O Coquimbo i Swansea

Ignacio Acosta (2017)

O’r 1820au, bu mwyn copr yn cael ei gloddio yn Coquimbo, gogledd Chile a’i smeltio yng Nghwm Tawe Isaf, Cymru.

Câi’r mwyn copr ei gloddio mewn safleoedd pellennig cyn cael ei gludo gan fulod i Las Compañias, un o ganolfannau metelegol cyntaf Chile, lle’r oedd prosesau smeltio wedi’u sefydlu.

Byddai llongau’n cludo mwyn a chopr wedi’i smeltio’n rhannol i Gwm Tawe Isaf, lle câi ei smeltio a’i buro yn fetel copr. Roedd llygredd difrifol yn y dyffryn am dros ddwy ganrif, tan i waith cadwraeth y 1960au a’r 70au ddechrau adfer y tir.

Coquimbo

Frank Vicencio López

Mae Chile yn rhan o Gylch Tân y Môr Tawel. Mae'r wlad yn enwog am ei gweithgarwch seismig, sy'n cael ei achosi wrth i Blât Tectonig Nazca gael ei dansugno o dan Blât De America. Mae'r ardaloedd cydgyfeiredd (lle mae'r platiau tectonig yn cwrdd) yn rhoi'r amodau daearegol perffaith ar gyfer creu dyddodion copr. Chile yw'r wlad sydd â'r mwyaf o gopr yn y byd – oddeutu 175 miliwn tunnell o gopr 'pur', sef tua 28% o'r cyfanswm byd-eang.

Y dyddiau hyn, caiff copr ei gynhyrchu yn Chile drwy ddefnyddio'r dyddodion mwynau anferth ym mynyddoedd yr Andes ac Anialwch Atacama. Roedd y dyddodion mwynau yn rhanbarth Coquimbo – oedd yn rhan allweddol o ddiwydiant copr y 19eg ganrif – yn llai ond yn fwy cyfoethog, yn cynnwys hyd at 50% copr.

Mae copr wedi bod yn cael ei fwyngloddio yn rhanbarth Coquimbo ers cyn cyfnod yr Inca. Yn y cyfnod gwladychol (1600–1810), copr yn ei amrywiol ffurfiau – bariau, ingotau, a nwyddau – oedd cynnyrch mwyaf nodweddiadol economi allforio Rhaglawiaeth Peru.

Rhwng 1830 a 1870, bu mwyngloddio copr helaeth yn ardal Coquimbo. Câi'r mwyn copr o'r safleoedd echdynnu megis Arqueros, Brillador, Panulcillo, Rodeito, Talcuna, Tamaya a Tambillos, ei gludo ar longau rownd yr Horn yr holl ffordd i Gwm Tawe Isaf. Yn Coquimbo, cafodd prosesau smeltio diwydiannol newydd eu sefydlu. Gan nad oedd mwyn copr yn gystadleuol yn y farchnad fyd-eang, cafodd y shifft hwn ei gyflymu trwy gyfuniad o drethi uchel o Brydain a mentrau busnes lleol.

Ym 1840, ar safle 'Las Compañías', agorodd y peiriannydd mwyngloddio ac entrepreneur diwydiannol, Charles Joseph Emile Lambert (1793-1876) ganolfannau metelegol mawr cyntaf Chile, gyda thechnegau newydd. Gosododd Lambert ffwrneisi ar gyfer calchynnu, smeltio a phuro copr, yn ogystal â melin blât copr, melin rolio, malwr a hyd yn oed ffatri hoelion. Defnyddiodd Lambert y dechnoleg ddiweddaraf, gan sbarduno chwyldro technolegol a drodd Chile yn un o gonglfeini'r diwydiant copr. Bu'r smeltiwr yn gweithio tan y 1920au.

Daeth porthladd Coquimbo yn ganolfan bwysig ar gyfer cynhyrchu metelegol, wedi'i ariannu gan dai masnach Prydeinig. Bu angen Ewrop am gopr yn gyfrifol am greu rhwydwaith gymhleth, fyd-eang o safleoedd mwyngloddio a smeltio. Dau safle allweddol yn y rhwydwaith hon oedd ardal Coquimbo yn Chile, a phorthladd Abertawe a Chwm Tawe Isaf yng Nghymru. Teithiodd llawer o Gymru i Coquimbo, gan gynnwys y seiri a adeiladodd dai cyntaf y porthladd, smeltwyr a weithiai yn y ffatrïoedd metelegol lleol, a'r masnachwyr fu'n prynu a gwerthu'r copr.

