

Conservation Management Plan for the Blast Furnace Remains at Ballyvannan, Co. Clare

History, survey and structural assessment



An Chomhairle Oidhreachta
The Heritage Council



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1. Introduction

During the seventeenth and most of the eighteenth century the vast majority of iron used in Ireland was produced locally in blast furnaces. These monumental structures and their associated works would have dominated the landscape in the areas where they were active; economically, socially and visually. For a variety of reasons, Irish blast furnaces are preserved better than elsewhere and the surviving furnaces in the Sliabh Aughty area, on the Counties Clare and Galway shores of Lough Derg, present one of the finest collection of blast furnaces of that age anywhere worldwide.

The Sliabh Aughty Furnace Project was created in 2014 with the aim to study, conserve and educate about the iron industry in the Sliabh Aughty area.¹ In the Spring of 2015, a grant was obtained from the Heritage Council (Ref. CBH04830) to compose Conservation Management Plans for the four upstanding blast furnace remains in the Sliabh Aughty Mountains area. These Plans, consisting of the known historical information of the ironworks, detailed surveys of the structures and structural assessments of the same, the latter carried out by Architectural Conservation Professionals,² are seen as a first study of these furnaces and especially as documents which form the initial steps towards their future conservation.

This Plan concerns the blast furnace remains in the townland of Ballyvannan, Co. Clare.³ Ballyvannan furnace potentially represents the oldest upstanding blast furnace remains in Ireland. It is an unusual one, both in the way it is preserved and because of its setting. What is left today of the furnace consists mainly of half of its vitrified interior. Most of the walls have since disappeared and the parts still present are in a very poor condition. This is also the only furnace known in Ireland that lies far removed from a major contemporary transport route, either in the form of a road or waterway. Exceptional is also the fact that the associated dam, which held the pond that provided the power source for the works, is still visible.

1 www.furnaceproject.org and <https://www.facebook.com/pages/Sliabh-Aughty-Furnace-Festival/434485340026466>

2 Grageen House, Cappanuke, Cappamore, Co. Limerick www.acpgroup.ie

3 Coordinates (ITM): 562274, 681423

2. *Historical background*

2.1 **Iron smelting in Ireland in the 17th and 18th century**

Until the late sixteenth century, iron ore in Ireland was exclusively smelted in so-called bloomery furnaces. These installations were generally clay-walled chimneys, about one to one and a half metres high with an internal diameter ranging between 30 and 60cm. In bloomery furnaces the heat was used to remove the oxygen from the iron oxides in the ore and to smelt the non-iron parts of the same, but the iron itself never became liquid. The products of these furnaces are known as blooms and weighed from 20 to 40kg.⁴

Around the thirteenth century, in an area stretching from Sweden over Germany to Switzerland, an altogether different type of furnace appeared. Now the bellows are no longer blown by hand but driven by water-power, the furnaces themselves are substantially larger stone-built square structures (side lengths and heights between 4 to 5m) and the product is now liquid iron. This liquid iron is characterised by a higher carbon content than bloomery iron.⁵ The furnaces themselves are invariable equipped with two large arches, set in adjoining walls: one for the bellows ('blowing arch') and one for the removal of the iron and waste ('tapping arch'). The liquid state of the iron is not only due to a higher temperature as a result of the use of water-power, but also because of the use of more charcoal per fuel unit.

The liquid iron leaving the furnace could be poured into a mould resulting in cast iron objects. Because of their high carbon content, cast iron objects cannot be forged; they shatter upon being struck with a hammer. Alternatively, the iron could be cast into large bars of iron known as sows.⁶ These sows are then brought to an installation known as a finery where the iron is re-melted in an oxidizing environment to remove the excess carbon. After further operations at the chafery (renewed reheating) and the hammer forge (shaping), so-called wrought iron is obtained which could then be further forged into a variety of shapes by the blacksmith. The finery, chafery and hammer forge all utilised water-power and were frequently part of the same plant.

