

History
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EARLY NINETEENTH CENTURY IRON FURNACES
A COMPARATIVE STUDY

by

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EARLY NINETEENTH CENTURY IRON FURNACES

A COMPARATIVE STUDY

The following report makes no attempt to be a definitive study of early 19th century iron furnaces. It is purely pragmatic in its objectives, for the study was undertaken primarily to find data which would be helpful in planning the restoration of Hopewell Furnace and its outbuildings. Since two of the most important features of that furnace, the Bridge House and the Cast House, are missing at present, their authentic reconstruction has long been planned. But data on the construction details of these elements of the Furnace Group is far from complete, and it was hoped that a comparative study of furnaces contemporary with Hopewell Furnace would provide some of the desired answers.

Assistant Director Lee, when recommending early in 1952 that this research project be undertaken, suggested a "documented study of comparable existing furnaces . . . , complete with plans, measurements and photographs." This suggestion, unfortunately, could not be followed in its entirety, since most early 19th century iron furnaces, comparable to Hopewell, have disappeared completely or have become merely picturesque piles of stone and rubble. Several disappointing trips were taken during the course of this study to old furnace sites, but nothing of any value was discovered regarding the construction details of anything but the furnace stack itself.

The only well preserved ironworks, dating from before the Civil War, which could be found was Cornwall Furnace, in Lebanon County,

Pennsylvania, about 40 miles west of Hopewell. This furnace, administered at present by the Pennsylvania Historical and Museum Commission, was visited in the hope that significant and helpful information would be forthcoming, but it was found that it cannot be considered comparable to Hopewell and other early 19th century furnaces. Although first established in 1742, a quarter-century before Hopewell, the existing furnace and related structures at Cornwall date from the late 1850's, when it was extensively rebuilt to take advantage of technical innovations in the ironmaking industry. For that reason it is in many ways closer to the modern blast furnace than to the more primitive ironworks characterized by Hopewell. Its Bridge House and Cast House, for example, are made of brick and are considerably larger than those formerly at Hopewell, so that while the general structural arrangement is roughly similar there is no real similarity in construction details.

The attempt to find existing furnaces which might aid in the Hopewell restoration having failed, we began a search for photographs or drawings of early 19th century ironworks. It was believed that more success would result from this project, in the light of former Park Historian Kurjack's discovery in 1949 of old Hopewell photographs in the Chester County Historical Society. Visits were made to that organization and to the Berks County Historical Society in the hope of finding similar views of other nearby furnaces, and a few were discovered (see Photos 1 and 2 below). No drawings or sketches of any kind could be located, however, and the available photographic evidence was not overly helpful.

The most important photographic collection examined was located in the library of the American Iron and Steel Institute in New York City. This collection was made about 25 years ago by A. T. Keller, Chief Construction Engineer for the Bethlehem Steel Company, and was purchased in 1948 by the Institute. It consists of well over 3,000 photographs of more than 500 separate ironworks, located primarily in the eastern seaboard states, about two-thirds of them in Pennsylvania. The collection is still being catalogued, but was made available in its entirety for this study. Most of the photographs were taken by Mr. Keller around 1930, and are therefore of slight value for our purpose, but several older pictures, found by Mr. Keller in private hands and in libraries, were included. Some of these were valuable for a comparative study of early ironworks, although they unfortunately did not provide the detailed information we were seeking. The photographs included in this report came from these various sources, and are representative of all furnaces studied.

Six Pennsylvania furnaces are shown, all roughly contemporary with Hopewell Furnace during the period in question. Sally Ann Furnace (Photo 1) was built in northern Berks County about 1791, and operated until 1869; it was rebuilt in part in 1879 and abandoned in 1881 after a fire. Windsor Furnace (Photo 2) was also located in northern Berks County and was built in 1768; it was abandoned about 1850 until rebuilt after the Civil War, and finally went out of blast in 1882. Curtin or Eagle Furnace (Photo 3) was built in Centre County about 1817 and operated until 1915; during its later history

it was a hot-blast furnace. Hecla Furnace (Photo 4), also in Centre County, was built in 1820, rebuilt and modernized in 1864, and operated until 1921. Joama Furnace (Photos 5 and 6), in Berks County about 5 miles southwest of Hopewell, was built in 1792, rebuilt for steam power in 1847, and operated until about 1890. White-Deer Furnace (Photos 7 and 8) was built in Union County in 1846 and abandoned in the late 19th century.