Bu'r fasnach gopr rhwng Coquimbo ac Abertawe hyd yn oed yn ddylanwad ar liwiau'r tîm pêl-droed lleol, Coquimbo Unido, sy'n gwisgo crysau melyn a du – lliwiau Dewi Sant. Ym 1903 cafwyd gêm bêl-droed rhwng trigolion lleol a chriw'r llong Brydeinig Flora, a rhoddwyd crysau fel anrheg gan George L. Ansted, Conswl ei Mawrhydi yn Coquimbo a chyn reolwr busnes y teulu Lambert.

Arweiniodd datblygiad mwyngloddio rhwng 1830 a 1870 at newidiadau anferth i'r economi leol a'r gymdeithas. Dysgodd entrepreneuriaid Chile dechnegau mwyngloddio a smeltio'r Prydeinwyr, gan ddefnyddio'r wybodaeth ar gyfer eu busnesau eu hunain. Yn y rhanbarth economaidd, creodd y diwydiant copr alw mawr am gynnyrch amaethyddol o'r Ariannin, fel gwartheg, bwyd, a mulod i gario mwynau. Rhoddodd hwb i'r diwydiant glo yn ne Chile, bu cynnydd yn nhraffig llongau'r ardal, ac arweiniodd at adeiladu rheilffyrdd ac adeiladau sy'n rhan o dreftadaeth bensaernïol yr ardal. Yn gymdeithasol, arweiniodd at symudedd miloedd o weithwyr, a datblygodd grŵp o entrepreneuriaid cyfoethog. Ond yn hytrach na newid y strwythur cymdeithasol pyramidaidd ddaeth i'r amlwg yn y cyfnod gwladychol, ei begynnu wnaeth y diwydiant mwyngloddio. Bu'r oligarchiaid yn gwario'r arian ar harddu'r brifddinas, Santiago, tra'r oedd y dosbarth gweithiol yn byw mewn tlodi ac yn ddibynnol ar waith corfforol caled.

Swansea

Dr Tehmina Goskar

Mae gan bobl berthynas hir iawn â chopr – hirach nag unrhyw fetel cyffredin arall. Mae'n hawdd ei drin, yn dargludo trydan a gellir ei ailgylchu am byth; yn wir, credir bod 80% o'r holl gopr a gloddiwyd erioed yn dal i gael ei ddefnyddio. Fel arfer, mae wedi'i guddio – mewn ffonau symudol er enghraifft, yn ein cysylltu â'r we, neu'n dod â goleuni i'n cartrefi.

Tua dechrau'r 18fed ganrif, daeth Abertawe'n rhan o'r stori 7,500 oed hon, pan adeiladwyd y smeltwyr copr masnachol cyntaf ar lannau afon Tawe, yng nghanol un o feysydd glo mwya'r byd. Yr afon oedd yn cysylltu de Cymru â gweddill Prydain a'r byd. Câi glo ar gyfer peiriannau stem y gweithfeydd ei allforio, a chopr (o Gernyw yn bennaf) ei fewnforio i fwydo smeltwyr Abertawe. Cafodd y dref y llysenw 'Copperopolis'.

O ganol y 18fed ganrif, Cernyw a Chymru fu prif ardaloedd copr Prydain. Rhoddodd copr fantais sylweddol i'r llynges Brydeinig wrth i longau gael eu gorchuddio. Roedd copr yn sail i ddarganfyddiadau chwyldroadol ym meysydd trydan, telegraffiaeth a ffotograffiaeth; roedd yn allweddol i ddiwydiant cynhyrchu enfawr Birmingham a Chanolbarth Lloegr, wrth i sosbenni copr, dyfeisiau mesur, boeleri trenau stêm a phob math o ddyfeisiau eraill newid bywydau miliynau o bobl.