As a blast furnace was expensive to build, required highly specialised labour and had a high

4 Rondelez 2014: 245-246. Water-powered bloomeries could produce substantially larger blooms.

5 Iron produced in the bloomery can have a low carbon content or a medium one. In that latter case it can be considered as steel. In the blast furnace the iron has to be converted to wrought iron (low carbon content) after which carbon needs to be added to obtain steel.

6 From the late 18th century these are known as pigs of iron

strategic value, it spread only very slowly outside of its original heart-land. Only at the very end of the fifteenth century are the first installations of this kind built in England, in the south-eastern Weald counties of Kent and Sussex. Only when the woods in that area could no longer provide sufficient fuel for the furnaces, around the middle of the sixteenth century, did blast furnaces spread further afield, into northern and central England and Wales. This is the period when the Plantation of Ireland got under way and already in the 1560s we hear of proposals of establishing a blast furnace in the area around Carrigaline, Co. Cork as part of the Kerrycurrihy Plantation.⁷

It is unclear if this furnace was ever built and for the rest of the sixteenth century the sources mention only further proposals and unspecified ironworks working in Ireland, all in Counties Cork and Waterford. The earliest definite evidence of a blast furnace in Ireland is the one built by Sir Thomas Norris in Mallow, Co. Cork which operated from 1583 to 1589.⁸ In beginning of the seventeenth century, during several decennia of relative calm, multiple blast furnaces were built in Ireland. Among the most proliferous were the ventures of Sir Richard Boyle, First Earl of Cork, in Co. Waterford and by Sir Charles Coote's ironworks in County Laois and the ones built by both in Leitrim.⁹

Many of these furnaces were destroyed during the Civil Wars of the 1640s but already in the 1650s new ones were built and surviving ones brought into production again. This is the period when the long-lasting works at Enniscorthy, Co. Wexford are constructed.¹⁰ In the 1660s and 70s, William Petty established a substantial iron-producing industry in County Kerry,¹¹ but it was especially in the 1680s that new plants were started up, many in areas with no previous recorded blast furnaces, such as Counties Cavan, Mayo and Galway. In the eighteenth century we have many references to blast furnaces active all over Ireland, but the limited source material together with little research on the subject means that we cannot yet present a clear picture of the industry at that time. Many ironworks closed down around the middle of that century, with a handful continuing production up till about 1780. These then close down due to lack of fuel and competition from abroad.

In the Sliabh Aughty area, ironworks were active over a period of well over a hundred years (Fig. 1). The earliest furnace, at Ballyvannan, Co. Clare, possibly dates to before 1610.¹² The first furnace

7 BL, Cotton Titus B/XII f.10, Rondelez 2014: 99

8 Rondelez 2014: 108

9 Rondelez In Press

10 Barnard 1985

11 Barnard 1982

12 See below.

for which we have solid evidence is the one built in 1630 at Scarriff, Co. Clare by English merchants. After legal problems and the onset of the civil wars of the 1640s, the same merchants crossed the Atlantic and were involved in the first functioning blast furnace in the Americas at Saugus, Massachusetts. Back in Ireland, the iron industry along Lough Derg was only started up again in the 1680s, in Scarriff and in Woodford, Co. Galway. About a decade later, a furnace was built near Feakle. We are badly informed about the eighteenth century, but it would seem likely that the remaining furnaces were built during the earlier part of that century. We know that Whitegate furnace was in use in 1760.¹³ If Lewis is correct, the industry in the Sliabh Aughty area ended in the late 1770s with the closure of the Woodford ironworks.¹⁴

