from the ground may be hard and rocky when dry, but clay-like at other times, depending on specific content and moisture as well as location.[117]

the Pemberton Borough Council ordered Hanover Street covered with grey marl in an effort to improve its surface. The condition of the road became worse than ever, incurring "the wrath of the citizens. . . . The marl will have to be all dug out and gravel substituted before the thoroughfare can be made passable."[32]

Marl even presented challenges to the builders of the very railroads intended to haul it, such as the Pemberton and Hightstown Railroad: "[Near Hornerstown] the marl was very difficult to dig through in making cuts for the roadbed and involved considerable expense to the company."[33]

When planting trees, horticulturists tried to avoid the solid layers, as the roots failed to penetrate and water would puddle surficially.

Several other uses for marl developed, including its inclusion in bricks and cement, which had no particular impact on South Jersey's situation.[34]

The Second Train Trip—Promoting Marl and Earning Profits

With the prospect for profits from marl production made possible by the expansion of railroad capabilities, efforts were undertaken to promote investment and interest. In July 1869, a special excursion train traveled to the Squankum & Freehold Marl Company.[35] Filled with newspaper publishers, potential investors, and dignitaries, when the train reached Farmingdale in Monmouth County,[36] it backed down into the marl pits "so that all could have a view of the work, the rails being laid at the bottom of the marl bed for the purpose of loading the marl expeditiously. A large force of men were at work loading the marl while the party were there."

On board the train was Professor George Hammell Cook of Rutgers University, also the influential State Geologist, who remarked that "the marl they were then taking out was the finest he had ever seen," and he further observed "how rich it was in all that tends to make good land, its cheapness . . . [and] its permanent good to all lands to which it is applied."[37] Among Cook's first research projects was the chemical analysis of "greensand marl." This research ultimately led to his appointment as state geologist.[38]

Several years earlier, he wrote: "The transportation of marl on our railroads is rapidly increasing. . . . Every mile of new railroad adds to the value of our farms; it gives cheaper and quicker access to markets and makes it possible to bring in fertilizers to enrich the soils and increase the crops."[39]

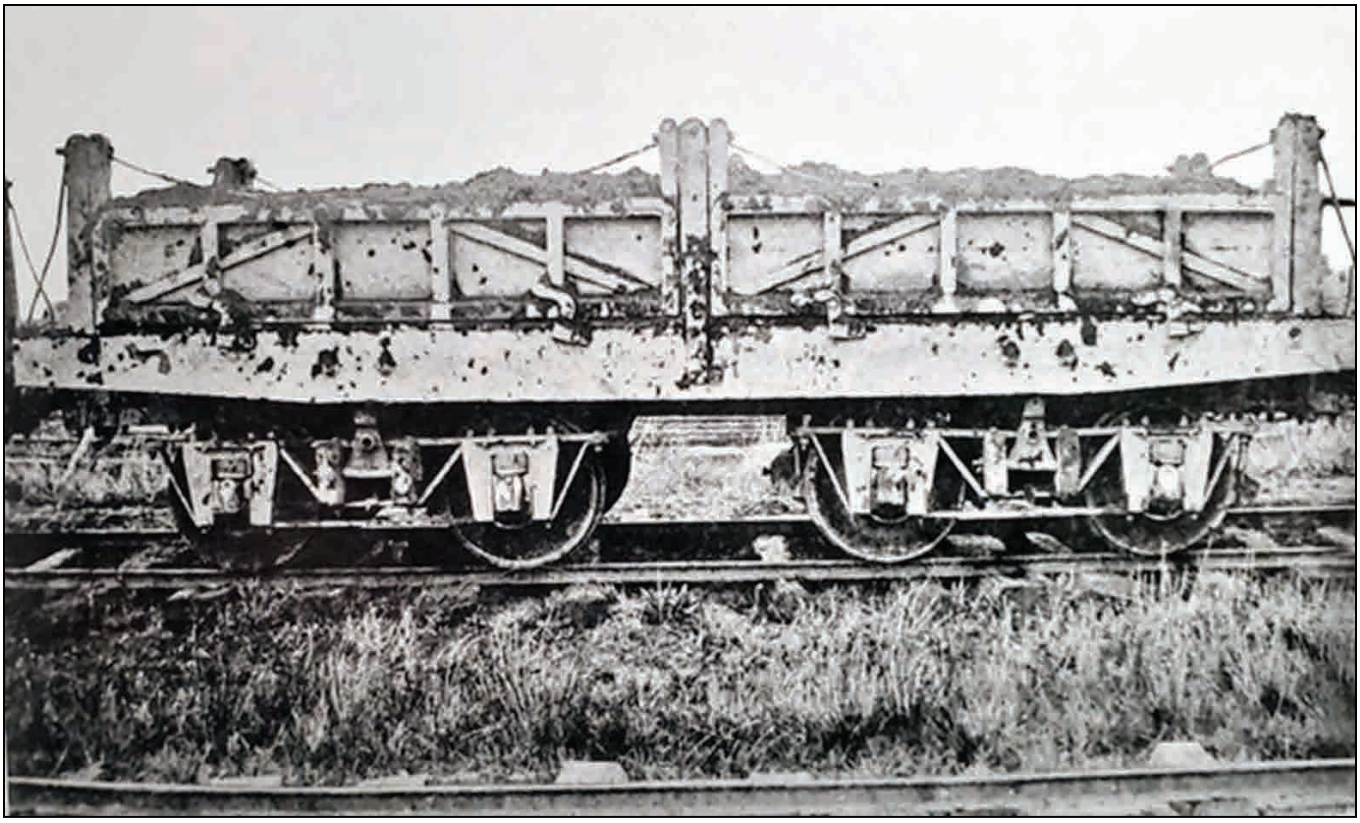
Advertisements for the product aimed at farmers cited Cook's analysis.[40] His embrace of marl led him to speculate some years later that it might be possible to "increase the number [of marl pits] until they actually join each other, and the whole distance from Sandy Hook Bay to the Delaware River has become one great marl pit."[41]

J. G. Stevens, a member of the Stevens family who had built the Camden & Amboy Railroad, a pioneering, wealthy, and politically influential New Jersey force in the nineteenth century, also joined the train that day. The C & A Railroad had stepped in with financing when local investors failed to raise sufficient capital. Now, J. G., grandson of the revered Colonel John Stevens, told the group about the prospects for good profits, and, while deferring to Cook for scientific details, said: "looking at it as a railroad man it was a good thing, and railroad men are not often mistaken."[42]

At the time, the Camden & Amboy, while still retaining its political power and influence, was entering a period of rising expenses, partisan challenges, and the advanced age of its original leadership team.[43] Commodore Richard F. Stockton, grandson of Richard Stockton, signer of the Declaration of Independence, for whom Stockton University is named, had stepped down from the presidency of the controlling company, and the new management was seeking a wider array of revenue sources.[44]

The Third Trip

Lest it appear that the railroad was ignoring South Jersey, it must be noted that while the railroad established its headquarters in Trenton for political purposes, Bordentown served as its main equipment location; it



The Camden & Amboy constructed marl cars such as this one in its Bordentown shops. Easily-opened sides facilitated pushing the marl off at destination.[118]

also had offices in Camden. Thus, yet another marl tour train occurred on October 30, 1859. Those onboard comprised a similar group of railroad executives, investors, and politicians.[45] This time, the train made a lengthy stop at Burlington County's Pemberton marl pits, which the newspaper account noted had started some six years earlier, and whose owner, the Pemberton Marl Company, was headed by President A. W. Markley. Described as the most successful in the state at the time, it was producing 30,000 tons of marl a year, being dug as deep as 40 feet in places.

One passenger, James W. Allen, had escaped death from the Mount Holly marl train explosion earlier that year. As this train left Mount Holly, headed back to Camden, he must have cast his eyes south on the connecting Mount Holly, Lumberton, and Medford Railroad, which he had just laid out, whose opening was but a month away. That line, too, would become an important marl hauler.

The importance of such trips in encouraging financial and political support for the marl railroads can be sensed by newspaper reports about several such trips: "The train was comfortably filled with guests from every section of New Jersey and other states. One of the largest cars was fitted up as a refreshment saloon, filled with all that could satisfy craving of more fastidious palates and with wines, liquors and cigars in profusion."[46] And an earlier trip ending in Monmouth County: "A fine luncheon was served up on the train, to which all on board appeared to do justice . . . [and later] coaches were in attendance to take us to the hotels, or a drive along the beach. . . . About three o'clock dinner was announced, very much to the gratification of the excursionists. . . . The dinner was an excellent one [followed by presentations on the benefits of marl to both farmers and investors]."[47]

Marl and its impact on agriculture became regular news in the second half of the 1800s, and to a much lesser extent in the early 1900s. Two towns (Marlboro Township in Monmouth County and Marlton, part of Evesham Township in Burlington County) were named after it, and another place in Cumberland County was also called Marlboro. It was taken from the ground at dozens and dozens of places.[48] Several larger marl pits illustrate the development and evolution of the industry, three in Burlington County, one in Gloucester County.

Pits varied in size and configuration. Small ones could be found on farms throughout the region. When

Northwest corner of recent opening of William Hoffman's Pit at Birmingham, Burlington County, N. J. Showing efflorescence and stratification of the greensand and creep along the face of the old bank, indicated by the contortion of sand-filled crevices.

the marl was near the surface, the farmers could simply dig it up and spread it on nearby fields.

The Pemberton Pits

In a number of locations, the vast amount of marl present resulted in large open pits being mined. When the marl was under a top level of sand or soil, dangers of collapse existed.

> THE ACCIDENT AT THE MARL-PITS.
> Mr. John Troth went to Gaskill's Marl Pits in Pemberton Township for marl on Tuesday morning. . . . He was anxious to obtain his load as quickly as possible, and going into one of the pits with Mr. Gaskill's son, they commenced digging, when an overhanging mass of marl caved in upon them. Mr. Troth was almost entirely embedded in it, and when taken out, was found to be severely injured. All possible assistance was rendered him, but of no avail. He lingered until about 5 o'clock, the same day, when death relieved him of his sufferings. . . .[49]

The pits at Pemberton were located near Birmingham Road, where the northern branch of the Rancocas took several twists, and the land was low. Nearby areas were also mined for sand, later in particular by the Norcross and Edmunds Company.[50] In 1867, trains hauled 25,000 tons of marl to eager farmers from the main Pemberton pit.[51] The area was examined and reported on in detail in a 1922 report on New Jersey's greensands.[52]

The Vincentown Pit

Perhaps best remembered for this widely used photograph below, believed to date to circa 1866, the

Vincentown pit reportedly produced over 100,000 tons of marl during its lifetime.[53] Seen standing at the left with his cane is General John S. Irick, president of the line, and one of the wealthiest people in South Jersey at the time. In 1861, the New Jersey State Legislature incorporated this short railroad branch as the Vincentown Branch of the Burlington County Railroad.[54] With financial backing from the Camden & Amboy, the branch line ran several miles south of Ewansville from the Burlington County Railroad's mainline, which at the time extended from Burlington to Pemberton. An extension of the branch ran from the Vincentown station, south across Race and Mill streets, for about a mile to reach the pits, which stood adjacent to a small tributary of the South Branch of Rancocas Creek. Expectations for more profits from hauling marl ran so high that an amendment to the Vincentown Branch Railroad charter in 1863 allowed for additional spurs to any other marl pits within a two-mile distance, but none were ever built.