Câi copr ei smeltio ac yna'i buro mewn cyfres o ffwrneisi adlewyrchol – y Broses Gymreig fel y'i gelwid. Caiff ffwrnes adlewyrchol ei phweru gan lo, sy'n gwresogi'r mwyn yn anuniongyrchol. Roedd y broses hon, gyda'r simneiau tal a thenau a chwythai fwg gwenwynig, yn gyfrifol am drawsnewid tirwedd Cwm Tawe Isaf.

Roedd cymysgu'r gwahanol fathau o fwyn copr yn grefft, ac roedd y broses yn amrywio rhwng y gwahanol weithfeydd. Arweiniodd y broses gymhleth o rostio, smeltio ac ail-doddi at arddull benodol o bensaernïaeth ddiwydiannol, gyda simneiau tal iawn a neuaddau smeltio hir. Fel y gweithfeydd mwyngloddio, roedd rhaid i'r smeltwyr redeg bob awr o'r dydd.

Erbyn y 1830au roedd gweithfeydd mwyn copr Prydain yn cael trafferth i gwrdd â gofynion smeltwyr Abertawe, ac roedd rhaid

edrych dros y môr am ffynonellau newydd. O Cuba i Chile, Awstralia i Dde Affrica a thu hwnt, mae rhwydwaith copr Abertawe yn edrych fel map llwybrau hedfan modern, yn cysylltu pedwar ban byd. Roedd y Cape Horners enwog yn hwylio mewn llongau wedi'u haddasu'n arbennig i gario copr, a bu'r diwydiant copr yn gyfrifol am farwolaeth nifer fawr o longwyr, o ganlyniad i afiechydon a llongddrylliadau.

Cyfrannodd diwydiant byd-eang at dwf y farchnad gopr: caethwasiaeth. Câi copr ar ffurf gwialenni pres, llestri a breichledi eu defnyddio fel arian i brynu caethweision o Orllewin Affrica, a gâi eu cludo i India'r Gorllewin ac America i weithio ar blanhigfeydd siwgr – roedd y diwydiannau siwgr a rỳm hefyd yn defnyddio llawer o gopr. Bu busnesau copr Prydeinig yn ymwneud â chaethwasiaeth ymhell ar ôl pasio Deddf Diddymu Caethwasiaeth 1833.

Ond daeth natur ryngwladol y diwydiant copr â chyfleoedd newydd hefyd, yn sgil mudo economaidd. Roedd gofyn mawr am sgiliau mwyngloddwyr, smeltwyr ac adeiladwyr llongau ar hyd a lled America, Awstralia, Seland Newydd ac Affrica. Heddiw, gellir gweld olion y dreftadaeth hon mewn mynwentydd, capeli ac enwau teuluoedd a llefydd.

Mae'n bosibl mai copr oedd y diwydiant trwm cyntaf i gael ei globaleiddio'n llwyr, ac o tua 1830 i 1870, roedd de Cymru ar flaen y gad, gydag Abertawe wrth galon y diwydiant. Am gyfnod yng nghanol y 19eg ganrif, câi 90% o gopr Prydain ei smeltio o fewn 20 milltir i Abertawe.

Roedd cwmnïau rhyngwladol fel Pascoe Grenfell and Sons, Vivian and Sons a Williams, Foster and Company â'u gwreiddiau mewn busnesau bancio a mwyngloddio o Gernyw. Sylweddolodd yr entrepreneuriaid hyn fod mwy o arian i'w gael mewn smeltio na mwyngloddio, ac aethant ati i fanteisio'n llawn ar hyn gan redeg smeltwyr yn Abertawe a gwneud busnes ledled y byd. Gadawodd y cwmnïau hyn farc parhaol ar Gwm Tawe Isaf – hen weithfeydd Hafod a Morfa, er enghraifft, a'r olion sydd o dan Stadiwm Liberty a thai newydd Copper Quarter.

Yn aml iawn, mae twf diwydiannol yn arwain at drychineb amgylcheddol. Erbyn y 1950au roedd Cwm Tawe Isaf – fu'n rhan greiddiol o ddiwydiant copr y byd am dros 200 mlynedd – yn un o ardaloedd diffaith gwaethaf Ewrop, wedi'i wenwyno gan ddegawdau o wastraff diwydiannol. Ers y 1960au, mae blynyddoedd o blannu coed wedi troi'r dyffryn yn wyrdd drachefn, a phrin bellach yw olion Copperopolis.

