The Industrial Revolution in Lincolnshire. Part 1: Manure!

Although parts of the county are currently some of the most heavily industrialised in the UK, notably the area around Immingham that was my introduction to Lincolnshire, and Scunthorpe, it is often still

LI	NCOLN.
POPULATION AND HOUSES IN 1851.	POPULATION, INCREASE OF POPULATION
Persons . 407.222 Males . 203.083 Females 202.139 Houses { Inhabited . 81,3 Uninhabited 3.4 Building 5	18 18 19 18 19 19 10<
Area { In Square Miles 2,776 To a In Statute Acres 1,776,738 Mi	Square 146 persons. In 50 years
The County returns 4 Members to Parliament, v parts of Lindsey; Boston 2, Grantham 2, Annual Value of Real Property ass	iz., 2 for the parts of Kesteven and Holland, and 2 for the Stamford 2, Great Grimsby 1, Lincoln 2; Total 13. 258ed to Property Tax, 1850-1 £3,009,456.
PRINCIPAL TOWNS, AN	D THEIR POPULATION IN 18st.
Alford	$\begin{array}{ccccc} & & & & & & & & & & & & & & & & &$
RELIGIOUS WORSHIF { Belonging to Church ,, Other D EDUCATION { Day Schools Sunday Scho	of England :Places of Worship 657; Sittings 165,087 enominations , 844; , 149,957 . 1,420; Day Scholars . 52,165 08 830; Sunday Scholars 97,120
Manual State And State Bakers Mo Y Cocupations Cocupations Bakers 8/6 Y Bakers 2,773 Grapots and Brick layers Brakers 2,773 Grapots and Gra	W (Population in 1831 + + 400,216). Birth-PLACE. des and Professions. family factures, de. mail (action of the constitution of the consthe constitution of the constite of the cons
	4 F
Fig 1: 1851 census inf	ormation for Lincolnshire

regarded, and with some justification, as a predominantly agricultural county. In the past this was even more marked, as can be seen from the information from the 1851 census, which records 52,046 agricultural labourers and 11,048 farmers, whilst only 1,144 people are listed as being involved in all of the *"Chief Manufactures"* combined, a ratio of around 45.5:1.

As someone who grew up on Tyneside, with a keen interest in industrial archaeology and an exaggerated disinterest in anything predating the Reformation, you might think that there would be little of interest to me in Lincolnshire, which can appear to have been almost by-passed by the industrial revolution... **HOWEVER**, there is of course plenty of interesting industrial history in Lincolnshire; the industrial revolution did happen there, although it took place about

35 years after it was traditionally over in some other places, and of course was strongly linked to the agriculture for which the county was known. So, whilst still in quarantine, I decided to write a series of posts about the industry of Lincolnshire, which, I should point out, will be highly selective, biased to my interests, and perhaps most importantly very, very boring to 99% of people. Questions, complaints and jeering should be directed to <u>a.telford@allenarchaeology.co.uk</u>.

As already noted, much of Lincolnshire's 19th century industry was connected to the needs of agriculture, so what better place to begin our survey than with fertiliser! It can probably be taken as a given that ever since they took up farming humans have been attempting to improve the fertility of the soils in which they grew their crops. Manuring of fields with animal and human "organic waste products" and liming with chalk or marl, along with crop rotation and intercropping with plants that would restore the nitrogen levels in the soil are methods that have been around since the medieval period, if not earlier, but such techniques are beyond the scope of this article, where we will be more concerned with, for example...

Superphosphate!

Essentially the first of the chemical manures, the invention of superphosphate is, as with almost everything, somewhat controversial. The use of bone dust as a fertilizer in the UK is thought to date to the 18th century. A possibly apocryphal story about this use attributes it to the sale of bone dust as a by-product from the cutlery workshops of Sheffield, where the dust was created in the process of making handles. The presence of phosphorus in bones was recognised in 1769 by the Swedish chemist and metallurgist Johan Gottlieb Gahn, but the use of untreated bone dust as a fertiliser has limited use, as the phosphates are insoluble in water, and thus are not taken up to any great extent by the crop.



