

David Thomas: Father of the American anthracite industry

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Abstract

At the Ynisedwyn Iron Works at Ystradgynlais in the Swansea Valley David Thomas conducted experiments during the late 1820s to smelt iron ore using the plentiful supplies of local anthracite coal. Hearing of Nielson's use of the hot blast in furnaces in Scotland, Thomas tried out the new method at Ynisedwyn. By a judicious method of using the right mixture of ore and fuel, he succeeded in making first class pig iron in 1837, and in so doing, played a major part in transforming the Swansea Valley into a major iron producing centre. But his greatest influence was upon the iron industry of the United States.

In Pennsylvania lay a huge anthracite coalfield waiting to be developed. News of Thomas's success in Wales of led the directors of the newly-formed Crane Iron Company to invite him to come to Pennsylvania; David Thomas was hired for an initial period of five years. He and his family sailed in May 1839. He settled on a site near Allentown for his first furnace, running the first pig iron in 1840. Within a few short years, Pennsylvania was outstripping South Wales as the world's largest iron producer. Ten years of feverish activity, led by Thomas, completely changed the Lehigh Valley, where the iron industry, fuelled by anthracite coal, was transformed from a rural, plantation-based system into a modern, large-scale enterprise. Its importance in the industrial history of the United States can perhaps be compared to that of the Severn Valley in Britain a century earlier. Both valleys in their respective times became the world's major centre of iron production.

On 6th May 1839 Mr David Thomas, superintendent at the Ynisedwyn¹ Iron Works, Ystradgynlais, South Wales, received a letter from Mr Townsend Wood at Liverpool, informing him that three state rooms had been booked on the American packetship *Roscious* sailing to New York on the 13th of that month². Rooms were booked for David, his wife Elizabeth, their three sons and two daughters. David subsequently boarded the *Roscious* with his family for the journey to the United States to begin a new life as an ironmaster with the newly-formed Lehigh Crane Iron Company in Pennsylvania.

David Thomas, born in 1794, was the only boy of four children at Ty Llwyd Farm, Cadoxton, Neath. He was first tutored at the Alltwen school and then attended the Neath Academy. Like all the farming families of the district, the Thomases were experiencing some distress caused by a sustained period of wet, unproductive weather and low harvest yields. Young Thomas saw a better future in industry and at 17 became apprenticed to the Neath Abbey Iron Works, where two cold blast furnaces were in operation. The works was owned by a Quaker named Price, who was one of the largest builders of mining machinery and Cornish pumping engines of that day. It was here that Thomas was quickly earmarked as a leader by Henry Taylor, the chief engineer, who gave him leave to visit Cornwall in 1817 to erect a pumping engine. His abilities soon caught the attention of Mr Parsons, the owner of the Ynisedwyn Iron Works, where Thomas was offered the position of steward, not only of the furnaces but also of the coal and iron mines connected with the works, a position he occupied for the next twenty-two years.

The Ynisedwyn Iron Works had been in operation since 1720 though iron had been produced on the site since 1612. When Parsons went bankrupt in 1817, the works were left in the receivership of a Swansea banker, and Thomas supplemented his income by selling coal and lime and by working for the Brecon Forest Tramroad at Defynog, near Brecon, built expressly to provide raw materials for the furnaces at Ynisedwyn. According to his son Samuel, his later work with anthracite came when David, considering the rich resources of the Swansea Valley, decided that the Almighty had not wasted his creative powers in putting these materials together for no purpose, and on that faith he began his experiments³.

At the time, even though the Ynisedwyn Works, situated 13 miles from Swansea, lay at the edge of one of the largest fields of anthracite coal in the British Isles, the coal contained such a low quantity of potential gas that it did not coke properly and was therefore considered useless for iron smelting. Anthracite was referred to as 'stone coal'. The Ynisedwyn Works had to procure its coal supplies by canal from as much as 14 miles distant. Further east, the coal was either bituminous or semi-bituminous and burned more easily⁴. In fact, the three largest ironworks in Britain were in Southeast Wales, at Cyfartha, Pen y Darren, and

Blaenavon. All three had profited greatly from the process of puddling discovered by Henry Cort in 1783 which had finally ended the industry's reliance on charcoal, at that time in very short supply.