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Coquimbo & Swansea

Ignacio Acosta (2017)

From the late 1820s, copper ore was extracted from the Region of Coquimbo, northern Chile and smelted in the Lower Swansea Valley, Wales.

Copper was mined from remote sites and brought by mule to Las Compañias. One of Chile's first industrial metallurgical centres and where smelting processes had been established.

The ore and partly-smelted copper was shipped to the Lower Swansea Valley to be refined. The valley was heavily contaminated for more than two centuries, until the1960s and 1970s when conservation work was carried out to reclaim polluted land.

Coquimbo

Frank Vicencio López

Chile sits on the Pacific Ring of Fire. A country famous for its seismic activity, which is caused by the continuous subduction or sinking of the Nazca Plate Tectonic under the South American Plate. As typical feature of these convergence zones (i.e. joining plates), conflicted edges provide the ideal geological conditions for the generation of copper deposits. Chile has the largest world copper reserves, estimated at about 175 million tons of 'fine' or pure copper, which account for 28%.

In Chile, copper has been accumulated in three major types of deposits: 'porphyries', 'estratoligados' and 'vetiformes'. The first two are the origin of the current production and can be found in the heights of the Andes and Atacama Desert. While the third type 'vetiformes', played a crucial role in the northern Region of Coquimbo during the nineteenth century. These deposits were relatively close to the coast and very high in mineral grade, reaching up to 50%.

The extraction of copper in the Coquimbo region goes back to the pre-Inca times. During the colonial period (1600 to 1810), copper in its various forms of bars, ingots, shafts, minerals and copper wrought goods became the most representative product of the export economy to the Viceroyalty of Peru.

During 1830-1870, extraction of copper flourished in the region of Coquimbo. Copper ore mined from extraction sites – such as, Arqueros, Brillador, Panulcillo, Rodeito, Talcuna, Tamaya or Tambillos, was shipped around Cape Horn to the Lower Swansea Valley. In Coquimbo, new industrial smelting processes were established. This shift was accelerated, because copper-ore was uncompetitive in the global market, through a combination of high taxes from Britain and local entrepreneurial ventures.

In 1840, in the site 'Las Compañías', the engineer in mining and industrial entrepreneur Charles Joseph Emile Lambert (1793-1876), opened one Chile's first large metallurgical centres with advanced techniques. Lambeth installed furnaces for calcining, smelting and refining copper, Chile's first copper plate mill, a roller mill, crushers and even a nail factory. Lamberth used state-of-the-

art technologies, provoking a technical revolution that turned the country into one of the strongest players in the international copper business. The smelter worked until the 1920s.

The port of Coquimbo became a point of departure for an enormous metallurgical production, financed by British commercial houses. European demand for local copper, placed remote extraction and smelting sites in Coquimbo, in the centre of a complex global network of extraction and smelting of raw materials. At the heart of this system was the port of Swansea and the Lower Swansea Valley. From Wales, arrived the carpenters who built Coquimbo's first houses, the smelters who worked in local metallurgical establishments and the merchants who traded the copper.

The trading of copper between Coquimbo and Swansea even influenced the traditional uniform of the local football club 'Coquimbo Unido', which used yellow and black, the same colours of the Patron of Wales: St. David. This occasion was marked by a football match between the crew of the British ship 'Flora' and locals in 1903, when shirts were given in the form of gift from George L. Ansted, Her Majesty's Consul in Coquimbo and former manager of Lambert family business.

The development of mining between 1830 and 1870 brought major changes in the local economy and society. Chilean entrepreneurs learned new techniques of mining and smelting brought by British, and applied this knowledge to their own businesses. In the economic area, copper industries generated a great demand for agricultural products from Argentina; such as cattle, food and mules for carrying minerals. It boosted coal mining in southern Chile, intensified traffic of coastal shipping and stimulated the construction of the first railroads and developed buildings, which today are part of local architectural heritage. In the social sphere, the mining industry contributed to the mobility of thousands of workers and the emergence of a wealthy group of mining entrepreneurs. Moreover, instead of changing a pyramidal social structure, which emerged during the colonial times, the mining industry polarized it. A local oligarchy keeps re-investing their revenues in beautifying the capital of Santiago, while the working class remained impoverished and dependent on manual labour.

