

MORWELLHAM QUAY AND THE DEVONSHIRE GREAT CONSOLIDATED COPPER MINING COMPANY

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Morwellham Quay

The great granite intrusions of Dartmoor and Bodmin Moor and their metamorphic aureoles have been the sites of tin and copper extraction since the early Bronze Age 4000 years ago. Morwellham Quay was established by the Benedictine Monks of Tavistock Abbey in the C10. There was a lime kiln burning lime for mortar, and tin ore was shipped from the medieval dock from the C12 onwards. At the Dissolution the Abbey lands were granted in 1539 to John Russell, Earl of Bedford, whose successors became the Dukes of Bedford from 1694. Copper deposits were subsequently found in the area. Copper ore was exported from Morwellham from 1712 and the mine that became the George and Charlotte was opened in the C18. From 1714 until 1854 the quays were leased to members of the Gill family who often had an uneasy relationship with the Dukes of Bedford and their agents. In 1755 John Edwards leased New Quay a short distance down river. In 1790 new lime kilns were built at Morwellham as lime was now used for fertiliser and coal was imported from South Wales to burn it. A new dock was cut and subsequently more buildings were constructed including a manganese crushing mill c1828 and a cooperage to make barrels to export the crushed ore. New quays were developed for the handling and export of ore.

By the early C19 the increased tonnage of ore being shipped exceeded the capacity of the pack horse teams then in use especially from the copper mines of Wheal Crowndale and Wheal Friendship south of Tavistock. In response, a canal was constructed in 1817 from Tavistock to a point 237 feet above Morwellham. At the top a water wheel connected to large drums lowered wagons by chain down a twin-track platway on an inclined plane. Once on the level they continued on trough rails to the quayside. Ore was also conveyed on a branch inclined plane to be deposited through ore shutes onto the eastern quay.

In 1844, four miles to the north, the discovery of rich copper lodes at Devon Great Consols (DGC) and subsequently large deposits of arsenic, gave rise to a boom in the quay's trade. The vast quantities of copper ore that needed to be transported led to the construction of a standard gauge railway from the mines to Morwellham in 1858. The Great Dock was also constructed, able to take vessels of up to 300 tons laden. It was flanked by tiled ore floors to make the handling of the ore heaps or doles easier. The railway reached the broad quays by another inclined plane powered by a steam engine. The wagons were lowered down through a tunnel and then along rails on raised trestles to discharge the ore onto the ore floors. Samples of ore would be ground and assayed for quality and then the sold to merchants using written bids. The ore was exported to the smelters of Swansea by a fleet of sailing barges which returned with cargoes of coal for the many steam engines used by the mines. Timber was also imported in large quantities as well as machinery and gunpowder.

Morwellham village expanded to meet the needs of the transport, processing and shipping of ore. As well as an assay laboratory there were workshops for iron smithing and carpentry as well as a school, a shop, a chapel and *The Ship Inn* used by visiting merchants and sea-captains. There was also accommodation for the port workers including cottages, a large tenement building, formerly a malthouse, a large merchant's house and a row of 20 improved workers' cottages built by the landowner, the Duke of Bedford in 1856.

After the 1860s arsenic was produced at DGC and exported from Morwellham but apart from the ore trade, the docks at Morwellham had been in decline since the opening of the Plymouth and Tavistock Railway in 1859 which reduced the cost of transporting lime, coal and manure. The Tavistock Canal ceased to trade in 1873. The cheaper prices of foreign ore led to the closure of the regions copper mines and in 1902 all mineral production at DGC ceased. Morwellham's prosperity was over, the docks silted up and the buildings fell into disrepair. One small revival occurred in 1933 when the water flowing down the canal was harnessed to power a small hydro-electric plant in Morwellham.

The Morwellham site was taken over by a trust in 1970 and a substantial amount of restoration was carried out. In 2006 Morwellham was granted World Heritage Site status. In 2009 the Devon County Council withdrew its support grant and the site went into receivership. It was purchased by the owners of Bickton Park in 2010 and reopened. Sadly, emphasis has been put on theme park style activities and many of the restored historic remains have fallen into disrepair. Docks have silted up again and many of the railway gantries have collapsed.

The Devonshire Great Consolidated Copper Mining Company

Devon Great Consols (DGC) is a shortening of the name of the mining company that developed and operated the copper and arsenic mines at Blanchdown Wood above the River Tamar 4 miles north of Morwellham. The area had been mined since the early C18, principally for tin, but without great success. In 1844 Josiah Hitchins and John Taylor, local men who had previously worked the Devon Friendship Mine at Peter Tavy, secured a lease on the site from the Duke of Bedford and capitalised their enterprise with 1024 £1 shares owned by six men, including Josiah Hitchins and William Morris Snr (the father of the artist and writer of the same name).

