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A VENTILATION FURNACE ON THE FINDALL IRON MINE, SOUDLEY, FOREST OF DEAN

DIANA COURT
IAN STANDING

Plate 1

This paper describes a primitive ventilation furnace, gives some details of early hot air ventilation practice in mines and suggests a date around 1800. Repair work was carried out over 1976/77 in the interests of preservation.

High in the woods above Soudley stands a fine stone chimney stack at SO 652105. It has been built on the edge of a sizeable scowle hole - an ancient surface excavation for iron ore from which entrances lead below ground. The situation is dramatic for deep green mosses and ferns in the depths of the scowle contrast with elegant masonry. It is a site of interest for the historian for only two such stacks remain in Dean, one at Dodsmore, associated with a colliery and this one on an iron ore mine.

Description

The furnace consists of a nearly square base some 2.5M by 5M high, surmounted by a round stack to a total height of nearly 15M. The transition from square to round section is neatly accomplished by two courses of octagonal masonry. The structure is built in whitish pink Drybrook Sandstone which outcrops on the hillside above. All the exterior stone is well dressed but inside more random stone and some brick have been used.

In the front aspect of the square base is a rectangular opening

0.75M wide by 2.5M high. Excavation in this area, prior to repairs, revealed coal ash, some coal and some iron firebars out of situ. Fixed in situ inside the base of the stack is an iron plate visible in Plate 1. The remainder of the fill comprised fallen masonry. The space was clearly a firebox.

From the base of the firebox was found a squarish masonry constructed trench leading out and immediately dividing into two. The shorter of these trenches continues straight out to the bank and terminates after 2M adjacent to a small crop hole. This was the access for de-ashing.

The longer trench with a cross section of 0.75M turns sharply to the left descending and crossing the floor of the scowle hole for 14M to disappear beneath slipped material in a mine entrance. Exploration below ground reveals this trench or flue crossing the floor of a churn before becoming a small circular descending shaft. Careful examination of the top edges of the trench revealed impressions in the mortar of small round timber which had lain across the trench to roof it. This was presumably rendered with mortar or clay to make it airtight.

Infront of the main stack there must have been a platform to roof the trench flues and to provide a working surface from which to fuel the firebox. The entrance to the firebox above this platform must have had some means of closure such as a cast iron door to prevent surface air diminishing the draught. The straight short trench below platform level must similarly have been closable for the same reasons. No trace of either platform or doors came to light during excavation. It is possible that the platform was at the level of the projecting stone seen to the left of the firebox in Plate 1 and this would make some sense for the projecting pier to the right. Any such platform was probably of flagged construction and robbed from the site long ago. Robbing of a metal door and more particularly its surround would help to explain why the entire inner quoins either side of the firebox were absent.

