



The History of the Pencil

Leaded or Unleaded?

The core of a pencil, confusingly named the 'lead', is formed from a naturally occurring element known as graphite, discovered in the Lake District of England in the early 1500s. Graphite is not the first example of an element hewn from the ground and used as a mark making tool – this process dates back to the very first examples of human art seen in the prehistoric cave paintings which were created using both charcoal and chalk in the era between 40,000 and 10,000 BC. These substances were ground and mixed into a paste with either saliva or animal fats and smeared onto the porous cave walls. So important were these prehistoric paints that the painters travelled far and wide to obtain the pigments:

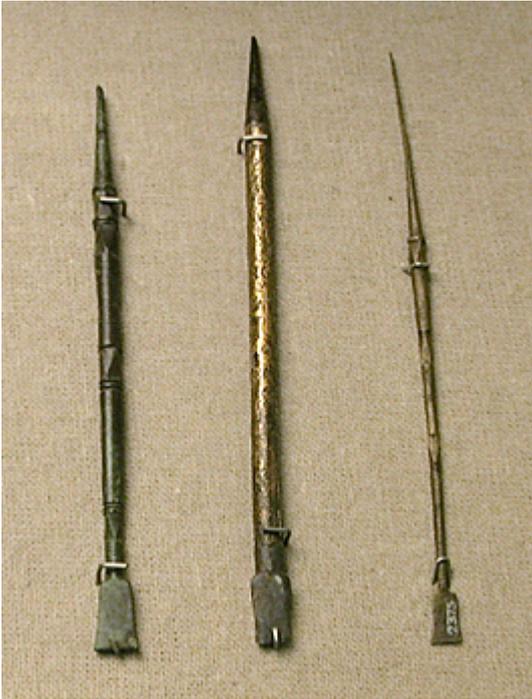
“In every locality where prehistoric sites have been discovered from, Texas to South Africa, trails lead to near and distant hematite deposits where man mined. Historians have deduced that the impetus behind all mining activities was prehistoric man’s need for ochre pigments. Cave men might have travelled as far as 25 miles to obtain iron earth pigments for their paint in the Lascaux area.”ⁱ



The Roman Lead Stylus

One theory about the origin of the term *lead pencil* lies with the ancient Romans who used styluses made from lead to scratch letters into tablets that were covered in a thin layer of wax. In the same way as many pencils hold an eraser at the tip for removing errors, the lead stylus had a flattened end that could be used for smoothing over and therefore erasing the unwanted text. Marking text onto a wax surface limited the early Roman script to straight lines, just as the first writing system, Sumerian Cuneiform was compiled of triangular and other straight-edged shapes and symbols.

In time, the lead stylus evolved to be used with papyrus, upon which the lead would leave a faint mark. One distinct advantage of the lead stylus over reed pens was that they did not require a secondary ink source. Whilst paper was first invented in China in the first century AD, it did not reach Europe until the 8th century and was not widely available until the first paper mills were built in the 13th century. This meant that the development of ink and brush writing systems that were very popular in Asia was not as expansive in Europe.



In medieval times, scribes of manuscripts would have used a metal stylus, made of either lead or silver to rule lines onto the parchment pages to ensure that the writing would be straight. This implement was known as a *plummet*. A metal point would also be used by the illuminator to sketch out any illustrations to be painted onto each page once the writing had been completed. The plummet has been referred to as an early ancestor of the pencil and was in use from the 11th or 12th century. ⁱⁱ

Discovery of Graphite or Black Lead

In the first part of the 16th century, locals discovered a large quantity of solid graphite in Borrowdale, near Keswick in the Lake District of England. Chemistry and metallurgy were both sciences in their infancy and this led to the naming of the substance as *plumbago*, the Latin for 'lead ore' as it was believed to be a form of black lead as opposed to a form of carbon.

This misnomer has transcended many languages throughout the world where the word for a pencil translates as 'lead pen', including Arabic, German and Gaelic. The term *pencil* was only first used to describe a 'graphite writing implement' towards the end of the 16th century. The origins of the word are in the Latin word *penicillus* meaning 'little tail', used to describe either a fine artist's brush or lead stylus and was first used in the Post-Classical period of history, from the end of the 5th century AD onwards.