Formal operations at the pit ended well before the start of the twentieth century, with part of it being leased out to a farmer in 1889.[55] By 1927, the entire Vincentown railroad was abandoned due to its lack of business.[56]

The Reeve Site[57]

When the five-mile short line from Mount Holly to Medford opened in December 1869, it featured one prominent siding at about the halfway point. This line's founders lacked the funding to start construction, so they turned to the Camden & Amboy for financial backing. The Medford line's first President was H. P. Ely, a doctor from Medford.

Josiah Reeve died in 1840, devising much of the property to his daughter Mary and son Josiah Richardson Reeve.[58] Dr. Ely had married Mary in 1844, was in medical practice with her nephew, Josiah R. Reeve Jr., and had purchased some land adjacent to the Reeve farm. Thus, conveniently, the railroad, designed by the C&A's James W. Allen, transected the middle of the Reeve farm, with a spur leading to the marl pit. A small station stood nearby, leading to the farm's access road being called Reeves Station Road.

Endeavors such as Ely's benefited from and participated with the marl railroads. For instance, Ely served as the lead incorporator in 1869 of the Fostertown and South Branch Marl and Transportation Company.[59] In 1881, after his death, it reportedly hauled 8,000 tons of marl, nearly as much as the Pemberton pits.[60] It is likely that wagons hauled the marl to the railroad. Other vendors and suppliers would have benefited, too.

In 1888, another family purchased the Reeve farm,[61] and in 1896, the Rogers family acquired the farm,[62] who apparently primarily focused on farming, for many years growing tomatoes for Campbell Soup. No doubt, the farm produced an abundant crop, based on the enriched soil from the marl that had been spread on the farm over the decades. Around World War I, the farm's eastern part, site of the most productive pits, was sold off.

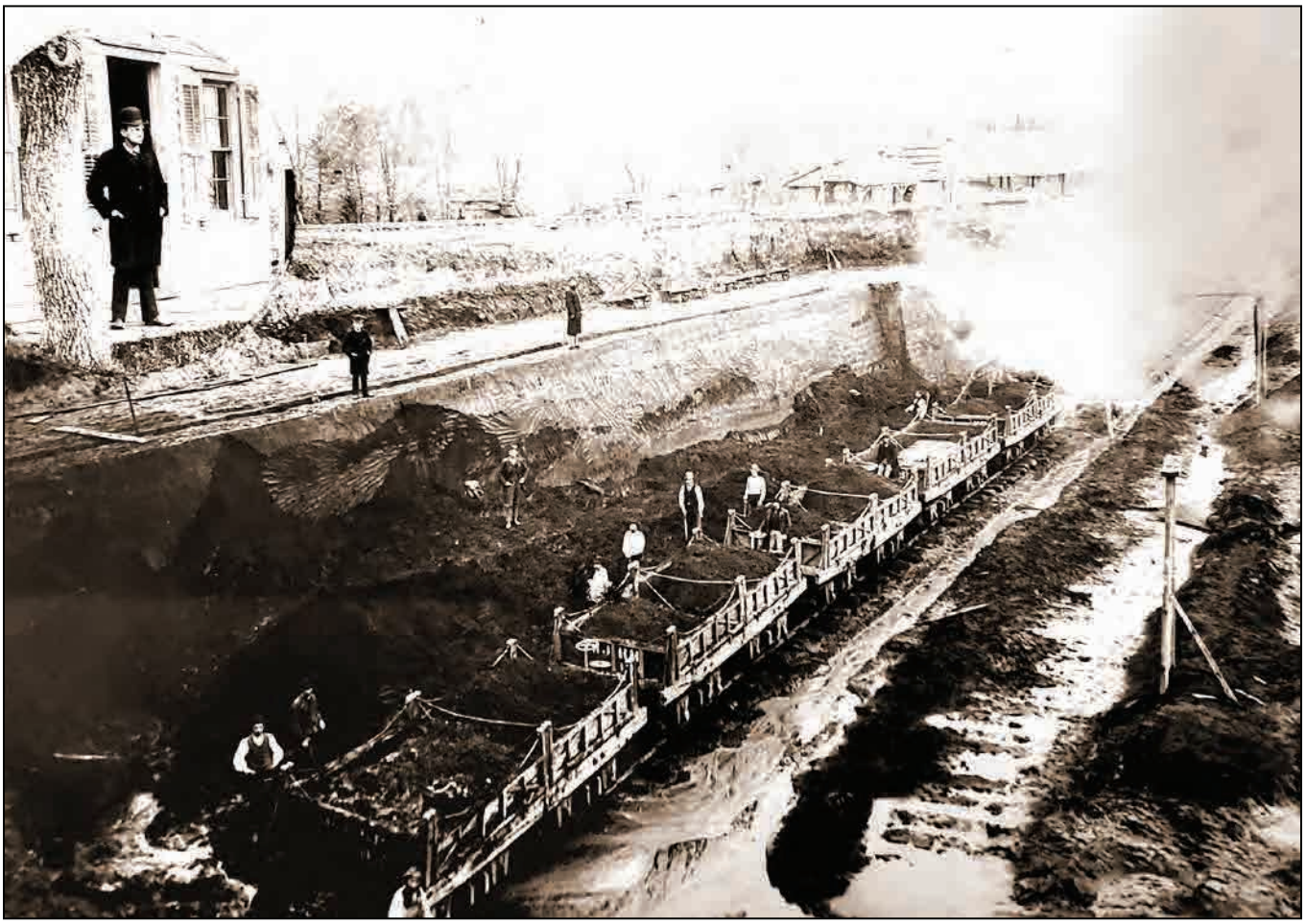
West Jersey Marl and Transportation Company

The benefits of marl for farmers gained recognition farther to the southwest in Gloucester County. In 1863, the West Jersey Rail Road had joined in the creation of the West Jersey Marl and Transportation Company, and they began acquiring local marl pits near the railroad and arranged to carry marl to market from others. In the years following the Civil War, the railroad expanded through acquisitions and agreements, which allowed it to deliver marl from various pits throughout its trackage area, which by then extended from Camden to Cape May. By agreement with the Camden & Amboy, it could ship to more distant customers, even by barge from Camden.

It was an exciting development. Describing just one of its pits, it was noted: "Thirty men on an average are busy all the time in pits, removing the overlay or earth covering, digging the marl out, etc. The facility with which these operations are done is wonderful. But with a locomotive engine in a marl pit, what may they not do?"[63]

As a result of the close relationship between the railroad and pit operations along the West Jersey Rail

West Jersey Railroad locomotive pulling a train of marl cars. Courtesy of the Paul W. Schopp collection.

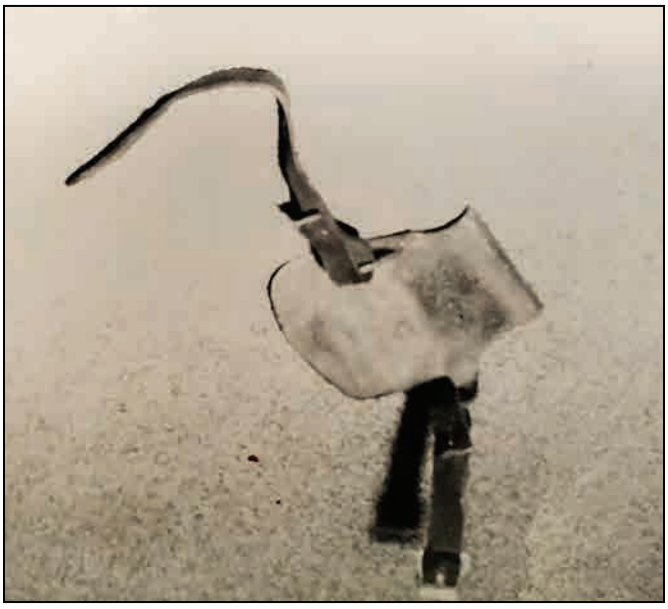


Marl pit at Sewell, c. 1888, later to become the Inversand Company operation. Note that as workers dug out the marl at the edge of the pit, the tracks would be repositioned to place them closer to the walls of the expanded dig area, facilitating manually loading the marl cars.[119]

Road, the area it served became the largest producer of marl in the state.[64] Years later, one of the sites associated with the West Jersey system, known as the Inversand Site in Mantua Township, was to take on a new life.

How it was dug

Marl extraction from the ground depended on time, topography, the nature of the marl, and economics. Small deposits on farms might be shoveled up by the farmers. Higher production areas might start out with manual labor, in some cases involving Irish immigrants,[65] and then progress to more complex methods. Larger pits might require steam shovels, and, later, more advanced derricks and dredging equipment. Where the marl lay buried under hardened rock, explosives might be required to break through.



The photo above, from the Pemberton site, is identified on its back as a "Spitting [sometimes referred to as "splitting"] Iron. Worn on left shoe to protect arch during years of hand digging for marl."[66] Local documents indicate that at that site, workers manually dug much of the marl: "This is the way most of the marl was dug. It was too hard-packed for the steam shovel. The steam shovel was used primarily for removing the over-burden, top six to ten feet of top soil, to get to the marl."[67]

Many pits filled with ground water with deeper excavation. In some cases, pumping equipment was used; in others, derricks might simply drop their shovels under water and scoop up the marl, as seen in Marlton on the next page, or use other hydraulic methods.

Some pit operators would set aside the soil overburden and return it to the pit after extracting the marl, sometimes planting vegetation to restore the area. Many smaller pits were simply abandoned, with nature left to handle them. Small holes on farms simply eroded adjacent soil inward, leaving low spots that viewers might not perceive to have been marl pits. Some larger ones simply took on the appearance of natural lakes.

