Furnace Head Race and Slag Heap

at Pine Grove Furnace State Park

This short interpretive path begins to the south of a small parking area below the Ironmaster's Mansion, along Bendersville Lane (a minor road between Bendersville Road and Route 233).

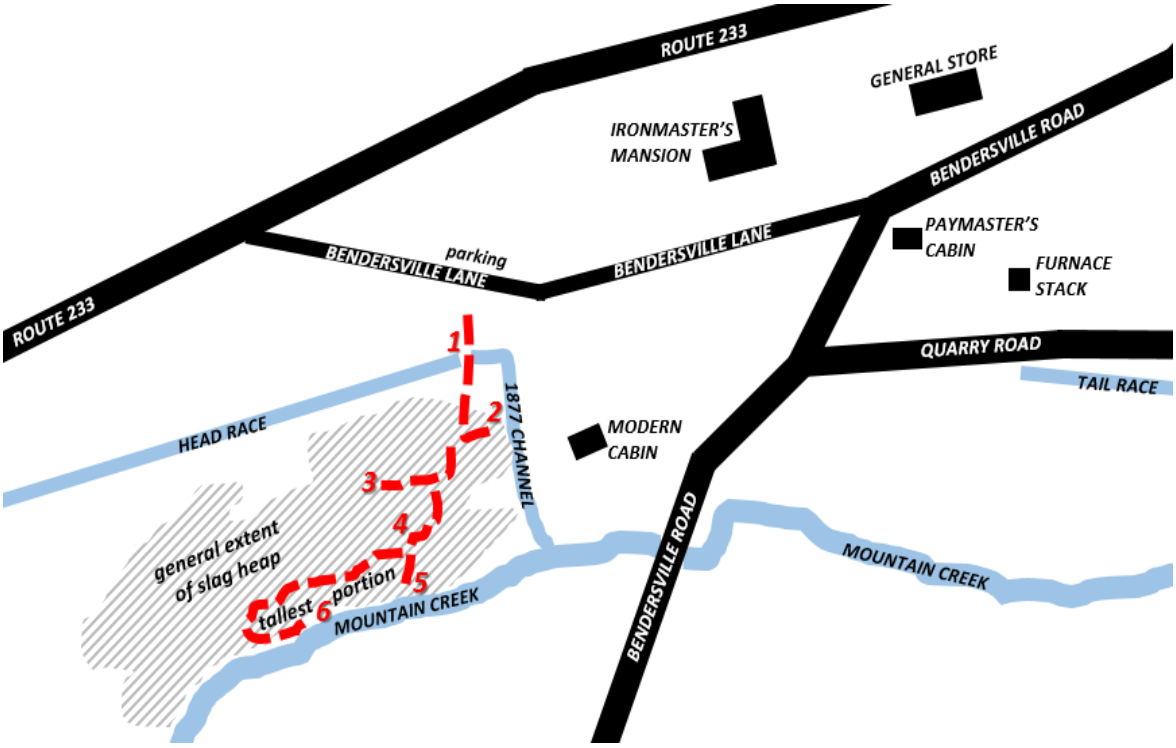
The informal trail includes uneven terrain, moderate slopes, and possibly a little mud. Walk slowly. Don't fall or twist an ankle while crossing areas of loose rock and occasional tree roots. Watch out for dense Japanese barberry and privet, invasive plants with nasty thorns.

What is a **head race**? Consider the large stone structure at the heart of Pine Grove Furnace, in operation from the 1770s to April 1895. This was a blast furnace used to smelt pig iron from iron ore. The word "blast" refers to a constant blast of air forced into the bottom of the stone stack. During its first hundred years of operation, this blast furnace used water to turn a large water wheel which was connected to a pair of pistons called blowing tubs. The water wheel depended on water carried from Mountain Creek in a long narrow ditch, the head race. This race also powered an early 19th century sawmill located to the west of the furnace below the Paymaster's Office (today a rental cabin). When the furnace water wheel was replaced by a steam engine in 1877, the head race was no longer needed... but was not filled in. Nearly a mile long, it can still be seen today running parallel to Route 233, except for the last couple hundred yards before it reached the furnace which were filled with dirt.