They began mining at what became Wheal Maria, named after Hitchin's wife (*Wheal* comes from the Cornish *weal* meaning *a place of work*). A lode of chalcopyrite copper (copper-iron sulphide - CuFeS_2), was struck at 15 fathoms and ultimately was worked for a distance of 2 miles to the east by 42 miles of tunnels and stopes. In places the lode comprised up to 30 feet of high % copper ore and had a vertical depth of 100 fathoms. New mines were opened along the lode including Wheal Fanny (Hitchin's daughter), Wheal Anna Maria (The Duchess of Bedford), Wheal Josiah and Wheal Emma (William Morris Snr's wife).

Early steam engines installed proved expensive and inadequate and a large leat was constructed diverting water from the River Tamar to drive giant water wheels 12 feet wide and 30 feet in diameter connected to flat rod systems that were laid uphill to the DGC mines. The power was used to pump water from the mines but was also used to pump large volumes of river water uphill to fill reservoirs and drive 40 water wheels on the higher slopes. Large tree trunks were imported from the Baltic and Canada to shore up the workings such as the stope at Wheel Fanny which was 25 feet wide, 100 feet deep and 900 feet long.

The railway from Wheal Anna Maria to Morwellham was completed in 1858 and was the only standard gauge railway built for a south-west metal mine. Subsequently branches were constructed to serve the other mines including Wheal Emma and Wheal Josiah. Three steam locomotives were employed and 60 wagons, 8-10 of which were used to form each ore train.

In the first six years of operation DGC produced 90,000 tons of rich copper ore yielding 9,362 tons of copper metal (9.61% pure). Royalties were paid to the Duke of Bedford of £44,000 (£4 million today) and dividends to shareholder of £207,000 (£18 million today). By 1864 it was considered the most productive copper mine in the world. During the copper producing years of the mine the value of the metal produced was £3.4million (£530 million today). DGC employed 1284 workers in 1864 including 220 women and girls and 203 boys. The women, known as *bal*

maidens, *ba/* being the Cornish for mine, worked on the surface sorting and breaking the ore with hammers into ever smaller pieces.

But by the 1870s the quality of the copper ore being extracted had declined and this combined with falling prices and cheaper overseas supplies led the company to turn to producing arsenic, which was found as arsenopyrite (arsenic-iron sulphide - AsFeS_2), alongside the copper ores. Arsenic was then widely used in the manufacture of pesticides, medicines, cosmetics and pigments. William Morris Jnr who became a director of DGC, used the arsenic-based Scheele's Green in his wallpapers. The substantial copper mining waste heaps were processed in a new 8-acre facility and DGC became the largest producer of arsenic in the world responsible for 50% of global production. By the time falling prices forced the arsenic production to cease in 1903, 72,000 tons had been produced worth £710,000 (£104 million today), enough to poison the population of the world many times over. After production finished, the great processing plant was completely demolished.

Arsenic production was restarted during WWI to produce blister gas and in 1920 a new processing plant was built which continued in use until 1930. The principal remains of the 1920s plant show clearly the arsenic production process. Ore was first crushed in a mill, now ruined, and the fed into two Brunton calciners (existing) where it was roasted over a coal furnace. The fumes from the calciners were led to a labyrinth (existing) where they combined with oxygen to form Arsenic Trioxide (As_2O_3) which condensed on the labyrinth walls as a white *soot* or *white arsenic*. Two sets of winding labyrinth tunnels (existing) were used alternately, one for condensing and one where men, in inadequate overalls and damp face cloths, scraped the *white arsenic* from the walls. The residual gases from the condensation process were led via a long flue, through a lime *washer* which removed sulphur oxides, to a tall chimney (existing). Some of the arsenic was ground to a finer powder in a grinding mill (existing) and taken to a reverberatory furnace (existing) to be roasted again by indirect heat. The fumes from this process were clean of any contaminants from the heating fuel and once condensed in another labyrinth (destroyed) created a very pure form of 99.5% arsenic trioxide. This was packed into barrels and transported to Morwellham for export.

Attempts were made to recover copper from the dumps as late as 1970. Now the mine is part of the Cornwall and West Devon Mining Landscape World Heritage Site and has been open to visitors since 2009.

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