In some areas, the owners provided worker housing.[68] Rails for trains might be laid and relocated in the pit areas. Various mechanical means of lifting marl onto the cars sometimes supplemented manual labor.

While marl trains varied, one description of a train indicated that:

> The usual marl train carried over 200 tons in 32 cars, each the size of the familiar small coal jimmy. Such a train could be loaded in about one hour, entirely by hand. The marl trains moved out on spurs to main lines and rumbled through towns and villages by mid-morning, on the way to farms in most of New Jersey.[69]

Delivery by train was typically made at existing stations or siding stops, but for an additional charge, some trains might stop between stations to discharge their cargo to adjacent farms.[70] It also appears that in isolated instances, a marl train might stop, and, after laying a temporary connecting track, back the cars out into the fields for dumping.[71]

The Demise of the Marl Fertilizer Industry

Despite all the promotion and investment, large-scale marl production for agricultural uses barely lasted fifty years.

An early indicator of the demise could be seen in the Pennsylvania Railroad's roster of railroad cars designed to carry marl. In 1875, the company owned 447; a year later, many had been scrapped or converted to other uses, leaving only 322.[72]

In a report issued by the State Geologist,[73] the Superintendent of the West Jersey Marl and Transportation Company reported:

> Our business has been small for the year 1878, and I feel very much ashamed of it. I could not do any better. Our farmers are very much discouraged. The price of grain, &c., is very low. Very few farmers have made both ends

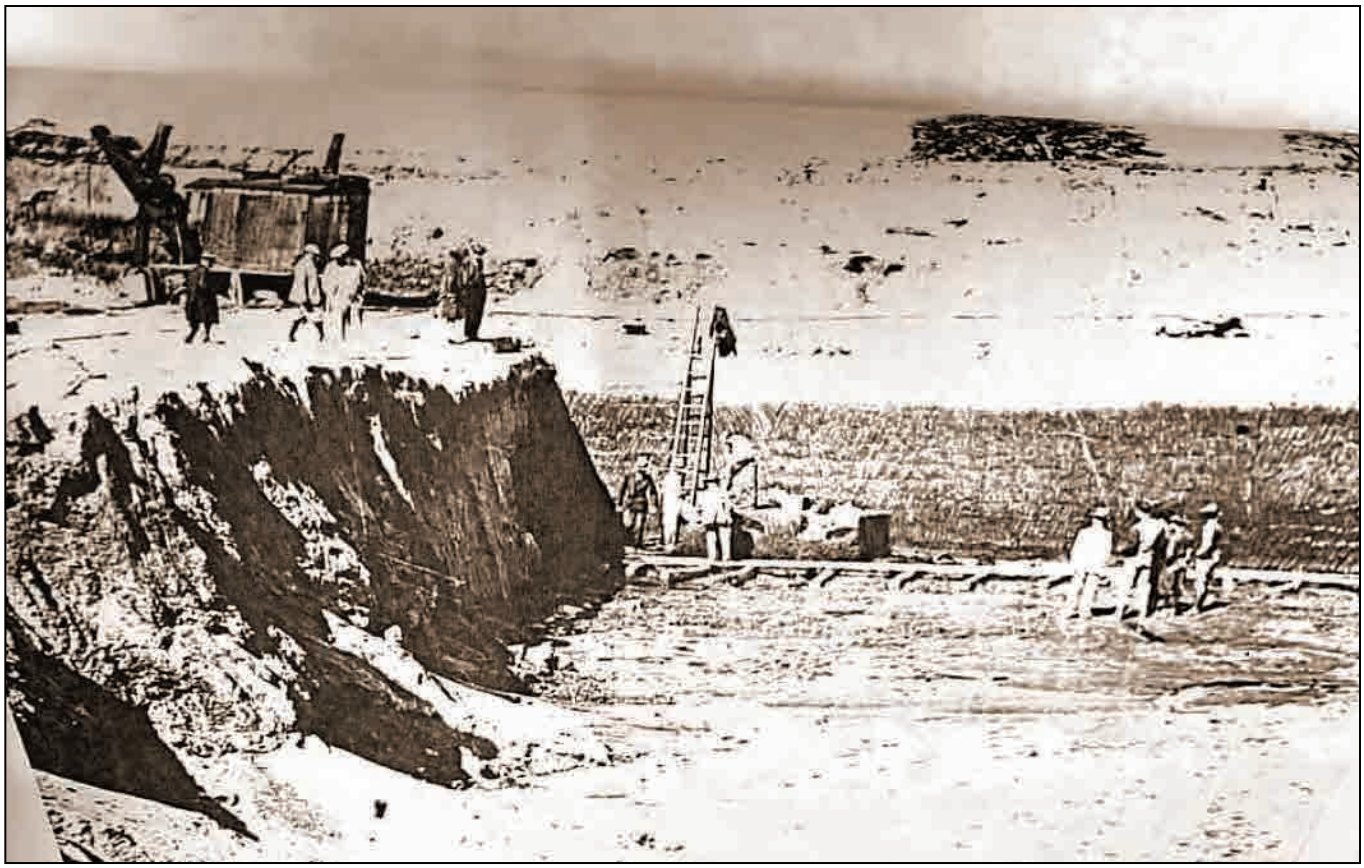


Photo shows the steam shovel at ground level at the Pemberton pit, while workers toil below.[120]

Dredge pit and stock pile of Atlantic Potash Corporation about 1.1 miles east of Marlton, Burlington County, N. J.[121]

> meet. . . . Farmers complain very much of the price of marl, and think it ought to be lower."

As early as 1868, farmers in Gloucester County attempted to fight the West Jersey Marl and Transportation Company's charges for providing marl, which they felt were exorbitant.[74]

Marl production in New Jersey in 1890 had diminished to 138,117 tons, valued at $61,723, with farmers performing virtually all the work for themselves. At that point, only three organized companies in New Jersey continued producing marl, representing only ten per cent of the entire output. Contributing to the lack of demand was many farmers' belief that one application of marl to their land would benefit the soil for many years.[75]

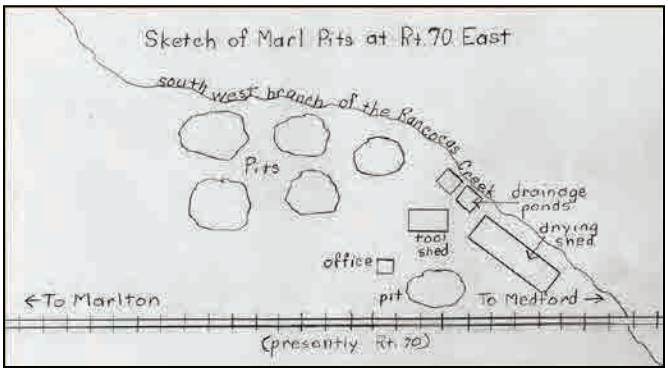
The railroad began removing the tracks into the Pemberton Pit in late 1901, when it was commented that "There has not been any marl dug for a long time, and the railroad thinks the rails are of more value up than they are in the ground."[76]

By turn of the century, farmers had become dependent on commercial potash sources, much of it coming from overseas, in particular from Germany, which had extensive deposits that were mined and processed for easier transport and uniform application. With the advent of World War I, officials realized that potash was not only a source of nutrients that farmers needed, but also important in munition manufacturing. Thus, the British- and the German-imposed blockades prevented the import of potash into the United States.[77]

In discussing problems regarding potash shortages that already existed in New Jersey in 1916, the State Board of Agriculture observed

> There has been a great deal of carelessness and a great deal of loss because of the fact that the plant food in commercial fertilizer has been rather abundant and cheap, and we have preferred to depend upon that. . . . There has been some talk about opening up the old [marl] pits. Now, we have not been able to find any pits that have really been opened, and have not been able to find any extensive use of greensand marl in the State.[78]

There had actually been attempts to reopen marl pits, including by companies such as the Atlantic Potash Company, and Potash-Marl, Inc., both east of Marlton in the area of the current NJ 70, both at Radnor Boulevard and Elmwood Road,[79] but they generally faded once foreign imports resumed after the war.



Marl operations often involved more than one pit. As one was depleted, nearby holes were dug. This location, east of Marlton, which closed around 1930, involved sucking up wet marl and drying it out.[80]

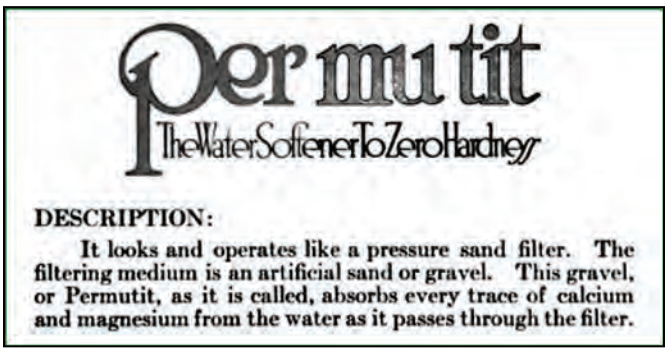
> Four companies have undertaken [after World War I] to produce or utilize the potash from New Jersey greensand. Small quantities of potash have been produced and marketed by some of these companies, but none are now producing. The potash industry of the United States was dealt a severe blow by the conditions arising after the armistice was declared. It seems probable, however, that some of the large developments will survive. Whether or not greensand may have a place in the American potash industry will depend on how well the greensand operators may be able to compete not only with German producers but also with American producers of potash from other sources.[81]

However, several developments in South Jersey renewed hope for the industry, albeit in a different way.

New Approaches

As the use of marl as a fertilizer diminished, several companies undertook new efforts to use the material.