As can be seen from these pictures, all early blast furnaces were built on the same principles. That is, all were tapering structures of stone or brick built near the side of a small hill or bank. The furnace was charged at the top with iron ore and fuel, and the molten iron was tapped from the bottom of the furnace. A Bridge House was built from the bank to the tunnel head or top of the furnace to provide a means for the conveyance of the ore and fuel, and a Cast House was built against the furnace at the point where the iron was tapped. While these principles were followed in all cases, the construction details were usually quite different, the variations due largely to differences in local conditions and terrain. For example, some of the Bridge Houses depicted are supported on masonry walls and some on wooden pilings; some appear to be almost level while others have a definite upward slope. On the other hand, the two Cast Houses shown (Photos 3 and 4) are roughly alike, since the problem here was simpler; both have rather steeply pitched roofs, large entrance doors, and a ridge ventilator. Only one picture was found showing a Bridge House interior (Photo 8), but it is likely that the framing was essentially similar in most cases, simplicity being the keynote.

After all, early American ironmasters were neither engineers nor architects, nor did they hire such technicians to draw up blueprints before building an industrial structure. They were eminently practical men who in the most common-sense fashion solved each problem as it arose or delegated it to an experienced carpenter or mason. The main factors they considered were speed and utility, since labor and building materials were relatively cheap in that period. These buildings, moreover, were not intended to be permanent, for they could easily and economically be repaired or rebuilt if necessary. As a result, some of ~~the~~ these structures appear haphazard or possibly unscientific at first glance, and it seems difficult to find any common denominator. We cannot, admittedly, learn all the structural details of the Hopewell ironworks from studying these pictures, but we can find support for seeking an empirical and common-sense solution to our problems as Mark Bird and Clement Brooke, the two greatest Hopewell ironmasters, did. We must continually realize that Bridge Houses, Cast Houses, and other similar outbuildings were built only to serve a purpose---as a means to the end of producing iron.



1. Photo No. 122-4

Sally Ann Furnace

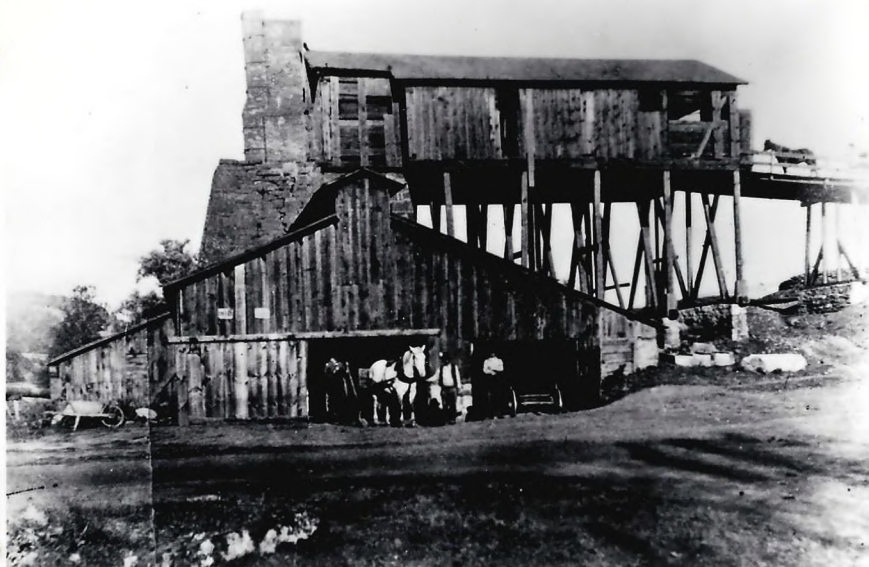
This picture, taken ca. 1920, shows the ruins of the Furnace and the Bridge House walls. Note that the Bridge House floor had no appreciable upward slope.



2. Photo No. 122-7

Windsor Furnace

This picture, probably taken in 1894, shows a long Bridge House with a marked upward slope. The Bridge House is apparently supported on masonry walls.



3. Photo No. 122-11

Curtin or Eagle Furnace

This picture, taken ca. 1915 just before the Furnace went out of blast permanently, shows a Bridge House supported on wooden pilings. The Bridge House floor appears to be fairly level, but note the slope of the approach ramp. Note also that ore and fuel carts are horse-drawn.