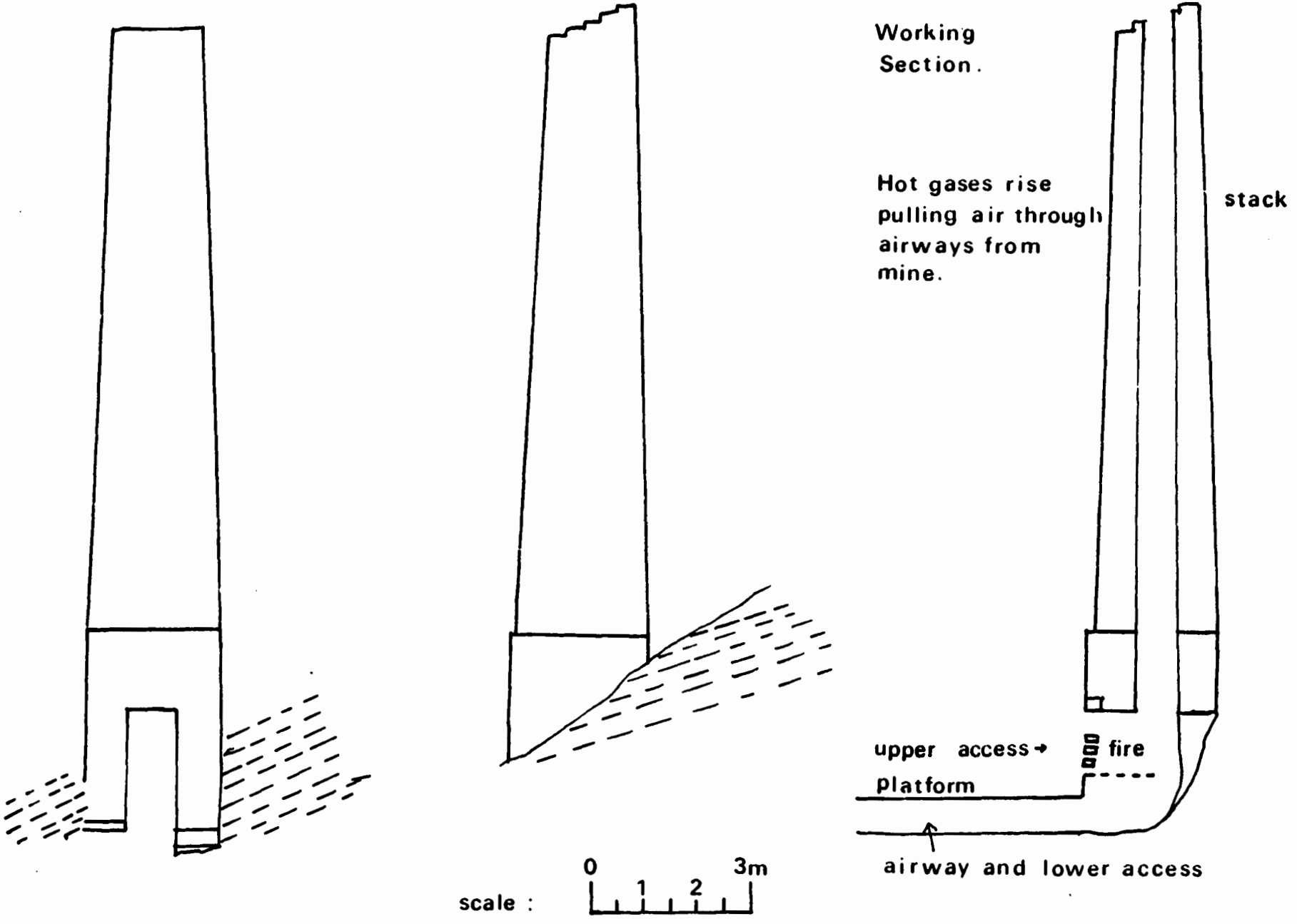
Major slips have occurred along the edge of the scowle hole and no trace of an access track, a fuel store or a cabin for the stoker remain. Collieries existed along the crop of the High Delph Seam a few hundred yards up the hillside and the fuel used was coal. The amounts of ash shown by excavation were not large, possibly being obscured by other material or possibly suggesting a short working life.