Around 1923, the Permutit Company of New York and London acquired the old Pemberton pits at Birmingham, along with other nearby properties totaling some 500 acres, from the Hoffman family. Permutit was a trade name (derived from the Latin term *permutare* for "change") for water softening achieved by use of a "gravel" (a specially processed marl) placed in equipment through which water passed, resulting in the extraction of undesired minerals from the water. This shift from marl being used as a fertilizer required installation of new manufacturing facilities at the site,



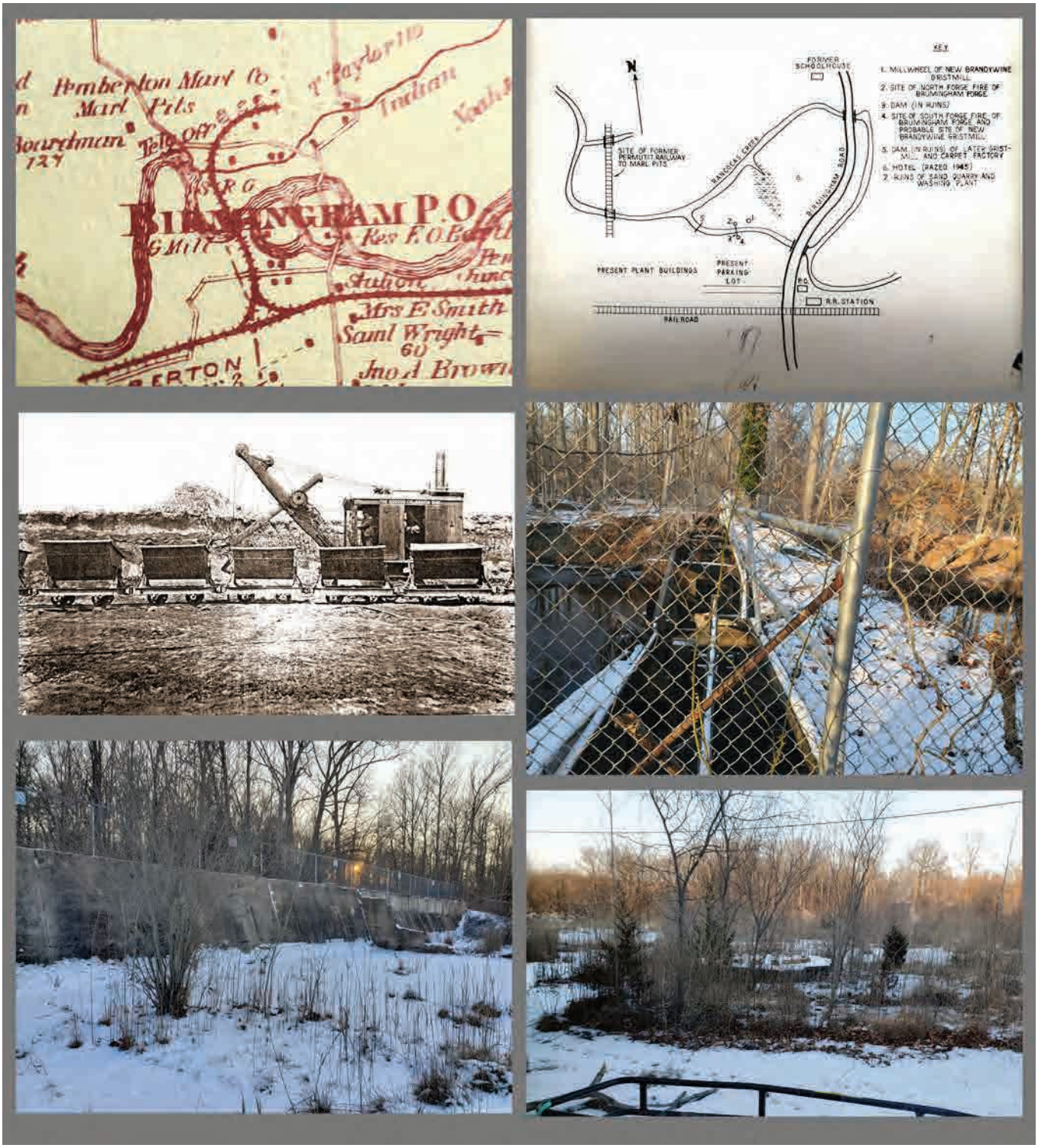
Greensand pit Birmingham, New Jersey

which came to be known as the Birmingham site, named for the road and part of Pemberton Township in which it was located. The resulting product was specially processed greensand, sometimes referred to as a synthetic zeolite, which used ionic exchange processes to capture the impurities. The company produced special equipment and advertised it for use in homes. Soon advertisements appeared such as this to the left, in addition to promotion for use in municipal water supply facilities.[82]

Permutit initially hauled the marl from the pits by truck to the main railroad line, where gondola cars carried it for processing at existing facilities in Brooklyn, New York, but in 1925, it started construction of a substantial production plant at Birmingham. At that point, the company constructed a narrow-gauge railroad line, a short-line, to haul the raw product from the pits to the new factory. As seen to the left,[83] the cars were designed so that at the factory, their contents could be pushed out their bottom-hinged sides for processing. Production at the Pemberton pit continued for many decades.[84]

Typical of those sites that developed more complex processing methods, the Pemberton site evolved to more of a manufacturing plant as seen below.[85]

With the advent of successful chemical replacements for the greensand products, excavating at the pit ended around 1956, and eventually, with several ownership changes involving foreign companies, all production halted there. The site currently handles warehousing and back-office functions and is fenced off for safety.[86]



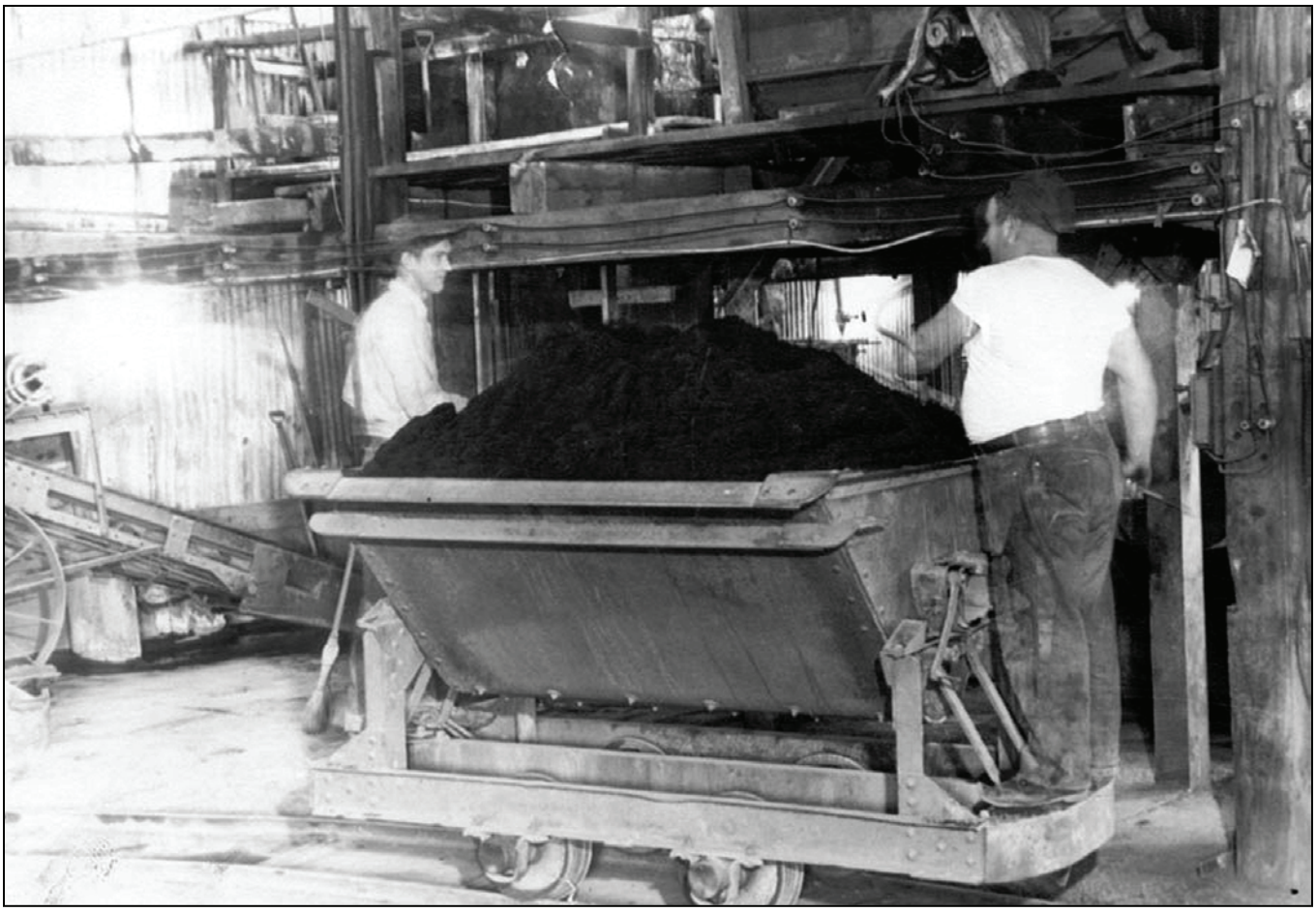
The Birmingham site over the years. Top row, from left to right: 1876 area map shows wide area encompassed by marl mining and original railroad spur to the pits.[122] There were multiple locations there dug for marl. Later map with detail on plant buildings, showing "island" that had been created by digging new waterway to allow small dams for power, formerly dug for marl, then site of Birmingham Inn, later used as ballfields.[123] Second row, old steam shovel with cars.[124] Current remains of railroad trestle to pits across Rancocas branch. Third row, concrete railroad embankment where incoming materials were transferred for processing.[125] Typical area behind and just north of current plant, showing regrowth of trees over former buildings area and remaining foundations.[126]

Photograph on next page: partial view of former pit, now a lake, as seen in 2025 from Birmingham Road.[127] The lake, now the property of Burlington County, awaits potential park development.

The Rogers family sold the property at Reeves Station to the R. S. Ryan Company shortly after World War I.

Addressing the need to extract the otherwise slow-releasing potash from the greensand for better fertilizing purposes, Ryan instituted processing methods under an experimental new model, using scientific studies done elsewhere.[87] The property was then sold to the Zeolite Chemical Co., and operations continued on an expanded basis. Then, with the marl being dug from the large pits closer to Fostertown Road, it was hauled on a narrow-gauge railroad to the plant, where it was combined with sand dug from nearby pits across the road, which was brought onto the property by tramway.[88] Then it was passed through a rotary kiln, and further processed with sodium to produce a refined potassium. Unprocessed marl was also available for sale.

