

A World of Copper: Globalising the Industrial Revolution, 1830-1870

Swansea Workshop

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Abstracts

Des Cowman, Mining Heritage Trust of Ireland

‘From the Benign to the Malign: Three Different Irish Mining Experiences’

“There are no mines in Ireland”, stated a geography text-book of the 1950s. There are in fact hundreds of mines in Ireland when all minerals are considered. Thirty four of these sold copper in Swansea according to the Mineral Statistics. However, most of these and other mines were short-lived. There three exceptions – Avoca in Wicklow (1822-1892), Allihies in Cork (1812-1884), Bunmahon, Waterford (1824-1876). Only in these could mining communities and traditions develop though in different ways depending on ownership.

James E. Fell, Jr., University of Colorado Denver

‘Technological Transfer and Technological Change: the Swansea Process in the American West, 1865 to 1885 and After’

Beginning in the 1860s, Americans living in the trans-Mississippi West began to develop copper mines in the region, and among the technologies imported to reduce the ores was the famous process used at Swansea, Wales. It made its appearance in many places, but often failed for various reasons. In Colorado, however, Nathaniel P. Hill, a resourceful former college professor as well as mineowner, came to believe that the technology used to reduce copper ores at Swansea was the solution to Colorado's technological impasse in recovering gold. After two trips to Britain and the Continent to study technology, he hired Welsh, Cornish, and German-trained metallurgists and workers, obtained capital, and founded the Boston and Colorado Smelting Company. In 1868, this enterprise opened a plant that used the Welsh technology so successfully that by the mid-1870s, it was reducing more than half of Colorado's total metallic output in terms of silver and gold. Copper was a minor by-product. Meanwhile, somewhat similar technological problems assailed the minerals industry in the gold mining town of Butte, Montana. That in turn prompted a mineowner there, William Andrews Clark, to visit Hill's plant

to discuss the situation. As a result, Hill, Clark, and others founded the Colorado and Montana Smelting Company, which established a plant at Butte in the late 1870s, a facility which resolved the technological issues that Clark and others faced. But the long-term results were different. While the Boston and Colorado Company remained focused on using the Welsh technology to recover gold and silver, the continued development of Butte revealed the presence of massive copper deposits which became the focus of production as the gold and silver content of the ores there declined. As a result, Butte emerged as one of the world's greatest copper producing centers in the late 19th and early to mid-20th century. The Swansea technology brought to Black Hawk and Butte then spread through the American West where it continued to evolve well into the 20th century even as smelting industry in Wales declined and faded away.

Igor Goicovic, Universidad de Santiago de Chile

‘Corporate structure of copper mining during the growth cycle. Illapel, Chile, 1840-1870’

Copper mining in Chile experienced an important expansion in the 1840-1870 cycle. This was expressed in a substantial growth in output and employment and increased participation of Chilean exports of copper in the world market. However, the business structure that operated this process was characterized by archaic features, which in fact appeared during the colonial period. In the region of Illapel, copper mining was carried out by small and medium size producers who organized their mining operations upon the recourse to family members and acquaintances through networks. These tasks hardly had any equipment or modern technology, tools; inputs and supplies were very similar to those used in colonial times, while molten tasks were carried out at foundries which were, in many cases, capital intensive. In this paper we analyze the characteristics of the business structure mining in Chile, particularly through the economic practices of the miners of Illapel.

Stephen Hughes, Royal Commission on the Ancient & Historical Monuments of Wales

‘The Topography of Copperopolis/Swansea’

The key to the foundation and later development of Swansea as a national and then international copper-smelting centre were twin networks of transport. These were central to Swansea’s rapid rise as a smelting centre. The naturally navigable River Tawe made accessible the largest coal reserves to sailing-ships travelling from the major copper-mining complex of Cornwall and west

Devon and the thirteen substantial copper-smelters were all sited on this river. The copper-smelters had to be located on accessible coalfields in proximity to the copper-mining areas because one tonne of copper required four tonnes of coal to smelt it, and Swansea was the nearest large coalfield to Cornwall reachable by substantial sailing-vessels. In turn this coal had to be made accessible to the copper-smelters by separate shore-based networks of transport that evolved in form and complexity over time. The water-power for eighteenth-century rolling-mills was provided by tributary streams and watercourses alongside the three miles of navigable river and by a series of three watermills sited on the main river above the head of navigation.