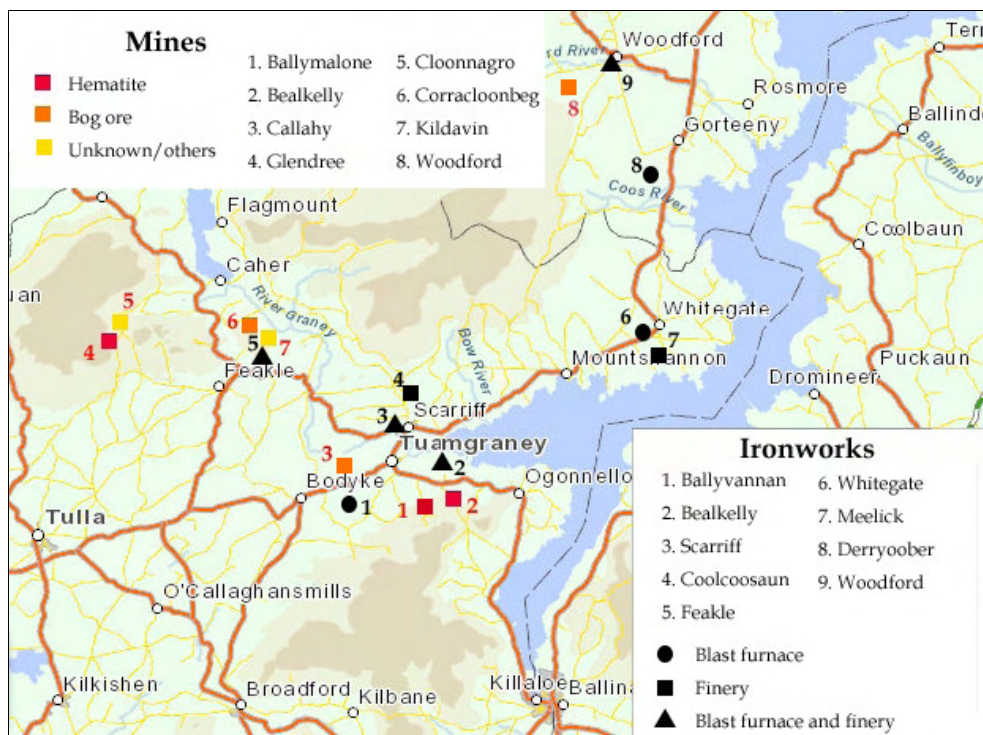


Fig. 1. The Sliabh Aughty ironworks and associated iron mines

¹³ See the Conservation Management Plan for the blast furnace at Whitegate, Co. Clare (Rondelez et al. 2015)

¹⁴ Lewis 1837 Vol. II: 724

2.2 Historical background of Ballyvannan Furnace

No documentary sources have been found to date which definitely relate to this furnace. It might be related to the ironworks which Henry Tokefield had before 1610, 'upon the river Shenan [Shannon]'.¹⁵ If so, then Ballyvannan is the oldest furnace in the area and represents the oldest standing blast furnace remains in the country. It is mentioned on the first edition Ordnance survey map (1830s) and while the two nearby lime kilns are clearly represented, the furnace is not (Fig. 2). It is unclear what the dotted line to the west indicates. The furnace together with the two lime kilns are rather poorly included on the 1910s Ordnance Survey map (Fig. 3).

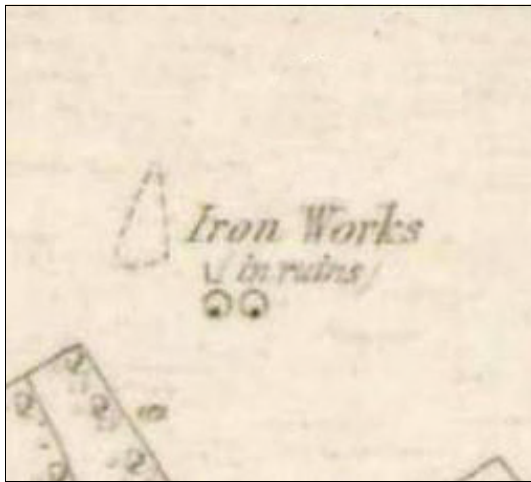


Fig. 2. Ballyvannan furnace on the 1830s OS map



Fig. 3. Ballyvannan furnace (yellow) on the 1910s OS map

¹⁵ CSPI, James I, Vol. III: 928

3. Survey of Ballyvannan furnace

The only prominent remains of Ballyvannan furnace are two sides of the interior of its chimney. This seemingly only upstanding because it is highly slagged and vitrified.