Sometime in 1817 George Crane, a former nailmaker, arrived at Yniscedwyn from Bromsgrove, in the English Midlands, as works manager. He later became part owner of the works. Described by contemporaries as being very religiously inclined and 'short in stature and temper', Crane was an ardent Anglican, a strict Sabbatarian, and 'a terror to drunkards'. He was known to visit public houses and 'woe betide the men he found there'⁵. On one occasion he suspended work at the furnaces and conducted a religious service in the carpenter's shop. One of the skilled, sober and religious workers he trusted was David Thomas.

Thomas had begun his experiments soon after his arrival at Yniscedwyn. He was particularly interested in finding a way to use the plentiful supplies of anthracite in the district to smelt iron. At first, he used anthracite along with coke at a ratio of 1:20 and though he did quite well with this mixture, whenever anything had gone wrong with the furnace, the workmen always blamed the anthracite. According to George Crane, all attempts to utilize experimental dedication were deemed unprofitable until one day he was suddenly blessed with 'intuitive inspiration'. Apparently, he and Thomas were sitting in his parlour discussing a pamphlet by James Neilson, manager of a Scottish gas works, on the use of the hot blast in furnaces.

In the early 1830s the idea of using a hot blast had seemed absurd to many in the iron industry. Furnaces were known to produce more iron in winter in colder temperatures. What was not known was that it was the moisture in the summer air that made the difference, and not the temperature. Neilson's hot blast was produced by passing the current of air from the blowing engine through a chamber made of wrought iron plates, similar to a boiler, set in brickwork and heated by a coal fire beneath it. Experiments in Scotland had showed that raw coal could be used in the furnace for the increased temperature allowed the sulphur to be taken out as calcium sulphate in the slag. This would prove to be of immense value to those areas of the country where anthracite was readily available, especially before any effective system of rail transportation had come into being. And one of those areas was the Swansea Valley.

As Crane and Thomas watched the fire burning slowly and not too effectively in the grate, according to Thomas, the idea came to him that perhaps a hot blast applied to the fire would make the anthracite 'burn like pine'⁶. And so the idea was born of using hot blast to smelt iron with anthracite coal. David visited

Scotland to see the hot blast technique and returned to Yniscedwyn with a licence from Neilson to use it. He also brought back a mechanic to help him build the hot blast oven. The application of the hot blast to the furnace using anthracite proved to be an instant success, but it was Crane, and not Thomas, who received the credit and the patent for the process. He took out his patent on 28th September 1836. The first run of iron smelted by anthracite took place on 5th February 1837. A report in the South Wales newspaper *The Cambrian* stated that the use of the hot blast in the furnace at Yniscedwyn 'has brought into use a combustible material found in the neighbourhood, much cheaper than bituminous coal, and consequently much less expensive than coke, and of which a smaller quantity is required, and the quality of iron has been sensibly improved'. Its success not only opened up the West Wales anthracite coalfield but also had dramatic results in the manufacture of iron in the United States. Waiting to be exploited, there was a huge anthracite coalfield in Eastern Pennsylvania, with readily accessible ores and limestone. All that was missing was someone with the expertise, experience and managerial skills of David Thomas to unlock its enormous potential.

Though anthracite had been discovered in both Rhode Island and Massachusetts in the last half of the 18th century, in none of the colonies had the mining of the mineral been successfully carried out except in Pennsylvania, where virtually the total American supply was produced. In that state, anthracite had been discovered in the Wyoming Valley sometime before 1766, the year that a sample was taken to London to be presented to Thomas and Richard Penn by Joseph Tilghman of Philadelphia. Ample supplies were also found in the region of present-day Wilkes-Barre. In 1800, a wagon load of anthracite was taken to Philadelphia from Port Carbon by William Morris but was quickly returned as unacceptable for any purposes. Then, in 1812, Colonel George Schuemaker of Pottsville took nine wagons of anthracite to sell in Philadelphia. He managed to sell only two loads with great difficulty, being forced to give away the other seven loads. Many people in the city regarded him as an imposter who had tried to sell stone to the public as coal.