What is **slag**? Slag (also called cinder) is an unavoidable byproduct of smelting iron ore. The key ingredients loaded into the top of this blast furnace were **iron ore**, carbon fuel (mostly **charcoal**, but after 1877 sometimes coal) and **limestone** as a "flux" for chemical reactions. Iron ore locally is roughly 44% iron: the goal of smelting was to eliminate the remaining 56%. The portion of the ore that was not iron became bound to the limestone flux to create slag. Slag consists of calcium (from the limestone) plus common non-iron components of the earth's crust such as silica, magnesia and alumina. At Pine Grove Furnace, slag has several colors depending on changing conditions inside the furnace where it was formed, as well as minor impurities (bright blue slag, for example, reveals high levels of manganese in some local iron ores). This waste material was drained from the bottom of the furnace as a liquid at almost 3000 degrees F, allowed to cool and solidify, and hauled away.

Some slag might become road fill for wagon roads across the mountains, or ballast between railroad ties of the South Mountain Railroad (connecting Pine Grove Furnace to Carlisle, the railroad was built 1868-1869 and in full operation at the beginning in 1870). However, thousands of tons of slag were simply carried a short distance and discarded.

The slag heap or cinder pile visited on this tour is a small **mountain of man-made "volcanic" rock**! Most of the slag you will see likely dates from the late 1870s through 1892, when this furnace was at its peak of production making 4000 to 6000 tons of pig iron annually.



SEE OTHER SIDE FOR TOUR STOPS

SEE OTHER SIDE FOR TOUR MAP

Stop 1: Head Race **40.031533, -77.309115**

The start of this tour takes you directly across the furnace head race. (A pair of metal culverts below your feet were added by the State Park, probably in the 1980s.) To your right, you are looking upstream along the head race: it can be followed through the woods for 0.9 miles parallel to Route 233. The section of the race closest to this location is well defined, but after 150 years of neglect the section approaching its upstream origin is a bit less obvious. Nonetheless a connection to Mountain Creek can be found. Today there is no evidence of a stone and timber dam across Mountain Creek to store water in a mill pond, nor does the topography make a large dam likely. The creek flows fairly well even in the summer, so water storage may not have been needed. Instead a partial barrier called a wing dam may have been used to divert most of the creek directly into the beginning of the head race, but this is speculation.

Stop 2: End of Head Race after 1877 **40.031470, -77.308964**

The head race is visible to your left. Directly in front of you is a short ditch probably dug when the water wheel at the furnace was replaced with a steam engine. It serves as a kind of "short circuit" to let unneeded water flow at a 90-degree angle from the race down to Mountain Creek, 50 yards to your right. Digging a short connection down to the creek would have been much easier than filling in the very long head race upstream towards its origin off the creek.

Stop 3: Platform for Unloading Slag **40.031287, -77.309375**

You are standing on a large flat rectangular area made of piled up slag. To the sides, the natural terrain is visible roughly 8 feet below this level. There seems to be a narrow path down from the platform to your left (south), apparently where slag was transported away -- perhaps in hand carts, or there may have been a conveyor belt of some kind. This platform probably supported an extension of the railroad from the furnace west past Bendersville Road for the specific purpose of moving slag. The furnace is 350 yards to the east, in a straight line passing to the left of the 20th century cabin seen at Stop #2.

Detail of 1889 map with added labels:

A = Tour Stop #3
B = Mansion
C = Paymaster's Office
D = Bendersville Road
E = Mountain Creek
STAR = Furnace Stack

Stop 4: Very Large Chunk of Slag **40.030969, -77.309517**

Why was this massive piece of slag left mostly intact as a singe piece after it solidified next to the iron furnace, instead of broken into smaller sizes for transportation here?

Stop 5: Mountain Creek Overlook **40.030844, -77.309454**

From this location Mountain Creek is visible ten feet below. The original terrain is evident on both sides of the creek, but on this side the elevation quickly rises due to piled up slag. Looking to your left (downstream), Bendersville Road and its bridge across the creek are visible in the middle distance. The park campgrounds are one-quarter mile ahead of you

After Stop 5, walk along the bottom of the tall slag heap, then curve left to climb to the top. Be careful!

Stop 6: Top of Slag Heap **40.030854, -77.309950**

You are standing roughly 35 feet above Mountain Creek, on the highest portion of the slag heap. It continues upstream to the west at a lower elevation. Can you see the Mansion and furnace stack? Though it may feel as though you have walked into a deep wilderness, the slag pile would have been easily visible from other parts of the industrial complex, before invasive plants covered this area in the 20th century.

Please retrace your steps to return to Bendersville Lane.

FRIENDS OF Pine Grove Furnace STATE PARK
Pennsylvania Parks & Forests Foundation