Photo of R. S. Ryan pit taken around 1922.[128]



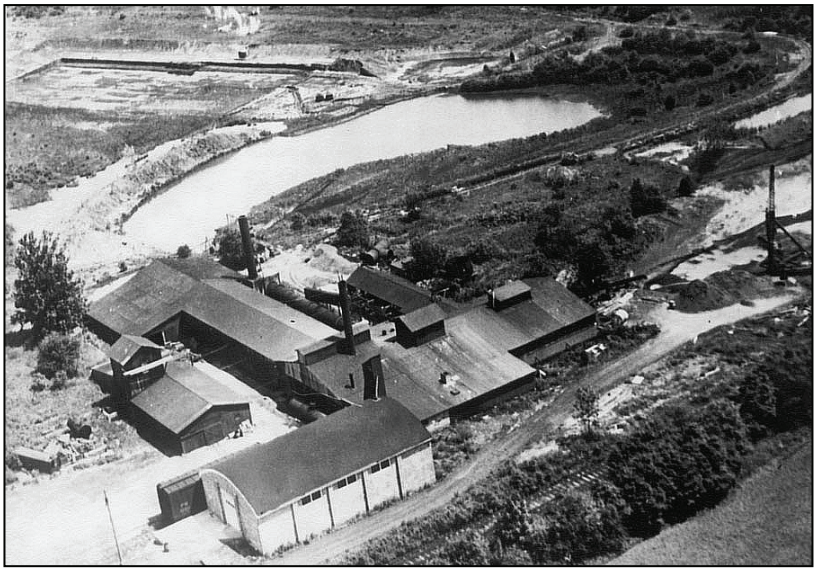
Processing marl at Zeolite Company in Medford.[129]

Depending on customer requirements, the end product was then shipped out on the Mount Holly, Lumberton and Medford Railroad (then part of the Pennsylvania Railroad) that Allen had designed to run across the property with H. P. Ely's encouragement. As seen in the lower right part of the image below and to the right, the long spur from the 1869 construction that was on the west side of the main line was now replaced with a shorter siding on the east side, immediately adjacent to the buildings, where boxcars could be loaded with the finished product.[89, 90]

By 1939, three companies in New Jersey produced the majority of greensand in the United States, at greatly reduced quantities, and used for water softening instead of fertilizer. At that point, and for that purpose, properly processed greensand reportedly still exceeded the effectiveness of artificially created zeolite, both of which used ion exchange processes to treat the water.[91]

However, by the 1950s, chemically-manufactured ion exchange resins had become superior, again curtailing much marl production, as at Birmingham.

Joseph S. Florentine purchased the Zeolite pits in Medford, in 1949.[92] Using the name Zeolite Sales



Company, Florentine marketed relatively unprocessed marl through his National Soil Conservation Service. Florentine tailored his advertising based on some researchers' concerns that plants were slow in absorbing the potash in marl. His initial newspaper ads claimed that while slow to dissolve in distilled water, plants absorbed the marl's potash well. Later ads simply referred to it as not a fertilizer, but a valuable soil conditioner.[93, 94]

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NOT SOLD AS A FERTILIZER. BRING THIS AD WITH YOU, PLEASE

In the mid-1920s, the Inversand Company acquired the Sewell pits at Mantua Township, as the West Jersey Marl and Transportation Company wound down its operations. Inversand, a subsidiary of Clayton-based Hungerford & Terry Inc., was a major provider of water-processing equipment. The latter needed a reliable marl-based media source used in its equipment. Inversand also acquired the Zeolite Chemical Corporation, which operated the Medford pits for many years.[95, 96]

The Inversand location in Mantua proved to be a major marl source, and the pit was actively operated until around 2015. For some years, however, large amounts of ground water seeped in, flooding the pit and requiring expensive pumping to allow continued access for mining. In addition, environmental regulations became expensive and difficult to manage. The adjacent area had developed, with homes and two big-box stores not far away, and operations became increasingly onerous.

In the meantime, the company had devised a new marl-based product, first called Manganese Greensand, then a modified product called GreensandPlus™.[97] It eventually became more economical to utilize a source

Inversand Pit opened for visitors.[130]

in Brazil for the raw material, and Inversand sold the pit to Rowan University.[98]

Marl's Future

Today, some organic farmers use greensand as a potassium source or soil conditioner,[99] but there is no longer any significant marl production as such in the United States.

Of the hundreds of marl pits that once dotted South Jersey—on farms and the larger commercial ones—the locations of most are no longer readily identifiable. As was noted as early as 1941, "The banks of these pits have long since slumped down and they are now covered with dense vegetation. In most cases the center of the pit is not only thickly overgrown but is swampy or boggy, or even an actual pond."[100]

The presence of fossils in marl pits would be the subject of significant long-term interest. At first, many shark teeth and the like were regarded as something of a curiosity or production nuisance, but others provoked scientific interest.

Late in 1929, for example, at the Pemberton pit, a major find of crocodile bones deep in the marl led to their inspection on site by state and university officials as seen above right, and their subsequent transfer to the State Museum and then the American Museum of Natural History for preservation and study.[101]

In Camden County's Haddonfield, the skeleton of *Hadrosaurus foulkii*, estimated to be 25 feet long and weighing seven or eight tons, was unearthed in marl during the mid-1800s.[102] It is now the official State dinosaur.

The fossils at the Inversand site at Sewell, however, stand out today because of their quantity and nature. To date, with paleontologists examining only a small portion of the Inversand pit, more than 50,000 marine and terrestrial fossils, from mosasaurs and crocodiles to sea turtles, sharks, boney fish, coral and clams have been unearthed.[103] A major aspect of the pit, by virtue of the many fossils preserved there in

Keeping the pit dry for visitors and research required constant pumping, now continued by the Inversand Company under contract to Rowan University. Elsewhere, many marl pits have become ponds.[131]

the marl, is the hypothesis that it reveals a record of a significant event dating back some 66 million years: the Fifth Extinction.[104]

Research at the site, led by Fossil Park Director and Founding Dean of Rowan's School of Earth & Environment, Dr. Kenneth Lacovara, is shedding light on this mass extinction, when a large meteor hitting the Yucatan Peninsula disrupted the earth's skies, air, and ground. As a result, the dinosaurs that then inhabited South Jersey and other places died off (except for certain bird-like types) and 75% of all species on Earth went extinct—a pivotal, calamitous moment that paved the way for the modern world.[105]

The Inversand Company initially opened the pit periodically, which company had encountered fossils there for nearly a century, allowing visitors to dig for fossils.[106] Now, with the 2025 opening of the Jean and Ric Edelman Fossil Park and Museum, the full scope of these wondrous remnants from eons ago offers a new opportunity for marl to play a fascinating educational role.

Thinking of it all

The availability of marl provided a boost to American agriculture at a critical time, and it led to recognizing the value of fertile soil as a foundation of modern living. And although short-line railroads built to haul the marl generally ended those operations within only about half a century, their impact on rural regions across the state was not without significance in itself. In fact, they provided important transportation in an era before modern highways.

Looking back at the early days of this agricultural miracle, the fate of just four individuals involved in marl's promotion is of interest.

George H. Cook, who had so eloquently advocated the benefits of marl for farmers, went on to create New Jersey's federally recognized land-grant college, known then as the Rutgers Scientific School, and build the Rutgers Agricultural Extension Service, which today serves all 21 counties. Cook College was named in honor of his achievements. His work and name remain highly respected even today.

One of the displays reconstructed from fossils found in Rowan University's Jean and Ric Edelman Fossil Park and Museum.[132]

Marl pit where visitors may dig for fossils.[133]

H. P. Ely, who had steered the little railroad south from Mt. Holly across his wife's family farm and marl pits to Medford, died only two years after the short line opened. While for several years, hauling marl was a major revenue source, before long revenues started their decline, but later the pit became a focal point of renewed efforts. The line stimulated central Burlington County's development, an important accomplishment in itself.[107] Such development happened elsewhere in South Jersey too. Upon his passing, he was described as a "beloved and public-spirited citizen."[108]

James W. Allen, a skilled railroad design and construction engineer, worked his way forward to become the head of Maintenance of Way for the Pennsylvania Railroad's South Jersey operations, which had taken control of local railroads in 1871. In his later years, he held several Federal posts. He died in his native Bordentown in 1901, but his son carried on his father's legacy and had also become a railroad engineer.

J. G. Stevens. After the Pennsylvania Railroad leased the Camden and Amboy Railroad in 1871 for 999 years, the lessor company restyled itself as the United New Jersey Railroad and Canal Company in 1872 and Stevens became the head of this corporation.[109] Beginning with the Panic of 1873, railroads, which had borrowed large sums for expansion, were hard hit, and many railroad investors lost substantial funds in the ensuing years as part of the prolonged panic.[110] The concurrent drop-off in revenues from hauling marl, which he had so arduously promoted in earlier years, did not help the situation.

Early in 1886, Stevens committed suicide by shooting himself; he had tried twice before. It was reported that "of late years he has been depressed, owing to financial matters."[111] Whether any personal losses from marl investments were involved was not stated. Strangely, another railroad executive who had been involved in the marl trade had committed suicide a decade earlier.[112]

As for what would come next for South Jersey's marl otherwise, around 1918 it was conservatively estimated that the New Jersey greensands contained 256,953,000 short tons of potash (K20) that could be mined by open-pit methods. It was further projected that this quantity could have supplied the agricultural needs of the United States for nearly 1,000 years, and that should it ever become practicable to use underground methods of mining, the available quantity would be even greater.[113]

Only a very small amount of that treasure was ever exploited. Under the fields, roads, homes, and businesses in a good part of the Great Marl Region, much of this buried wealth of South Jersey quietly remains to this day.

Local residents occasionally took pen in hand to remember their experiences with old marl holes:

> Our land with marl is underlaid,
> A fertilizer that nature made;
> It beats all fertilizer makers,
> For one rod makes rich a dozen acres.[114]

> One of the greatest spots of our delight
> Was the marl holes an unusual site.
> There we would fish or swim in summer
> and show it with pride to any
> newcomer!
> In winter here we would glide and skate
> thin ice and hope that the ice would
> hold at any rate.[115]

Author's note

When I first discussed this research endeavor with Paul Schopp, he not only encouraged it, but immediately provided a series of helpful suggestions as well as access to his significant personal library of research materials. His insight and support are most appreciated.

About the author

Jim Alexander is retired from an extensive career in local and state government. He has written about many aspects of history. Initially focusing and published on railroad history, his previous works in *SoJourn* have involved the Lumberton Nike Base, the Tuckerton Mound, and a history of South Jersey solid waste management.

Endnotes

1 "A View of a Section of the Marl Bank now being worked by the Pemberton Marl Company." Photographed by SWAIM, Mill Street, Mount Holly, New Jersey November 28, 1865. Scan courtesy of Railroad Museum of Pennsylvania, Pennsylvania Historical and Museum Commission.

2 The term derives from the title of an article "The Buried Wealth of South Jersey," *Lippincott's Magazine of Literature, Science and Education* (October 24, 1879). Accessed from https://archive.org/details/sim_mcbrides-magazine_1879-10_24.

3 William Parry, et al., *New Map of Burlington County: From Actual Surveys & Official Records* (Philadelphia, PA: R. K. Kuhn & J. D. Janney Publishers, 1859). Accessed at http://hdl.loc.gov/loc.gmd/g3813b.la000442.