In the Lehigh region, anthracite was discovered on Mauch Chunk Mountain in 1791, but because there were difficulties in getting it to burn, most of it was thrown away as useless for any purpose except as gravel for footpaths. Yet the slow-burning 'stone coal' was already being used in stoves and grates as fuel. In 1804 in Philadelphia, Oliver Evans had patented a 'luminous grated stove' that could use mineral coal, and Dr Thomas James is on record as having been one of the first to use anthracite habitually in his house. In 1808, Judge Fell of Wilkes-Barre was successful in burning

anthracite in his grate, and this may have been the first attempt to use the new fuel for domestic purposes in the United States or in any other country, for it was not used in Wales in this way until 1813. Ellis Roberts tells of Judge Fell's success in burning anthracite coal without having to apply a forced draft. He also tells of the experiments of the Smith brothers of Wilkes-Barre who shipped anthracite as fuel to New York City⁷. In 1824, the Delaware and Hudson Canal was completed to a length of 124 miles expressly to carry the coal from the Wyoming Valley to the Eastern Markets. But though anthracite coal was found to be suitable for use in domestic fireplaces, it did not solve the problem of finding a cheap, readily available fuel to smelt iron ore in sufficient quantities to be profitable.

Before the arrival of Thomas in the United States, one of the greatest needs had been that of being able to free the country from dependence upon Britain for its supplies of good quality iron, and especially for iron rails. In most of the early experiments, problems of low production, poor quality iron and that of finding the correct mixture of furnace size, blast pressure and temperature caused production to be abandoned. An indication of the problem can be found in the fledgling railroad industry, for when proposals were submitted for the furnishing of rails for the Columbia and Philadelphia Railroad in 1831, there were none at all for American iron, and the whole quantity was subsequently purchased in Britain, the majority being produced in south-east Wales⁸.

As long as the iron ores and the coal of the anthracite region were incapable of fusion, the ores were of little use, and up to 1840, the year that Thomas began his operations at Catasauqua, the iron of eastern Pennsylvania was comparatively small in quantity and high in price. In Pennsylvania alone, over 80,000 tons of iron were imported and of these, 49,000 tons were of railroad iron. Though the situation was deplored by a contemporary writer, Harry Scrivenor, he had the prescience to see which way the future lay. 'Let us hope', he wrote of Thomas's efforts, in a book published in 1854, 'that with this new power ... acquired, we shall rescue ourselves hereafter from such a costly humiliation. We owe it to ourselves, not thus to throw away the bounties of Providence, which in these very materials has blessed us with a profusion wholly unknown elsewhere. Pennsylvania has five times as much coal and iron as the country to which we pay annually eight or ten millions of dollars for iron. The anthracite masses of Pennsylvania are six or eight times as large as those of South Wales. With these resources, you could have abundant employment, if you could only supply the present wants of the country, for which we are now dependent upon foreigners. But the sphere of demand is every day widening for the consumption of

iron. The time has come when nothing but iron roads will satisfy the importance of travellers and the competition of trade'.

At the Lehigh Coal and Navigation Company, experiments with smelting iron ore had been taking place as early as 1826 in an attempt to manufacture iron rails but had to be abandoned on account of the expense and the difficulties involved. In fact, the manufacture of pig iron in the whole country had hardly changed since the establishment of the first iron works at Saugus, Massachusetts in the late 17th century. These had used charcoal and water-powered bellows to produce small quantities of high-priced, high-quality iron for agricultural and mechanical implements⁹. In July 1834, the board of directors of the Lehigh Coal and Navigation Company passed a resolution to give in fee simple all the water power of any one of its dams between Allentown and Parryville, except that necessary for the operation of the canal, to any company who would expend the sum of \$30,000 to establish works and to smelt iron with anthracite. The experiment had to be started by August 15, 1835 and completed within two years. No-one was successful!

After news of the astonishing success of the Yniscledwyn Iron Works reached Pennsylvania, the advantages of using the new methods of smelting became quickly apparent. It was an inspector of rails, Solomon Roberts, who was sent to Yniscledwyn by the Philadelphia Railroad to see what was going on that was causing such a stir in Britain and the industrialized world. Roberts was a nephew of Joseph White, manager of the Lehigh Coal and Navigation Company which operated the Lehigh Canal and which owned large tracts of anthracite coal lands in north-eastern Pennsylvania. After acquainting himself with the methods used at Yniscledwyn, Roberts recommended that one of George Crane's associates, preferable David Thomas, should come to the United States to be employed by his company. In 1836, the Lehigh Crane Company was organized and accepted this proposal. Upon the recommendation of Solomon Roberts, company representative Erskine Hazard was sent to Wales to hire David Thomas. Consequently, Thomas and his family agreed to come to the United States for a period of five years, a decision which was, according to George Crane, in a letter he wrote to David, soon after the latter's arrival in Pennsylvania, a decision that would lead to the Welsh iron master's becoming 'the greatest benefactor to Pennsylvania that ever lived'.

