

## COKE

Copyright and all Rights Reserved

Lawrence J. Fleenor, Jr.

Big Stone Gap, Virginia

March 10, 2020

Version 4-10-2020

Industry in Wise County, Virginia was initially all about making iron. To make iron one needs three things - iron ore, lime stone, and a source of high heat and of carbon. Historically charcoal had been used to smelt iron. It supplied both the needed heat and carbon. However, the trees consumed in making charcoal were largely gone within transportable distance of the smelters early in the 19th century. Hard coal, also called anthracite, was substituted for charcoal, but by the end of the Civil War its supplies were becoming exhausted. Fortunately, about this time it was discovered that soft coal, also known as bituminous coal, could be converted into coke just as wood was converted into charcoal. In both cases hot ovens were used in the process. Black Mountain contained some of the best coking coal in the world, the Taggart seam. The Imboden seam was almost as good. Many hundreds of coke ovens were built in Wise County. The first experimental one was built at Mudlick (Osaka), then known as Pioneer. It produced coke from the Imboden seam that was of better quality than Connellsville coke, the best in Pennsylvania.



**COKE OVENS AT RAMSEY, VIRGINIA - NOTE THE KILLED VEGETATION AND THE LARRY - THAT WOMAN WHO HAD JUST HUNG HER LAUNDRY OUT IN THE MIDST OF ALL THIS WAS A DETERMINED HEROINE OF HER TIME AND PLACE**

Almost all of the coke ovens were of the bee hive type, which had evolved from ovens used to make charcoal. They were a three dimensional arch or dome made of fire brick, or 'refractories'. The interior shape of the ceiling reflected the radiant heat produced by the burning coal back onto it. There was a double cast iron door with air holes on the front side, and an approximate 18 inch hole at the top. They were built in double rows, back to back, and encased in stone and earth. There was a narrow gauge track that ran along the top of the double rows, along which ran a wheeled coal bin called a 'larry'. The larry was moved along the rail, and dumped coal down the top hole (charging). The coal was lit from the front door, and was allowed to burn in the absence of air for two days. At the end of that time every other oven was quenched with water and the coke pulled out with a coke rake, which was about eight feet long, and had a wide hook of either end. The hook on the far end was pushed behind the coke, and the other end was placed behind a laborer's back, who leaned backwards into the hook at his back, and who pulled the coke onto the ground. A conveyor was then used to load railroad cars with it.

The methodology was that every other oven was 'pulled' every other day, or after a 48 hour period. Over the weekend the coke baked for three days, or 72 hours. Thus, there was both '48 hour coke', and '72 hour coke'. The 72 hour coke was purer, and more expensive. The ovens that had just been pulled were recharged with coal, and the heat from the burning ovens on either side ignited it. The volatile chemicals within the coal were driven out, and burned at the hole in the top, or at the cracks in the doors, where they met air. Massive amounts of smoke and soot were released into the air in the process. The rain was black with soot. Trees near the ovens died. Everything in neighboring buildings was greasy and black. If there was a high overcast in the night sky, the cranberry red color produced by the fires reddened the skies for half a dozen miles around.



COKE OVENS AT ESSERVILLE



**MORE ESSERVILLE OVENS**



**COKE OVENS AT NORTON**



MORE COKE OVENS AT NORTON

All the bee hive ovens except for those at Keokee were made of fire brick (refractories) made of pressed and heated sand stone and clay mix. This gave them particular undesirable characteristics. Sand, when heated, turns to liquid glass. This process is called 'glazing'. This happened to the bee hive ovens made of sandstone / clay brick. The sand stone turned to impure glass, and the bricks lost their individual identities as the molten sand ran together and fused into one big glob. This was not a problem as long as the ovens were kept in use, and stayed hot. But when the fires went out, the brick within the oven contracted, crumbled, and gave way. The coke ovens collapsed. That is the reason that there are none of this type of oven left in Wise County, and the ovens fell into disuse in mid twentieth century.

The one exception are the coke ovens at Keokee, which were built out of refractories made from a dolomite (a type of limestone) / clay mix. This type of fire brick was more expensive, but they did not glaze, nor shrink as much when cooled, nor crumble. Each brick maintained its individuality, even the name of the manufacturer has remained crisp and very legible, even after over a century of use and abandonment. These ovens look just like they had been laid. They have not collapsed.