About a hundred metres west of the furnace are the remains of the dam wall holding the pond which supplied the water-power to the furnace bellows. A gap very likely representing the sluice placement has on its south side consisting of a wide earthen bank while on the north it has a stone-revetted bank. Interestingly, many pieces of dense iron-rich slag are found around the earthen bank. This is very likely the waste from the finery process and the only indication to date for this installation.

South of the furnace are also two lime kilns. As these are very similar to others in the area it is unlikely that they are contemporary with the ironworks. There is a poorly built wall between one of these kilns and the furnace and another at more or less right angles to this wall and also connected to the furnace. It is likely these are later walls with an agricultural function.

As none of the outer furnace walls are preserved no elevation drawings were done. Also the few outer faces did not allow to produce a ground plan.

3.1 Interior and arch wall

The south- and east-facing inner walls of the hearth area and chimney are preserved up to a visible height of 4.3m. Abutting the lower parts of the inner walls are the remains of the stone-built hearth lining which is covered and replaced by a thick layer of slag (Figs. 4 and 5). On the eastern side, at the base, a rectangular cavity is visible (Fig. 6). On the other, southern base, an irregular cavity is seen, possibly deformed by fire action (Fig. 7). The interior walls would have enclosed an area with a side length of approximately 1.3m. The inclining upper walls are heavily vitrified and have some unreduced pieces of iron ore adhering.

To the east of this, the upper courses of the side of one of the arches and small part of the outer furnace wall are visible (Fig. 8). The arch wall is about 2.5m long and is placed at an angle of about 60° to the outer wall.



Fig. 4 Interior of Ballyvannan furnace from the south



Fig. 5. Interior of Ballyvannan furnace from the east



Fig. 6. Rectangular cavity in the northern hearth lining

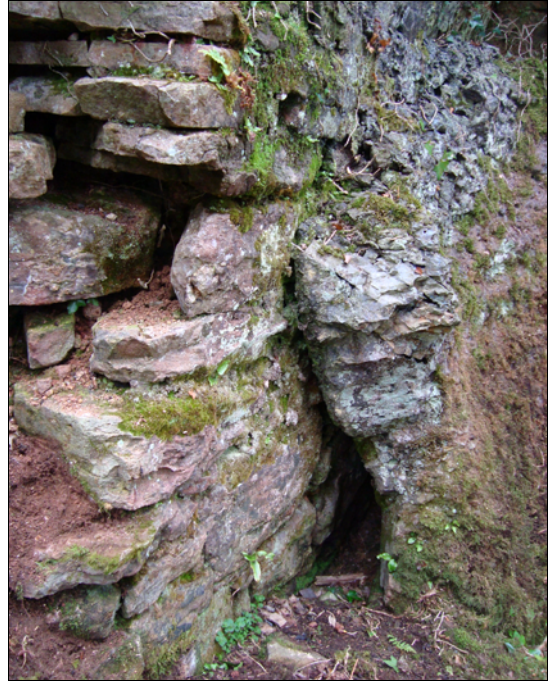


Fig. 7. Irregular cavity in the western hearth lining



Fig. 8. Arch wall and outer wall section from the east

3.2 Exterior

Apart from the section of outer wall mentioned above, the exterior of the furnace consists of poorly preserved masonry and accumulated wall collapse (Figs. 9 and 10).



Fig. 9. Furnace exterior from the north



Fig. 10. Furnace exterior from the west

4. Structural Assessment of Ballyvannan furnace¹⁶

The survey involved the visual inspection of each of the furnace structure and fabric elements within the site.¹⁷ The purpose of the inspection is to identify works required to make the structure safe and to prevent further deterioration of the fabric. A more detailed assessment would be required to identify further works.