Hot Air Ventilation

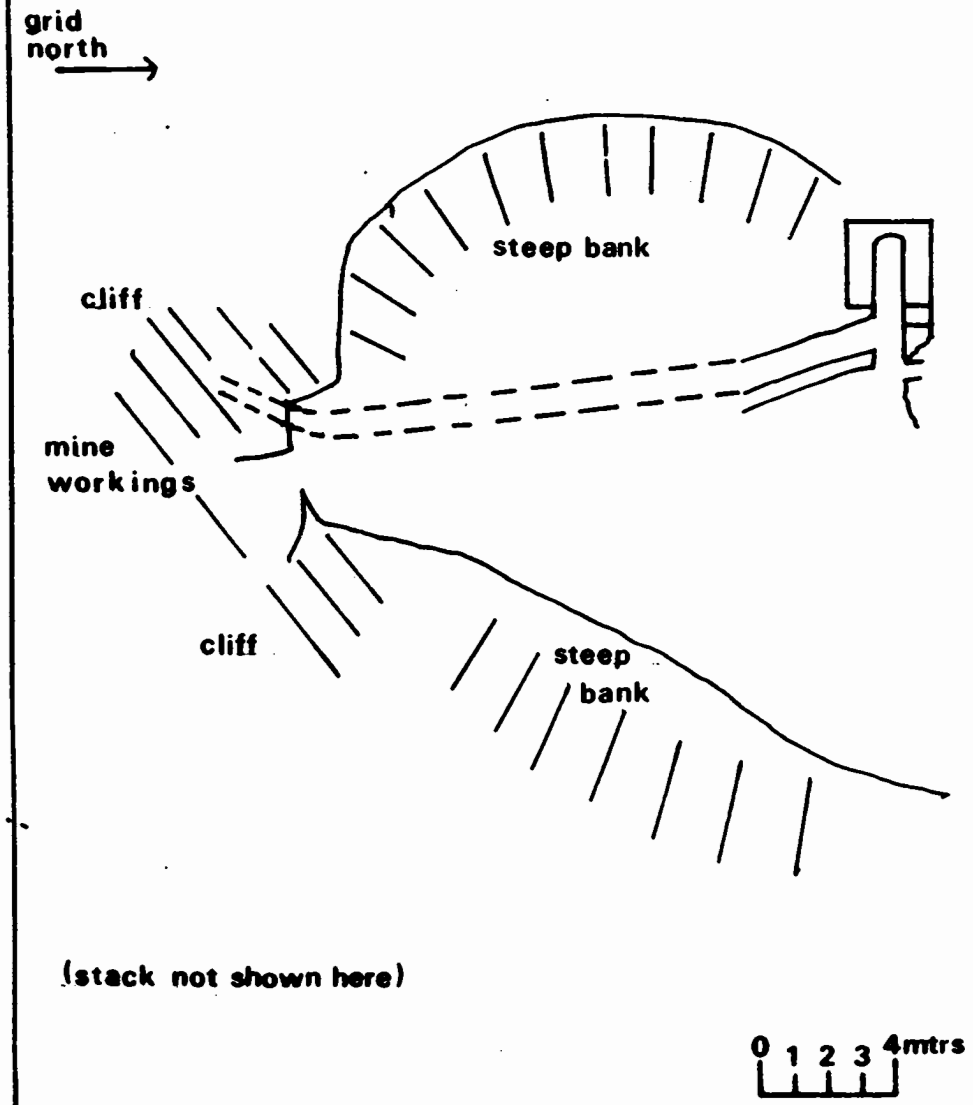
Even though there are no explosive gases in Dean mines ventilation soon becomes necessary to prevent accumulations of blackdamp. This term is applied generally to gas mixtures where the carbon dioxide levels are raised. With small increases in carbon dioxide content work becomes immpossible while larger increases of say 3% can be fatal, even though oxygen levels may still be adequate. Working men and animals excrete considerable amounts of carbon dioxide and being heavier than air it tends to accumulate unless flushed out with fresh air.

In collieries, oxidation of exposed coal will form blackdamp rapidly and perhaps the simplest method of drawing fresh air into a small pit was by use of a firebucket. This would be lowered into a shaft and the hot air from the fire would draw fresh air in by convection