There is one other curious difference in the design on the coke ovens at Keokee, and that is that there is duct of about a foot's diameter that comes into the rear. This duct connects to the adjoining oven, and conducted hot exhaust gasses from the burning oven of the pair into the newly charged cold oven in order to heat it. This cut the time required to make coke by

25%, thus increasing production. However the expense of construction of this type of oven, called a 'Mitegell Oven', was too great to override its increased production. Also, the quality of the coke produced by the beehive oven was superior to that made in a Mitegell. (see addendum)

'Coke pullers' were usually muscular Black men. White men simply could not take the heat. Stonega had the first coke ovens built on the property of the Virginia Coal and Coke Company, and the laborers were either all Blacks, or mostly so. Housing was built up Possum Trot Hollow, which lay adjacent to the ovens. The houses were initially painted all red, and the community was therefore called 'Red Row'. Later the hollow was converted into a slate dump, and the community was moved to the 'Upper End' of the Stonega Camp. The houses were actually built into a compact square, but because of their heritage were still called 'Red Row'.

After World War II the ovens began to cave in due to decades of usage. Also, it was getting harder and harder to find labor willing to work them. Therefore, the coal company decided to build new coke ovens that were designed in such a way as to require less labor. The job of coke puller was entirely mechanized. An entirely new coal mine into the Taggart seam, along with 180 coke ovens of a new design, were built on Roaring Fork where it was joined by a small tributary called Pine Branch. This type of oven was called a "Mitchell". The terms 'Mitegell' and 'Mitchell' are sometimes confused. The mine opened in 1946, and the ovens were built around 1958. The new oven was designed like two bee hives joined together



**COKE OVENS AT PINE BRANCH - NOTE THE RAIL RUNNING ALONG THE GROUND**

at their rear, thus forming a continuous tube. They were charged as before. However, there was a track on one side of the row of ovens. On this side was a motorized ram on wheels. When the coke was ready to be removed from the oven, the doors on both sides were opened,



COAL WASHER REFUSE FROM PINE BRANCH MINE - TIPPLE IN REAR



THE VIEW THROUGH THE DOUBLE OVENS AS SEEN TODAY.

GOOGLE IMAGES

the fire quenched, and the ram activated. It pushed the coke out the door on the other side, where there was a conveyor belt running to a railroad car. There are about half a dozen of these ovens still left, and which can be photographed from the Roaring Fork Road (frequently mistakenly called the Pine Branch Road). This operation went off production in 1970.

Coke is still being made in Buchanan County, Virginia. The coal used is the Pocahontas seam, which is even better than the Taggart. Due to environmental concerns most of the American coal used for coking is shipped to China, where it is both coked and used in steel smelting. Most of the remains of the collapsed bee hive ovens have been scraped up, and used in strip mine road construction. The last ovens to burn in Wise County were around Norton. These were still in use when the author got his first 35 mm slide camera, and one of his first usages was to capture images of the hellish red glow of these ovens at night time. His conversion of these color images into digital JPEGs is what precipitated the writing of this article. It started as an opportunity to present these unique images to the public. It has ended in our better understanding of our area's treasure trove of industrial artifacts, as evidenced by the remains of three historic types of coke ovens, and of Keokee's connection to Hamilton, Ontario Canada. (see the following)

#### ADDENDUM

Exploring deeper into the interesting idiosyncrasies of the Keokee coke ovens gives some greater understandings of the dynamics of the development of that community. The key to understanding these related events is Charles Page Perin. He was the world's foremost geologist, metallurgist, and industrialist consulting engineer of his era. He developed the 'Birmingham of Canada' (Hamilton, Ontario; Birmingham, Alabama; the Tata Steel Corp. of India; steel industries in Siberia, South Africa, and China. He also developed Keokee, Virginia, including its unique coke ovens. The usage of dolomite refractories, and the Mitegell type of preheated coke oven, likely is the result of his experiences in Hamilton. This will require a little introduction.

Perin was the main intellect behind the development of the greatest center of Canada's steel industry, which is located at Hamilton, Ontario. The facilities there were associated with United States Steel. Conveniently located at the very western tip of Lake Ontario at the best harbor on that lake, and near the eastern end to the Welland Canal which connects Lake Ontario with the rest of the Great Lakes, Hamilton receives by ship iron ore from northwestern Ontario and coking coal from the Ohio River basin. The American coal was imported as such, and converted into coke in ovens located at Hamilton. The process continues to this day. That general region became a focal point in the development and manufacture of refractories (fire brick), which are used to line coke ovens as well as iron furnaces.

Dolomite, when heated by itself, is environmentally unstable, but when combined with aluminum (from clay) it exhibits a chemical and structural stability comparing very favorably to standard refractories usually made in part from sandstone. White dolomite is mined at Eagle Lake (the one near Haliburton, Ontario and not the one in far northwestern Ontario) and hauled by truck to brick kilns at Markham, St. Catherines, and Hamilton, Ontario. This brick is off white in color, and neither glazes, nor fuses, nor runs. It is pretty enough that houses are built from it.

