



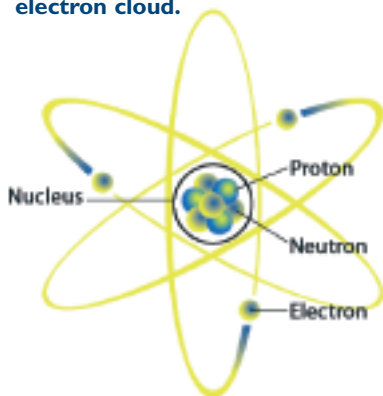
Elements in the Leather Industry (Part 1)

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The elements of the periodic table have a diverse and interesting history. This article (and those to follow) will attempt to bring some richness to the elements that are used or are present in the manufacture of leather or the treatment of its waste. This is not intended to be an exhaustive academic indulgence but more of an interesting interlude.

All matter is made up of atoms and is found in three phases viz., solid, liquid and gas (plasma is recognised as a fourth phase). Elements are groups of atoms that are characterised by the number of protons (positively charged atomic particles) in its nucleus, and similar chemical and physical properties. The atom consists of a solid nucleus that contains protons and neutrons (neutral atomic particle) surrounded by a cloud of electrons (negatively charged particle) as shown in *Panel 1*:

Panel 1: A representation of an atom with protons and neutrons in the nucleus surrounded by an electron cloud.



At least 117 elements have been identified (some synthesised by nuclear reactions) so far and are represented in the periodic table of elements. Only 94 of the elements occur naturally on earth.

We will start with the elements which form the basis of the mineral tannages.

Chromium (Cr)

In 1797, a Frenchman named Louis Nicolas Vauquelin isolated the oxide of a new element from a sample of the mineral, *crocoite*, PbCrO_4 . *Crocoite* at this time was known as *Siberian Red Lead* and was mined from the Ural Mountains in Russia. In 1798, Vauquelin isolated the metal itself by reducing the oxide with charcoal. Chromium was subsequently named after the Greek word, *chroma*, meaning colour due to the variety of colours of its compounds. Rubies and emeralds owe their colour to the presence of chromium.

Aluminium (Al)

Ancient Greeks and Romans used aluminium salts for dressing wounds. Alum, $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$, as the salts are still called, is

derived from the Latin *alumen*, which means "bitter salt". In 1808, Humphrey Davey, identified the presence of the element in alum salts which he named "aluminium" and later "aluminum". This was soon modified to aluminium and is used throughout the world except in North America where the American Chemical Society decided, in 1925, to use aluminum. Hans Christian Oersted isolated an impure sample of aluminium in 1925 and Friedrich Wöhler isolated an improved sample in 1827. Both are often credited with its "discovery/isolation".

Zirconium (Zr)

Zirconium most likely derives its name from the Arabic, *zerk*, a precious stone, or the Persian *zargon* (gold-coloured). Martin Heinrich Klaproth, in 1789, proved that the "imperfect diamonds" he studied were distinct mineral species containing a distinguishing oxide he named *Zirkonerde* or zirconia. Zirconium containing minerals (jargoon, hyacinth, jacinth) are mentioned in biblical texts. It was only in 1824 that Jöns Jakob Berzelius produced an impure elementary zirconium and finally, in 1914 that high purity samples were first produced.

Titanium (Ti)

In 1791, a Cornish vicar, William Gregor, examined black sand from a local river and discovered it was attracted by a magnet. The black sand (now called ilmenite) contained iron oxide (which explained the magnetism), which he removed by treatment with hydrochloric acid. A white residue remained which Gregor realised was the oxide of an unidentified element. In 1795, Martin Heinrich Klaproth, independently discovered the new element oxide in the mineral rutile, mined in Hungary, and named it titanium, in honour of the *Titans* in Greek mythology. Klaproth confirmed that the unidentified element discovered by Gregor in 1791, was titanium. High purity titanium metal was only produced in 1910 by Matthew Hunter.

Iron (Fe)

Iron has been known since prehistoric times and has played the most important role of all metals in the progress of man. Iron beads dating to around 4000 BC were likely of meteoric origin but the first smelting of iron dates to the third millennium BC by the Hittites in Asia Minor. The Iron Age began around 1200 BC when the fall of the Hittite empire released the secrets of iron smelting to the rest of the world. The word iron is Anglo Saxon in origin (*iren*) but the symbol Fe and words such as "ferro-", ferrous and ferric are derived from the Latin *ferrum*. There would be little to no life on earth without iron because of its biological roles in the transport and storage of blood, as well as its role in electron transport. 🌐

Acknowledgements

- Greenwood N.N. and Earnshaw A., *Chemistry of the Elements*, Pergamon Press, Oxford, United Kingdom, 1984
- Panel 1: http://mail.colonial.net/~hkaiter/science%20images/Atom_diagram.png