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Tin: What the world owes this dull grey metal

By Justin Rowlatt
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Tin wouldn't come anywhere near the top of most people's list of the most important elements, yet the history of our species is very closely entwined with this dull grey metal.

Tin was the basis of man's first great technological revolution. Thanks to its low melting point, this relatively abundant metal was one of the first to be smelted - by placing a rock into a fire.

Metallurgists, working more than 5,000 years ago, discovered that mixing tin and copper would make a much harder and more durable metal than either metal alone, one you could fashion into blades which would - crucially - keep their edge.

They had discovered the world's first alloy. Mankind began to throw away its stone weapons and tools - the Bronze Age had begun.

Even as we moved from bronze to iron and on into the industrial age, tin remained at the centre of human culture, as I discovered in the impressive surroundings of London's Pewterers' Hall.

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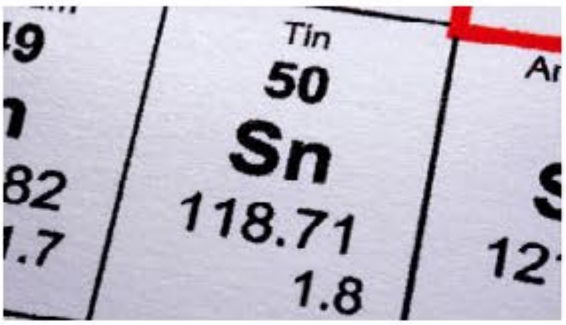
The building is modern, but this is the home of one of the most ancient of all the ancient Guilds of London, the Worshipful Company of Pewterers. The first reference to the company is in 1348 and, as its names suggests, it is dedicated to producers and workers of pewter, another tin alloy, made this time by combining it with small amounts of copper, antimony, bismuth or sometimes lead.

Pewter provided a cheaper alternative to gold and silver, explains Andrea Sella, a professor of chemistry at University College London, as we look at the huge ornate pewter plates, tankards and trophies on display. But the popularity of pewter - and therefore tin - declined rapidly, as mass production made cheap porcelain tableware available in the 18th Century.

Come the 19th Century, the metal found a new incarnation in **the eponymous "tin" can**. In fact, right from their beginnings towards the end of the Napoleonic Wars, cans were made predominately of iron or steel. However, they were plated in a smidgeon of tin, in order to protect the iron from its Achilles Heel - rust.

Tin - key facts



- Symbol: Sn (from Latin stannum)
- Atomic number: 50
- Melts at 232C (450F)
- In the carbon group (group 14) of the periodic table, next to Germanium and Lead
- Obtained from the mineral, cassiterite (SnO2)
- More than half of the world's tin comes from South-east Asia

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Today, many cans have dispensed with the tin altogether, relying instead on a plastic coating, or switching over to an entirely new metal in aluminium.

But that doesn't mean that man's adventure with tin is over. Over the years we have discovered all sorts of new and very different ways to use this versatile metal. The most obvious is in the electronics industry, the biggest modern user of tin.

"Tin is the glue that holds most our electric world together," pronounces Sella, producing the motherboard of a computer from his bicycle pannier with a flourish.

