Tin processing: Stamping and separation

Before 1600, the majority of tin came from working alluvial deposits by a process known as tin streaming. This involved digging a drainage trench into the proposed workings and then diverting a watercourse to the workings so that the streamer could wash the gravels in the valley floor and separate out the tin. Much of this 'stream tin' could be smelted without further treatment. Where the tin was mixed with granite, the tin gravels needed crushing *(stamping)* in a stamping mill.

A stamping mill *(*or *stamps)* consisted of a series of large upright poles, known as lifters, shod with iron and held in a frame. In front of these was a horizontally set axletree in which were set a series of cams. The axletree was rotated by a waterwheel built into one end of the axle. As the cams rotated they lifted corresponding caps fitted to the lifters, raising them and allowing them to fall freely. The tin gravel to be stamped was fed under the lifters and crushed into sand *(pulp).*

Prior to about 1600, the tin ore was stamped dry. Sir Francis Godolphin I, drawing on Dutch and German expertise, introduced modifications. Water was directed under the stamp head and gratings were added in front of the stamp heads, the size of the holes matching the size of the crystals of tin locked up in the rock. Once the grains were crashed small enough, they would splash through the holes in the grating. This enabled the waste to be separated from the tin more easily as the grains were of a uniform size.

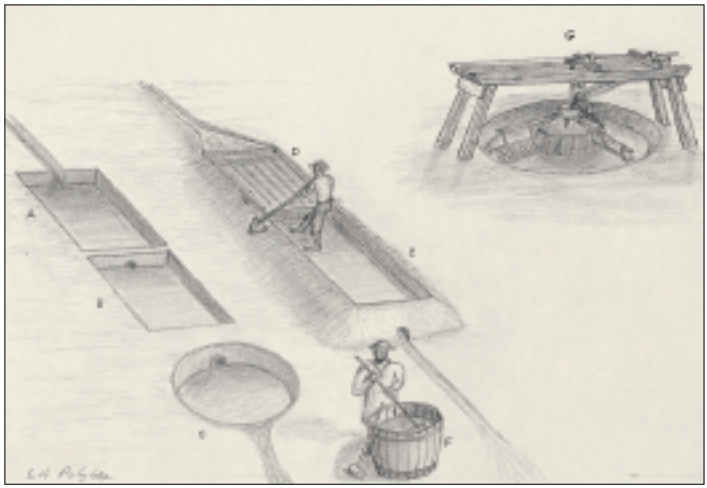
Once stamped the pulp flowed directly from the stamps into pit A. Being heavier than the waste, the purest of the tin oxide settled into this pit. Smaller tin particles together with most of the waste were carried into pit B. The finest waste particles along with a proportion of very fine tin (known as *slime*) were carried onto Pit C. The remainder flowed away as waste.

Pit A was subdivided into 2 parts, the *head* and the *tail.* This was then carried to the *buddle.* The tin dresser stood in the buddle and spread the tin ore, a shovel at a time, at the top of the *jagging board* D. A stream of water passed evenly over the jagging board and carried ore down into the buddle E. Here the tin dresser lightly scraped his naked foot over the tin in the buddle, this action raised the waste to the surface, and this was then carried by water to the back of the buddle.

The tin at the top of the buddle was set aside, while the rest of the buddle was retreated several times. Once the desired quality was reached, the buddled ore was then put into the *keeve* F. Filled one third with water, the tin ore was introduced a shovel at a time, while it was stirred *(tozed)* with a shovel. Once almost full, the stirring ceased and the sides of the keeve were beaten by boys with mallets to settle the tin leaving a thin film of waste on the top which was skimmed off and rebuddled.

The contents of pits B and C were further processed in slime buddles to extract the very fine tin.

By the mid-19th century, processing was by the semi-automated round buddle G, which in turn was replaced by the shaking table in the early 20th century.



Early Tin Dressing.

Balmaiden at Maiden Stamps Godolphin, 1910/20.

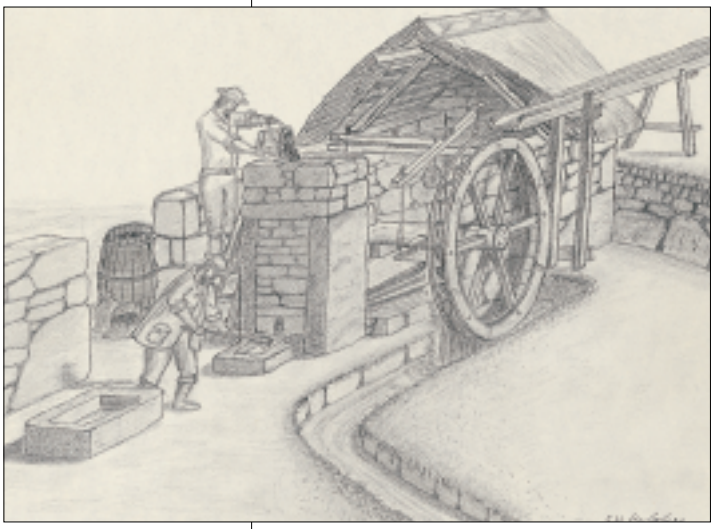
1938 Great Work miners.