The large deposit of graphite, the only one ever discovered on this scale, was soon observed by the local people to be very effective for the marking of sheep and small pieces were removed for this purpose. A secondary and far more lucrative purpose was also discovered by the military, which used the graphite as a lining for cannonball moulds. It became such a valuable asset that the graphite mine came to be guarded by the Crown who would flood the mine to deter thieves when it was not in use. A law was passed in 1752 to protect the graphite from theft, with the punishments including whipping, hard labour or transportation. This is hardly surprising when the value of graphite was £1300 per tonne, the equivalent of £169,300 today. ⁱⁱⁱ

Any use of graphite for mark making happened initially through small pieces smuggled out of the mine, the users of which soon discovered that the graphite not only left marks upon the hand but also could become brittle when held in the hand. Early casings for the graphite included small pieces of sheepskin or lengths of string.



The Borrowdale mines remained the only large source of good quality graphite and its pencils were soon exported to several European countries. These distinctive square sticks of graphite were renowned throughout Europe for their quality and unique strength in mark-making.

First attempts were made in the 1660s, in Nuremberg, Germany, to create graphite sticks from powdered graphite, but it was the Napoleonic Wars in the late 18th century when trade embargos forced the French to develop an alternative method and recipe for the core of the pencil.

A French army officer, Nicholas Jacques Conte, developed a mixture of clay and graphite powder (produced from poorer quality graphite) that was fired in a kiln. This breakthrough ended the British monopoly on quality pencil production. Conte, who was also a chemist further developed this manufacturing process, realising that using different quantities of clay and graphite would result in a harder or softer pencil mark which is seen today in the range of pencils available graded using the HB scale. This scale grades pencils according to their Hardness (H) and Blackness (B).

How Are Pencils Made?

The addition of a wooden casing surrounding the graphite stick was first developed by an Italian couple, Lyndiana and Simonio Bernacotti, as early as the 1560s. Their design featured a hollowed out juniper stick into which the graphite would be placed to produce a flat carpenter's pencil. The oldest example of a carpenter's pencil is dated from the 17th century and was found in the roof of a German house, built during this period.



In time, the manufacturing process evolved to use a wooden casing, sawn into two halves and then carved out for the graphite stick. The two halves would then be glued together. This technique proved so successful that it has changed little in the last four centuries.

There is uncertainty about the identity of the first manufacturer of mass produced pencils, although it is known that he was from Nuremberg, Germany:

“Hannss Baumann of Nuremberg, who died on 7 February 1659, was named in his son’s marriage contract as a pencil maker – the first time this trade is documented. The names of other citizens of Nuremberg, such as Jäger, Jänicke, or Friedrich Staedler (who was forbidden by a council decree of 1662 to manufacture pencils) have been recorded for posterity in this connection.”^{iv}

European pencils travelled with the first settlers to North America and they continued to be imported until after the American Revolution in the late 18th century. By 1812, the first American wooden pencils had been manufactured by William Munroe, a cabinet maker from Massachusetts. Subsequent design initiatives included the first octagonal and hexagonal wooden casings and by 1870 The Joseph Dixon Crucible Company was the world’s largest consumer and dealer in graphite. By the end of the 19th century, more than 240,000 pencils were used every day in the United States.

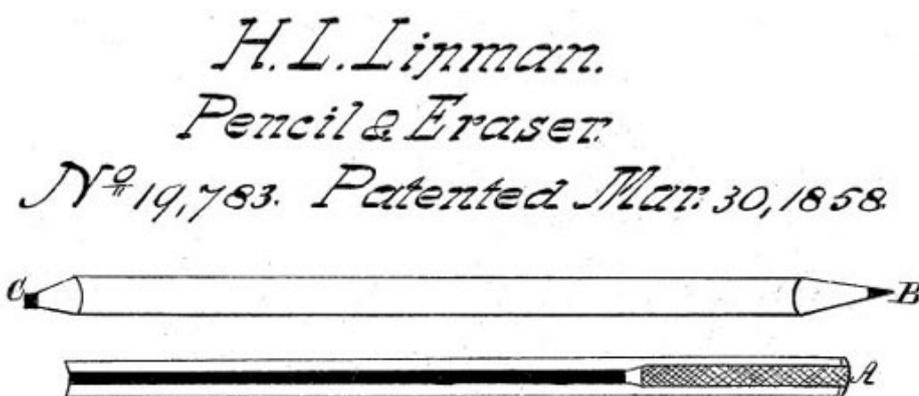
The enduring appeal of the pencil must be in both its longevity and its autonomy from ink bottles and cartridges. There are, however, accessories which improve the pencil writing experience even further, namely the pencil eraser and the pencil sharpener.