It was a difficult decision for Thomas. Already in his forties, he was enjoying a successful career at Yniscledwyn and was an important figure in the religious and social life of the town of Ystradgynlais as well. His initial reluctance to leave Wales was quickly

overcome, however, by his wife Elizabeth, who persuaded her husband to leave for the sake of a stable future for their three sons. She argued that they might have a better future in the New World, and David finally accepted the contract 'to manage the setting up of a furnace on or near the Lehigh River to smelt iron with anthracite and to generally use his best knowledge and services for the good of the company'.

The agreement with the Lehigh Crane Iron Company was very generous¹⁰. It offered to pay the expenses of the Thomas family in moving from Wales to Allentown, and to furnish them with a house and coal for fuel, and to pay a salary at the rate of two hundred pounds sterling a year until the first furnace on the Lehigh was got into blast 'with anthracite coal and making good iron', and after that at the rate of two hundred and fifty pounds sterling a year until a second furnace was put into operation successfully. At that time fifty pounds sterling was to be added to Thomas's annual salary, with fifty pounds sterling per annum in addition for each extra furnace that would be put into operation under his management. Should Thomas fail in his attempts, then the company would pay him a sum equivalent to the expense of removing himself and his family back to their residence in Wales. With this very generous offer, the Thomases said goodbye to their friends and relatives and began their journey to the United States.

Upon his arrival at Allentown, David Thomas wasted no time in setting up the first furnace projected by the company at Bierley's Bridge, later called Catasauqua. Here the Crane Works led the way in the growth of the anthracite industry in Pennsylvania, where it developed on such a massive scale that Lehigh County became known as the birthplace of the American Industrial Revolution. The furnace was blown in at Catasauqua in July, 1840, the first run of iron coming on July 4. It was an immediate success and, apart from later difficulties caused by a flood, continued to make good quality iron for a number of years. It was quickly followed by many others built by different iron masters in the state, some successful, some not. Following the breakthrough by Thomas, in the fall of 1840 William Henry built an anthracite furnace on the Lackawanna, near present day Scranton. He had difficulty obtaining the necessary fire brick, blast machinery, and hot blast apparatus from American manufacturers. Consequently it was not until October of the following year that he could attempt the first blast, and it was a total failure. It was another ironworker from Wales, John F Davies, who helped the Lackawanna Furnace finally succeed in 1842. By that time, the proven technical and management skills of Thomas had placed him well in the forefront of developments in the anthracite iron industry in the United States, a position he was to retain for many years.



David Thomas

One of the problems in constructing furnaces that utilised anthracite had been the design; earlier furnaces had been built to burn bituminous coal. Thomas's solution at Yniscledwyn and later at Catasauqua was to build the throats of the furnaces much wider in diameter in proportion to the boshes. With a narrower throat, the coal had partially disintegrated, detached pieces falling to the hearth, and the accumulation of carbonaceous matter was a serious disadvantage. The larger-throated furnaces greatly increased the facility of smelting with anthracite, which could be converted into a dense coke. At Number Two Furnace, constructed in the latter part of 1842, Thomas also conducted an experiment that his son Samuel believed to be the first of its kind in the country. This was undertaken with the aim of utilizing the waste gases for refining iron, taking out the gas at a depth of some nine feet below the top of the furnace instead of immediately under the dumping ring at the tunnel head. The practical purpose of the experiment was the refining and puddling of iron for making an extra quantity of bar iron and wire.

Before the end of 1842, the success of the first two furnaces at Catasauqua led to construction of Furnace Number Three. An argument developed as to what source of power should be used for the blowing engines. Thomas argued for steam, believing that not enough water remained in the Lehigh during the dry season to

blow an additional furnace. White, who argued at first for water power, eventually agree with Thomas and steam was used for the blowing apparatus. The furnace was even larger than the first two; it was 47 feet high, 40 feet wide at the base, with a 17 foot bosh.