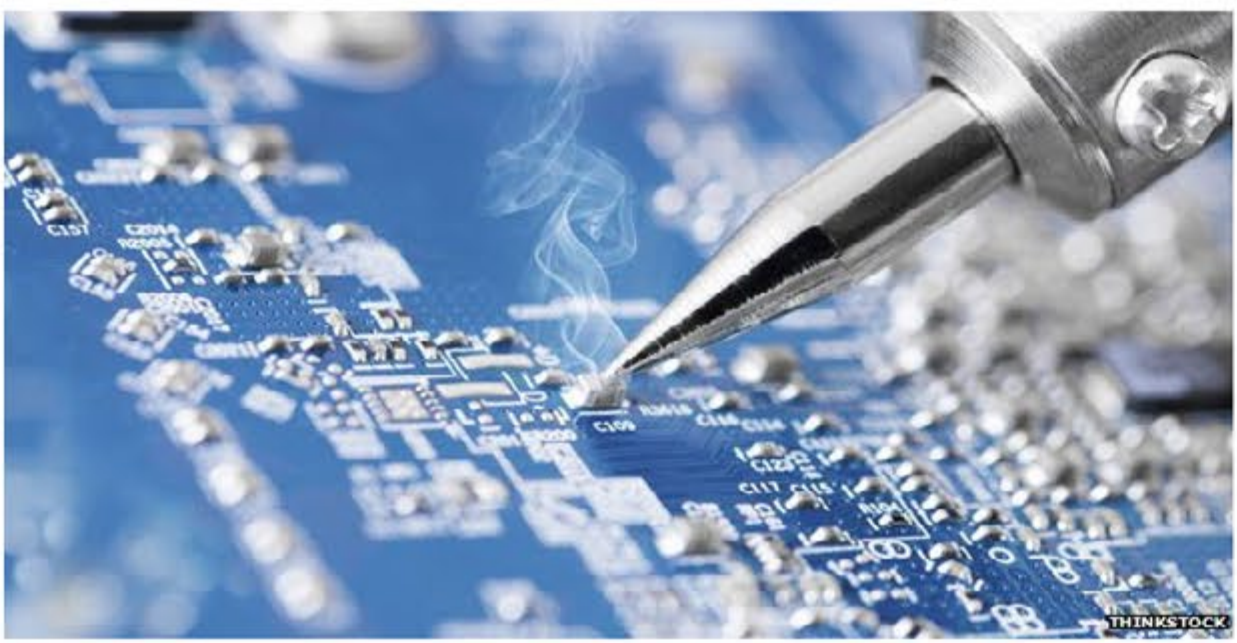
"Take a look at this, it looks like a cityscape," he says, tracing the tiny golden roads running between the silicon chips and other components that rise up like tower-blocks from the surface. He points out the tiny silvery blobs of solder at every junction

"If you warm solder up, it melts," he explains. "You can put a blob down and make an electrical connection between two wires. There are very few other things that combine a low melting point and a lack of toxicity."

More from the Magazine

The story of the tin can is one of ingenuity and endurance, and one that affects every one of us. It has changed the way we eat, the way we shop and the way we travel.

The story of the tin can



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Paradoxically, while pure tin may not be poisonous, certain organic compounds of tin can be incredibly toxic. Tin is located in the same column of the periodic table as carbon, and is able to mimic carbon's behaviour in building the organic chemical compounds that are the basis of all life.

Organotin compounds are substances not found in nature. Many are still widely used as fungicides and insecticides, but their use has been controversial.

For many years one variety of these tin compounds, tributyl-tin, was used in special anti-fouling paints. These were designed to stop barnacles and weeds growing on the hulls of ships. Fouling slows ships down and can increase fuel consumption dramatically.

These tin-based anti-fouling paints were very effective. The problem was that the tin compounds were so toxic they caused terrible damage to the marine environment. According to some studies, as little as one nanogram of tributyl-tin per litre of water could have damaging biological effects - that is one billionth of a gram. In 2008 the International Maritime Organisation banned any use of these compounds in the marine environment.

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A cousin of tributyl-tin is, however, used in the production of one of the most common plastics, polyvinyl chloride or PVC. The tin compounds are used to stabilise the plastic, stopping it going yellow or black and becoming brittle when it is heated up to mould into useful shapes such as drainpipes.

Another big user of tin is the glass industry, thanks to a revolution in glass production that began in Britain the 1950s. I was lucky enough to meet another venerable tin chemist, Ted Fletcher who was part of the team that refined this radical new process at the then family-owned British glass company, Pilkington.

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Over a cup of tea, 91-year-old Ted tells me how he first got an inkling that something was afoot more than 60 years ago, while he worked at a tin-smelting firm in the North of England.

"Pilkington's started to take some tin from us," he told me. "Why did they need tin at all, they'd never had tin before?" he wondered. Ted was to discover the reason after he went to work at the glass manufacturer in 1956.

Glass making had been a hot, dirty, dangerous and labour intensive process involving rolling molten glass on a huge steel plate. Alastair Pilkington, who by coincidence shares the name of the founding family, was convinced there must be a better way. His vision was to pour molten glass on to a bath of molten tin.

The company invested years of research and huge resources into developing what has become known as the "float glass process".

It could have bankrupted Pilkington's, Ted believes, but Alastair Pilkington's huge gamble paid off. The firm made millions setting up plants and licensing float glass operations around the world. Some 80% of the world's sheet glass is now made using the float glass process.

Find out more

In Elementary Business, BBC World Service's Business Daily goes back to basics and examines key chemical elements - and asks what they mean for businesses and the global economy.

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But now many of Pilkington's float glass patents have lapsed and, like so many innovative British firms, the company has been snapped up by a foreign rival. And the Cowley Hill site where the world's first float glass production line was opened in 1961 is in the process of being closed down.

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