The manufacture of superphosphate, initially by the treatment of bones with sulphuric acid, may have initially been suggested by Justus von Liebig in 1840, although for our purposes the important date is 1842, when John Bennet Lawes was granted a patent and began the production of superphosphate at Deptford Creek in London. This marks the beginning of the manufacture of superphosphate in Britain, and that manufacture soon spread to Lincolnshire.

At first the method used to make super was very simple, essentially involving throwing a load of vitriol on a heap of crushed and/or calcined bones, in a large room known as a den. Inevitably the process became more complex over time, with bones replaced by an array of 'phosphate rock', a catch-all term for a number of materials that included Peruvian guano and coprolites, first extracted in the UK in Suffolk in 1847, and increased mechanisation

involving mixers (Fig 2) and later mechanised dens (Fig 3). As harder types of phosphate rock came to predominate as a raw material, the addition of mechanical crushing plant became increasingly necessary.

Chemical manure works also became more vertically integrated through time. The sulphuric acid required in the manufacturing process was difficult to transport, SO establishing vitriol plant on site was a logical step. This was certainly true of the chemical manure works of John Jekyll, established in 1856 on Carholme Road in Lincoln, which certainly was producing vitriol as well as superphosphate by 1897. Another Lincolnshire chemical manure works that also produced vitriol



Fig 3: Mechanised den, Dagenham, Essex

was the Lindsey and Kesteven Chemical Manure Co., originally established in the early 1860s by George Foottit, beside the Fossdyke near Saxilby. Jekyll's works eventually became part of Fisons, and the site of the works currently lies beneath the modern 'Roman Wharf' development. No archaeological excavation of the works seems to have been undertaken in advance of the development. Foottit's works now lie below Allens Business Park on Skellingthorpe Road, where at least the site is largely undeveloped. A number of other superphosphate works were established in Lincolnshire, largely smaller and less integrated than the two discussed above. An extract from Kelly's Directory of 1892 lists 7, but this is not likely to be a comprehensive list. One chemical manure works worthy of note is that at Hubbert's Bridge, to the west of Boston, which is of interest because the buildings of the works largely survive. The works dates from the late 19th century and further details of the products made there are not available.



Fig 5: Former chemical manure works at Hubbert's Bridge on right

MANURE MANUFACTURERS.

- Markel thus * are Chemical Manure Manufs. * Blanchard Maxey Wm. Holmes lane. Louth Clapson T. jun. (blood), Waterside rd. Barton-
- on-Humber ⁶ Dawson A. T. & Co. office, Old Market place: works, West Marsh, Gt. Grimsby Doughty, Son & Richardson, 201 High street
- Doughty, Son & Alchardson, 201 high sheet & Corn exchange, Lincoln
 Duckering Alfred, East Barkwith manure works, East Barkwith, Wragby
 Ellis & Everard, Midland Railway Station, Stamford, & atUfington, Tallington, Bourn,
- & Deeping St. Nicholas
 Farmers' Company Limited (Thomas Pigott, sec.) Barton on Humber; Yarborough mills, Brigg (Robert Norfolk & Sons, agents); Thames street & Corn exchange, Louth, & East Marsh street, Great (Grimehy)
- agents); Linances struct from the change, Louth, & East Marsh street, Great Grimsby Fison Jas. & Sons, Corn exchange, Lincoln Lindsey & Kesteven Chemical Manure Co. Limited (William Porter Jackson, mana-ger), Saxilby, Lincoln, & at Cornhill, Lincoln
- Jekyll, Glasier & Co. Offices, Cornhill & New Corn exchange, Carholme rd. Lincoln See advert Nell & Smith (artificial), Corn Market &
- River head. L onth
- Prat Wm, & Hugh, Pinchbeck, Spalding Quibell Bros. Corn exchange, Lincoln Robinson J. N. (artificial) Anderby, Alford Simpson Thomas & Co. Limited, East road, Sleaford
- Sinclair William & Co. New York, Boston
 Walmsley John, Newton-on-Trent, Newark,
 & Walkergate, Louth

Fig 4: Extract from Kelly's Directory, 1892

Slag!