At Catasauqua, Thomas built four more furnaces for the Lehigh Crane Company, each one with a larger productive capacity than the previous one. Other furnaces were added gradually so that by 1870, the company's six stacks were producing about 100,000 tons of pig iron a year, and the USA was far outstripping Wales in the manufacture of this important product. During the years 1855 to 1875, in fact, more iron was produced in the United States with anthracite than with any other fuel. In the 1870s over half the iron made in the country came from works in Pennsylvania, principally in the valleys of the Lehigh, Schuylkill and Susquehanna Rivers. Foremost among these works was the Thomas Iron Company, founded in 1854 at Hokendauqua, following the original Lehigh Crane Iron Works at Catasauqua. By 1892, the Pennsylvania anthracite coal fields alone were producing 40 million tons of iron a year. It is quite right that David Thomas should be revered as the father of the American anthracite iron company.

The first manufacture of the heavy iron rails needed for the rapid increase in the rail roads being built in many areas of the country began in 1844 at the Mt Savage Rolling Mill in Alleghany County. There, the very first rail struck in the United States was one of the kind known as the Evan Rail, patent of the Dowlais Iron Works in Merthyr Tydfil. In 1845 the Montour Mills at Danville were built with the express purpose of rolling iron rails, and the demand soon led to mills sprouting up everywhere to keep up the supply. By 1854 over 1,700 miles of railroad had been built in the States, and another 12,000 were being built, making a total of more than existed in the rest of the world. The Tariff Act of 1842 had encouraged home production; it provided the impetus necessary to the American manufacture of iron rails.

Sixty years after the family had arrived from Wales, Samuel Thomas, David's youngest son, who had helped his father survey the site for the first furnace at Biery's Bridge, described their early days in the new country. When David Thomas first arrived at Allentown, he had been regarded as something of a visionary. After all, so many experiments with the use of anthracite for smelting iron had proved unsuccessful. One leading charcoal master told him that he would eat all the iron that Thomas could make with anthracite. And this boast seemed to express the general feeling of the trade at the time. The ironmaster did not keep his promise, however, even though Thomas later invited him to dinner cooked in the company's first furnace.

In 1855 David Thomas relinquished control of the Crane Works to devote his full time to the Thomas Iron Company. Here, the production of pig iron per furnace was greater than that at any other iron works in the United States and perhaps in the entire world. The furnaces were the highest and the largest and had the most powerful blast machinery in the country. No only was the company the largest iron works in Pennsylvania, but it was also known as a model of good management and practice.

In his reminiscences, Samuel tells of a practical joke he played on the whole town in those early, exciting days. At the time, the steam whistle was an unknown sound in the Lehigh Valley. Samuel had one made secretly by Mr Lehman, a brass founder at Bethlehem. When Number Three Furnace was ready, and the large whistle attached to the boilers, Samuel 'let her off'. The tremendous blast startled the whole town, and occasioned much laughter especially when some women gathered up their children and ran through the streets in panic, thinking they had heard 'the last trump'.

At the time, when no facilities of telegraph, telephone, or railroads existed, it took three whole days to transact business between the Crane Works in Allentown and Philadelphia. Even as late as 1855, the only means of transporting coal from Mauch Chunk and magnetic ore from New Jersey was by canal. The hematite ores and limestone came by wagon, 'the whole country literally swarming with teams'. In 1855, however, the Lehigh Valley Railroad opened, with David Thomas as one of the directors, and as Samuel put it in 1899, 'those connected with the manufacture of iron began to have a taste of the labour-saving facilities so generously enjoyed today'.

In its heyday, the Thomas Iron Company had 13 blast furnaces in operation, backed by ownership of collieries, iron ore mines, and limestone quarries. It also possessed one of the largest rolling mills in the state and a large fire brick company. Thomas became a director of many iron works, coal mines and railroads. He unsuccessfully contested as a Republican candidate for Congress in 1866, refusing the indignity of canvassing for votes, presided over the Ironmaster's Convention in Philadelphia in 1874 and, with his wife, celebrated their 65th wedding anniversary. He died just before his 88th birthday.

At Thomas's funeral, attended by hundreds of his workmen as well as dignitaries from all over the state, testimony was given to him as an honoured and much-beloved national benefactor. His three sons were trained to take on responsibilities and management duties at the company. Their paternal interest in the welfare of their work force was proverbial and, like their father, they were heavily involved in the religious, educational and

social aspects of the communities connected with the iron works. Samuel became the second vice-president of the Hokendauqua Works, followed by his brother John, who later fulfilled an ambition to build an iron works in Alabama at a place later called Thomas in his honour.