Erasers

Early pencil marks were erased using breadcrumbs until the French scientist and explorer Charles Marie de la Condamine brought ‘Indian’ rubber back from his explorations in South America, where it was used by tribes as an adhesive. Small cubes of this rubber began to be used to erase pencil marks to great effect as the famous scientist and discoverer of oxygen, Sir Joseph Priestley, observed in 1770:

“I have seen a substance excellently adapted to the purpose of wiping from paper the mark of black lead pencil”.^v

Whilst rubber proved effective at removing pencil marks, it rotted easily and so it was not until Charles Goodyear discovered the process for vulcanising rubber in 1839 that erasers became popular. A patent was issued in 1858 to a Philadelphia man, Hyman Lipman, who attached an eraser to the end of a pencil. This patent was not long-lasting, however, as it was decided that this was not a new product but a combination of two existing ones.



The science behind the pencil eraser is simple – the ‘stickiness’ of the eraser’s molecules is greater than that of the paper’s molecules and therefore the graphite marks made by the pencil are lifted from the page. Modern pencil erasers are made from a range of materials including plastic and foam. The last decade has seen the invention of the electric pencil eraser which features a very small disc which gently buffs the pencil marks from the page in a technique reminiscent of the palimpsest process but for the technological age.

Pencil Sharpeners

The use of a small knife to sharpen a pencil would have come naturally to early adopters of graphite writing instruments. The term *pen knife* has its origins in the knife used to prepare a quill feather for writing with ink, until the introduction of the dip pen in the early 19th century.

The first patent for a pencil sharpening device was issued to French mathematician Bernard Lassimone in 1828, although it would be a further twenty years before a pencil sharpener was manufactured on a large scale. Thierry des Estivaux, a fellow Frenchman, introduced his device in 1847. The reason for Estivaux’s success over his predecessor was the introduction of a conical opening in which to insert the pencil, as is commonly seen in the prism sharpeners used today.

By the end of the 19th century, a further design triumph came with the patenting of the A B Dick Pencil Pointer, a sharpening device which would hold the pencil whilst sharpening it, therefore reducing the risk of a broken lead.



Electric pencil sharpeners first appeared at the beginning of the 20th century, but became popular in offices in the 1940s. During the Second World War, there was such concern about wastage of both wood and lead that rotary pencil sharpeners were outlawed in favour of returning to the whittling tradition of previous generations.^{vi}

Mechanical Pencils

Whilst a mechanical pencil might seem a significant technological advance on a conventional wood-encased pencil, early examples were merely graphite sticks held within different media, with the advantage of being able to remove the graphite for sharpening or replacing. The earliest known example of a mechanical pencil was found aboard HMS Pandora which sank off the coast of Australia in 1791.^{vii} Over the next century, a range of mechanisms were introduced, including the addition of a spring to propel the lead.

A propel-repel mechanical pencil differs from a mechanical pencil in that it is possible to advance and also retract the lead. Alonzo Cross, one of the pioneers of Cross Pens, is credited with the invention of the first propel-repel mechanical pencil in 1879, which acted as the technological forerunner to today's modern mechanical pencil. Further patents were issued in the decade that followed, including a patent in 1885 which focused on the screw mechanism and the ability to expel the redundant lead when it needed replacing.

Remarkable New Invention
Parker 61
LIQUID LEAD® Pencil

Sharpens itself as you write . . . point cannot break. Rolls words on paper smoothly in a smudge-proof, erasable line. It's always ready to write!

To Install Replacement Cartridge

- 1 Pull off metal cap.
- 2 Unscrew eraser-holder.
- 3 Pull out old cartridge.
- 4 Insert new cartridge. Replace eraser-holder and cap.



Mechanical pencils have evolved significantly over the last century and now include models that feature liquid graphite, such as those marketed by Sharpie, the largest writing brand in North America.

Have you ever wondered...

Is pencil poisoning possible?

Whilst pencils have never contained a lead-based core, there were many cases of lead poisoning from pencils, but these were caused by the lead-based paint that coated the exterior of the pencil until the middle of the 20th century. The risk of lead poisoning was dramatically increased if the pencil user was fond of chewing or sucking the end of the pencil whilst deep in contemplation.

Why are most pencils yellow?