Prior to the foundation of the first Swansea (Llangyfelach) copper-smelter in 1717 the local gentry coal-owners and exporters had developed a network of pack-horse tracks for bringing Swansea-area coal to shipping points on the river. The second Cambrian Copperworks, founded in 1720 under local ownership, also made use of these tracks.

The owners of the large White Rock Copper-works, the third Swansea Copperworks, founded in 1732 with larger corporate capital originating in Bristol, had 'The Great Coal Road' constructed for ox-drawn carts to bring large amounts of coal from the adjacent Llansamlet Coalfield for smelting. The other copper-smelters followed suit such as Morris, Lockwood and Company's Forest Copper and Lead works which had a carefully graded coal road built obliquely up the western side of the directly Swansea Valley from inception in 1747-52. A network of coal roads built up in the early and mid-eighteenth century and has been mapped by the Welsh Royal Commission as part of their Copperopolis study.

The owners of the large copper-works at Swansea also tunnelled into the hillside behind their works to determine what coal was available in direct proximity to the works, something that was also done in large south Wales ironworks such as Blaenavon. This was done at White Rock Copperworks when it was founded in 1737 and the colliery tunnel driven after the foundation of the Forest Copper and Lead works in 1747-52 was developed as an underground canal, eventually penetrating a mile into the hillside. If this waterway had been built in that period it might have been the first of many mining canals built internationally but the documentary evidence is not confirmed by mapping evidence which only first shows this feature in the 1770s. Another underground canal was probably built in the adjacent Clyne Valley.

In 1756 the well-funded London entrepreneur Chauncey Townsend brought the Newcastle-based railway engineer to the Swansea valley. In the 27 years between 1756 to 1783 just over 13 miles of largely wooden-tracked surface railway (or 'waggonway') were built in the lower Swansea Valley. This was largely a mis-application of Great Northern Coalfield practice to the far harsher topography of the lower Swansea Valley. The evolution of a far more appropriate and efficient transport system for the lower valley involved the construction of a system that used local canals running on the landward side of seven copper smelters in 1784-91. Rather than the previous rather inefficient system of surface railways running to expensively wound and pumped coal-mining shafts these were fed by an extensive system of colliery railway and canal tunnels. These were some of the first canal/rail integrated transport systems that came to be fundamental to development in upland industrial areas and led to the foundation of the first public railway system. The canals were also dual purpose and fed process water to the copper-smelters.

The Tawe River navigation was gradually dredged, provided with a towing-path and thirteen river docks, as well as extensive quays, were provided for copper-smelters and collieries. In the late 1840s the first floating dock was provided for sailing-ships by impounding the lower river and building a diversion canal. A whole new era of docks infrastructure construction began which primarily came to feed the coal-export and other industries.

Sources:

S. Hughes, *Copperopolis: The Early Industrial landscapes of Swansea* (RCAHMW, Aberystwyth, 2000), pp. 71-154;

S. Hughes, 'The Emergence of the Public Railway in Wales' in *Early Railways 4, Papers from the Fourth International Early Railways Conference* (Six Martlets Publishing, Sudbury, 2010), pp. 107-24.

Louise Miskell, Swansea University

‘To the cost of the Costers: Swansea’s copper entrepreneurs and the re-configuration of the industry in the eighteenth century’

This paper examines the business practices of Swansea’s pioneer copper smelters in the first half of the eighteenth century. Focusing in particular on the management of Swansea’s Llangyfelach works by Robert Morris senior, the approach to finance, partnerships and alliances with key figures involved in the mining and in the purchasing of copper will be examined. I will argue that entrepreneurial skills were key to loosening the dominance of the existing Cornwall-Redbrook power axis in the British copper industry, and the influence of earlier entrepreneurs like the Coster family. An understanding of the business decisions of men like Morris, it is suggested, is as important a consideration as other factors like technological advances and the natural advantages of the Swansea valley location, in understanding Swansea’s emergence as a prime smelting site.