Although superphosphate was the most common phosphatic fertiliser used during the 19th century, in the 20th century another important source of phosphates was manufactured in Lincolnshire. The fertiliser in question is basic slag, a by-product of the steel industry which was developed in



Fig 6: Tapping slag from a basic open-hearth furnace, Appleby-Frodingham, Lincolnshire

Lincolnshire from 1888, when Maximilian Mannaberg, from Lipník in what is now the Czech Republic established a basic open-hearth plant comprising two 15-ton furnaces. The basic sreel industry of Linconshire expanded significantly with the construction of the integrated iron and steel works of John Lysaght and Co. at Normanby Park, which was begun in 1910 and producing steel from 1912. Following the First World War steel plant was erected at many of the other ironworks in the Scunthorpe area, including Appleby-Frodingham, Redbourn Hill and the Trent Ironworks which had been acquired by John Brown of Sheffield. Basic slag was a by-product of basic (as opposed to acid) steelmaking, which was developed from 1879 as a way of using iron ores with high phosphorus content, *i.e.* most British ores, to produce bulk steel. Since the phosphorus passed into the slag, it could be ground into a fine powder and used as fertiliser, first marketed in the 1880s as *Thomas' Precipitate*, after Sidney Gilchrist Thomas, who, with Percy Gilchrist, developed the basic form of Bessemer steelmaking. The sale of basic slag for use in agriculture became an economically important side-line to the steel industry, and by 1910, when the construction of Lincolnshire's first steelworks began, the UK was producing somewhere between 600,000 and 850,000 tons of basic slag as a by-product. For comparison, in the same year the UK produced 733,262 tons of superphosphate.

Sulphate of Ammonia!



So phosphatic much for manures, but I expect everyone is wondering about the production of nitrogenous fertilisers in Lincolnshire! Equally if not more important as phosphates, the main source of nitrogen fertiliser in the 19th was sulphate of century ammonia, ammonia being, of

course a compound of nitrogen and hydrogen (NH₃). Sulphate of ammonia was produced by the distillation of ammoniacal liquor produced as a by-product of gasworks and coke works, and being a relatively cheap and easy process, many of these established by-product plant for the manufacture of sulphate of ammonia, among other things. By 1882 Lincolnshire had around a dozen gas undertakings, and later, in the early 20th century the batteries of by-product recovery coke ovens at both Redbourn Hill and Normanby Park iron and steel works were producing sulphate of ammonia. The national figure for the production of ammonium sulphate in 1910 (for reference to the phosphate figures given previously) is 367,587 tons, of which 167,820 tons were from gasworks and 92, 665 tons from coke works. Although not their primary function, it can be seen that these undertakings constitute an important part of the chemical industry in Lincolnshire.

As the word count for this post is now rapidly approaching 1500 words, I'll knock it on the head, but of course I'd be happy to provide more detail to anyone who's interested....

Select Bibliography

Birch, A, 1967, *The Economic History of the British Iron and Steel Industry, 1785-1879.* London: Frank Cass and Co. Ltd.

Carr, J C and Taplin, W, 1962, *History of the British Steel Industry*. Cambridge, MA: Harvard University Press

Christopher, J E and Byrom, T H, 1921, *Modern Coking Practice. Volume II: By-products*. London: Crosby Lockwood and Son

Fritsch, J, 1920, *The Manufacture of Chemical Manures*. English translation by H B Stocks. London: Scott, Greenwood and Son

Gray, A N, 1944, *Phosphates and Superphosphate*. London: E T Heron and Co. Ltd.

Grigg, D, 1966, *The Agricultural Revolution in South Lincolnshire*. Cambridge: Cambridge University Press

Leigh, G J, 2004, *The World's Greatest Fix. A History of Nitrogen and Agriculture.* Oxford: Oxford University Press

Lunge, G, 1916, Coal Tar and Ammonia. Part III: Ammonia. London: Gurney and Jackson

Wright, N R, 1982, *Lincolnshire Towns and Industry*. Lincoln: Society for Lincolnshire History and Archaeology