4 Excerpted from the *New Jersey Mirror* (Mount Holly), May 26, 1869. (Microfilm at Burlington County Library.) Further information on the wreck and its locomotive from Paul Schopp can be viewed at https://prr.groups.io/g/Prototype/topic/prr_fax_question_about_an/20477927.

5 Judith Lamb Olsen, *Pemberton: An Historic Look at a Village on the Rancocas* (New Orleans, LA: Polyanthos, 1976), 102. Note that Schopp's information regarding number of cars differs from Olsen's.

6 For instance, marl located under and near England's White Cliffs of Dover takes a harder form known as marlstone. Other deposits can be found as a common sediment in post-glacial lakes, and ponds of the northeastern United States. https://en.wikipedia.org/wiki/Marl. A detailed chemical analysis of marl samples taken in the late twentieth century from South Jersey may be read at John H. Dooley, *The New Jersey Geological Survey, Technical Memorandum 98-1. Comprehensive Chemistry of Select Greensand from the New Jersey Coastal Plain* (Trenton, NJ: New Jersey Department of Environmental Protection, 1998).

7 Geological history is beyond the scope of this paper, but further information may be seen at Katherine Fielding Graecen, *The Stratigraphy, Fauna and Correlation of the Vincentown Formation. Bulletin 52, Geologic Series* (Trenton, NJ: Department of Conservation and Development, New Jersey Geological Survey, 1941). Accessed at https://www.nj.gov/dep/njgs/enviroed/oldpubs/bulletin52.pdf.

8 Graecen, op. cit., 10. Graecen observes in her report that Governor Peter D. Vroom authorized the first geological survey of New Jersey in 1834, which she notes was coincident with the realization of "the fertility of the Marl belt."

9 In a letter dated June 3, 1868, to a Yale University professor, Pemberton Marl Company Superintendent J. C. Gaskill noted that chocolate marl was so "hard and chalky that our customers do not like it." Copy of letter in

author's collection.

10 George Rogers Mansfield, *Bulletin 727, United States Geological Survey*, *Survey*, *Potash in the Greensands of New Jersey*, in cooperation with the Department of Conservation and Development of New Jersey (Washington, DC: United States Geological Survey, 1922), viii. This report provides an exhaustive description of the characteristics and exploitation of marl in New Jersey.

11 Hubert G. Schmidt, *Agriculture in New Jersey: A Three-Hundred-Year History* (New Brunswick, NJ: Rutgers University Press, 1973), 62.

12 Mansfield, op. cit.

13 J. C. F. Tedrow, *Greensand and Greensand Soils of New Jersey: A Review* (New Brunswick, NJ: Rutgers University, Department of Ecology, Evolution and Natural Resources, 2002), 14.

14 Geologic map from https://www.usgs.gov/media/images/njgeologicmap. Map of pits based on Mansfield (referred to as 1923), as seen redrawn in Tedrow, Figure 11, 124.

15 William D. Shannon, "An Excellent Improver of the Soil: Marl and the Landscape of Lowland Lancashire," *Agricultural History Review* 68, no. 2 (December 2020): 141–67. Also, Robert A. Dodgshon, "Land Improvement in Scottish Farming: Marl and Lime in Roxburghshire and Berwickshire in the Eighteenth Century," *The Agricultural History Review* 26, no. 1 (1978): 1–14. Published By: British Agricultural History Society.

16 "New Mineral Manure for Clover," by Josiah Reeve of Rancocas creek, New Jersey, Communicated by Dr. Mease. *Memoirs of the Philadelphia Society for Promoting Agriculture* vol. I (Philadelphia, PA: 1808), 93. Accessed at https://ia804506.us.archive.org/29/items/memoirsofphilade1808phil/memoirsofphilade1808phil.pdf.

17 Schmidt, op. cit., 63. Also referenced in John T. Cunningham, *New Jersey's Rich Harvest* (Trenton, NJ: The New Jersey Agricultural Society, 1981), 9.

18 Major E. M. Woodward and John F. Hageman, *History of Burlington and Mercer Counties, New Jersey, with Biographical Sketches of Many of their Pioneers and Prominent Men* (Philadelphia, PA: J. B. Lippincott & Co., 1883), 424, 434.

19 Undated, unidentified newspaper advertisement, likely around 1866, courtesy Southampton Historical Society.

20 *Bridgeton Pioneer* (Bridgeton, NJ), August 18, 1855, 1.

21 "For the West Jersey Pioneer. Penny Town Correspondence," *Bridgeton Pioneer* (Bridgeton, NJ), November 18, 1854, 2.

22 Margaret Cridland, ed., *Medford: Pioneering Township* (Medford, NJ: Medford Historical Society, 1975), 40.

23 Olsen, op. cit., 89.

24 "Farm at Public Sale," *New Jersey Mirror* (Mount Holly), October 30, 1845, 3.

25 Rusticus, "Rural Economy," *United States Gazette,* March 15, 1816, 1.

26 *Annual Report of The State Geologist for the Year 1886* (Trenton, NJ: The John L. Murphy Publishing Company, 1887), 205.

27 "Something About Marl," *Monmouth Democrat* (Freehold, NJ), June 7, 1877, 1. Discusses various application methods and results on different crops.

28 "Marl as a Fertilizer," reprinted from the *Chicago Tribune* in the *Ann Arbor Courier*, January 19, 1887. Accessed at https://aadl.org/node/184047. One source said it was not helpful on clay soil: "Something About Marl," *Monmouth Democrat*, op. cit. Usefulness on clay soil may have depended on the particular soil composition or marl sample.

29 Reeve, Ibid.

30 Advertisement as found in the *Gloucester County Democrat* (Woodbury, NJ), February 25, 1892. 2. The ad was repeated in many editions of the paper.

31 Olsen, op. cit., 135.

32 Olsen, op. cit., 158.

33 John Brinckmann, *Pemberton and Hightstown: A Chronicle of Railroading through the Farm Belt of New Jersey* (Edison, NJ: Self-published, 1987), 42.

34 Use in early bricks in South Jersey is suggested by Philip Y. Yanella in his work, *Lumberton: The Early Years* (Lumberton, NJ: Lumberton Historical Society, 1974), 13, 14. (Also see his endnote 27.) The use of marl in making English bricks is documented at the website describing the Harris and Pearson Firebrick Works https://harrisandpearson.info/brickmanuf3.htm, in which it is also noted that some old clay pits were called marl holes. Marl's use in cement is discussed in Ravil Z. Rakhimov, et al., "Properties of Portland Cement Pastes Enriched with Addition of Calcined Marl," *Journal of Building Engineering* (May 2017). Accessed at https://www.sciencedirect.com/science/article/abs/pii/S2352710216303394. Its use in the United States in its (ground) rock form as a component of cement is discussed at *Marl*, Office of the State Geologist (Arkansas). Accessed at https://www.geology.arkansas.gov/minerals/industrial/marl.html.

35 "Another Excursion to the Squankum Marl Pits," *Monmouth Democrat* (Freehold, NJ), July 8, 1869, 2. Note that the Camden & Amboy organization controlled the *Democrat* by then, assuring favorable press coverage.

36 A publication that contains numerous references to early marl developments in Monmouth County is Franklin Ellis, *History of Monmouth County* (Philadelphia, PA: R. T. Peck & Co., 1885.

37 "Another Excursion . . ." op. cit.

38 "Our History: How George H. Cook Shaped Rutgers." https://execdeanagriculture.rutgers.edu/george-h-cook.html.

39 Geo. H. Cook, *Report of State Geologist for the Year 1867* (Trenton, NJ: Printed at the True American Office,

1868), 14.

40 Undated newspaper advertisement provided by the Southampton Historical Society to the author.

41 George H. Cook, *Geology of New Jersey* (Newark, NJ: Printed at the Daily Advertiser Office, 1868), 264.

42 "Another Excursion . . ." op. cit.

43 George Love Reilly, "The Camden and Amboy Railroad in New Jersey Politics, 1830–1871" (PhD dissertation, Columbia University, 1951). ProQuest (0003379).

44 For further information on the Camden & Amboy Railroad, readers may consult J. Elfreth Watkins, *The Camden and Amboy Railroad: Origin and Early History*, Address Delivered at Bordentown, N. J., November 12, 1891. Available at https://books.google.com/books/about/Camden_and_Amboy_Railroad.html?id=sHIpAAAAYAAJ.

45 "The Railroads of New Jersey: A Pleasant Excursion over Track," *The Philadelphia Inquirer*, November 1, 1859, 2.

46 Brinckmann, op. cit., 40.

47 "Another Excursion . . ." op. cit.

48 George H. Cook, *Annual Report of the State Geologist for 1886* (Trenton, NJ: John L. Murphy Publishing Company, 1887), 169 ff. lists a number of locations.

49 *New Jersey Mirror* (Mount Holly), November 29, 1860. The "Gaskill Pit" was actually the Pemberton Marl Pit, of which J. C. Gaskill was Superintendent (ownership or leasing arrangements unclear), 3.

50 Advertisement in *Evening Courier* (Camden, NJ), July 3, 1926, 120.

51 Cook, *Report of State Geologist for the Year 1867*, op. cit., 16.

52 Mansfield, op. cit.

53 N. R. Ewan and Wm. H. Gratz, "The Marl Trains of the Camden & Amboy R. R.," *The Railway and Locomotive Historical Society Bulletin* no. 90 (May, 1954), 154–56.

54 Wikipedia: *Wiki Project, Trains/ICC valuations/Camden and Burlington County Railway*. https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Trains/ICC_valuations/Camden_and_Burlington_County_Railway.

55 Indenture made March 25, 1889, between The First National Bank of Vincentown, New Jersey . . . and Solomon R. Simons. Courtesy Southampton Historical Society.

56 Christopher J. Young Jr. and William J. Coxey, *Two Roads to Medford* (Palmyra, NJ: West Jersey Chapter, National Railway Historical Society, 2017), 7, 8. The date for removing the tracks on the spur into the Vincentown marl pits is something of a mystery (email to author from William J. Coxey), but they do appear on a general map in the Mansfield 1922 publication (Plate 2), available at https://pubs.usgs.gov/publication/b727.

57 Extracted from George H. Cook, State Geologist, C. C. Vermeule, Topographer. *A Topographical Map of the Vicinity of Mount Holly.* State Atlas Sheet 12 ([Trenton, NJ:] New Jersey Geological Survey, 1887).