4. Photo No. 122-12

Hecla Furnace

Taken ca. 1920, this picture shows another Furnace Bridge House supported on wooden piles instead of masonry walls. This is similar to Photo No. 3 in the slope of the ramp, the level Bridge House, and the horse-drawn vehicles.



5. Photo No. 99-16

Joanna Furnace

This photo (ca. 1920) shows the ruins of the Coal House and the beginning of the ramp and Bridge House. Apparently, the slope of the ramp and Bridge House was appreciable.



6. Photo No. 99-17

Joanna Furnace

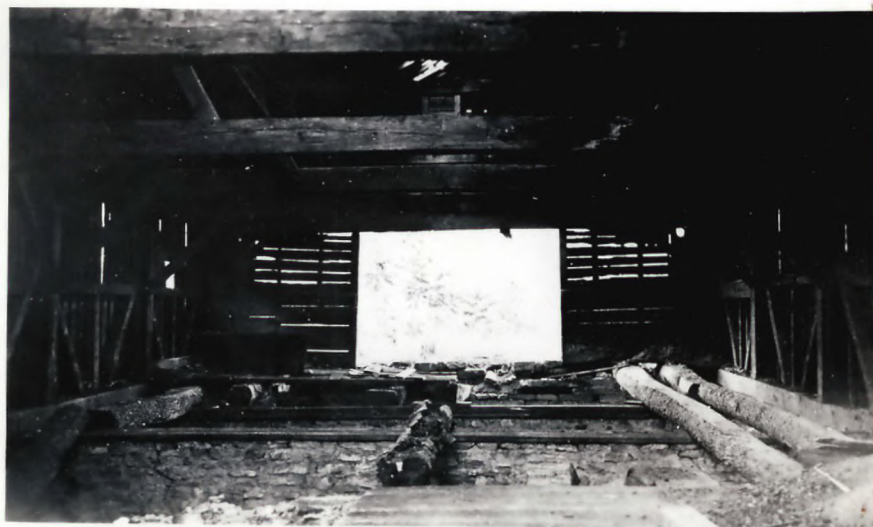
Another view, showing the Furnace stack and part of the Bridge House in the background.



7. Photo No. 122-14

White Deer Furnace

This picture, dated about 1932, shows the ruins of the Furnace and the fairly well-preserved Bridge House. This appears to be level, supported on three or four masonry walls.



8. Photo No. 122-16

White Deer Furnace

An interior view of the Bridge House, looking towards the tunnel head of the Furnace. Here again, the Bridge House seems level. Note the floor joists and the interior framing, especially the knee braces. This is probably similar to the construction of the Hopewell Furnace Bridge House.

history
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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
REGION ONE
RICHMOND, VIRGINIA

JAN 12 1954

Memorandum

To: The Director
From: Acting Regional Director, Region One
Subject: Report on Early Nineteenth Century Iron Furnaces,
Project HV-21, Hopewell Village NHS

Attached is a copy of Historian Hugins' report entitled "Early Nineteenth Century Iron Furnaces - A comparative Study" submitted in fulfillment of Project HV-21, Hopewell Village National Historic Site, together with a copy of Superintendent Cass' transmittal memorandum of January 7.

This report is essentially an analysis of the problem and an account of the research efforts toward its solution. Admittedly, it "makes no attempt to be a definitive study of early 19th century iron furnaces."

The statement of this fact is not, in any degree, intended as a reflection on Mr. Hugins' scholarship or industry. It is inevitable that, at times, research problems — despite mighty efforts expended upon them — must result in negative or meager findings.

Mr. Hugins, we believe, has exhausted the available research facilities and has reached some interesting conclusions. Until such time, if ever, as new research materials in this field may be discovered, we recommend that this report be accepted as representing completion of Project HV-21 at Hopewell Village National Historic Site.

(SIGNED)

E. M. Lisle
Acting Regional Director

Attachments

Copy to: Supt., Hopewell Village NHS

United States Department of the Interior
National Park Service

HOPEWELL VILLAGE NATIONAL HISTORIC SITE
Berks and Chester Counties
Pennsylvania

Hopewell Village National Historic Site was established by the Secretary of the Interior in 1938 for the purpose of preserving highly interesting buildings and other remains of a typical early American ironmaking community. It then contained 213.7 acres. In 1942 it was enlarged by Act of Congress, to its present 6200 acres.