Jeremy Mouat, University of Alberta

‘E. D. Peters, James Douglas, and the genesis of the American copper moment’

My paper hopes to shed light on the end of the Swansea moment by describing the genesis of the American moment. The American dominance of copper smelting was clearly in evidence by the 1880s, when Edward Peters published *Modern American Methods of Copper Smelting* (New York: Scientific Publishing Company, 1887). Peters’ book had its origins in a series of articles that he had prepared for the New York-based technical journal, the *Engineering and Mining Journal*, and it was soon acknowledged as a definitive treatment of the topic. The eighth edition came out ten years after the book’s initial appearance, with a slightly different title, *Modern Copper Smelting*. The change suggests that “Modern American Methods” had become so ubiquitous that they no longer needed to be referenced. These methods supplanted the Welsh process, a development that attracted the attention of another prominent North American copper metallurgist of the late nineteenth century, James Douglas (the man to whom Peters had dedicated his book). My paper will discuss the role of both Peters and Douglas in the emergence of American copper smelting expertise, assessing the explanations for this growing American prominence as well as those that address the eclipse of Welsh copper smelting.

Luis Ortega, Universidad de Santiago de Chile

‘The rise and fall of the Chilean copper mining industry. The tensions between modernization and tradition 1810-1885’

Output of copper minerals went up five fold between 1845 and 1875 and thus Chilean offer in the London market reached an average of 36 per cent by the mid 1870s. But such an important increase in production was based mainly upon traditional (colonial, labour intensive) mining methods and a modicum incorporation of new technologies. Mining entrepreneurs were bent on tradition and reluctant to invest. When by the mid 1860s the copper industry began to restructure in Europe and the United States, the Chilean copper miners were unable to face the challenge the decline in the international price through productivity increases, and went into a profound and protracted crisis. This paper analyses the main features of the Chilean industry and sustains that it was the predominance of tradition in both technologies of production and processes which explain its downfall.

Robert Protheroe Jones, National Waterfront Museum, Wales

‘From leader to laggard? Reassessing the technology of copper smelting and refining in Wales’

Origins of the so-called ‘Welsh process’ and its seldom examined relationship to other internationally significant metalliferous sectors concurrently operating in the region (charcoal- and coke-refined wrought iron, tinsplate, smelting of lead and other non-ferrous metals); comparison of rates of process evolution and sources of innovation between these industry sectors. International diffusion of the ‘Welsh process’ and its modification and change, especially in the USA from whence new variants diffused internationally. The rate of uptake of converter technology by Welsh copper smelters, examining oft-repeated accusations of technological conservatism, and seeking comparisons with the region’s other metalliferous industries. Welsh aspects of the origins of commercially viable electrolytic refining, reassessing the degree to which it was adopted by south Wales smelters, the factors responsible for its differing rates of adoption internationally, and the contrasts between metallic purity and physical

properties which resulted in significant niche markets for fire refined copper – and hence prolongation of this element of the Welsh process.

Sharron Schwartz, University of Glamorgan

“The Aristocracy Of Labour”: Cornish Mineworkers’ Attitudes to Faith, Class, Race, Slavery And Collective Action On The Copper Mines Of Latin America’

As the most visible immigrant labour force on Latin American copper mines for much of the nineteenth century, the Cornish were the flag bearers of Britain’s informal empire and their behaviour was constantly in the spotlight. This paper argues that in order to dominate the emerging international mining labour market, the Cornish displayed ‘nested identities’: Cornish, English and British. This led to a host of differing and at times paradoxical behaviours, for example, their allegiance to Methodism which made them unwelcome in Chile and almost ignited a religious storm at Cobre, Cuba, and their attitude to other ethnic groups and people of colour, particularly the Chinese, whom they subjected to considerable ‘othering’. Some of their attitudes appear hypocritical, for example towards slavery, and their willingness to engage in collective action, which threatened the future of British run mining companies in Cuba, are at odds with the dominant discourse of Cornish miners’ apparent disinterest in forms of collectivist working class activity. Brought up as they were within a social system that championed the greatness of the British Empire and its overt privileging of whiteness, this paper demonstrates that received notions of superiority were further complicated for the Cornish, refracted as they were through the prism of ethno-occupational prowess within the global hard rock mining industry.