58 Will of Josiah Reeve, 1829. Accessed at The Reeves Project. https://thereevesproject.org/data/tiki-index.php?page=18290416_NJ_14772C.

59 Acts of the Ninety-Third Legislature of the State of New Jersey. . . . Chapter CCCLXI, Enacted March 31, 1869 (New Brunswick, NJ: A. R. Speer, 1869).

60 *Geological Survey of New Jersey, Annual Report of the State Geologist for the Year 1881* (Trenton, NJ: John L. Murphy, Book and Job Printer, 1881). It is possible that the figure shipped included what was produced on the Reeve location, as it was all the same family.

61 Tiare Fullmer. *Reeves Station, Part 2.* https://tiaretales.wordpress.com/2013/01/28/reeves-station-part-2/.

62 Tiare Fullmer, *Reeves Station, Part 3*. https://tiaretales.wordpress.com/2013/01/28/reeves-station-part-3/.

63 Quote originally from *The Constitution, and Farmers' and Mechanics' Advertiser* (Woodbury, NJ), June 1867. Quoted in *A Bicentennial Look at Mantua Township*, The Mantua Township Bicentennial Committee and The Mantua Township Lions Club, Page 189, obtained from https://thisweekinmantuatownshiphistory.blogspot.com/, which provides a comprehensive overview of marl operations in the Mantua area, as well as copy of the publication in the author's collection.

64 Tom Downing, *This Week in Mantua Township History*, May 2, 2019, provides an extensive overview of marl development in the West Jersey area. Accessed at https://thisweekinmantuatownshiphistory.blogspot.com/2019/05/ceres-park-and-gardening-of-state.html.

65 Downing, op. cit.

66 Photo taken in 1966 with notation "Spitting Iron." Lanxess Historical Archives at Birmingham, courtesy of Frank Bracchi, Site Manager.

67 From undated partial documents in the Lanxess site archives, likely published in 1960s by the Ionac Chemical Company, which succeeded Permutit as operator at the Pemberton site. Courtesy Frank Bracchi, site manager. These refer to the "spitting iron" as an "arch protector." Mr. Bracchi also provided an extensive tour of part of the site, and answered numerous follow-up questions.

68 *Bicentennial Look at Mantua Township,* op. cit.

69 John T. Cunningham, *Railroads in New Jersey: The Formative Years* (Andover, NJ: Afton Publishing, 1997), 224. Note that given the limited power of early locomotives, and weak coupling equipment between cars, it is likely the railroads operated shorter trains in some sectors, especially in the earlier years.

70 "South Jersey Marl Pits," *Evening Journal* (Vineland, NJ), April 13, 1881, 1.

71 Recollection of Paul Schopp, who cites an engraving he remembers showing such. This likely would have occurred in times of cheap labor. This would presumably have happened only for large farms adjacent to the railroad. At this writing, efforts to locate the picture are underway.

72 James Dredge, *The Pennsylvania Railroad: Its*

Organization, Construction, and Management (London: Offices of "Engineering," 37, Bedford Street, Strand, W.C.; New York: John Wiley and Sons, 1879), Table XXIII.

73 *Geological Survey of New Jersey, Annual Report of the State Geologist for the Year 1878* (Trenton, NJ: Naar, Day & Naar, Printers, 1878), 118.

74 "Resolutions adopted by the Bowentown Farmers Club," *Bridgeton Pioneer* (Bridgeton, NJ), January 17, 1868, 2.

75 Jefferson Middleton, *Marl, Report on Mineral Industries in the United States at the Eleventh Census.* https://www.google.com/books/edition/Report_on_Mineral_Industries_in_the_Unit/sHEUAQAAMAAJ?hl=en.

76 *The Mount Holly News*, January 1, 1901, 3.

77 Jason Szilagyi, "American Chemical Companies in the First World War," Paper 3A2, Proceedings of *Armistice & Aftermath: A Michigan Tech Symposium on WWI*, September 28–29, 2018. Central Michigan University. Available at: https://digitalcommons.mtu.edu/cgi/viewcontent.cgi?article=1019&context=ww1cc-symposium.

78 *Forty-Third Annual Report of the State Board of Agriculture* (Trenton, NJ: MacCrellish & Quigley Co., State Printers, 1916), 82, 83.

79 M. W. Twitchell, *The Mineral Industry of New Jersey for 1925*, Bulletin 29, Geologic Series ([Trenton, NJ]: Division of Geology and Topography, 1927), 13. Also see Meredith E. Johnson, *The Mineral Industry of New Jersey for 1930*, Bulletin 37, Geologic Series ([Trenton, NJ]: Division of Geology and Topography, 1932), 23.

80 Image drawn by Edna Wirth, courtesy of John Flack.

81 Mansfield, op. cit.

82 Typical advertisement from the 1930s, in author's collection.

83 Tedrow, op. cit. Date of photo not stated.

84 Undated and untitled partial draft of article prepared by Permutit Company, in archives at Birmingham plant, courtesy Frank Bracchi. Also see *The Permutit Company, Birmingham, New Jersey and Its Successors 1933 – 1985 As Remembered by Paul W. Miller* (1985). Obtained through University of Delaware Interlibrary Loan Program, courtesy Paulie Wenger.

85 Undated postcard, likely early 1950s. Courtesy Frank Bracchi.

86 *Ion Success* 7, no. 6 (July 26, 2016). https://industrytoday.com/ion-success. Describes the process and history of the Pemberton location and corporate changes.

87 *Annual Report, Department of Conservation and Development, State of New Jersey* (1920), 45.

88 Mansfield, op. cit., 81.

89 Descriptions of Ryan and Zeolite may be consulted at Cridland, op. cit.; Young and Coxey, op. cit.; and Mansfield, op. cit.

90 Cridland, op. cit., 81. Aerial photo of Zeolite plant, copy shown courtesy Dennis McDonald, undated but apparently 1947 as it appears in Young and Coxey, op. cit., 58. The latter image is annotated as to the functions performed in the various buildings.

91 H. Herbert Hughes, *The Mineral Handbook, 1939* (Washington, DC: United States Department of Interior, Government Printing Office, 1939). Accessed at https://digital.library.wisc.edu/1711.dl/QGHPBQDKJTJZH9E.

92 Cridland, op. cit.,82.

93 The belief that marl worked by physical properties more than chemical nutrient means was later echoed by J. R. Heckman and J. C. F. Tedrow, "New Jersey: Greensand as a Soil Amendment," *Better Crops* 88, no. 2 (2004), accessed at https://ucanr.edu/sites/nm/files/76652.pdf. Other research performed decades after its use suggested some possible concerns with heavy metal properties in marl: John H. Dooley, *Comprehensive Chemistry of Select Greensand from the New Jersey Coastal Plain*, New Jersey Geological Survey Technical Memorandum 98-1. (Trenton, NJ: New Jersey Department of Environmental Protection, Division of Science and Research, Geological Survey, 1998). Available at https://dep.nj.gov/wp-content/uploads/njgws/reports/tmemo/tm98-1.pdf.

94 News clipping in author's collection from 1960, referencing soil conditioning attributes. Advertisements from 1950 claimed fertilizer values.

95 Personal communication, Thomas J. Carrocino, President of Hungerford & Terry, to author via email. March 8 and 11, 2024.

96 Inversand pit, undated but likely 1920s. Photo Courtesy Thomas J. Carrocino.

97 https://www.inversand.com/, including press releases therein. Also, information from Thomas J. Carrocino.

98 Personal communication, Carrocino, op. cit.

99 Personal communication, William J. Bamka, County Agent, New Jersey Agricultural Experiment Station, Westampton, NJ, to author via email. September 22, 2017.

100 Graecen, op. cit., 21.

101 Charles C. Mook, "Recent Discovery of Crocodile Bones." Reprinted from *Natural History, Journal of the American Museum of Natural History* (March-April 1931). Lanxess historical archives at Birmingham, courtesy of Frank Bracchi, Site Manager.

102 *The Story of Haddonfield's Dinosaur*. http://hadrosaurus.com/. Also see *Mastodon Musings*. https://geologymuseum.rutgers.edu/about-us-geology-museum/mastodon-musings/mastodon-musings/255-the-story-of-new-jersey-s-state-fossil-hadrosaurus-foulkii.

103 *Rowan Breaks Ground on $73 million Fossil Park Museum*. https://today.rowan.edu/news/2021/10/rowan-breaks-ground-on-73-million-fossil-park-museum.html.

104 *Jean & Ric Edelman Fossil Park: A World-Class Museum*. https://www.rowan.edu/fossils/.

105 Jean & Ric Edelman . . . op. cit.

106 Megan Smalley, "Sand Quarry to Become Fossil Dig

Site," October 3, 2015. https://www.pitandquarry.com/sand-quarry-to-become-fossil-dig-site/.

107 James Alexander Jr., "Dr. Ely's Legacy: The Mount Holly, Lumberton & Medford Railroad," *Milepost*, Friends of the Railroad Museum of Pennsylvania, October 2018.

108 "Death of Dr. Ely," *New Jersey Mirror* (Mount Holly), January 23, 1873, 4.

109 *The Monmouth Inquirer* (Freehold, NJ), January 14, 1886, 2.

110 Personal Communication, Christopher T. Baer, Curator Emeritus, Hagley Museum, and Historian, Pennsylvania Historical and Technical Society. March 4, 2024. Email discussions regarding general transition from founding families to the PRR ownership and impact of the 1873 Panic on the railroad.

111 "John G. Stevens Shoots Himself Through the Head," *Courier-Post* (Camden, NN), January 07, 1886, 1.

112 In 1875, A. W. Markley committed suicide in Camden, following a period of unspecified depression. Markley had been involved with the creation of local marl railroads and had served as President of the Pemberton Marl Company. "Suicide of A. W. Markley," *Monmouth Democrat* (Freehold, NJ), September 30, 1875, 2. Also see "Camden & Amboy Railroad," *Bridgeton Pioneer*, January 31, 1868, 2.

113 *Annual Report for the Year Ending June 30, 1920* (Trenton, NJ: Department of Conservation and Development. State of New Jersey, 1920), 23. Accessed at https://babel.hathitrust.org/cgi/pt?id=hvd.32044102943651&seq=33.

114 Samuel Thackara, a resident of Medford, *The Products of New Jersey* (Medford, N.J. Privately printed, 1906). Copy in Kirby's Mill Museum. Quoted in Cridland, op. cit., 81.

115 From Autobiography of Albert E. Rogers, quoted in Fullmer, op. cit. Accessed at https://tiaretales.wordpress.com/2013/01/28/reeves-station-part-3/.