The early manufacturers of wooden cased pencils were very proud of the appearance of their writing instruments and therefore they remained unpainted in order to accentuate the superior quality of the timber used. The tradition of painting pencils began in the late 18th century and the most famous of these early painted pencils was produced by the L & C Hardmuth Company of Austria-Hungary in 1890.



They introduced a yellow painted pencil known as Koh-I-Noor, so named after the world famous diamond which had become part of the British Crown Jewels just two decades earlier. The choice of yellow proved fortuitous as it became associated with high quality graphite and craftsmanship and this led to the reproduction of the colour by other pencil manufacturers who wished their products to be viewed in the same favourable light by consumers. In the United States today, 2.1 billion pencils manufactured annually are painted yellow, representing 75% of the total produced.

Why are most pencils hexagonal?

As with many aspects of pencil design, simplicity equates to success. The hexagonal shape of the pencil barrel was first introduced by Ebenezer Wood, a contemporary of William Munroe, in the middle of the 19th century. Wood was the first to introduce a circular saw to the manufacturing process and using straight edged lengths to form the wooden casing proved more time efficient. It is likely that this design feature endured for the beneficial reason that a hexagonal (or indeed octagonal) pencil will not roll when placed on an inclined surface. This serendipitous design change proved beneficial for both manufacturer and consumer.



The Future for Pencils

Whilst it might seem that the world has been seduced by the 14.8 billion pages on the internet and that everyone thrives on a daily diet of emails, text messages, tweets and posts, the reality is that only the lowly pen or pencil allows written communication without a power source. Whilst this might seem merely a romantic notion, sales figures support the idea that the handwritten word is more popular than ever. Whereas the combined worldwide projected sales figures for personal computers, tablets and smartphones for 2012 was a meagre 1.162 billion;^{viii} annual global sales for the pencil reached 16 billion pieces last year, an increase of 7% on the previous year^{ix}.

With each pencil capable of 35 miles of writing, which equates to approximately 45,000 words or 300 average-sized emails, it seems those simple pencils of 2012 could write the world's emails for ten months, although with an estimated 17% of emails received as spam perhaps they could last all year.^x

The uniqueness of the pencil as a writing instrument cannot be underestimated. What other media has been used in space, underwater and by school children tentatively producing their first letters, throughout every continent for the last five centuries? If one includes the lead styluses of the Romans, the pencil is the most widely used writing instrument over the longest period of time. If one considers the graphite contained within pencils as a carbon descendent of the charcoal found in the earliest cave paintings, that humble HB found in your desk drawer has a heritage as rich as your own DNA.

ⁱ Quotation taken from *Painting Techniques* article on *Pigments through the Ages* website located online at <http://www.webexhibits.org/pigments/intro/early.html>

ⁱⁱ Information gathered from N Silvester, *Stylus, Quill and Pen: The Short History of Writing Instruments*, February 2014, located online at <http://www.brighthubeducation.com/history-homework-help/123138-stylus-quill-and-pen-short-history-on-writing-instruments/>

ⁱⁱⁱ Statistics taken from J Munroe, *Grey Matters: The Power Inside the Pencil*, page 9, The Fitzwilliam Museum Cambridge located online at <http://www.fitzmuseum.cam.ac.uk/onlineresources/ebooks/Graphite.pdf> and <http://www.measuringworth.com/ukcompare/>

^{iv} Quotation taken from - <http://www.faber-castell.co.uk/~media/Faber-Castell/brochures/en/Press/A%20brief-history-of-the-pencil.ashx>

^v Quotation cited in *Pencil and Eraser Trivia* M. Bellis <http://inventors.about.com/library/inventors/blpen.htm>

^{vi} Information gathered from H Petroski (2010). *The Pencil: A History of Design and Circumstance*. New York, NY: Random House LLC cited at <http://en.wikipedia.org/wiki/Pencil>

^{vii} More information about this archaeological discovery can be found at the Queensland Museum's website located at <http://www.qm.qld.gov.au>

^{viii} <http://www.computerweekly.com/news/2240146544/PC-sales-forecast-to-grow-44-in-2012> and <http://mashable.com/2012/05/16/mobile-phone-sales-down-2-percent/> and <http://www.forbes.com/sites/canaccordgenuity/2012/02/10/2012-smartphone-predictions/>

^{ix} <http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/9368695/Pencils-are-status-symbols-for-men-says-Faber-Castell.html>

^x Statistic on spam email taken from <http://www.radicati.com/wp/wp-content/uploads/2011/05/Email-Statistics-Report-2011-2015-Executive-Summary.pdf>

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