The anthracite era which David Thomas was to set in motion almost as soon as he arrived in the United States lasted nearly 80 years before being displaced by the manufacture of steel at Pittsburgh and other centres. During his supervision, the Thomas enterprise was easily the leading anthracite iron producer in the country and for many years its prices set the market for pig iron. In 1904, at the fiftieth anniversary of the Thomas Iron Works, there were nine active stacks in operation. The company had earned a reputation for high-class foundry work as well as for basic and mill iron and could point with pride to a record of fifty years during which they had used an all-ore mixture. It also claimed to be the oldest company in the US manufacturing pig iron that had not been reorganized or had its original corporate name changed since its beginning. In the late 1920s the company was still producing 260,000 tons of iron a year from five active furnaces.

From all we know of David Thomas, he was an extremely modest person. It was left to his son Samuel to take upon himself the duty of establishing the claims of his father to the successful application of anthracite to the production of pig iron in the United States. Samuel believed that his father did not assert himself more emphatically due to his modesty and early lack of means and influence to obtain a patent. 'With all due respect to George Crane', stated Samuel, 'he was in no sense of the word a mechanic or a technical man, but a shrewd business man, with a faculty for recognizing the merits and promoting the commercial application of the inventions of others — a faculty which is essential to the industrial progress as the genius of the investigator and inventor'. Crane, of course, had not shared any credit with David Thomas, his superintendent of works at Yniscledwyn in the crucial period when experimentation with the use of anthracite had been taking place. There is every reason to agree with those writers such as James Swank, who called Thomas the 'Father of the American anthracite industry'¹¹, and with those later writers such as Stapleton, who argue that Thomas should be recognized as one of the most influential men in the growth of American industry in the 19th century¹².

Notes

- 1 The spelling of Yniscledwyn is taken from original letters to Thomas from Wales.
- 2 Thomas David: Letters. Hagley Museum, Wilmington, Delaware.
- 3 Thomas, S, 'Reminiscences of the Early Anthracite Industry', *Transactions of the American Institute of*

Mining Engineers 29 (1899).

- 4 Peckitt, L, *Iron In Industry: Progress of 100 Years*. (Princeton, N.J. 1940), p.18.
- 5 The story is told in Peters, R, *Two Centuries of Iron Smelting in Pennsylvania*. (Philadelphia 1921).
- 6 Peckitt, p.19 (Peckitt, from Yorkshire, worked at the Crane Iron Works at Catasauqua.)
- 7 Roberts, E, *Flames and Embers of Coal*. (Washington, DC 1990).
- 8 Scrivenor, H, *A History of the Iron Trade* (London 1854). Reprinted New York, 1968.
- 9 Stapleton, D H, *The Transfer of Technology to the United States in the Nineteenth Century* (Philadelphia 1987) p.258.
- 10 The contract is detailed in full in Peckitt.
- 11 Swank, J M, *Introduction to a History of Iron Making in Pennsylvania* (Philadelphia 1878).
- 12 Stapleton (see note 8). In this way, Stapleton agrees with many late nineteenth century writers as to the importance of Thomas.

Author's note

This paper was presented at the 1994 HMS conference in Swansea. It is a summarised version of three chapters from a book that has since been published by the National Welsh American Foundation: Peter N Williams, *David Thomas: Iron Man from Wales. The story of an immigrant and the country he left behind* (Trucksville, PA 1995).

The author

Peter N Williams was born in North Wales. Raised in Flint, he was educated at the King's School, Chester and at University College, Swansea. After emigrating to the United States in 1957 he served with the US Army in Germany. He later completed his PhD degree at the University of Delaware. Founder and president of the Welsh Society of Delaware, he has studied Welsh language and literature, returning to Wales in 1992 and 1994 to study conversational Welsh at Aberystwyth and Lampeter. He began his study of David Thomas after reading a series of letters from friends and family in Wales to David during the period 1839-1842 which are now kept at the Hagley Museum, Wilmington, Delaware. For many years Peter was English Department Chairman at Delaware Technical and Community College. After retirement in 1992, he became a member of the adjunct faculty at Goldey-Beacom College, Wilmington, Delaware. He is also a director of the National Welsh American Foundation.

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