116 Photos by author. At left, visible layer of green marl just below the surface in Medford; at right, poorly draining field in Eastampton, New Jersey.

117 Photo by author. Sample at left was commercially available in small quantities for home use as of 2021; sample at right was dug from a construction site in Medford in Fall 2017, with assistance of Ken Fenimore.

118 Photo courtesy of the Paul W. Schopp Collection.

119 Courtesy Thomas J. Carrocino, President, Hungerford and Terry, Inc., and Inversand Company. An additional reference to relocating the tracks as marl excavation progressed may be found in "South Jersey Marl Pits," *Evening Journal* (Vineland, NJ), April 13, 1881, 1.

120 Courtesy Frank Bracchi.

121 Mansfield, op. cit., Plate VIII.

122 James Douglas Scott, *Combination Atlas Map of Burlington County, New Jersey* (Philadelphia, PA: J.D. Scott, 1876), 46–47. Reproduction atlas available from https://www.westjerseyhistory.org/maps/burlco_scott_1876_atlas/index13.shtml.

123 Sketch appeared in several undated publications in Birmingham site's archives, including "Birmingham New Jersey: Then and Now," Ionac Chemical Company. Unpaged. Courtesy Frank Bracchi.

124 Scan from undated copy in archives at Birmingham site. Courtesy Frak Bracchi.

125 Photo by author. January 24, 2025.

126 Both photos by author. January 24, 2025.

127 Photo by author. May 27, 2025.

128 Mansfield, op. cit., Plate IX.

129 Undated, courtesy Dennis McDonald, Medford Historical Society.

130 Courtesy Thomas J. Carrocino.

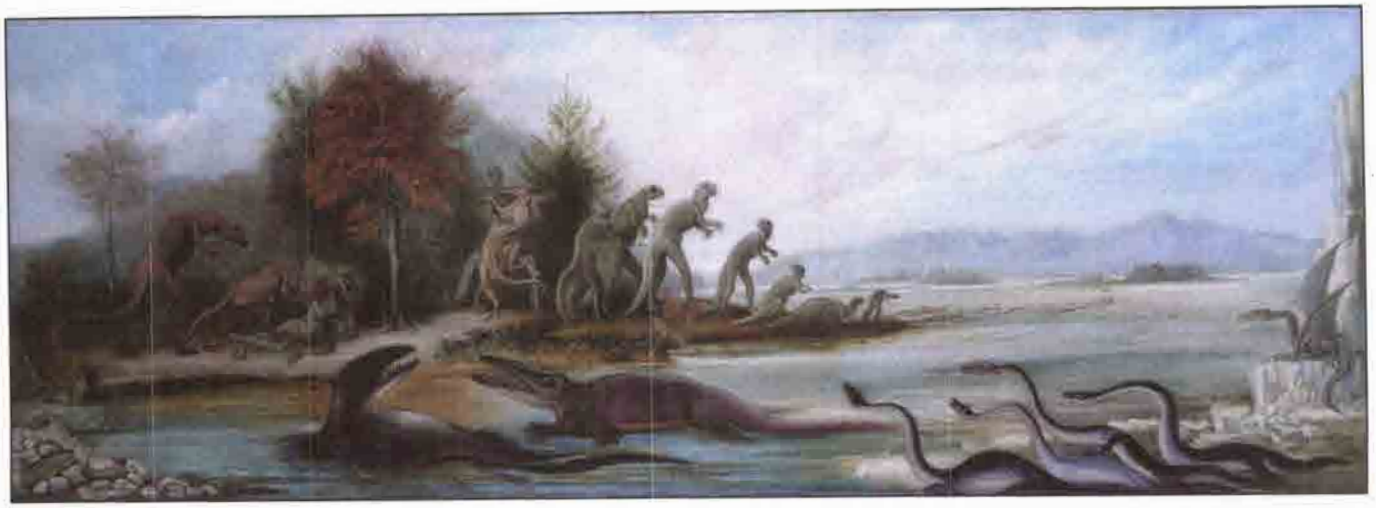
131 Photo courtesy Thomas Carrocino.

132 Photo by author. May 1, 2025.

133 Photo by author. May 1, 2025.

The Coming of the Great Marl Region

Jim Alexander



No humans were present to record the creation of New Jersey's Great Marl Region. In fact, it was millions of years later that humankind came into existence. Thus, there is no record of how the marl came to be, but scientists, writers, and artists have endeavored to portray what happened, based on the geologic and fossil record.

The 1877 painting shown above, a Princeton University art commission,[1] depicts an interpretation of the large life forms above the surface, living in or near what were then the coastal waters, likely until some 66 million years ago. Other artists showed a more tropical appearance, some with large flying creatures.[2] Much activity occurred under the water and in the sands below as well, where bodies sank and marine creatures lived and died. That was to be of special importance to later farmers who used the resulting marl to restore their depleted growing fields.

An interesting description appeared in 1858 when a small marl-hauling New Jersey railroad conducted a contest for an Essay on Marl.[3] The winner was Joseph B. Lyman, an agricultural editor. He wrote:

> Ages and ages ago, in the mists of geological antiquity . . . the ocean lapped the margin of a line between New York City and Philadelphia. . . . The line would have been mostly dry land, but part of it crossed firths and arms of the sea. . . . and broad marine swamps and meadows and lagoons, then growing rank with strange flora.
>
> Broad reaches of warm shoal water . . . huge reptiles disported . . . along oozy and slimy beds where giant turtles were sleeping. Enormous sharks darted after their prey through waters that teemed with scaly life.
>
> Down at the bottom of this ancient sea there were myriads of minute creatures, only a step advanced from vegetable life in their development and habits. . . . They were in their

> way vastly more useful than the giant reptiles that swam over them, and sprawled in the mud through which their shells were dispersed.
>
> Now that this dim and ancient life is exhumed from its geological grave by laborers . . . we find a broad, deep, and exhaustless bed of material . . . stored in this mysterious way for the benefit of unborn millions. . . .[4]

So massive were the deposits that observers decades later continued to rave of the Great Marl Region:

> Here . . . is a section . . of the line, from six to fifteen miles in width, in which the old sea-bottom crops out on the surface or is covered with only a thin layer of the drift-sand and gravel. Here are found deposits of marl or greensand of great extent and exceedingly rich in organic remains. These marl-beds are indeed so extended and so valuable that their fame is world-wide.[5]

And today it may be that their fame will reemerge from the fossils held in these massive deposits, which help tell the story of earth and its creatures.

ENDNOTES

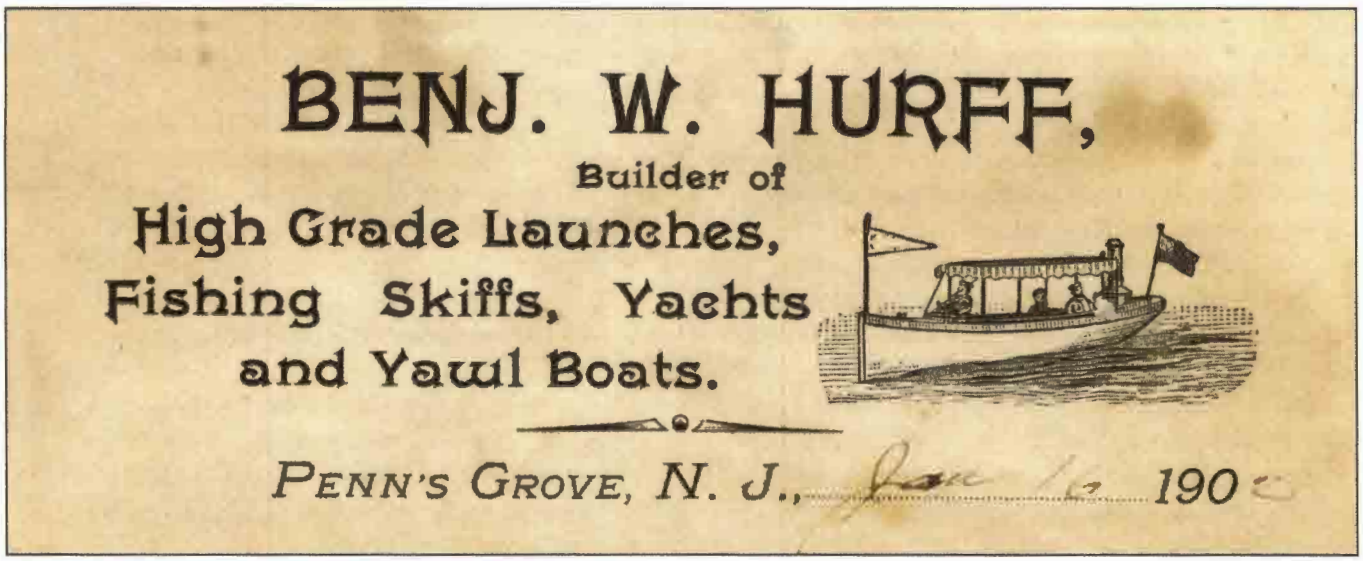
1 "Cretaceous Life of New Jersey," 1877. Benjamin Waterhouse Hawkins, 1807–1894; born and died in London, United Kingdom. Oil on canvas. 81 × 221.6 cm (31 7/8 × 87 1/4 in.) frame: 94.8 × 234.9 × 4 cm (37 5/16 × 92 1/2 × 1 9/16 in.) Image courtesy of the Princeton University Art Museum. Princeton University, Department of Geosciences, Guyot Hall. PP336.

2 See https://www.efm.org/. Retrieved August 1, 2024.

3 "$200 Prize Essay on Marl," *The Monmouth Inquirer* (Freehold, NJ), July 16, 1868, 2. Promoted by the Squankum and Freehold Marl Company, which operated a short railroad to haul marl from its pits. It was associated with the Camden & Amboy Railroad.

4 "Marl-What It Is?" *The Monmouth Inquirer* (Freehold, NJ), July 8, 1869, 2. Excerpted with minor word adjustments.

5 "The Buried Wealth of South Jersey," *Lippincott's Magazine of Literature, Science and Education* (October 24, 1879). Accessed from https://archive.org/details/sim_mcbrides-magazine_1879-10_24.



Benjamin W. Hurff was one of dozens, if not hundreds, of small boat builders with yards on the Delaware River and Bay. Born in October 1879 at Penns Grove to farmer and carpenter Samuel J. Hurff and wife, Emma, it appears Benjamin's woodworking abilities came naturally to him. He had a reputation for building fishing boats and cruising yachts but also constructed racers and speed boats. He built his own yacht, naming it the SWEET HEART. His death occurred in December 1928 on Christmas.