The data sheet assesses the condition of each building into five categories as follows:

Dangerous – Serious health and safety issue. Immediate work required to be carried out for the safety of the fabric and users/public.

Poor - Health and safety issue. Urgent work required to prevent active deterioration of fabric, and safety of users/public

Fair – Necessary work needed. Work could be carried out at a later stage.

Good – There is no necessary work needed. Desirable work maybe carried out for aesthetic reasons or adaptive use.

Excellent – There is no work needed but item should be kept under observation

4.1 Structural assessment of the furnace remains

Dangerous	✓
Poor	
Fair	
Good	
Excellent	

The remains of the furnace at Ballyvannan are in a very poor condition. While most of the structure is gone, the remaining section of the flue lining and associated fabric is still standing precariously. The North elevation shows the original flue lining and a large build up of slag at the bottom/hearth. The NW and NE sections of the flue lining are very narrow in places and are at risk of further collapse. The build up of slag seems to be acting as a buttress against the North elevation and as

¹⁶ The information for this chapter was compiled from the relevant report composed by Architectural Conservation Professionals (Humphreys and Collins 2015)

¹⁷ The structure was surveyed on the 8th August 2015. The following schedules set out the survey notes of the individual buildings/elements. It must be noted that no opening up was carried out on walls etc., and that this report is based on a visual inspection. We can only comment on those items which were both visible and accessible at the time of our inspection. (ACP)

such should be left in situ.

There is a build up of rubble and debris on the South elevation possibly due to the collapse of the main structure. Again this build up of material may be providing structural support to the base of the South elevation and should be left as is until further investigations can be carried out. The stone walls extending from the remains are in a fair condition and pose no risk to the structure. Further ground investigations are necessary to assess the footprint of the original structure.

Works Required: Urgent

The furnace remains at Ballyvannan are in danger of further structural failure if certain repairs are not carried out in the near future. The North East and North West sections of the flue are in danger of collapsing (Fig. 10). Loose masonry along the top and sides of the remaining sections need to be re-pointed (Fig. 11). Vegetation along the top and sides need to be trimmed back and treated prior to any re-pointing works to prevent further damage caused by vegetation.

The consolidation of the remaining sides of the flue should protect against further collapse of the structure. It is not recommended to remove any of the slag or material build up from the north and south elevations as they may be providing structural support to the flue lining.

Further archaeological excavations are necessary around the base of the remaining structure and immediate area to assess the design and footprint of the original furnace.

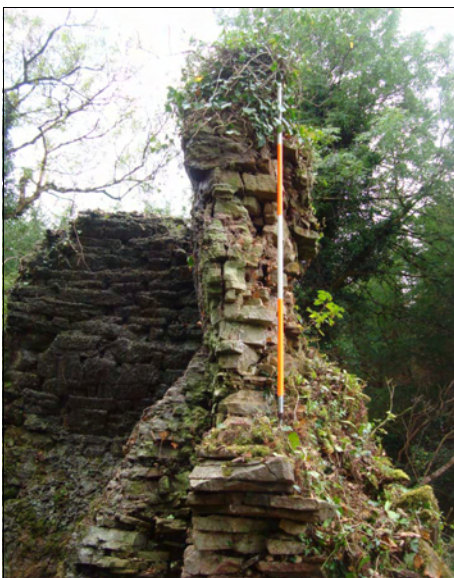


Fig. 10. Upper north east section



Fig. 11 Furnace interior showing poor masonry quality

4.2 Recommended and urgent repair works

The following works are required to prevent any further deterioration of the structures fabric and prevent also any further structural failures.

Urgent

- Removal and treatment of vegetation on the wall top and sides of the remaining flue.
- Re-pointing and consolidation of the remaining top and sides of the flue lining.
- Further archaeological excavations are necessary around the base of the remaining structure. This is necessary to assess the structural stability of the remaining furnace elements and the design and footprint of the original furnace

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