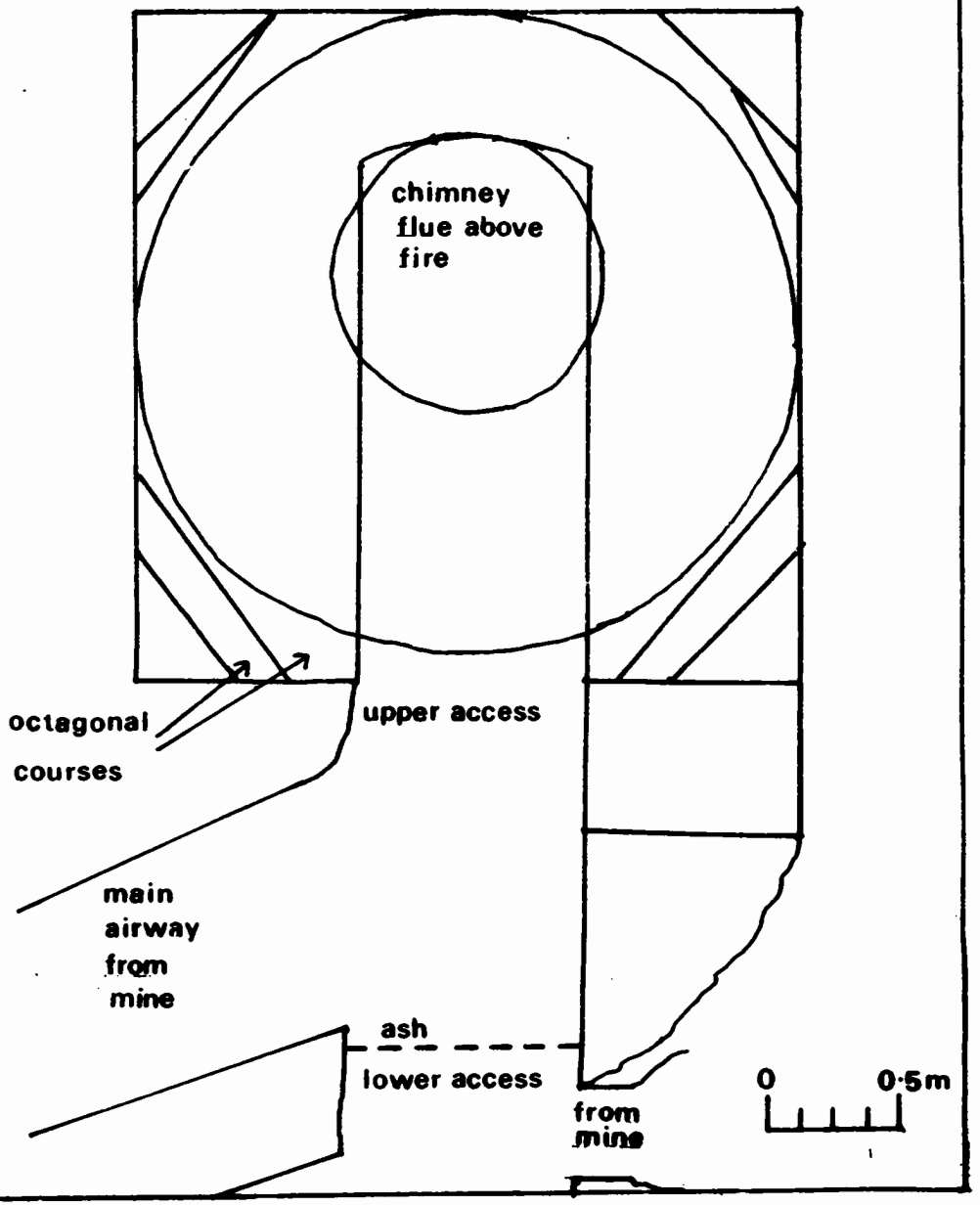
Ventilation Furnace Findall Iron Mine. Elevations.



Findall Iron Mine.
Ventilation Furnace And Airway.



Ventilation Furnace - Plan.



displacement. Clearly this arrangement works best if fresh air can enter by a second entrance. This practice has been used in some small coal pits in Dean this century.

In larger mines, particularly those worked by shaft it became common to have a permanent fire at the bottom of one shaft. The whole of the shaft space above thus filled with rising warm gasses which in turn pull fresh air into the mine by another shaft or entrance known as the intake or downcast. Enormous ventilation volumes were achieved last century using this method, often with complicated arrangements to prevent explosions of mine gases such as methane. The principle is to put the fire at the lowest point possible in the return airway. Sometimes a chimney was erected over a return shaft to lengthen the effective column.

In contrast to this sensible approach, the ventilation furnace at Findall is situated just about as high on the return airway as it is possible to get. Admittedly the sucking flue is conducted below ground to an unknown depth but the whole principle is wrong and the apparatus inefficient. It is known from soot deposits below ground, that fires were lit lower down on the return airways. No hearths have been found and it is not known whether these fires were for ventilation, perhaps contemporary with the furnace or used for firesetting to crack rock at an earlier date.

It seems possible that the furnace was built to encourage ventilation to enter the Findall Level in the valley below and exhaust out via old crop workings in the early phase of the mine. Once the workings had linked with Perseverance Pit mechanical ventilators were probably used.

Dating

The outcropping iron ores were doubtless worked at a very early date, but like all such workings they are not dateable prior to events such as the use of explosives and mechanical transport. The outcroppong ores lie in the Crease Limestone which dip steeply at about 60 degrees. Early working would proceed down dip probably reaching water levels by the late 17th. century. These random workings with their many entrances and essentially small work forces would probably survive with natural ventilation, and it seems unlikely that the ventilation furnace belongs to this era. The primitiveness of design is typical of the 18th. century and a simmilar furnace and stack appear in a painting of a coal pit mouth near Brosely by G.Robertson in 1788.

In Dean iron ore mining was moribund in the latter half of the 18th. century. The sinking of larger mines to exploit ores below water levels must have been prompted by the opening of coke blast furnaces at Cinderford in 1795 and at Parkend in 1799. Thus it is possible that some of the larger mines began sinking in the last decade of the 18th. century. The Findall Level would be one of these - a level driven cross measures from the valley bottom by Soudley Bridge towards and then along the Crease Limestone. Its workings would be certain to strike old work up dip and its ventilation problematical.