Jason Shute, Flinders University

‘South Australia’s opening encounters with “Copperopolis”’

In the early years of the South Australian copper-mining boom of the 1840s – ie, before Swansea ‘came’ to the colony in the shape of the Schneiders’ Patent Copper Company, in 1848-9 – what were the limitations of technology, labour and development generally which were going to stand in the way of the locals unlocking the wealth they had discovered? They were acutely aware of their isolation from expertise and markets. They also perceived indifference by the home government towards their need for growth of a labour force, despite widespread destitution in

Britain and Ireland presenting the potential to kill two birds with one stone (we can further ask whether there was a rôle for women in this). They aspired to making their own way as far as possible, with local entrepreneurs attempting to fill the gaps in available technology as best they could, with the lure of proximal Indian and Chinese markets. They watched closely any technological innovations overseas – including the wildest – longing to be part of advances which would reduce their sense of isolation and vulnerability. They wanted both the benefits of improving a home connection while maximising independence. Ultimately, they would be in Swansea's hands.

Alf Zachäus, IG BCE

'The Copper Countess dances on the High Wire: The Mansfeld Company from 1830 to 1900'

Two basic transformations determined the course of the mining and smelting industry of the Central German copper district Mansfeld: The rise up of Germany to one of the leading industrial nations in the world and the emergence of the capitalist world market.

By the foundation of the German Tariff Union in 1834, five companies ran copper mines and smelting works in the eastern and south eastern foothills of the Harz Mountains, the former County Mansfeld. The Mansfeld area did not distinguish so much from other Central European copper mining districts until the middle of the 19th century. The unification of the five Mansfeld companies to one trust in 1852 was conducted when the take-off of Germany began. Mansfeld was the only copper mining and smelting company in Germany which survived the following decades until the unification of the German states after the French-German War.

During that period, the Mansfeld area evolved into a highly dynamic mining- and smelting district. The new Mansfeld Trust participated on the long running railroad boom in the middle third of the 19th century. During the Great Depression, the company used the chance to increase production and income as supplier for the growing electrical and manufacturing industry.

In this respect, the course of the Central German copper mining and smelting industry in the second half of the 19th century distinguished from that of the copper smelters in South Wales as well as from that of the industry in the Chilean Norte Chico. The copper smelting industry of the

district of Swansea was given up by the end of laissez faire capitalism, when the age of the new copper trusts in North America and in Spain began. Unlike Mansfeld, the Chilean copper companies of Coquimbo missed their chance to form their own modern trusts when they reached their summit by 1870.

However, the price for the success of Mansfeld Trust was a permanent innovation on higher stage which made of it a permanent borrower. Difficult geological conditions and the particular character of the ore, the “Mansfelder Kupferschiefer” (slate of copper), forced the Trust to “escape forward” again and again.

When the new US-American copper giants and the Río Tinto Ltd. began to flood the world market with their supply, the price for the red metal dramatically decreased on the interior German market too.

In the decade after the eighteen seventies crash in 1873-74, Mansfeld’s mines and works managed to double their production. In the middle of the 1880s, however, the company faced itself being thrown down on the hard ground of reality. The massive increase in mining capacities caused water inrushes which made the reorganization and modernization of the whole mining area in the eastern foothills of the Harz Mountains necessary.

The financial burden, the stagnation of production and the decline in prices for raw copper induced the downturn of the profit rate of Mansfeld. Until now there hasn’t been a satisfying response to the following question: Why had copper mining and smelting in the Mansfeld area not been given up before the turn from the 19th to the 20th century already?

Altogether, the survival of the Mansfeld Company was due to the interplay of common hope and mutual dependences at least. Facing the continuing high demand for copper, the perspective of high profit rates in the long run, in spite of growing marginal costs, seemed to justify further investments. Therefore, banks as the Allgemeine Deutsche Credit Anstalt, ADCA (Leipzig) and the Disconto Gesellschaft (Berlin) continued to fit the Mansfeld Company with the credits which were necessary for the modernization of its mines and works. On the other hand, a bankrupt of

the only German copper trust would have seriously threatened many holders of its bonds as well. The still outstanding complete amortization of the lent capital and repayment installments which had been fixed for several decades forced Mansfeld's financiers for further engagements. The Copper Countess danced on the high wire without any net below. And with a terrified glance, the audience stared up to her.