The art of blowing

The name Blowing House comes from the building that housed the furnace used to melt the tin oxide. Each ingot usually weighed about 3cwt. As the ingots cooled they were stamped with the owner's mark. In the case of the Godolphins it was a rampant Dolphin. No Dolphin marks survive, but it was probably very similar to the rampant dolphin depicted on the lead guttering at Godolphin House.

Once smelted the tin was taken to a coinage town to be coined. The term *coin* comes from the French *quoin* for corner, as the corner of the ingot was partly cut then struck off as a test for purity. Helston was the nearest coinage town to Godolphin. Coinage took place here twice a year, but as output grew was increased to four times a year. Once coined, duty was paid on each ingot, the money going towards the cost of running the stannary parliament.

The blowing houses were primarily used for smelting stream tin, which produced a particularly pure tin metal. As quantities of mined tin increased, larger coal fired furnaces were developed. Deeper mined tin contained impurities in the form of sulphides, which needed further refining, so eventually the blowing houses became obsolete.



This illustration shows part of the wall and roof removed to reveal the furnace *(castle)*. The castle was built of granite *(moorstone)* and lined with clay. Black tin was brought to the blowing house in sacks, while the charcoal was brought in packs and tipped into a barrel to improve the quality and quantity. Fuelled with charcoal, the furnace was blown by bellows driven by the waterwheel. Once alight and warmed through, the furnace was loaded layer upon layer with charcoal and black tin. As the tin melted, it flowed out of the hearth eye into a trough called the *float*. The molten tin was then ladled into stone moulds.

Cat 'hot mark' of John Coke.

The cat eating the dolphin

Each smelting house had its own *hot mark,* which was registered in the Owners' Tin Sign Book at Lostwithiel. John Coke was stewart for the Godolphin Mines and smelting house, giving him responsibility for blowing all the tin. One night at dinner, Lady Margaret Godolphin whispered a cryptic message to her husband, Sir Frances Godolphin I, that "the cat is eating the dolphin". She'd discovered that Coke was marking quantities of their tin with his own hot mark.

Minerals

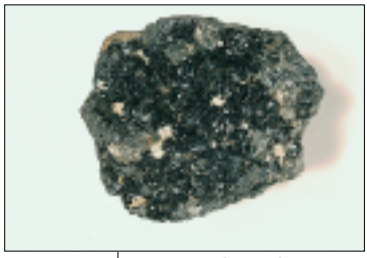
Minerals are found in veins (or *lodes*) within the granite and were formed as the molten granite cooled around 270-290 million years ago. Mineral veins can extend hundreds of feet down and their width varies from 20 inches to 30 feet or more. Try to imagine a sandwich stood on its edge, the bread being the granite and the filling being the mineral vein.

After the granite and mineral lodes were formed, the granite was eroded exposing the mineral lodes. Tin was washed free and deposited in riverbeds, the heavier tin particles settling below the granite sand. This was known as stream tin and was the first to be exploited by early tinners.

Lode mining came later and was first carried on in the form of open works on exposed lodes. As the workings became deeper, drainage became a problem. This was eventually overcome by driving a drainage tunnel *(adit)* on the lode from a much lower point on the hillside. This allowed all the lode material containing tin above the adit to be removed without the problems of water. When it became necessary to work the deposits below adit level, a shaft was sunk and the water was pumped up to the adit. Early on, these shallow workings were pumped with simple hand pumps, while some mines used waterwheel driven pumps. As workings became much deeper, greater power was needed and this coincided with the invention of the steam-pumping engine.

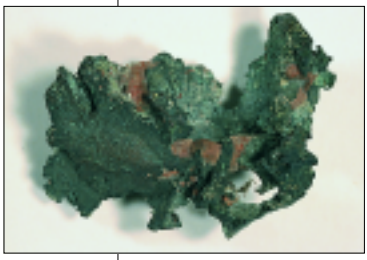
Water power

A leat was a manmade canal that brought water usually to the site of a waterwheel. Waterwheels fall into three basic categories: undershot, breast and overshot. The undershot wheel had a series of paddles set around the circumference and was driven by a flow of water running underneath. The breast and overshot wheels both had buckets set between the outer rings of the wheel. These wheels were fed by a launder that filled the buckets and thus turned the wheel. The overshot was fed from the top, while the breast wheel was fed from around axle height. Few undershot wheels existed in Cornwall, as they required a large volume of water to flow under the paddles. Breast and overshot wheels were more common as they made use of the smaller sources of water available. Storm water was also channelled into the leats and not a drop was wasted.

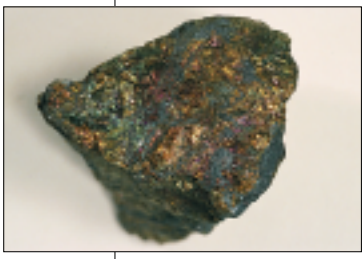


Cassiterite (tin ore) sample.

Local tin samples.



Native copper sample.



Peacock copper ore sample.

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