Sopwith's map of 1835 shows the cross measures adit complete and workings extending to the north towards Perseverance Pit, sunk between 1835 and 1855. A plan of 1858 shows Findall Level connected to Perseverance Pit which worked levels to the deep. Pumping was carried out at the nearby Shakemantle Mine. A coke blast furnace opened

in 1837 at Soudley and Findall ores went there. The Findall Level had shut by 1877 and the gale surrendered to the Crown in 1899, by Henry Crawshay.

It is interesting to note that only Sopwith calls it the Find All Level. Occasionally it is called the Scilly Point Level. Both Perseverance Pit and Findall Level worked the same gale and produced 370,000 tons of iron ore between 1841 and closure.

As to the ventilation furnace, no record of any sort has yet been found. There is no mention of it at the Gavellors Office. An indenture of the Perseverance and Findall Mines in 1890 lists all the buildings to be kept in repair but does not refer to the furnace. As Findall closed in 1877 this is perhaps to be expected. On an 1858 plan of Findall nothing is shown whilst the 1904 25inch map shows a square airshaft in the correct position.

We would suggest that the furnace was built around the time the Findall Level reached the Crease Limestone which would be somewhere between 1790 and 1820.

Repair Work 1976-77

This site had been known to many of us since youth and it had often been remarked that a few weekends spent repairing the broken masonry would be well spent.

Prior to our work the bank sloped past the stack at around head height of the figure in Plate 1. Fallen masonry further reduced the apparent size of the aperture seen above the newly inserted lintel and we were naively convinced that a small masonry arch was all that needed replacing. We accordingly approached the Forestry Commission who owned it, for their permission and support for repair work.

Work started early in 1976 excavating fallen debris and expecting to find intact masonry from which we could rebuild the supposed failed arch. Digging was still in progress several weeks later by an increasingly worried team. When foundation level was reached we had a huge void of missing masonry. The whole of the front was missing. Of the left hand stack wall only a thin outer skin remained with the odd outer quoin in place to give the front line. Daylight could be seen through this outer skin here and there. The right hand side was slightly better with a good outer skin and only a few outer quoins not in place. The inner aspects of the firebox, the inner quoins of both sides and the lining of the base of the chimney were completely absent. As one visiting engineer pointed out to us at least 150 tons of masonry stood perched above us and it was difficult to explain why.

Rebuilding started in midsummer 1976 with a team of four. Mike Howells and Phil Schwarz tackled the left flank and the authors the right. By Autumn, the left hand side had reached lintel level and afforded some support to the whole structure. Work on the right hand side having started at a lower level had yet to reach lintel height. By Spring 1977 the question of suitable lintelling arose. Excavation had shown the original lintel was a large flag stone of about four inches thickness. This was unsuitable as its fracture had contributed in part to the failure. The flagstone course is clearly visible either side of the new lintel in Plate 1. A replica was not indicated and a stronger larger stone weighing three or four hundredweight was imported from Milkwall. Its insertion was

quite the most difficult problem experienced.as it turned out to be three inches too long when hauled into place.whilst the stack was still too delicate to be modified to accomodate it. Steel and concrete completed the lintelling interiorly. The authors completed the remaining four foot thick masonry above whilst John Osborne rebuilt the firebox and interior lining of the chimney. Many weekends were worked in addition to the regular Wednesday evenings. Even so many shifts were completed only by the use of lighting.

Very many individuals helped over the two year period including, Maggie Stewart, Joanna Young, Jean Clissold, Doug Maclean, Peter Capper, Dave Sibly, John Hine, Robert Rutsch, Peter Thomas, Ray Carter and Geoff Broadman. Jessica, Julien and Nicholas Standing did a good deal of work in 1977.

The cost of the job was very small for the good result obtained. The Forestry Commission provided ten tons of sand whilst we provided about one and a half tons of cement. Labour cost nothing whilst petrol, perhaps the biggest item,was met by those concerned.

Acknowledgements.

Tribute must be warmly expressed to the Forestry Commission in Dean for allowing and contributing towards the repair. Without their positive outlook this furnace would certainlv have disapeared. The authors would also like to express thanks to Gordon Clissold of Staunton for his help surveying the site.

Plate 2