We need to be aware of the uniqueness of the few remaining coke ovens at Keokee, and whose longevity is directly attributable to their dolomite brick. We need to view them for what they are, artifacts of cutting edge industrial technology of the early 20th century and of the connectiveness of that world through the personage of Keokee's founder, Charles P. Perin.

Bibliography:

Prescott, E. J. - The Story of the Virginia Coal and Iron Company

Wolfe, Ed - Coal Camps, Tipplers, and Mines

Fleenor, Lawrence J. - "Coal Camp Tour" of the Southwest Virginia Museum and Historical State Park

Addendum Bibliography:

1 - Donald McElwain - truck driver between Eagle Lake quarry and the brick kilns

2 - Ed Wolfe - ceramic engineer, and retired manufacturer of brick, as well as local historian

3 - [https://books.google.com/books?id=Yv0bBQAAQBAJ&pg=PA179&lpg=PA179&dq=refractory+dolomite+bricks+Hamilton+Ontario&source=bl&ots=caL1CGdUSo&sig=ACfU3U2sMUMferL9xlnTy1h1AzHzHRh9Mw&hl=en&ppis=\\_e&sa=X&ved=2ahUKEwjB\\_ZTsmcXoAhXQU80KHYbPBIUQ6AEwAHoECAcQAQ#v=onepage&q=refractory%20dolomite%20bricks%20Hamilton%20Ontario&f=false](https://books.google.com/books?id=Yv0bBQAAQBAJ&pg=PA179&lpg=PA179&dq=refractory+dolomite+bricks+Hamilton+Ontario&source=bl&ots=caL1CGdUSo&sig=ACfU3U2sMUMferL9xlnTy1h1AzHzHRh9Mw&hl=en&ppis=_e&sa=X&ved=2ahUKEwjB_ZTsmcXoAhXQU80KHYbPBIUQ6AEwAHoECAcQAQ#v=onepage&q=refractory%20dolomite%20bricks%20Hamilton%20Ontario&f=false)

Discussed the chemical composition of different types of dolomite bricks and their performance characteristics as liners of steel blast furnaces - pls. 178-179

4 - [https://books.google.com/books?id=zNicdkuulE4C&pg=PA1475&lpg=PA1475&dq=history+refractories+Hamilton+Ontario&source=bl&ots=Nkvdz0C7xc&sig=ACfU3U2XyoU4c4QkhY\\_5s7nVhU-CIRQ2Tw&hl=en&ppis=\\_e&sa=X&ved=2ahUKEwj6x6brncXoAhXGGc0KHcgzA90Q6AEwC3oECAsQAQ#v=onepage&q=history%20refractories%20Hamilton%20Ontario&f=false](https://books.google.com/books?id=zNicdkuulE4C&pg=PA1475&lpg=PA1475&dq=history+refractories+Hamilton+Ontario&source=bl&ots=Nkvdz0C7xc&sig=ACfU3U2XyoU4c4QkhY_5s7nVhU-CIRQ2Tw&hl=en&ppis=_e&sa=X&ved=2ahUKEwj6x6brncXoAhXGGc0KHcgzA90Q6AEwC3oECAsQAQ#v=onepage&q=history%20refractories%20Hamilton%20Ontario&f=false)

Documents Hamilton as being a center of the development and manufacture of refractories

5 - <http://refractorymaterials.net/dolomite-refractory-bricks/>

Documents the stability of dolomite refractories

Additional Bibliography is this latest version

6 – [Coal Science and Engineering](https://www.sciencedirect.com/topics/chemistry/coke-oven) – Mazumder, M. <https://www.sciencedirect.com/topics/chemistry/coke-oven>

The Mitegell Coke oven and its attributes

7 – [Mitchell Oven – like Pine Branch](http://www.coalcampususa.com/westpa/pittsburgh/bentleyville/bentleyville.htm) - <http://www.coalcampususa.com/westpa/pittsburgh/bentleyville/bentleyville.htm>

8 – Curran-Knowels Coke oven – not patented until 1937, but describes how heated gasses from adjacent burning oven preheats the coal via an ‘air duct’ at the beginning of the coking process

9 – Mitchell Coke Ovens – invented Australia 1847 - <https://livinghistories.newcastle.edu.au/nodes/view/17809>

10 – Existing Mitchell Type Ovens in Pennsylvania - <https://landmarkhunter.com/178921-minersville-coke-ovens/>

11 – patent infringement suite with excellent description of Mitchell ovens (Pine Branch type) - no reference to the Mitegell heated air duct type oven (Keokee) – demonstrates the conflation of the names of these two types of ovens and further documents the association between Westmoreland County, Pennsylvania and Wise County, Virginia.  
<https://cite.case.law/f/231/131/>