Swansea

Dr Tehmina Goskar

Humans have had a longer relationship with copper than with any other base metal. Malleable, ductile, able to conduct electricity and infinitely recyclable, it is estimated that 80% of copper ever been mined is still in use today. It is mostly hidden from view, in our mobile phones, connecting us to the internet or bringing light into our houses.

The Swansea chapter in this 7,500 year-old human story began in the early 18th century when the first commercial copper smelters were built along the banks of the River Tawe in the middle of some of the world's largest coalfields. The river was South Wales's superhighway to the rest of Britain and the world. Coal for the steam engines that pumped hard rock mines was shipped out, and (mainly Cornish) copper ore was imported to feed Swansea's hungry smelters. The town was dubbed Copperopolis.

From the mid-18th century Cornwall and Wales became Britain's premier copper regions. Copper gave the British navy an unassailable advantage by sheathing its ships; it was the basis for landmark scientific breakthroughs in electricity, telegraphy and photography; it was the key ingredient for the mass production boom centred in Birmingham and the Midlands: copper pans, brass candlesticks, gauges and measuring devices, steam train boilers, changed the way of life for millions of people.

What became known as the Welsh Process was a procedure for smelting and then refining copper from its ores in a series of reverberatory furnaces. A reverberatory furnace is powered by coal and heats the ore indirectly. This process transformed the river and the landscape of the lower Swansea valley, festooned with tall, thin chimneys, disgorging poisonous sulphrous smoke.

There was an art to blending different types of copper ore, and the process varied between the different copperworks. The complex process of roasting, smelting and re-melting gave rise to a very particular style of industrial architecture, with very tall chimneys and long smelting halls. Like hard rock mines these smelters had to keep going 24-7.

From the 1830s British copper mines started to struggle to satisfy the demand of the Swansea smelters so they looked overseas for new sources of copper rich minerals. First Cuba, Chile, then Australia, South Africa and beyond, Swansea's copper network can be mapped like the flight paths of a modern-day international airline connecting the Cape of Good Hope to Cape Horn. The famous Cape Horners sailed in adapted ships called copper barques specially fitted for the transport of copper products. Countless mariners lost their lives to disease and shipwreck in the service of the copper industry.

A much darker globalised industry also fuelled trade in copper. Copper in the form of brass rods, vessels and manillas (torcs or bracelets) were used as currency to purchase enslaved West Africans who were transported to the West Indies and America to work in sugar plantations—the sugar and rum industries also being big consumers of copper. British copper businesses remained complicit in slavery well after the Slavery Abolition Act in 1833.

But copper's internationalism also brought new opportunity through economic migration, the skills of miners, smelters and ship builders were sought throughout the new world especially South America, the USA, Australia, New Zealand and South Africa. Today vestiges of this heritage can be seen in cemeteries, chapels, family names, place names and settlements.

From about 1830 to 1870 world copper production was dominated by the South Wales smelters with Swansea at the heart of what was possibly the first genuinely globalised heavy industry. For a period in the mid-19th century 90% of Britain's copper was smelted within a 20-mile radius of Swansea.

Multinational companies such as Pascoe Grenfell and Sons, Vivian and Sons and Williams, Foster and Company originated from Cornish mining and banking businesses. These entrepreneurs realised the real money was in smelting, not mining, and they exploited every commercial advantage of running smelters in Swansea and doing business the world over. These companies were responsible for leaving an indelible mark on the lower Swansea valley, today seen in the remains of the Hafod and Morfa copperworks or left as ghosts under the Liberty Stadium and new housing in the city's Copper Quarter.

And with industrial success often comes environmental tragedy. By the 1950s the lower Swansea valley—at the heart of this global concern for 200 years—was branded Europe's worst derelict landscape, poisoned by decades of toxic waste. From the 1960s, years of tireless tree planting made the valley green once more, nearly erasing all traces of Copperopolis.

Mae'r gwaith hwn yn rhan o 'Traces of Nitrate', project ymchwil wedi'i seilio ym Mhrifysgol Brighton, ac wedi'i ariannu gan Gyngor Ymchwil y Celfyddydau a'r Dyniaethau (AHRC).

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tracesofnitrate.org

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