The Iron-Making Village and Its Surroundings

The old ironworks itself was established by William Bird, who came to Pennsylvania early in the eighteenth century, and who by the 1740's was engaged in building extensively in this vicinity. In 1770 he raised Hopewell Furnace, and in a short time a self-sufficient village, almost feudal in economic pattern, developed about the works. This furnace continued in more or less constant operation until 1883, when, the production of cold-blast charcoal iron being no longer profitable, it was "blow'd out" for the last time.

Inactivity and neglect left their mark on Hopewell in the years that followed. The Bridge House, the Wheelwright Shop, and the Wheel House disappeared, together with the old Schoolhouse which once stood along the Joanna Road. Still preserved, however, are the Furnace itself, the Big House and several of its outbuildings, the Charcoal House, the Blacksmith Shop, and a few of the old Tenant Houses. Ingenious raceways which carried water to and from the Furnace are also in evidence.

Gradual stabilization of Hopewell Village is being carried on by the National Park Service as historical, architectural, and archeological research disclose additional information. It is hoped that water will eventually run through the races again, turn the furnace wheel, and thus operate the reproduced blast machinery. Reconstruction of other present or once existing buildings is planned to follow. Old-fashioned flowers and vegetables may be cultivated once more in the village gardens, and the Blacksmith Shop, where much of the original equipment is still in place, will ring anew with the activities of hearth and anvil.

Many miles of foot and horse trails traverse the wooded hills of this area. The Horseshoe Trail, part of the National Appalachian trail system, leads from French Creek Falls over Mount Pleasure and Williams Hill in a northwesterly direction toward Reading. The Boone Trail forms a loop around Hopewell Lake and passes the Fire Tower; and from this is an extension called the Turtle Trail. On the Lenape Trail one can hike from the Baptism Creek Picnic Area to the picnic grounds at Six Penny Creek. Rugged hikers like the Robbers Trail, which opens up the Chestnut and Bear Hill sections of the Site.

Natural Features and Wildlife

Wildlife in the area is protected, and under sanctuary conditions deer, foxes, rabbits, raccoons, opossums, ground hogs, squirrels, chipmunks, and other small

animals have returned to a more natural balance of the species. More than 78 kinds of birds live in or migrate through Hopewell, among them great blue herons, turkey vultures, several species of hawks and owls, ruffed grouse, ring-necked pheasant, quail, and a multitude of song birds. During the spring and fall, Canada geese, wild swans, and a variety of ducks use the 62-acre Hopewell Lake as a resting place on their trips north or south.

Trees, shrubs, and wild flowers of nearly endless variety add much to the attractiveness of hills and dales, and of the meadow areas. Flowering dogwood in spring and the flaming red and gold of its woodlands in October inspire many people to make annual pilgrimages to Hopewell Village at these seasons of the year.

Streams have been restocked with trout and the lake with large-mouthed bass, catfish, and sunfish. Fishing is permitted for holders of Pennsylvania State licenses under joint regulations of the Federal Government and the Pennsylvania State Fish Commission.

Overnight Accommodations and Picnicking

Tenting is permitted in restricted areas set aside for that purpose. There are also limited overnight cabin accommodations of a rough nature for hikers. The large Baptism Creek Area offers facilities for family and group picnicking.

Rules and Other Necessary Information

Please drive carefully at all times and park your car only in areas set aside for that purpose.

Tenting and other overnight stays require written permit. Please make application for permits in writing, or at the Superintendent's office.

Large organizations wishing to picnic in the area should make prior arrangements, but except in such cases no reservations are necessary.

Fishing is permissible under Pennsylvania State laws, and fishermen must carry their State license.

Hunting, trapping, or any other disturbance of wildlife, are prohibited. So also is the carrying of firearms in the area.

Trees and shrubs must not be cut or broken, nor is any picking of wild flowers permitted. Any injury or defacement of buildings or other Government property in the area is likewise prohibited.

No fires may be kindled anywhere in the Site except in the fireplaces provided for that purpose. Please extinguish fires completely before leaving, and do not throw burning tobacco or matches on the ground.

For additional information and reservations, please write to the Superintendent, Hopewell Village National Historic Site, Birdsboro, Pennsylvania.

